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Abstracts

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Contents

S5 Oral Presentations

S57 Poster Presentations

S301 Author Index

Oral Presentations

TRAUMA RESUSCITATION

O 1

The GERtality-Score: a feasible and adequate tool to predict mortality in geriatric trauma patients

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Introduction: A large number of prediction models and subsequent outcome scores for trauma mortality have been developed over the last decades. However, feasible scoring systems for the severely injured geriatric patient are lacking. The aim of this study was to develop a new mortality prediction model for severily injured geriatric patients.

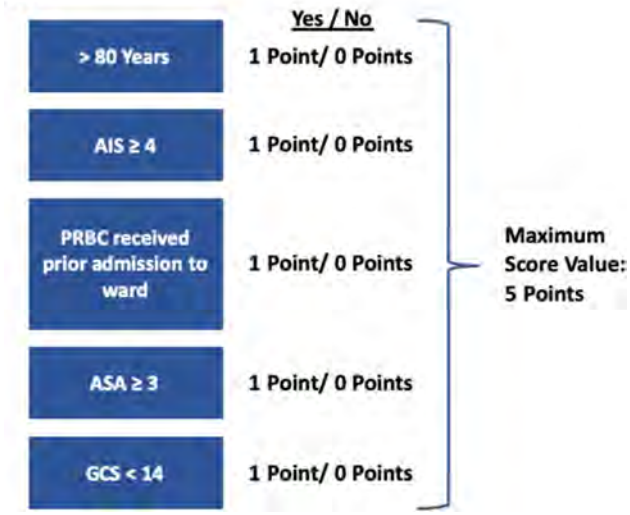
Materials and methods: The German Trauma Registry was utilized and all geriatric individuals ($\geq$ 65 years) admitted between 2008 and 2017 with an ISS [1] $\geq$ 9 were included. Patient and trauma characteristics, diagnostics, therapy and outcome data were gathered. The specific odds of all variables for mortality were calculated. Relevant variables were added to the novel GERtality-scoring system. Subsequently, this score as a sole predictor for mortality was compared with the Geriatric Trauma Outcome Score[2], ISS, patient‘s age and max AIS.

Results: A total of 58.055 trauma patients with a mean age of 77 years were included. Based on the univariable analysis, the following five variables were included in the GERtality- score: age $\geq$ 80 years, PBRC-transfusion requirements from admission to ward, ASA- score $\geq$ 3, GCS $\leq$ 13, AIS $\geq$ 4. The values of a given parameter are added to reach the total GERtality-Score (range 0–5 points). The AUC found in the novel GERtality-Score was 0.803, whereas the Geriatric Trauma Outcome Score had an AUC of 0.784.

Conclusions: The novel GERtality-Score is a simple and feasible scoring system that enables an adequate prediction of the probability of mortality in severely injured geriatric patients by using only five specific parameters.

References: 1. Champion HR, et al. The Major Trauma Outcome Study: establishing national norms for trauma care. J Trauma. 1990;30:1356–65.
2. Zhao FZ, et al. Estimating geriatric mortality after injury using age, injury severity, and performance of a transfusion: the geriatric trauma outcome score. J Palliat Med. 2015;18(8):677–81.

Fig. 1



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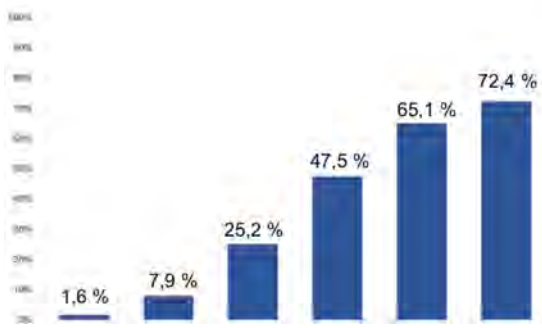

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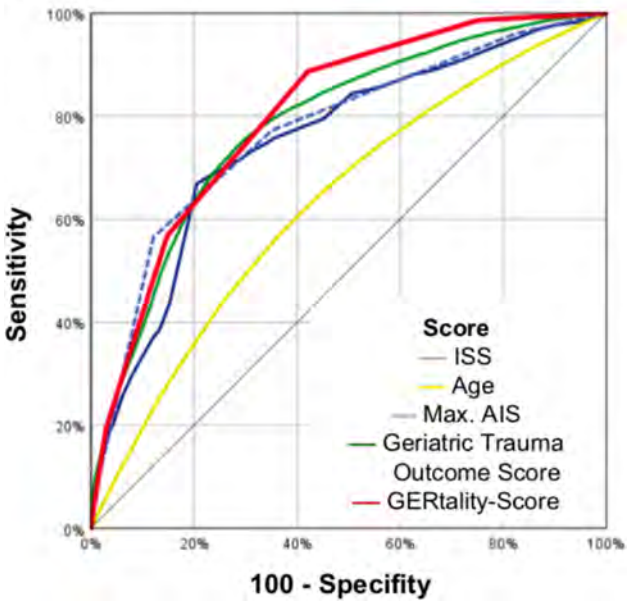

O 2

A completed loop VTE assessment and delivery audit. Why can't we get this right? Ideas for improvement

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Introduction: Hospital acquired venous thromboembolism (VTE) accounts for thousands of deaths annually. Surgical patients are at particularly high risk of VTE, with prophylaxis recommended by NICE (1). For this reason, the assessment and prophylaxis of VTE has been audited countless times. In our institution, we aimed to improve the rate of risk assessment and see the prescription and delivery of VTE prophylaxis.

Materials and methods: General surgical patients over 16 across all surgical wards on one day were included. Patients with contraindications to VTE prophylaxis were excluded. Patients and patient notes were reviewed for evidence of risk assessment, prophylaxis prescription and delivery. We then provided teaching sessions and posters to doctors and nurses, highlighting the importance of VTE prophylaxis. The second cycle was performed 8 months later using the same methodology.

Results: 38 patients were included in the first cycle and 33 in the second. Risk assessment improved from 8–58%. Prescription of pharmacological prophylaxis (Tinzaparin) rose from 94–100% and mechanical prophylaxis (TED stockings) from 97–100%. Tinzaparin delivery rose from 97–100% and TED stockings from 46–61%.

Conclusions: Improvements were seen in rate of risk assessment, and prophylaxis prescription and delivery. However, there is still room for further improvements in risk assessment and delivery of mechanical prophylaxis.

The multiple reiterations of projects similar to this one demonstrate an apparent corporate amnesia when it comes to VTE and the delivery of potentially life saving prophylaxis. VTE projects are carried out worldwide within local institutions, but with little or no cross communication. Perhaps it is time for a global initiative to improve delivery of VTE prophylaxis and link these multiple projects and data together.

Reference: 1. NICE. Venous thromboembolism in over 16 s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism (NG89).

O 3

Point-of-care 24/7 automated immune analysis of neutrophil phenotype is associated with infectious complications after trauma

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The amount of tissue damage and the amplitude of the immune response after trauma is related to the development of infectious complications later on. Changes in neutrophil phenotype have been linked to the amount of tissue damage and infectious complications. The study aim was to test whether point-of-care analysis of neutrophil phenotype can be achieved by 24/7 fully automated flow cytometry.

All trauma patients presented in the trauma bay of a level 1 trauma center were prospectively included. One extra blood tube was drawn from all presented trauma patients. Thereafter, one member of the trauma team placed the blood tube in the fully automated AQUIOS CL® "Load & Go" flow cytometer, that was located in the corner of the trauma room. Next, a modified and tailored analysis protocol for this study was automatically performed by the device, providing a read-out in 20 min.

The trauma team was able to successfully start the point-of-care flow cytometry analysis in 156/164 patients, which resulted in a 95% success rate. A correlation was present between the ISS and the %CD16dim/CD62Lbright neutrophils ($R^2 = 0.43$; $p < 0.0001$). Polytrauma patients who developed infectious complications had a significantly higher percentage of CD16dim/CD62Lbright neutrophils (8.4% (6.7–11.8%) vs 3.1% (1.3–6.8%), $p = 0.002$) compared to polytrauma patients who did not develop infectious complications (Fig. 1). Area under the curve value for CD16dim/CD62Lbright neutrophils is 0.90 for the prediction of infectious complications in trauma patients (Fig. 2).

This study showed that it is feasible to apply of a fully automated point-of-care flow cytometry system in the trauma bay. This study demonstrates that assessment of %CD16dim/CD62Lbright neutrophils within 30 min after arrival of the trauma patient correlates with the ISS. Furthermore, the assessment of CD16dim/CD62Lbright neutrophils directly after trauma has predictive value for infectious complications during hospitalization.

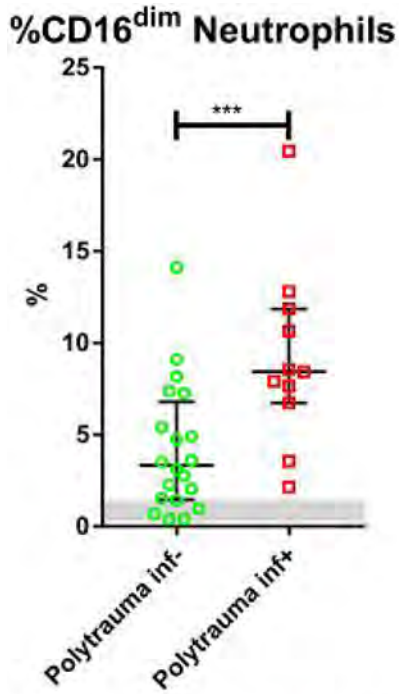

Fig. 1: Percantage CD16dim neutrophils. Polytrauma patients with infections (n = 11) (■) were compared to polytrauma patients without infections (n = 21) (●) with the use of a Mann Whitney U test. Data are presented as scatter plot with median and interquartile range. Reference values show interquartile range of monotrauma patients (ISS<16) (n= 55). ***=P < 0.005.

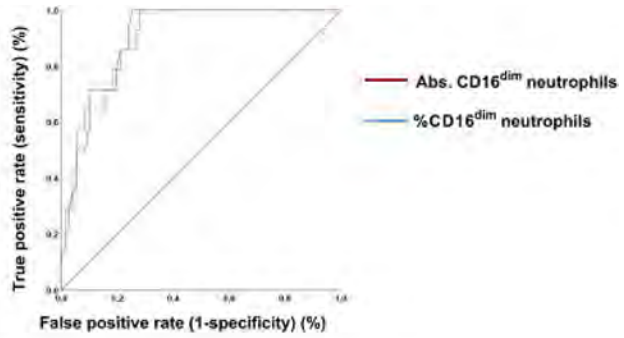

Fig. 2: Receiver operating characteristic (ROC) curve for the prediction of infectious complcations in trauma patients during presentation in the trauma room. Area under the curve (AUC) value for %CD16^{dim} neutrophils is 0.898 (0.829-0.968) and 0.903 (0.838-0.969) for absolute count CD16^{dim} neutrophils.

O 4

The longer the better! *'Extending thawed plasma shelf life to 14 days'*

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Introduction: Rapid availability of blood components is important during transfusion in haemorrhaging trauma patients. Due to the limited shelf life, plasma is mostly not cold stored. Extending the shelf life of thawed plasma makes in-hospital availability faster and allows pre-hospital implementation without increasing plasma wastage. We aim to evaluate the prolonged storage time of cold stored thawed deep frozen plasma (DFP) for up to 14 days.
Materials and methods: DFP (− 80 °C stored thawed Fresh Frozen Plasma, FFP) and Omniplasma (OMN, OctaplasLG) (n = 8) were thawed at day 0, sampled and subsequently cold stored at 4 °C. Whole blood (WB) was cooled to room temperature (WB0) or leukocyte depleted (WBF). Samples were filtered and WB0/WBF were centrifuged (15 min 2500G) prior to analysis. DFP, WB0 and WBF were compared with FFP day 0 and 4 °C stored WB0 day 21. Data are presented as median with interquartile range and analysed with unpaired Mann–Whitney U test.
Results: FFP and DFP were not different in coagulation factors (FV, FVII, FVIII, Fibrinogen) and proteinS on day 0. In OMN, coagulation factors V, VII and proteinS were significantly lower than FFP day 0. Fibrinogen levels were not affected during storage DFP (3.0 g/L), OMN (2.8 g/L). On day 14 coagulation factors FV and FVIII were significantly higher in DFP (0.7 IU/mL) and (0.6 IU/mL) in comparison with WB0 day 21. After 14 days, only proteinS was below the minimum threshold of 0.5 IU/mL in both DFP and OMN. Increase of factor VII, suggesting cold activation, occurred in all OMN, 2/8 DFP at day 14 and 1/8 WB0 at day 21.
Conclusions: Fresh thawed DFP was equal to FFP and contains more coagulation factor activity in comparison with other cold stored products. OMN was least active and shows strong contact activation during storage. We conclude that cold stored DFP can be cold stored at 4 °C for 14 days which makes it feasible for (pre)hospital application.
This study was sponsored by the Dutch Ministry of Defence

O 5

Zone depending comparison of acute circulatory changes of abdominal organs after resuscitative balloon occlusion of the aorta (REBOA)

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Introduction: Major bleeding is one of the most common causes of death after severe polytrauma. One of the most recent interventions that aims for bleeding control is Resuscitative Balloon Occlusion of the Aorta (REBOA). This study aims to compare macro- and microcirculatory changes of intraabdominal organs and the lower extremity during the use of reboa.
Materials and methods: Six pigs were anesthesized and received a median laparotomy. The REBOA catheter (Reliant balloon, medtronic) was inserted via the inguinal artery and occluded in zones 3, 2 and 1. The occlusion of the REBOA was vizualized with fluoroscopy. THe balloon was inflated for 10 min per zone. During this time the local microcirculation was measured with oxygen to see (O2C, Lea). Between each zone the balloon was deflated for 10 min. Blood pressure was measured at the carotis artery and the femoral artery.
Results: Baseline values of microcirculation differ significantly among organs. The flow rate is significantly higher in intraabdominal organs (Colon 205.7 A.U., Stomach 170.2 A.U.) compared to the extremity (67.0 A.U., $p < 0.001$). Blood pressure measured at the carotic artery increased significantly after inflation of the balloon ($p < 0.001$). This increase depends on the Zone of inflation (increase of + 60 mmHg in zone 1 compared to baseline). The increase of blood pressure after inflation in zone 3 is comparable to the baseline value. The colon is most sensitive to changes of microcirculation whereas the stomach and the extremity are most robust.
Conclusions: REBOA is a new device to control for massive bleeding. Different organ systems react differently to the same occlusion of the aorta. The systemic blood pressure does not mirror the local microcirculation of the abdominal organs. During emergency resuscitation with REBOA these changes should be kept in mind.
None of the authors have any conflicts of interests to declare.

O 6

Investigation of coagulopathies and its relevance with mortality and transfusion rates using thromboelastography in trauma patients

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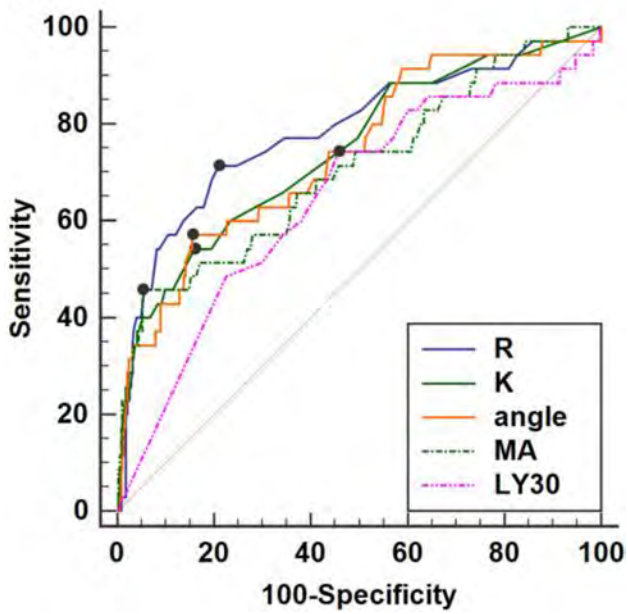
Introduction: The trauma patients can develop both hyperfibrinolysis and fibrinolysis shutdown Primary hyperfibrinolysis, an infrequent but highly lethal finding, plays a central role in acute traumatic coagulopathy. We investigated the hyperfibrinolysis and fibrinolysis shutdown phenomenon and their clinical and prognostic impact in trauma patients.
Materials and methods: We included 452 trauma patients visiting our Level 1 Trauma Center between January 2017 and May 2018.

Thromboelastography (TEG) was performed upon trauma center admission. The measured TEG variables included clot time (r), clot formation time (K), rate of clot formation (α angle), maximum amplitude (MA), and clot lysis after 30 min (LY30%).

Results: Three fibrinolytic phenotypic groups were as follows: fibrinolysis shutdown (N = 219, 52.5%), normal fibrinolysis (N = 131, 31.4%), and hyperfibrinolysis (N = 68, 16.3%). A total of 226 (53.9%) patients received transfusion and 219 (52.3%), 84 (20.0%), and 48 (11.5%) received packed red cell, plasma, and platelet transfusions, respectively. The total mortality rate was 8.6% (n = 39) and differed significantly between fibrinolytic phenotype groups ($P = 0.03$, fibrinolysis shutdown group: 11.9%, normal fibrinolysis group: 3.8%, and hyperfibrinolysis group: 8.7%). The R-value and K-value of TEG showed a positive correlation with PT, aPTT, D-dimer and FDP ($P < 0.01$), and negative correlation with fibrinogen, AT and platelet count ($P < 0.01$).

Conclusions: Dysfunction of the fibrinolytic system can be detected by TEG testing and can predict the need for transfusion and mortality rate in trauma patients. Early identification and correction of coagulopathy can potentially improve patients' outcomes and decreased mortality.

Fig. 1



O 7

Low clot dissolution, not clot strength, signals adverse outcomes in critically ill trauma patients

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Introduction: Fibrinolysis shutdown after injury is a common and lethal coagulopathic phenotype. Patients with polytrauma, especially those with brain hemorrhage, require delayed initiation of prophylactic or therapeutic anticoagulation despite a measurable hypercoagulable state. To understand and modulate the post-trauma coagulation milieu, we assess patients with daily thromboelastography(TEG). We hypothesized that persistently high clot strength and low dissolution is associated with thrombotic adverse outcomes in severely injured patients.

Materials and methods: Adult patients with blunt or penetrating injuries admitted to the ICU of a Level I urban trauma center from Jan-Jul 2019 were included. Adverse outcomes were defined as death, ventilator-free-days (VFD) = 0, acute lung injury (ALI), acute kidney injury (AKI), and venous thromboembolic events (VTE). We assessed trends of clot dissolution (fibrinolysis, LY30%) and strength (maximum amplitude, MA) in the first 5 ICU days using linear mixed models to account for repeated measures and missing observations. LY30% was Box-Cox power-transformed to approximate normality. Significance for pairwise comparisons at each time was adjusted by false-discovery-rate.

Results: 175 patients: median age 48-years, 23% female, ISS 15 (IQR 9–24), 89% blunt mechanism, median 4 ICU days (IQR 3–8). Overall, 16% developed one or more of the following; 9%VFD = 0, 8%ALI, 14%AKI, 5%VTE, 7%death. LY30 was persistently lower in patients with adverse outcomes compared to those without (Interaction time*adverse_outcomes p = 0.046), with FDR-adjusted significant differences at ICU days 1 and 2 (Fig 1). Conversely, MA did not differ significantly by adverse outcome status(Interaction time*complications p = 0.44, Fig 2).

Conclusions: Low clot dissolution, not clot strength, is associated with adverse outcomes in severely injured trauma patients. Additional work is underway for earlier identification of SD phenotypes and strategies to mitigate impaired fibrinolysis.

Fig. 1

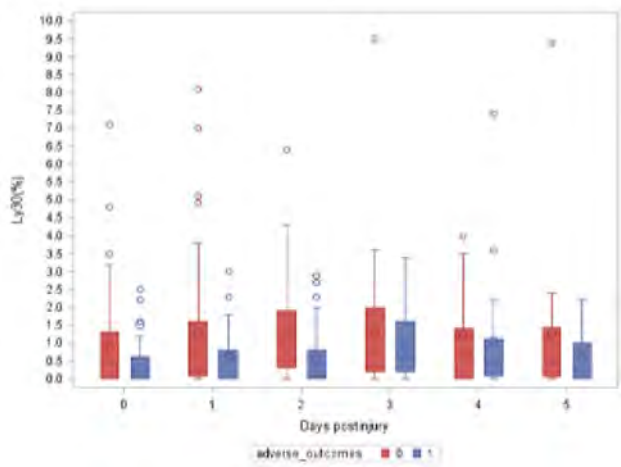
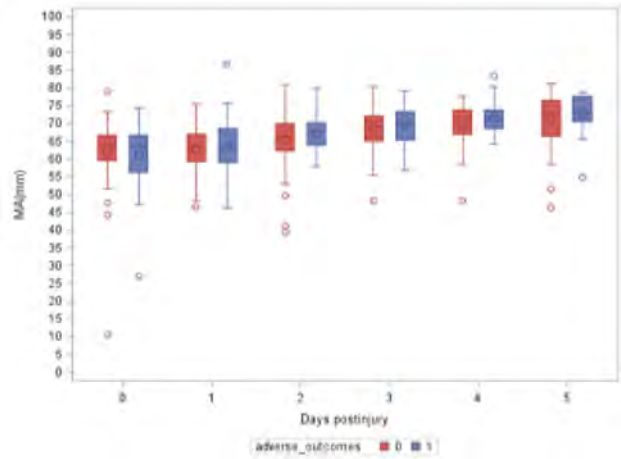


Fig. 2



O 8

Trauma deaths at a major Scandinavian trauma centre: impact of resuscitation strategies over time

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Introduction: Oslo University Hospital (OUH) is Norway's busiest trauma centre. From 2003 to 2016 annual trauma team activations increased from 800 to 1900, whereas mortality for severely injured (ISS > 15) decreased from about 18–12% with continuous efforts for improvement, including optimized resuscitation strategies in the last half of that period. Our aim was to analyse trauma-related deaths.
Materials and methods: We performed a retrospective observational study of trauma deaths (< 30 days from injury) at OUH during the period 2003–2016. Data was drawn from the OUH Trauma Registry. We defined two periods; 2003–2009 (P1) and 2010–2016 (P2). Changes over time, including time to death and cause of death, were explored. Mann–Whitney and Chi square tests were used to compare variables.
Results: Overall 1094 trauma deaths were registered, 531 in P1 vs 563 in P2. The groups were comparable in admission characteristics, ISS, probability of survival and demographics except for age, with older patients in P2 (median 65 years (IQR 41, 81) vs 55 (31,75) in P1, p value < 0.001). While death rate due to TBI and MOF remained unchanged from P1 to P2 (51.0% vs 50.6% and 6.6% vs 7.5%), the percentage of deaths due to exsanguination decreased from 19.6% to 9.2% (p value < 0.001). Furthermore, we saw a sliding of time to death from early after admission to day 2 and 3, most likely reflecting the reduction in deaths due to exsanguination.
Conclusions: The 14-year period has been characterized by more than doubling of the annual trauma volume and a significant increase in survival. We found that median age of patients who died increased and death from exsanguination was halved coinciding with an improvement in trauma resuscitation.

O 9

Feasability of intraoperative angioembolization for trauma patients using c-arm digital substraction angiography

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Introduction: Angioembolization (AE) is can be both diagnostic and therapeutic in management of a hemodynamically unstable trauma patient. However, patients who would benefit from AE typically require emergent surgery for their injuries. The critical decision of transferring a patient to the operating room versus the Interventional Radiology suite can be bypassed with the advent of intra-operative angioembolization (IOAE). While the ability to perform such an intervention was previously limited by the availability of costly rooms termed RAPTOR (resuscitation with angiography, percutaneous techniques and open repair) suites, it has been suggested that using C-arm digital subtraction angiography (DSA) is a comparable alternative. This case series aims to establish the feasibility and safety of IOAE.
Materials and methods: We conducted a retrospective anlaysis of all trauma patients at our Level 1 trauma centre who underwent IOAE with a concomitant surgical intervention from January 2011 to April 2019.
Results: A total of 49 patients (79.6% male, 43.9 ± 17.3 years, 91.8% blunt) underwent IOAE using the C-arm DSA. All but one patient underwent exploratory laparotomy, 20.4% of which underwent an additional surgical procedure (ex. exploratory thoracotomy, orthopaedic). Either Gelfoam (89.8%), coils (2.0%), or a combination of both (8.2%) were used for embolization. Internal iliac embolization was performed in 85.7% of cases (57.1% bilateral) and five patients (10.2%) required hepatic embolization. AE was successful in all but one case, inferior vena cava filters were placed in 71.4% of cases, and 12.2% of patients required a second AE. The 30-day mortality was 30.6%.
Conclusions: Our results suggest IOAE is a feasible and safe management option in severe trauma patients with the advantage of concurrent operative intervention and ongoing active resuscitation with good success in hemorrhage control.

EMERGENCY SURGERY

O 10

End-tidal carbon dioxide as an indicator of partial REBOA in normovolemia and hemorrhagic shock in anesthetized pigs

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Introduction: Partial resuscitative endovascular balloon occlusion of the aorta (REBOA) is a new concept of aortic occlusion to reduce the ischemic injuries below the occlusion level. It is, however, difficult to determine when the occlusion is partial in a clinical setting. End-tidal carbon dioxide (ETCO2) is a product of aerobic metabolism and its production is reduced during ischemia and anaerobic metabolism. The aim of this study was to investigate if ETCO2 is a good predictor of the degree of aortic occlusion during normovolemia and hemorrhagic shock in a porcine model.
Methods: Nine pigs, 25–32 kg, were anesthetized and surgically prepared. Then, gradual zone 1 aortic occlusion by 33%, 66% and 100% was induced, during first normovolemia and then controlled hemorrhagic grade IV shock. Hemodynamic/respiratory variables, blood gases, aortic/mesenteric blood flow, blood pressure of common femoral artery and ETCO2 were measured continuously. Oxygen consumption and carbon dioxide production were calculated for each timepoint for correlation measurement to different methods for partial occlusion determination.

Results: The occlusion caused gradual increases in systemic blood pressure above the occlusion level and gradually lower blood flow and pressure below the occlusion level. Oxygen consumption and carbon dioxide production were gradually reduced with increasing occlusion. The best correlation to oxygen consumption and carbon dioxide production was found to the blood flow of the superior mesenteric artery followed by ETCO2, aortic blood flow and last femoral blood pressure.
Conclusion: End-tidal carbon dioxide may be a reliable estimator of partial REBOA and can be used in a clinical setting with ventilated patients.
Keywords: Partial REBOA, Oxygen delivery, ETCO2, Hemorrhagic shock, Ischemia

O 11

Could a hot gallbladder pathway reduce the incidence of gram-negative bacteraemia?

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Introduction: The incidence of gram-negative sepsis (GNS) in the UK is rising[1], which has prompted the Government to launch an ambition to reduce cases of GNS by 50% by 2023[2]. The hepatopancreatobiliary (HPB) cohort of GNS patients is the second largest, accounting for 15–20% of cases nationally, with most cases caused by gallstone disease[1]. Despite this, few strategies to reduce the incidence of HPB-related GNS have been proposed. In order to determine whether a "hot" cholecystectomy pathway could reduce the incidence of HPB-related GNS in our trust, we analysed our trust's HPB cohort data.
Materials and methods: We performed a retrospective analysis of 433 cases of HPB GNS from the trust's database between April 2015 and May 2019. We extracted key data relating to each case from hospital and GP records, including: the underlying source of GNS; previous documented evidence of biliary disease; any previous surgical or non-surgical management the patient received.
Results: Out of 433 cases of HPB GNS, 388 had clear evidence of HPB origin. The source of GNS was related to gallstone disease in 282 of the 388 cases (73%). Of these gallstone-related HPB GNS cases, 124 (32% of the total HPB GNS cohort) had previously been diagnosed with gallstone disease either clinically or radiologically, whilst for 158 this was their first presentation with gallstone disease. Of the 124 with a previous presentation of gallstone disease, 101 (81.5%) had been managed non-surgically for previous presentations compared to just 23 (18.5%) who had been surgically managed.
Conclusions: Our data suggest that the incidence of HPB GNS could be reduced by up to 32% if patients with gallstone disease were to receive a cholecystectomy at their index presentation.
References: 1. Preventing healthcare associated Gram-negative bloodstream infections: an improvement resource. Public Health England. May 2017.
2. Tackling antimicrobial resistance 2019–2024. HM Government. January 2019.

O 12

Safety and efficacy of conservative management for acute appendicitis: a meta-analysis of Randomized controlled trials

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Background: Acute appendicitis is one of the most common surgical emergencies worldwide. The aim of this meta-analysis of randomized controlled trials was to compare the safety and efficacy of antibiotic treatment versus appendicectomy as the primary treatment for patients diagnosed to have acute appendicitis.
Methods: A systematic online search was conducted using the following databases: PubMed, Scopus, Cochrane database, The Virtual Health Library, Clinical trials.gov and Science Direct. Only Randomized controlled trials (RCTs) that compared Antibiotics treatment (A) versus surgical treatment (S) as primary treatment of appendicitis were included.
Results: Eight RCTs with 1.849 patients were included: 897 in the antibiotics group and 952 in appendicectomy group. Higher rate of treatment success was noted in appendicectomy group 96.5% versus only 67.8% in the antibiotics group ($P < 0.00001$) (Fig. 1). Follow up period for recurrence was one year in all studies and the recurrence at 1 year was reported in 15.2% (136/897) of patients treated with antibiotics and 69.9% (95/136) of them underwent appendicectomy. Moreover, rate of overall were 8.3% in A group and 16.2% in S group (Odd ratio 0.44 [0.21–0.94], CI 95%, p-value: 0.0002) (Fig. 2). A longer length of hospital stay was reported among antibiotics group (2.96 ± 0.52 in A group versus 2.51 ± 0.56 in S group, P 0.02).
Conclusions: Appendicectomy has significantly higher efficacy rate but higher complications rate when compared to antibiotics treatment. Most of the studies included in this meta-analysis conveyed a high risk of bias, hence more well-designed RCTs are recommended.
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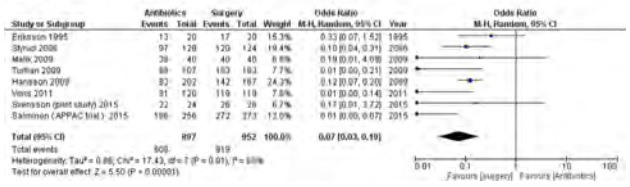
8. Svensson JF, et al. Non-operative treatment with antibiotics versus surgery for acute non-perforated appendicitis in children. Ann Surg. 2015;261(1).

Fig. 1



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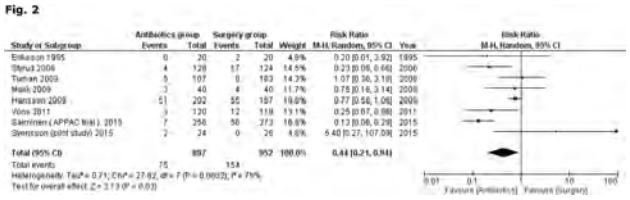

O 13

Point Of Care UltraSound by Surgeons (POCUSS) Trial: results of a multicentric study

B. D. Dumbrava[1], *G. A. Bass*[1], *J. Pereira*[2], *A. Biloslavo*[3], *G. Bellio*[3], *M. Zago*[4], *T. N. Walsh*[1]

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Introduction: Bedside ultrasonography is a versatile, easily reproducible technical skill, well-suited to surgical practice. The majority of conditions referred to the on-call general surgeon benefit from diagnostic imaging in tailoring further management; such imaging, however, may be not readily available at the point-of-care.

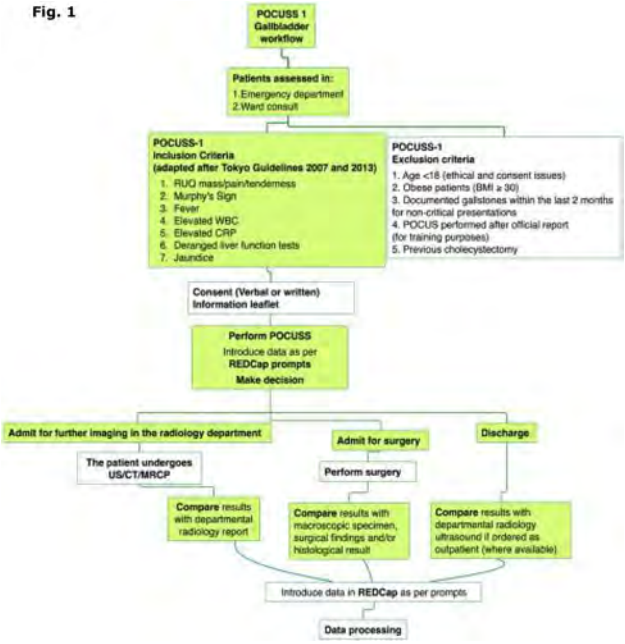
Materials and methods: We present the data from our international multi-center prospective study of surgeon-provided point-of-care ultrasound (POCUSS Trial®, ClinicalTrials.gov NCT02682368). This trial was designed to assess the sensitivity and specificity of point-of-care ultrasound by surgeons. It is focused on diagnosis and measurement of severity in patients presenting to Emergency Department with a clinical suspicion of acute cholecystitis (POCUSS-1) or sigmoid diverticulitis (POCUSS-2). The primary outcome was the accuracy, sensitivity, specificity of ultrasound diagnosis while secondary outcomes were length-of-hospital-stay and the agreement with radiology department.

Results: Six surgeons from 3 different countries scanned 145 patients:100 in the POCUSS-1 group and 45 in the POCUSS-2 group. After sonography 79/100 of POCUSS-1 patients underwent formal radiological investigations, 5/100 underwent direct laparoscopic cholecystectomy without further imaging and 16/100 were discharged. Overall POCUS-1 accuracy was 88.1% with a 94.2 sensitivity and 78.1 specificity. Cohen's Kappa was 0.74, confirming substantial agreement between surgeons and radiologists for biliary disease. All POCUSS-2 patients underwent subsequent CT-scan and the overall POCUS accuracy was 88.8% with a 0.56 Cohen's Kappa. Mean time from POCUS to the official radiology report was 11.9 h in the gallbladder group and 9.14 h in the diverticulitis group.

Conclusions: Point-of-care sonography is a useful adjunct to the clinical examination in facilitating a timely diagnosis and can be safely and successfully performed by surgeons for common emergencies.

References:

Fig. 1



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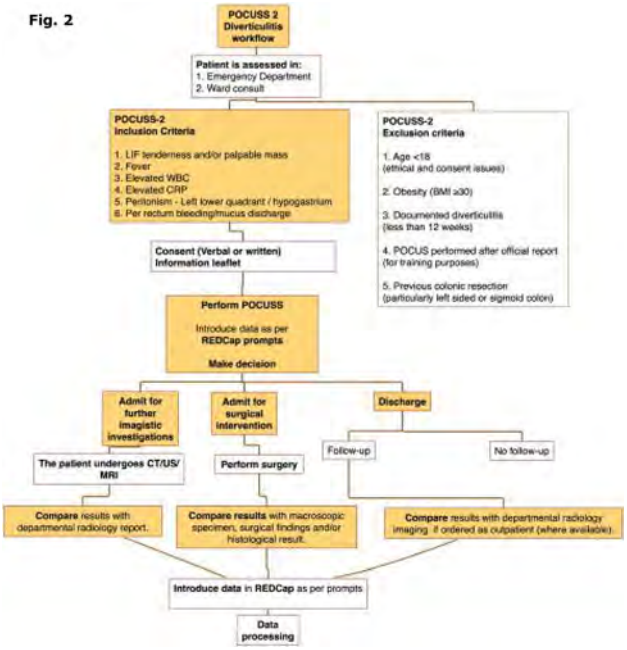

O 14

Outcomes of high risk emergency laparotomies in an emergency general surgery unit: a comparison by sub-speciality

M. Fok[1], *A. Kattakayam*[1], *F. Wileman*[1], *N. Misra*[1]

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Introduction: Emergency laparotomy (EL) still carries a significantly high risk of mortality and morbidity. Our hospital has a defined emergency general surgical unit which works closely with sub-specialty colleagues, to produce an almost symbiotic model of care. This study assesses whether the subspecialty of surgeon lends to different outcomes when performing specific procedures in EL in our unit.
Materials and methods: A prospective database of all patients undergoing EL from 2014 to 2019 at our institution was interrogated. Primary outcomes defined were 30-day mortality. Statistical analysis was by Kaplan–Meier survival analysis and ANOVA.
Results: A total of 950 patients were identified who under EL (average age 62.8 ± 16.7, male:female 454:502, in hospital mortality 16.2%, median ASA 3 IQR 2–3). Of these 105 patients underwent Hartmanns procedure, (47, 32, 26 performed by colorectal surgeons, EGS and non-colorectal/non-EGS surgeons respectively). Overall in hospital mortality was 16.2%, mortality subdivided by speciality as before was 17%, 13% and 19% respectively. Survival to discharge measured with Kaplan–Meier curves were non-significant between groups ($p = 0.908$). This was without significant differences in age (mean 66.2 ± 15.4, $p = 0.391$), ASA (median 3 IQR 2–3, $p = 0.541$), and predicted mortality from p-possum and NELA risk prediction scores (mean 23.5 ± 23.7, $p = 0.195$ & mean 12.0 ± 14.3, $p = 0.435$ respectively). This data was consistent for colorectal resection ($n = 164$ patients, Kaplan–meier analysis $p = 0.123$), upper GI operations ($n = 95$ patients, (bleeding and perforation), Kaplan–meier analysis $p = 0.622$) and small bowel obstruction or resection ($n = 328$, Kaplan–meier analysis $p = 0.451$).
Conclusions: Our model of symbiotic emergency surgery care does not lend to significant differences in outcomes for procedures in EL. Our model may be applicable to other hospitals with a subspecialised EGS.

O 15

Targets for emergency operative experience in the United Kingdom: a numbers game?

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Introduction: The UK Joint Surgical Training Committee mandates trainees to achieve indicative numbers for key surgical procedures for training progression. Procedures are divided into elective procedures and emergency general procedures. A recent report recognises a need for greater training in acute general surgical emergencies (1) and anecdotal evidence illustrates many trainees meeting requirements for sub-speciality procedures while struggling to achieve requirements for emergency procedures.
Materials and methods: Mean indicative numbers based on completion of training were calculated for a 6 month training rotation across 5 general procedures; Emergency laparotomy, Hartmann's procedure, segmental colectomy, appendicectomy and inguinal hernia repair. Mean values were compared to numbers achieved in a 6 month training rotation with an Emergency General Surgery and Major Trauma (EGSMT) team at a UK major trauma centre. Training ratios were calculated to represent training opportunity.
Results: National guidance requires the UK surgical trainee to complete a mean 8.3 emergency laparotomies per 6 month rotation. 21 were performed in EGSMT (training ratio 2.52). Of these, a mean 0.42 Hartmann's and 1.67 segmental colectomies are required. Training ratios achieved with EGSMT were 4.80 and 1.80 for Hartmann's and segmental resections respectively. For appendectomy, a mean 6.67 is necessary. 21 were performed in EGSMT (training ratio 2.40). Lastly, a mean 5 inguinal hernia repairs are necessary per 6 month rotation. 10 were completed with EGSMT (training ratio 2.0).
Conclusions: Based on a 6 month cross-section, surgical trainees embedded in this EGSMT team can expect to surpass mean national training requirements for emergency/general procedures. These results suggest surgical training within an EGSMT team offers vital experience for surgical trainees regardless of chosen sub-speciality.
References: 1 Improving Surgical Training. RCS England. 2015

O 16

Oxiplex-AP may reduces development of intra-abdominal adhesions after laparotomy

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Introduction: Post-operative adhesions are associated with increased risk of morbidity and mortality. Up to date no effective measures has been introduced to decrease intra-abdominal adhesions following laparotomy. Oxiplex-AP gel has been used in extra-abdominal surgical procedures to prevent adhesions. In the current study Oxiplex-AP was tested in a mural animal model to investigate its efficacy in reducing post-surgical intra-abdominal adhesions.
Materials and methods: Forty rats subjected to laparotomy were randomly divided into 4 groups of 10. A serosa injury was made on the small intestine and three different treatments were applied: simple suture, simple suture + OxiplexAP, and Oxiplex-AP only; the last group received no treatment of the injury before closure of the abdomen. All animals were kept alive for 14 days, and a second laparotomy was done to measure the intra-abdominal adhesion by the Nair Classification.
Results: At second look laparotomy a significant difference in adhesion was noticed between the simple sutures and simple suture + Oxiplex-AP were the latter had developed less adhesions. There was also a trend towards less adhesion development between the simple sutures and Oxiplex-AP only group, with less adhesions in the latter.
Conclusions: The use of Oxiplex-AP was associated with decrease adhesion formation in the current animal model particularly without suturing. Further investigations into these findings are needed.
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O 17

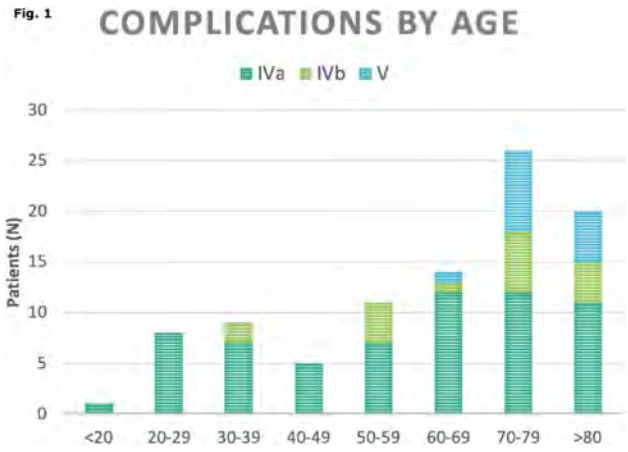
Unplanned intensive care admissions following emergency laparotomy

M. Sejka[1], A. Papachristos[1], B. Thomson[1], A. Skandarajah[1], J. Wong[1], R. Shakerian[1]

[1]The Royal Melbourne Hospital, Department of General Surgical Specialties, Parkville, Australia

Introduction: Emergency abdominal surgery is known to result in high morbidity and mortality. Furthermore, evidence suggests that unplanned admissions to the Intensive Care Unit (ICU) are associated with higher in-hospital mortality than those patients with planned ICU admissions[1]. The aim of the study was to describe the patient population who required an unplanned admission to ICU following emergency laparotomy at the Royal Melbourne Hospital.
Materials and methods: A single-centre retrospective observational study was performed using prospectively collected data between 2012 and 2017. Patients who underwent an emergency laparotomy and experienced an unplanned ICU admission were included. Patients who underwent a trauma laparotomy were excluded from the study.
Results: 764 emergency laparotomies were performed. Of these, 94 (12.3%) required an unplanned admission to ICU. Fourty-two patients (45%) were female, and 60 patients (64%) were aged 60 years and above. Sixty-three (67%) were admitted due to single organ dysfunction (Clavien-Dindo IVa). The median time to ICU admission was 5 days in patients classified to have experienced Clavien-Dindo IVa, while it was 6 days in patients who experience multi-organ dysfunction (Clavien-Dindo IVb). Thirty-seven patients (39%) were admitted to ICU due to complications classified as cardiopulmonary.
Conclusions: Recognising that emergency laparotomy is a high risk procedure, with the elderly patients accounting for the majority of unplanned ICU admissions, it is imperative to utilise risk stratification methods to guide optimal peri-operative management. This should result in improved utilisation of critical care resources and overall patient outcomes.
References: 1. Frost SA, Davidson PM, Alexandrou E, Hunt L, Salamonson Y, Tam V, Parr MJ, Aneman A, Hillman KM. Unplanned admission to the intensive care unit in the very elderly and risk of in-hospital mortality. Crit Care Resusc. 2010;12(3):171–6.

Fig. 1



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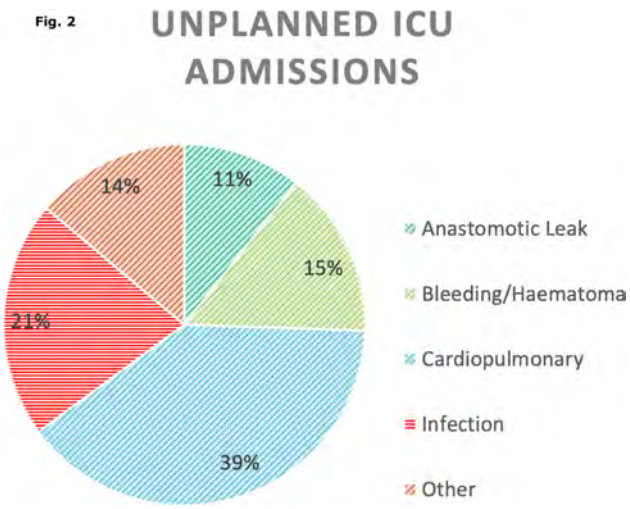

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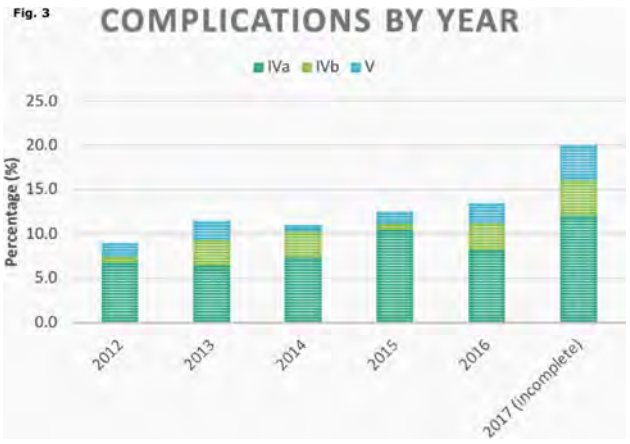

O 18

Functional end-to-end versus hand-sewn anastomosis in trauma and emergency surgery; which is safer?: a retrospective study

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[1]Tokyo Medical and Dental University, Trauma and Acute Critical Care Center, Tokyo, Japan

Introduction: The way of reconstruction following intestinal resection in the emergency settings is still controversial. The question which is better between hand-sewn and stapled anastomosis in trauma and emergency surgery occasionally arises; however, there have been few reports comparing these methods.
Materials and methods: A record-based retrospective study was performed to compare hand-sewn with functional end-to-end anastomoses in trauma and emergency operations from October 2014 to October 2019 in one of the largest trauma and emergency centers in Japan. The patients who had intestinal resection with functional end-to-end or hand-sewn anastomosis in an emergency surgery were included. The patients who had covering ileostomy or colostomy, or who underwent surgery as an elective operation were excluded. The primary outcome is the rate of complication associated with

anastomosis. The statistical analyses were performed using a Chi square test for nominal and a t-test for continuous variables.
Results: A total of 105 patients met the criteria, and among them, 74 (70.5%) had a functional end-to-end anastomosis (functional group) and 31 (29.5%) had hand-sewn suture anastomosis (hand-sewn group). Age, sex, and operative time were not significantly associated with the rate of complications. The rate of anastomotic complication in the functional group was 16.2%, and that in the hand-sewn group was 0.0%. ($p < 0.05$) Regarding types of intestines, small-to-large intestine anastomosis was more complicated (33.3%) than small-to-small (9.9%) or large-to-large (0.0%) intestinal anastomosis. ($p < 0.05$)
Conclusions: Functional end-to-end anastomosis was shown to cause more complications than hand-sewn anastomosis in this study.
References: Brundage SI, et al. Stapled versus sutured gastrointestinal anastomoses in the trauma patient: a multicenter trial. J Trauma. 2001;51:1054–61.

O 19

Incidence of endoscopic verified bleeding ulcer and the effect of tranexamic acid in treatment of bleeding ulcer. Cost recommendations

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[1]University Hospital, Surgery, Linkoping, Sweden

Introduction: Patients presenting with signs of gastrointestinal (GI) bleeding is a common group in an ER-setting. GI-bleeding is frequent and has life-threatening potential, in Sweden about 136/100 000 is affected, the mortality rate is 8–6%, most among patients with cardiovascular diseases. Regarding upper GI-bleeding there is suggestions that TXA anti-fibrinolytic effect may decrease the need for acute endoscopy and other treatments.
Materials and methods: The material in this retrospective case–control study are from the years 2010–2016. In total 1331 patients were examined. There were 387 patients included with endoscopic verified ulcer, 247 without TXA and 139 with TXA treatment. Studied variables were sex, age, blood pressure, hematemesis, melena, hematochezia, abdominal pain, re-bleeding, length of hospital stays, days of ICU care and 30-day mortality at the University hospital of Linkoping, Sweden.
Results: The incidence of upper acute gastrointestinal bleeding was 0.0126 during the studied years. In this study the mean age was 71.2 year, 153 (39.5%) were female, 24 (6.2%) had re-bleeding and 40 (10%) had ICU care. Median hospital stay was in 4.7 (0–37) days and 25 (6.4%) had 30-day mortality. Patients with tranexamic acid included treatment had re-bleeding in 16 of 247 cases ($p = 0.004$). Logistic regression analysis showed no difference between length of hospital, re-bleeding, ICU care or other studied variables.
Conclusions: The incidence of acute upper gastrointestinal bleeding in this material was 0.0126, still quite high. No significant results regarding re-bleeding, hospital stay and 30-day mortality was found. Cost for TXA use and time-consuming work for nurses at the hospital could be used on better things. It is not unusual that TXA acid are used, anyhow ordinary patients and even those treated at the ICU don't have any benefit of TXA. In conclusion we could say from this study, stop use tranexamic acid in patients with bleeding ulcer.

O 20

Abdominal wall reconstruction (AWR) for complex abdominal wall hernia in high-risk patients: interim results of a prospective longitudinal study

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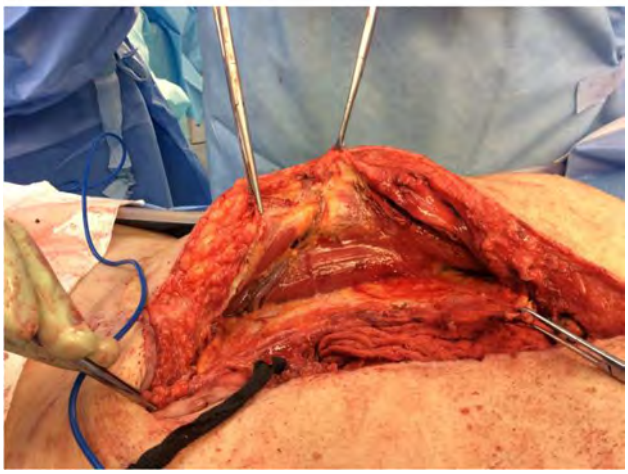
Introduction: Complex abdominal wall hernia (CAWH) present with significant technical challenges and it is an ever-evolving field. Our study aims to evaluate the early and long term clinical outcomes of the acellular porcine dermal matrix in high-risk patients at a tertiary care university hospital.
Materials and methods: This is the mid-term results of an ongoing prospective study which started enrollment in July 2017. All patients who underwent abdominal wall reconstruction with biological mesh for CAWH were included in the analyses. The data is being collected for demographics' etiology of hernia, comorbidities, and frailty. Intraoperative variables include the type of surgical approach and component separation (anterior, posterior or combined), mesh type, size, and placement technique, and associated procedures (intestinal resection, stoma/fistula takedown). Population of interest are elderly, post solid-organ transplant and CAWR in acute phase. Perioperative complications are noted down based on Clavien- Dindo class and comprehensive complication index.
Results: Of 114 patients with a mean age of 58 ± 14.2 years, males were in majority as compared to females (62.3% vs. 37.7%). Elderly (aged ≥ 65 years) were the largest sub-segment of our patient population (34.2%) and the overall incidence of frailty was 30.2%. The AWR was performed electively in 65% of cases and under emergent/urgent settings in 35% of patients. Majority of patients had higher ventral hernia working group grade (VHWG 3 & 4) i.e. 60.5%. About 75.4% of patients had higher ASA score 3, 4 and 5. The 30-day, 90-day and 120-day readmission rates are 13.2%, 5.3% and 3.5% respectively. Wound infection (14%) is the most common complication followed by wound necrosis (5.3%) and seroma (2.6%). There has been no recurrence on 2 years of follow-up.
Conclusions: High-risk patients with multiple comorbidities and higher VHWG class may safely undergo AWR with the porcine Acellular dermis.

Fig. 1



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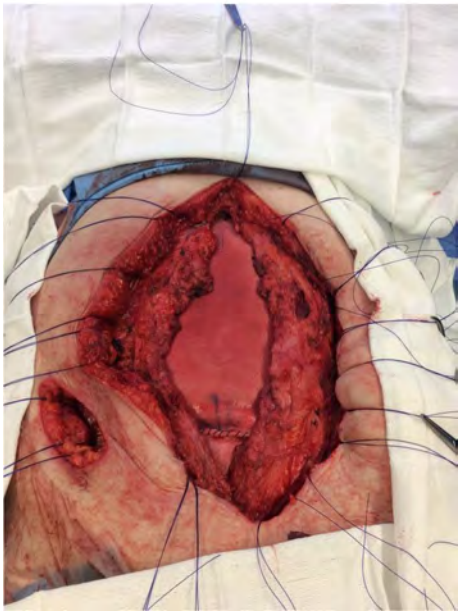

ABDOMINAL TRAUMA

O 21

Poor compliance with obstetric trauma imaging guidelines: is it time to re-evaluate the role of CT and X-ray?

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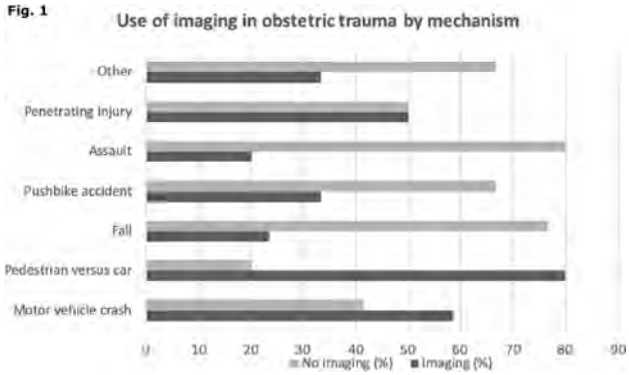
Introduction: Trauma occurs in 8% of pregnancies and is the leading cause of non-obstetric fetal and maternal death. The principle of management of obstetric trauma patients is that they should be assessed as if non-pregnant, with the fetus being the second priority. As such, obstetric patients should receive imaging as per trauma guidelines, based on mechanism of injury and clinical status, as highlighted in the Royal Melbourne Hospital (RMH) pregnancy and trauma guidelines. A previous study at RMH showed compliance with guidelines is poor, and this study aims to assess if this has improved.
Materials and methods: A retrospective review was conducted of the RMH Trauma Registry identifying all pregnant patients presenting to RMH emergency department from January 2015 until December 2018 following trauma. Demographic data, mechanism of injury, initial vital signs, and initial imaging completed in the emergency department was collated. This information was compared to the imaging guidelines for pregnant trauma patients to establish compliance with guidelines.
Results: The compliance with imaging guidelines was examined in 388 pregnant major trauma patients, 124 of whom were involved in high-risk mechanism trauma. Of the high-risk group, imaging was performed in 80.6% of patients, but complete in only 14.5% of patients. Over the four years, compliance with computer tomography (CT) of chest and abdomen/pelvis increased and decreased with pelvic and chest x-rays (XR).
Conclusions: Fear of radiation in pregnancy appears to have persisted, with ongoing poor compliance with obstetric trauma guidelines. The trend towards CT and away from XR may reflect a reasonable practice by clinicians to minimise radiation. While improving compliance with guidelines is important, so is reviewing the role of x-ray in obstetric trauma guidelines.

Fig. 1



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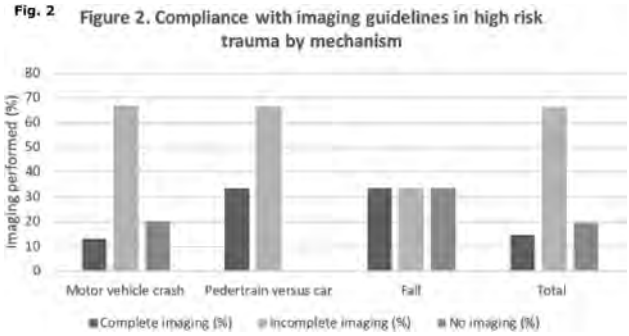
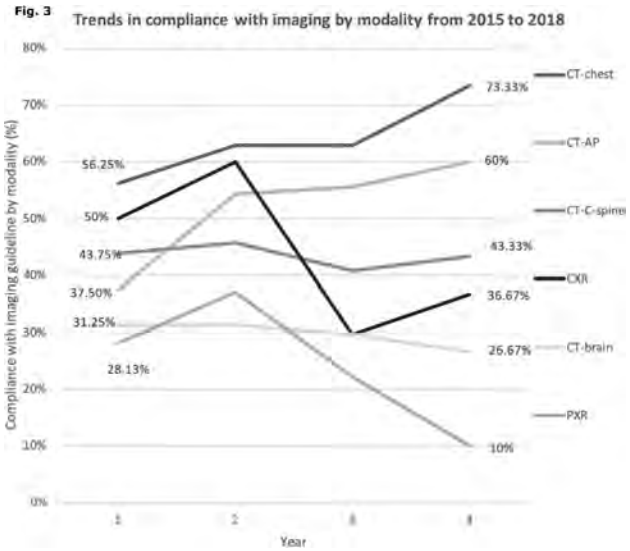
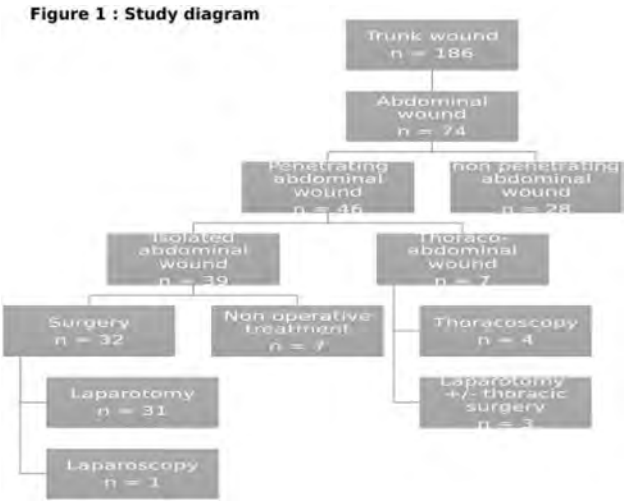






O 22

Complication and quality of life and after laparotomy for penetrating abdominal trauma

G. Pauleau[1], M. Senra[1], Y. Goudard[1], G. Goin[1], B. De La Villéon[1], P. Sockeel[1]

[1]Laveran Military hospital, Digestive surgery, Marseille, France

Introduction: Injuries are the fourth leading cause of death in Europe. Laparotomy is the standard treatment for penetrating abdominal wounds. Because of the morbidity and the high rate of negative laparotomies, the nonoperative treatment is effectively developing. The aim of this study is to analyze the complications and the quality of life of the patients after laparotomy for this kind of wounds.

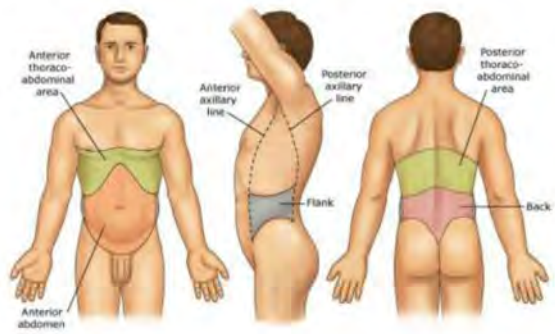
Materials and methods: A retrospective cohort of patients was studied between 2007 and 2016 at the Laveran military teaching hospital in Marseille. One hundred and eighty-six trunk gunshot or stab wound were recorded, including 74 abdominal wounds. Thirty-four patients were managed by laparotomy and included in this study. The patients and their referring general practitioners were contacted to complete missing data and the SF-12 quality of life score.

Results: Among the 34 patients included, the average age was 39 years and most of them were men. The indication for laparotomy was mainly based on the hemodynamic instability, then according to the results of the computed tomography in case of suspicion of specific lesions: bowel injuries, major vascular injury, mesenteric or mesocolic vascular injury, diaphragmatic injury and intraperitoneal bladder rupture. Only 5 laparotomies were negatives. Eleven complications after laparotomy were found (32,4%), including 7 early (within the 30 days) and 4 late. No complication was found after negative or non-therapeutic laparotomies. The quality of life of the patients after one year is similar to those of the general population.

Conclusions: The most common indication for laparotomy for abdominal penetrating trauma is hemodynamic instability. The rate of laparotomy complications for penetrating abdominal trauma is similar to those of scheduled surgeries. The quality of life after this care remains unchanged. These results may insist on the fact that the "gold standard" treatment for penetrating abdominal injury remains the laparotomy.

References: 1. Fink C. Br J Surg. 2014.
2. Bain K. Surg Endosc. 2018.

Figure S1 **Location of wound entry port (n=74)**



	Anterior abdomen	Back	Flank	Thoraco-abdominal area
Penetrating (n=46)	26	4	5	11
Non penetrating (n=28)	11	12	2	3

Table 1 ***Patient characteristics***

	n	%	Media n	Min-max
Total	34			
Male	31	91,2		
Females	3	8,8		
Age (median years)			39	19-85
Mechanism of injury	*n*	%		
stab	19	56		
gunshot	15	44		
Associated Injuries	*n*	%		
Head and neck	1	2,9		
Face	2	5,8		
Chest	11	32,3		
Extremity	10	29,4		
Trauma Scores				
Injury Severity Score			13	4-29
Revised Trauma Score			11	6-12

Table 2 *Trauma laparotomy indications (n=34)*

Clinical indications	n	%
Haemodynamic instability	8	23,5
Abdominal pain with defence	4	11,8
Evisceration of bowel/omentum	6	17,6
Object in place	1	2,9
Positive findings on CT scan		
Mesenteric or mesocolic vscular injuries	2	5,9
Bowel injuries	5	14,7
Diaphragmatic injuries	1	2,9
Without indication criteria (clinic or CT scan)	7	20,6

Table 3 ***Complications according to Clavien-Dindo***

	n	%	Early (before D30)	Late (after D30)
Clavien I				
Ileus	1		1	
Clavien II				
Sepsis	1		1	
Abdominal wal abscess	2		2	
Clavien III				
Intra-abdominal abscess	3		2	1
Incisional hernia	2			2
Samll bowel obstruction	1			1
Clavien IV				
Acute Respiratory Distress Syndrome	1		1	
Total	**1**	**32,4 %**	**7 (63,6%)**	**4 (36,4%)**

O 23

Complications following splenic embolization: have things changed over time?

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Objectives: Splenic artery embolization (SAE), a routinely used adjunct in the non-operative management (NOM) of splenic injuries(SI), was widely adopted in trauma about two decades ago. We examined complications that occurred with this modality at a level 1 Trauma Center over a recent 8-year period and compared this to the prior 11 years.
Methods: Patients who had SAE for SI between 2011–2018 were identified. SAE complications were noted. Splenic abscess, splenic infarction and contrast-induced renal insufficiency were considered major complications. Coil migration, fever and pleural effusions were regarded "minor" complications. The results were compared with data from a prior study examining similar indices at the same trauma center between 2000 and 2010. Fishers exact test was used for comparison.
Results: There were 716 patients admitted with SI in the recent period, of which 159 (22%) underwent immediate splenectomy. SAE was performed in 74 (13.3%) of the 557 patients who underwent NOM. Of these SAE patients, 50% had a contrast blush and 41.9% were either AAST Grade 4 or 5. Five SAE patients (6.8%) had splenectomy for continued bleeding. The overall complication rate was 28.4%. Major complications occurred in 11 patients (14.9%) and minor in 13 patients (17.6%). Embolization location in the splenic artery was proximal in 54.1%, distal in 20.3% and in both in 25.7%. There was no association between complications and coil location by logistic regression. Differences between the two periods shown in Table 1.
Conclusion: SAE continues to be a useful adjunct in NOM of SI and has seen increased utilization. Complications continue to occur, - although fewer minor complications were noted in the second period. No association between embolization location and complications was noted in the recent period. Judicious utilization of SAE is imperative given the complications that continue to be noted from this procedure.

Fig. 1

	Prior Study (2000 – 2010)	Current Study (2011 – 2018)	P value
Initial Nonoperative management	1085/1383 (78.5%)	557/716 (77.8%)	0.7380
Splenic Embolization (SAE) Rate	**88/1085 (8.1%)**	**74/557 (13.3%)**	**0.0012***
Major SAE complication	12/88 (13.6%)	11/74 (14.9%)	0.8256
Minor SAE Complications	**30/88 (34.1%)**	**13/74 (17.6%)**	**0.0206***
SAE Failure	5/88 (5.7%)	5/74 (6.8%)	1.0000
Increased complication with Distal Embolization	Yes	No	

O 24

The effect of the time spent in the emergency department on the mortality rates and cause of death in patients who underwent emergent laparotomy

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Introduction: The purpose of this study was to a) examine the effect of the time spent in the Emergency Department (ED) on hypotensive patients in need of emergent laparotomy and b) to determine the mortality rates and cause of death in these patients.
Materials and methods: Between 2007–2017, 184 patients were included (99 men and 85 women, mean age 45.2 years) who underwent laparotomy less or equal to 90 min from ED admission. Of the 184 patients, 107 (group 1) had a systolic blood pressure (SBP) greater than 90 mmHg and 77 had a SBP less or equal to 90 mmHg. All patients had abdominal injuries with an Injury Scale Score (ISS) between 3 and 6. The in-hospital mortality represented the primary outcome, while secondary outcomes included cause of death and time to death.
Results: In this study both groups spent a median of 51 min in the ED, but the time from the ED to the operating theatre was shorter in the group 1 (40 min versus 76 min). In total, the mortality rate was 27%, but in the group 1 the mortality was 49%. The SBP on arrival in the ED was strongly associated with the risk of death. Furthermore, we observed significant positive correlation between the probability of death and the time spent in the ED, with an increase of probability of death equal to 0.40% per minute spent in the ED. In both groups the hemorrhage was the commonest cause of death (62%).
Conclusions: The results of this study indicate that, in patients with abdominal injuries requiring emergent laparotomy, the probability of

death is proportional to both extent of hypotension and the length of time spent in the ED. Especially, in patients who were presented with a SBP inferior of equal of 90 mmHg, this probability increased as much as 2% for each 5 min. Despite many advances in trauma surgery, half of hypotensive patients are going to die in the first 24 h.

References: 1. Gruen RL, Jurkovich GJ, McIntyre LK, Foy HM, Maier RV. Patterns of errors contributing to trauma mortality. Ann Surg. 2006;244(3):371–80.
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Fig. 1

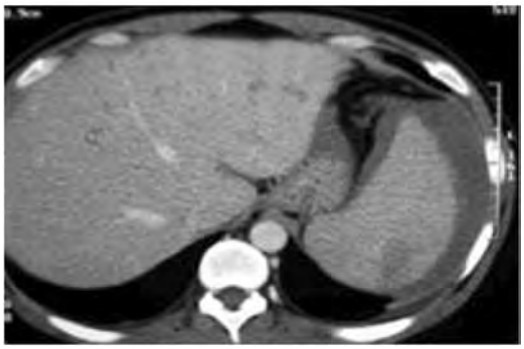
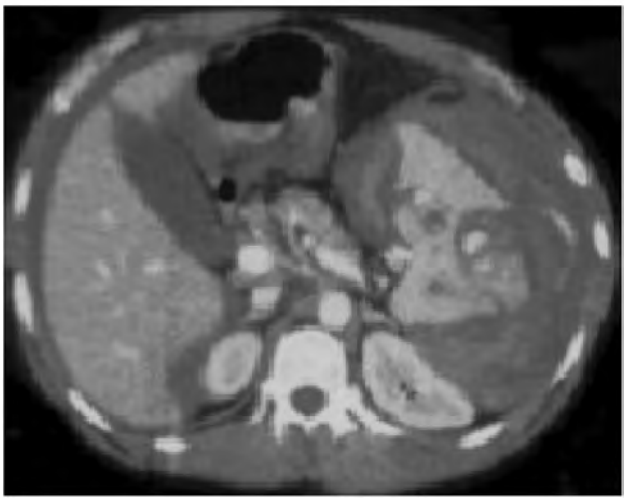


Fig. 2

Fig. 3



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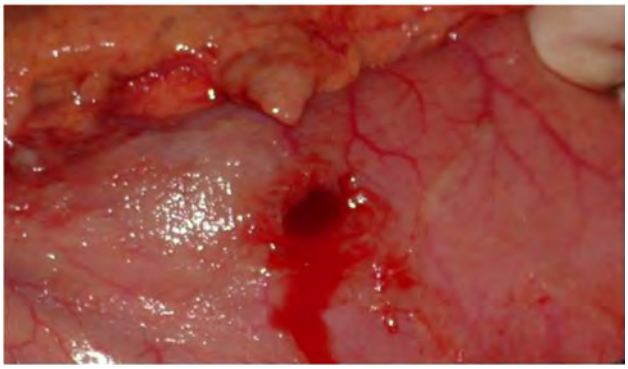
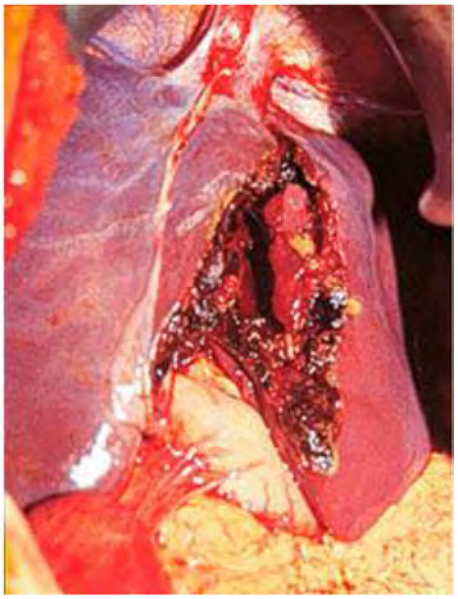


Fig. 5



O 25

A study to assess pancreatic endocrine and exocrine functions in patients with pancreatic trauma

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Introduction: Injury to the pancreas may lead to significant morbidity and mortality. We studied the prevalence of pancreatic endocrine and exocrine functions and evaluated the morphological regenerations in pancreas following partial pancreatectomy.

Materials and methods: Patients with pancreatic trauma were recruited ambispectively from January 2010 to December 2017. Endocrine functions were assessed at the time of admission and at 6 months follow up with 75 g oral glucose tolerance test (OGTT), Serum Insulin and C-peptide levels, HbA1c estimation and exocrine functions were assessed with Faecal Elastase Test. Pancreatic

volumetry was done with imaging studies at 1- and 6-months post discharge.
Results: Twenty patients were studied with a median age of 30 (18–48) years at the time of injury. All the patients were normoglycemic on admission; only one patient who underwent pancreatic resection developed Diabetes Mellitus requiring Insulin on follow up. 7 patients (35%) were found to have Prediabetes by American Diabetes Association (ADA) Criteria. 11 patients (55%) had Pancreatic Exocrine Insufficiency. Pancreatic Volume increment, from mean pancreatic volume of 48.65 cm3 to 54.29 cm^3, was noted in partial pancreatectomy patients.
Conclusions: Overt endocrine and exocrine insufficiency is rare in pancreatic trauma patients. But subsets of patients are biochemically predicted to have higher risks of endocrine dysfunction and exocrine insufficiency. Hence, while dealing with pancreatic trauma patients, one should remember the possible metabolic disorders associated and the need for specific investigations. Pancreatic volume increment is a new finding which opens up more opportunities for further research.
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O 26

Rope bullfights related trauma injuries: the first descriptive study

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Introduction: Rope bullfights are traditional events in the Azores islands, where a bull is set on the streets, arrested by a rope on its neck. Around 220 events happen every year and it is already part of the island's touristic attractions. Inevitably, every year, people get injured either from direct trauma with the bull or from falls when trying to escape from the animal. The aim of this study was to characterize the type of injuries that occur in these bullfighting events, as to their incidence, mechanism of injury, anatomical affected area and severity.
Materials and methods: We prospectively registered all cases of injured people who suffered any type of trauma during rope bullfights and received emergency therapy in the local Hospital, between 2018 and 2019.
Results: 56 patients recured to the emergency department, 16.1% female, with mean age of 44.2 years. Regarding the mechanism of injury, 66.1% occured due to direct trauma to the animal while in the remaining 33.9% resulted from falls during escape or handling of the rope. The most commonly affected anatomical areas were the limbs (39.3%) followed by the head and neck (23.2%) and thorax (7.1%). In 26,8% of the cases, patients suffered from multiple traumas. In 76.8% of the cases the treatments performed were wound care, wound closure and/or symptomatic therapy. In total, 10 patiens were hospitalized, 5 patients required interventions in the operating room (4 closed fracture reductions and 1 exploratory laparotomy with splenectomy) and 2 patients were hemodynamically unstable upon admission (hypovolemic shock due to splenic fracture and CET).
Conclusions: The rare articles published describe the mechanisms of injury associated with bullfights in spanish centers and injuries resulting from wild cow accidents in indian cities. This is the first local descriptive study on the prevalence of traumatic injuries associated to this specific type of rope bullfights.

O 27

Management of traumatic abdominal wall hernias: is there associated bowel injury?

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Introduction: Traumatic abdominal wall hernias (TAWH) are rare, and mostly due to high energy trauma. Because of this low incidence and the wide variety of associated injuries, ideal timing and surgical procedure are still unclear. A retrospective study was conducted to evaluate the feasibility of TAWH's non-operative management of the parietal wound and to highlight the high rate of associated abdominal injuries.
Materials and methods: A cases series retrospective review was achieved in a Level 1 Trauma Centre at Edouard Herriot Hospital in Lyon, France between July 2014 and May 2019.
Results: We report 9 cases of TAWH Bodyscan enabled diagnosis of intra-abdominal injuries for 5 patients. Emergency laparotomy was performed for more than half of the cases. Three of them were indicated because of bowel injuries; bowel sutures/resections were made. Hernia was not repaired and conservative management was decided because of the hernia's width. Conservative hernia management was chosen for seven patients (78%) without any complications. Median follow up was 2,5 months. Patients did not present any symptoms related to the hernia. Median BMI at time of accident was 27.4 kg^{-2}.
Conclusions: TAWH are rare and their management is not well standardized in the literature. Obese patients are more at risk, probably because of incorrect seatbelt placement. Intra-abdominal injuries are often associated. When bowel injuries are suspected, emergency explorative laparotomy must be achieved. If immediate surgery is not needed, non-operative management is safe.
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Matalon SA, Askari R, Gates JD, Patel K, Sodickson AD, Khurana B. Don't forget the abdominal wall: imaging spectrum of abdominal wall injuries after nonpenetrating trauma. Radiogr Rev Publ Radiol Soc N Am Inc. 2017;37(4):1218–35.

Fig. 1

Fig. 2

Fig. 3

Abdominal wall grade	Definition
I.	Subcutaneous tissue contusion
II.	AW muscle hematoma
III.	Single AW disruption
IV.	Complete AW disruption
V.	Complete AW disruption with abdominal content herniation
VI.	Complete AW disruption with evisceration

O 28

Prophylactic embolisation of the splenic artery fot traumatic lesions diagnosed in CT and/or MRI imaging can prevent a two-stage rupture

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Introduction: The two-stage splenic rupture is seldom, its risk is unpredictable and a precise diagnosis of a CT and/or MRI imaging unexpectable or unexcludable. Generally, and due to our experience and current literature a two-stage rupture occurs within one week after trauma. Though dramatic courses after two or three weeks are known. Therefore, it is suggested to perform a prophylactic angioembolization in (still) hemodynamically stable patients.
Materials and methods: A retrospective study in a level-one trauma centre of Switzerland did analyse all patients that underwent a prophylactic angioembolisation after an explicit diagnose by CT and/or MRI of a splenic parenchymal lesion after trauma between 2010 and 2016. Further inclusion criteria were hemodynamical stability (sys RR > 90 mmHg) and missing indication for immediate laparotomy.
Results: 11 patients (4 f, 7 m) with an average age of 44 ± 15 years underwent preemptive angioembolisation after traumatic lesions of the spleen. The AIS abdomen was 3 in 9 and 4 in 2 patients. Besides a splenic injury 3 patients did also have a kidney injury. The overall ISS was 22 ± 5 points. 8 patients suffered additional thoracic or head trauma. In 5 patients the angioembolisation was performed on admission, in 1 on the 1st, in 3 at the 2nd and respectively 1 in the 3rd and 4th day of. In 1 case an uncomplicated selective embolization of a main duct of the splenic artery was performed. In 10 patients the trouble-free proximal embolization of the splenic artery was done. The average stay was 11 ± 6.0 days. No deaths or complications seen due to angioembolisation or splenic rupture. There were no complications or operative procedures necessary in the median follow-up of 3 month (0–36 month).
Conclusions: The angioembolisation of the splenic artery is a possible and minimal invasive method to prevent the feared and risky complication of a two-stage splenic rupture after abdominal trauma.

O 29

Operatively treated traumatic abdominal wall hernias in a major scandinavian trauma center

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Introduction: Traumatic abdominal wall hernias (TAWHs) are uncommon, and the optimal management is debated. TAWHs most often result from blunt trauma and are associated with severe intraabdominal injuries. Our institutional protocol mandates primary repair only if the patient undergoes laparotomy for other reasons and is without mesh. Since 2011, primary repair of lumbar hernias included bone anchors when indicated. We wanted to describe the TAWH patients treated operatively during initial hospitalization focusing on injury mechanism, diagnosis, associated injuries, operative techniques, early complications and outcomes.
Materials and methods: We performed a retrospective, descriptive cohort-analysis of data from the institutional Trauma Registry from 2007–2018. All operatively managed TAWHs were identified based on AIS codes, NCSP codes and relevant key words.
Results: Of the 30 identified patients, 14 (47%) were women. Median age was 37 years (range 10–73). Median ISS was 20 (1–57) and 21 patients had ISS > 15. Injury mechanism was blunt except for one explosion. 25 patients (84%) had been in a MVC, and 23 of these (92%) had seat belt injuries. 22 of these patients had a disruption of the muscle from the iliac crest, and one had a hernia through a fractured iliac wing. 3 bicycle falls and 1 fall from height had hernias in the anterior abdominal wall. Two meshes were placed, with no known complications. Bone anchors (Twinfix®3,5 mm) were used in 7 patients. No recurring hernias were identified in the 18 patients with routine follow-up (1–21 months).
Conclusions: Surgery for TAWH is uncommon in our institution. TAWH is often associated with severe torso injuries and primary repair is only done when laparotomy for other reasons is indicated. Primary suture of the muscle, including use of bone anchors seems to be adequate treatment, as we have identified no recurrences. A long-term follow-up study is warranted for operated and non-operated patients with TAWH.

O 30

A comparison of sub-specialty operative adolescent patient outcomes in adult and pediatric trauma centers

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Introduction: Adolescent trauma victims may be treated at either an adult (ATC) or pediatric trauma center (PTC). These centers have different resources, surgeon training and overnight in-house coverage. It is not known how outcomes compare with regards to the very small subset of patients that actually undergo a surgical trauma intervention. We hypothesized that presentation to a PTC would yield increased mortality when subspecialty intervention was required and that this would be most pronounced at night when in-house attending coverage is absent at all state PTCs.
Materials and methods: A review of the Pennsylvania Trauma Outcome Study (PTOS) database was performed to capture patients aged 12–18 who underwent any non-orthopedic trauma surgery. Cohorts were created for cranial, thoracic, abdominal or vascular surgery from 2007–2017. Trauma centers were divided as adult level 1 (ATC1), adult level 2 (ATC2) or pediatric (PTC). Groups were created based on time of arrival with 7AM-7PM being dayshift and 7:01PM-659AM being night shift. Age, race, mechanism of injury, vital signs, GCS, ISS, LOS and mortality were evaluated. ANCOVA was utilized to control for ISS variation. SPSS was used for all analyses.
Results: 1851 patients met initial criteria. ATC1s saw more minority patients and more males than other center types. ATC1s saw an overall older cohort (16.9 years vs 16.6 years in ATC2 and 14.6 years in PTC, $p < 0.001$). Despite this age difference, presenting systolic blood pressure was lowest at the ATC1s (117.8 mmHg vs 125.7 mmHg at ATC2 and 125.34 mmHg at PTC, $p < 0.001$). ISS and TRISS and overall mortality were not different and this included when grouped by day or night shift. Of note, trauma thoracotomy was more likely to be performed at night in adult centers. Hospital length of stay was significantly lower for ATC2 (8.33 days vs 10.41 in ATC1 vs and 11.38 in PTC).
Conclusions: Adult and pediatric trauma centers see different patients. Operative trauma cases are surprisingly low at our state's PTCs and trauma thoracotomy was more likely to be performed at night in ATCs than PTCs. Broader study is needed to uncover differences in operative care and outcomes.

Fig. 1

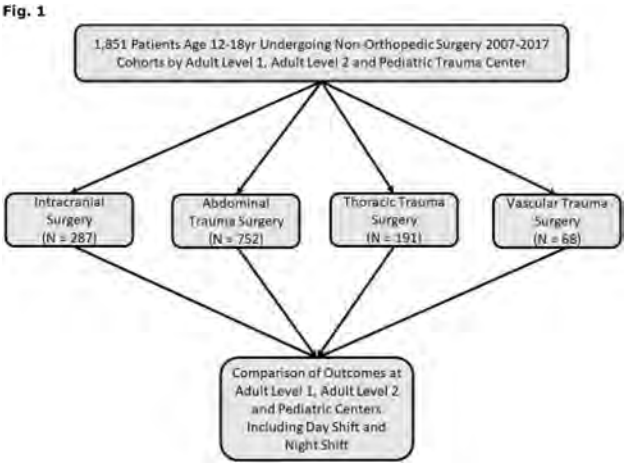
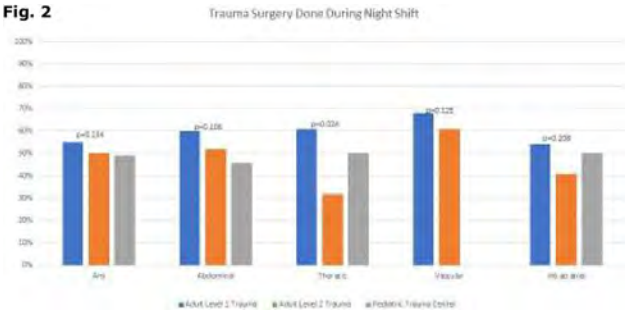


Fig. 2



LOWER EXTREMITY INJURIES

O 31

Treatment of dislocation of the patella as a result of sports injuries in children. Forecast and consequences in adulthood

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Introduction: Dislocations of the patella with a rupture of the medial patellofemoral ligament (MPFL) account for 8–10% of acute injuries of the knee joint [1, 2]. Inadequate therapeutic tactics of these injuries in childhood and youth, as a result of sports injuries, are fraught with complications in the form of the instability of the knee joint, residual deformities and contractures in patients in adulthood [2, 3].
Materials and methods: In the period from 2014 to 2018 349 cases of rupture of MPFL among children aged 7–18 years who were involved in sports were observed. The examination included conducting a clinical examination, axial radiography with flexion of the joint at angles of 45° and 90°, MRI of the knee joint.
Results: In 87.9% (307 cases) the integrity of the MPFL(with a reduced number of sutures) was restored using a Yamamoto suture, and in 42 cases (12.1%), the autoplasty of the MPFL was performed. Excellent medium-term (5 years) clinical and functional results according to the IKDC scale were noted in 80.2% of cases, good in 14.9%, satisfactory in 4.9%. In 12 patients (3.4%) there was a relapse of dislocation after performing an MPFL suture during the first year after surgery mainly due to noncompliance with the recommendations.
Conclusions: Injury to the knee joint with the patella dislocation in childhood and adolescence, associated with a sports injury is an indication for surgical treatment in order to adequately restore the integrity of the MPFL and prevent disabling complications. Our Yamamoto suture technique is more optimal for treating young patients with instability of the patella and is recommended for widespread use in pediatric orthopedists due to its undeniable clinical advantages.
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2. Chotel F, Bérard J, Raux S. Patellar instability in children and adolescents. Orthop Traumatol Surg Res 2014;100 Suppl:S125–3.

O 32

Optimal variants of proximal tibial fractures fixation

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Introduction: Proximal fragments of the fractured tibia are often fixed with bone plates. However, nailing is also a method of choice to treat such fractures.
Materials and methods: The mathematical simulation of the elastic strain conditions in a bone-implant system after proximal tibial fracture analyzed the extent of bone fragments' displacement depending on injury to an anterior or posterior tibiofibular ligament, and interosseal membrane. To create the model, we used tibial

osteotomy with a defect 1 cm placed 8 cm below tibial plateau. 4 types of fixation have been simulated: plate fixation of only a medial pillar, plate fixation of only a lateral pillar, plate fixation of both pillars, and locking intramedullary nailing.
Results: In case of plate fixation of only a medial pillar, the injury to an interosseal membrane causes an expressed valgus deformation at axial loading, leading to a reasonable (1095.2 MPa) overload of the fixator in the osteotomy area. The use of a lateral plate leads to excessive loading on an external pillar, while the medial pillar remains unsupported. This causes overloads of the fixator in the osteotomy area (880.6 MPa). The double plate fixation is typical of the lowest extent of bone fragments displacements (1.25 mm). This is a super-rigid type of osteosynthesis, able to cause a stress-shielding syndrome in the adjacent bone. It has been estimated that the method of IM nailing is an optimal fixation method, with minimum loading of the fixator (250.4 MPa) and the best distribution of changed elastic strains in the bone-implant system.
Conclusions: The mathematical simulation demonstrates that fixation by a medial plate is possible only if support functions of the ligament system and interosseal membrane remained intact. If an injury is a high-energy one, nailing is preferable.

O 33

Fibrous demineralized bone matrix (f-DBM) is safe for use in critical size defect bone healing

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Introduction: Treatment of large bone defects is one of the great challenges in contemporary orthopedic and traumatic surgery. Grafts are necessary to support bone healing. A well-established allograft is demineralized bone matrix (DBM) prepared from donated human bone. A recent development is a new fibrous demineralized bone matrix (f-DBM) with a high surface-to-volume ratio. In this study we examine toxicity of an innovative DBM fibers preparation.
Materials and methods: f-DBM was transplanted to a 5 mm, plate-stabilized, femoral critical-size-bone-defect of 5 mm in Sprague–Dawley (SD)-rats (n = 6). Healthy animals were used as control. After 3 months histology, hematological analyses as well as serum biochemistry was performed.
Results: Superoxide dismutase (control: 0.24–0.44 U/mL; f-DBM: 0.20–0.43 U/mL; $p > 0.1$), malondialdehyde (control: 9.6–12.6 μMOL/L; f-DBM: 9.1–15.0 μMOL/L; $p > 0.1$) and glutathione (control: 5.8–16.2 μMOL/L; f-DBM: 6.0–28.8 μMOL/L; $p > 0.1$) were measured as indicators of free radical exposure. There were no significant differences between the control group and animals receiving f-DBM. Hematology as well as biochemistry did not differ between operated animals and control. Histologically no evidence of damage to liver and kidney and a good bone healing could be observed in most cases.
Conclusions: Taken together, these results provide evidence for no systemic toxicity of the bone allograft.
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O 34

Intramedullary nailing through suprapatellar approach in distal tibia fractures: a retrospective study evaluating clinical and radiographic results

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Introduction: Distal tibia fractures (DTF) can be operated either by intramedullary nailing (IMN) or by ORIF with plates. The current literature shows a higher rate of malalignment and consolidation delay with IMN when compared to plates. In these studies, an infrapatellar approach for the IMN is performed. Recent studies show a better alignment in DTF treated with IMN by suprapatellar approach, though functional and biological outcomes have not been analyzed yet. Our goal is to assess the clinical and radiographic results of the treatment of DTF with IMN using a suprapatellar approach.
Materials and methods: A two-center retrospective study was performed, collecting the cases with DTF treated with suprapatellar IMN from 05/2011 to 08/2018.
Results: A total of 82 patients were obtained, with a mean age of 45.5 years. The average follow-up was 13 months. 82% of the fractures were AO type 43A, presenting the remaining 18% intra-articular involvement. 6 patients presented complications, corresponding in 4 of them to superficial infections. As for clinical results, complete mobility in the knee and ankle was obtained in almost all cases. At the radiographic level, a total of 15% (12) of distal malalignment cases were detected, defined as more than 5° deviation from normal axis in the coronal and sagittal planes. Most of the fractures consolidated in a period of 3–4 months. There were 13 cases of delayed consolidation, from which 2 developed pseudoarthrosis.
Conclusions: Intramedullary nailing through a suprapatellar approach for DTF offers good clinical and radiographic results, with low rates of malalignment and lack of consolidation. More studies are required to compare the results obtained with other fixation methods for these fractures.
Reference: Avilucea FR, Triantafillou K, Whiting PS, Perez EA, Mir HR. Suprapatellar intramedullary nail technique lowers rate of malalignment of distal tibia fractures. J Orthop Trauma. 2016;30(10):557–60.

Fig. 1

Fig. 2

Fig. 3

Table 1 : Characteristics of patients (N=82)		
Variable		
	N/Mean	%
Age (years)	45.5	
Sex (% males)	50	61
Days until surgery	3.7	
Trauma energy		
Low	45	54.5
High	37	45.5
Open fracture	17	20.7
I	5	29.4
II	8	47.5
IIIA	2	11.6
IIIB	1	5.88
IIIC	1	5.88
Initial external fixation	6	7.3

Fig. 4

Reduction manoeuvre		
Closed	46	56.1
Percutaneous clamp	30	36.5
Pollar screw	6	7.3
Additional articular fixation	18	22
Cannulated screws	15	83.3
Posterior plate	3	16.6

Fig. 5

Distal coronal angle		
Immediate	-1.26°	4.29
3 months PO	-1.83	4.4
Distal sagittal angle		
Immediate	83.37	13.74
3 months PO	83.52	13.76
Proximal depth		
Coronal	12.37	11.8
Sagittal	14.65	10
Distal depth		
Coronal	11.24	4.15
Sagittal	11.52	4.23
ACN°°	10.45	6.82
PCN	46.64	7.52
Ratio ACN/PCN	0.18	0.09
ML ratio		
Immediate	0.51	0.07
3 months PO	0.49	0.06
AP ratio		
Immediate	0.49	0.09
3 months PO	0.48	0.07
Distance from fracture to tibial platfond (mm)	64.66	16.04

O 35

Is routine radiography in the follow up of trauma patients with ankle fractures (cost) effective?

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Introduction: The clinical consequences of follow-up radiographs in ankle fractures are unclear and indications for these radiographs are seldom well-defined. Routine radiographic imaging in the follow up of patients with an ankle fracture adds to treatment costs, although retrospective studies dispute its usefulness. The aim of this study was to assess if a protocol with a reduced number of routine radiographs would lead to cost savings, without compromising clinical outcomes.
Materials and methods: A multicentre randomized controlled trial was conducted. Patients were randomly assigned in a 1:1 ratio to usual-care (consisting of routine radiography at one, two, six and twelve weeks) or reduced-imaging (radiographs only obtained for a clinical indication at six and twelve weeks). Functional outcome was assessed using the OMAS and AAOS ankle questionnaires, Quality of Life was measured with EQ-5D-3L and SF-36 questionnaires. Other outcome measures included complications, pain, the number of radiographs, health perception and self-perceived recovery. Costs were measured with self-reported questionnaires
Results: The study group consisted of 247 participants, of which 154 (63%) received operative treatment. Patients in the reduced-imaging group received median 4 radiographs, whilst patients in the usual care group received median 5 radiographs ($P < 0.005$). OMAS, AAOS scores, Quality of Life, pain, health perception and self-perceived recovery did not differ between groups. We observed 32 complications in the reduced imaging group. This did not differ significantly from the usual care group (29 complications $P = 0.51$). A significant reduction in radiographic imaging costs was observed (− €48 per patient, 95% CI − 72 to − 25). Overall costs per patient were comparable (130 [95% CI − 2975 to 3723]).
Conclusions: Implementation of a reduced imaging protocol in the follow up of ankle fractures leads to cost savings and more importantly does not lead to worse functional outcomes.

Fig. 1

Table 2: overall outcome scores per treatment allocation, crude and adjusted differences in scores

Abbreviations:

	Usual care (N=126) *Median (IQR)*	Reduced imaging (N=119) *Median (IQR)*	*UC vs RI, Adjusted β (95%CI)*
OMAS *0-100*	75 (50-90)	75 (50-90)	-1.4 (-5.0 to 2.2)
AAOS ankle score *0-100*	89 (77-96)	88 (74 – 97)	-0.2 (-3.0 to 2.5)
AAOS shoe score *0-100*	67 (40-100)	60 (33-100)	-2.7 (-7.9 to 2.6)
EQ-5D *0-1*	0.82 (0.78-1.0)	0.82 (0.78-1.0)	-0.02 (-0.05 to 0.01)
SF36 PCS *0-100, 50 = average*	47.9 (37.7-54.6)	45.7 (35.3-53.9)	0.3 (-1.3 to 1.9)
SF36 MCS *0-100, 50 = average*	54.3 (48.3-54.6)	55.5 (49.1-59.1)	-0.6 (-2.2 to 1.0)
VAS pain rest *0-10*	1 (0-2)	0.8 (0-2)	0.2 (-0.2 to 0.5)
VAS pain movement *0-10*	1.9 (0.8-3.4)	1.5 (0.5-3.5)	0.1 (-0.3 to 0.5)
VAS Health status *0-10*	8 (7.0-9.0)	8 (7.0-8.5)	0.1 (-0.2 to 0.4)
Recovered *1-5, higher = better*	4 (3-4)	4 (3-4)	0.1 (-0.1 to 0.2)
Function *1-5, higher = better*	4 (2-4)	4 (2-4)	0.04 (-0.2 to 0.2)

OMAS: Olerud Molander Ankle Score
AAOS: American Academy of Orthopaedic Surgeons
EQ-5D: Euroqol 5D
SF36: Short Form 36
PCS: Physical Component Score
MCS: Mental Component Score
VAS: Visual Analog Scale
IQR: Inter Quartile Range
CI: Confidence Interval

Fig. 3

Table 2 Mean cost (in euros) per participant in the intervention and control group and mean cost differences between groups during follow-up

Cost category	Control n=128, mean (SEM)	Intervention n=118, mean (SEM)	Cost difference crude, mean (95%CI)	Cost difference adjusted, mean (95%CI)
Intervention	266 (9)	222 (9)	-44 (-70 to -20)	-48 (-72 to -25)
Primary care	967 (154)	1266 (187)	299 (-170 to 1421)	137 (-277 to 1018)
Secondary care	7435 (971)	7803 (1176)	368 (-2156 to 3457)	-169 (-2230 to 2178)
Medication	35 (9)	27 (7)	-9 (-27 to 11)	-8 (-27 to 12)
Informal care	671 (121)	647 (131)	-24(-338 to 312)	-46 (-373 to 262)
Absenteeism	976 (212)	1218 (312)	242 (-397 to 1008)	306 (-373 to 1109)
Presenteeism	4903 (627)	4373 (605)	-530 (-2084 to 979)	-29(-1503 to 1408)
Unpaid productivity loss	789 (152)	757 (164)	-32 (-467 to 410)	-12(-437 to 427)
Total	**16046 (1419)**	**16314 (1741)**	**267 (-3370 to 4778)**	**130 (-2975 to 3723)**

O 36

Results after percutaneous and arthroscopically assisted osteosynthesis of calcaneal fractures

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Introduction: Operative treatment of calcaneal fractures using the extensile lateral approach is associated with high rates of soft tissue complications. During the last years there has been a trend towards less invasive fixation methods. Percutaneous and arthroscopically assisted calcaneal osteosynthesis (PACO) combines the advantages of good visualization of the posterior facet of the subtalar joint with a minimally invasive approach.
Materials and methods: We conducted a clinical and radiographic follow-up of 24 patients with 25 calcaneal fractures treated by PACO

with a minimum follow-up of 1 year. There were 16 Sanders II and 9 Sanders III fractures. The mean follow-up period was 17.6 months (SD 6.7). Our primary outcome was the American Orthopaedic Foot And Ankle Society (AOFAS) Ankle-Hindfoot score. Secondary outcomes were the Calcaneus Fracture Scoring System (CFSS), the Manchester-Oxford Foot Questionaire (MOxFQ), the Visual Analog Scale (VAS) for pain and the incidence of complications. Radiographs were obtained to evaluate the reduction of the fractures as well as the presence of subtalar osteoarthritis.
Results: The median AOFAS score was 85 (range, 50–100), the CFSS score 85 (26–100), the MOxFQ score 26.6 (0–76.6). The VAS pain score was 0 (0–5.7) at rest and 4.05 (0–8.2) during activity. The Böhler angle improved from mean 3.5 degrees (SD 12.6) preoperatively to 27.8 degrees (10.7) postoperatively. However, the follow-up radiographs showed subsidence of the fractures and a Böhler angle of 20.4 degrees (13.2). 96% of the operated feet showed signs of post-traumatic subtalar osteoarthritis. There were no wound healing complications. Two patients were reoperated with screw removal due to prominent screws.
Conclusions: Our results suggest that PACO gives good clinical results and a reduced risk of complications in selected calcaneal fractures. Prospective longterm studies will be necessary to better evaluate the potential advantages and limitations of PACO.

O 37

The use of locally improvised negative pressure wound therapy in the management of open fractures of the lower limb in a resource restricted setting

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Introduction: The management of open fractures of the lower limb remains a challenge for orthopedic surgeons in resource poor settings. With the nascent state of microsurgical services in the region the application of negative pressure wound therapy (NPWT) has proven to be very helpful. An improvised NPWT has made it locally available to patients. This report aims to show how this has improved the management of open fractures of the lower limb in a resource restricted setting.
Materials and methods: A 30-month review of cases of lower limb open fractures managed at a regional trauma centre in Nigeria was done. The type of wounds were classified based on region and need for soft tissue coverage.
Results: A total of 256 cases were reviewed approximately 53% of these case were Gustilo and Anderson type III. Of these 87 had NPWT as part of their management. Some of the benefits of observed were; reduced frequency of wound dressings, and shorter time to optimize wound for closure.
Conclusions: The locally improvised NPWT has proven to be an affordable and cost-effective tool in the management of open lower limb fractures. It remains an invaluable alternative of care in the absence of microsurgical skills and patented device with are far from reach owing to financial constraints.
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O 38

Amputation and mortality after lower extremity vascular trauma

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Introduction: Lower extremity vascular trauma may result in limb loss or mortality. This study examined outcomes of lower extremity vascular trauma (LEVT) and potential associations to amputation/mortality.
Materials and methods: A retrospective cohort study of patients (n = 79; 82 limbs) with LEVT between 2000 and 2018 in a single trauma center. Only patients requiring a vascular procedure were included. Data were extracted from the Swedish Vascular Registry (Swedvasc) and the Swedish Trauma Registry (Swetrau).
Results: Mean age 35 ± 17 years; men 85% (67/79); trauma mechanism 49% (39/79) blunt and 51% (40/79) penetrating. 71% of patients underwent preoperative CTA; 30% of patients (23/76) were transferred to hybrid operating room. Arterial injury was present in 73/82 limbs (89%) and venous injury in 43/81 limbs (53%). The most frequently injured artery was popliteal artery (25/73; 34%) followed by superficial femoral artery (23/73; 32%). Most common vascular operative procedure was arterial bypass/interposition graft (45/82; 55%). A vascular shunt was used in 32% of cases (25/78). Fasciotomy was performed in 49% (40/81) of limbs. Four patients were lost to follow-up after less than five days. There were eleven limbs (11/75; 15%) amputated within 30-day postoperative follow-up. All amputations were caused by blunt trauma. 28% (7/25) of arterial injuries below-the-knee led to amputation. Thirty-day mortality rate was 5.3% (4/75). Univariate analysis showed that fractures ($P < 0.001$), soft tissue injury ($P < 0.001$), multiple injuries ($P = 0.011$), and blunt mechanism ($P < 0.001$) were associated with amputation and mortality after LEVT.
Conclusions: This study showed that amputations after LEVT are caused by blunt trauma. Also LEVT combined with fractures, soft tissue injury, or multiple injuries increased the risk of amputation and mortality. Multi-center study enabling multivariate analysis to adjust for potential confounding factors is imperative to confirm these findings.

O 39

Incidence, treatment and financial burden of tibial plateau fractures in Belgium between 2006 and 2018

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Introduction: Tibial plateau fractures (TPF) are complex injuries. Indications and strategies for surgical treatment are well discussed. However, complications are not uncommon, resulting in prolonged length-of-stay (LOS) and higher financial costs. (1) This study aims to

describe the incidence, evolution in management and financial burden of TPF in Belgium between 2006 and 2018. We compare national data with data from UZ Leuven (UZL), the largest university hospital in Belgium.
Materials and methods: This study includes all TPF treated in Belgium between 2006 and 2018. We identified 35.226 TPF, of which 861 fractures were treated in UZL. Despcriptive statistics were used to analyze the data.
Results: The annual incidence increased from 20.6 to 29.1/100,000/y. An increase in number was true for both operatively treated patients (OTP) and non-operatively treated patients (NOTP), but was more pronounced in the latter (31% vs. 68% increase). The rate of surgery (ROS) decreased from 41.4% to 35.5%. The mean ROS for UZL was 49.0%. The total financial burden in Belgium increased with 36%, mainly driven by increasing costs in OTP. Hospitalisation rates for NOTP decreased from 34% to 16%, as day hospital admission occured more commonly. The mean hospitalisation cost was €8,754 for OTP and €9,103 for NOTP. Costs for UZL inpatients were €10,358 and € 9,163. Nursing days accounted for 64% of the cost in OTP and 75% in NOTP. The mean LOS was 15.8 days for OTP and 18.7 days for NOTP. UZL patients had a mean LOS of 16.3 and 11.7 days.
Conclusions: TPF are associated with increasing hospital related healthcare costs. As nursing days determine the majority of the financial burden, measures should be taken to avoid prolonged LOS.
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O 40

Bilateral low-dose computed tomography assessment for postoperative rotational malalignment after intramedullary nailing for tibial shaft fractures: reliability of a practical imaging technique

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Introduction: Rotational malalignment (RM) is a common postoperative complication after intramedullary (IM) nailing of tibial shaft fractures. Computed tomography (CT) is commonly used for detection of malrotation, however reliability is frequently questioned. The purpose of this study is to evaluate the intra- and inter-observer reliability of low-dose protocolled bilateral postoperative CT-assessment of rotational malalignment after IM nailing of tibial shaft fractures.
Materials and methods: A total of 155 patients were prospectively included with tibial shaft fractures that were treated with IMN in a Level-I Trauma Center. All patients underwent postoperative bilateral low-dose CT-assessment (effective dose of 0.03784–0.05768 mGy) as per hospital protocol. Four observers performed the validated reproducible measurements of tibial torsion in degrees, based on standardized techniques. The Intra-Class Coefficient (ICC) was calculated to evaluate intra- and inter-observer reliability. The intra- and inter-observer reliability was categorized according to Landis and Koch.
Results: Intra-observer reliability for quantification of rotational malalignment on postoperative CT after IMN of tibial shaft fractures was excellent with 0.95 (95% CI = 0.92–0.97). The overall inter-observer reliability was 0.90 (95% CI = 0.87–0.92), also excellent according Landis and Koch.
Discussion and conclusion: First, bilateral postoperative low-dose—similar radiation exposure as plain chest radiographs—CT assessment of tibial rotational alignment is a reliable diagnostic imaging modality to assess rotational malalignment in patients following IMN of tibial shaft fractures and it allows for early revision surgery. Second, it may contribute to our understanding of the incidence, predictors, and clinical relevance of postoperative tibial rotational malalignment in patients treated with IMN for a tibial shaft fracture, and facilitates future studies on this topic.

TSACO—PRIZE WINNING REGISTRAR ORAL PRESENTATION

O 41

The Trauma Emergency Laparotomy Audit (TELA)

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Introduction: Mortality for shocked trauma patients undergoing emergency laparotomy remains unchanged for 20 years. The TELA study aimed to describe the contemporary peri-operative management and patient outcome following abdominal injury.
Materials and methods: A prospective multicentre observational study of all patients undergoing emergency abdominal surgery within 24 h of injury was performed in the UK and Ireland for six months from the 1st January 2019. Shock was defined as the receipt of blood transfusion, with clinical or biochemical evidence of hypoperfusion.
Results: The study included 363 patients from 35 hospitals, of whom 159 (44%) were shocked and received a median of 6 units red blood cells. Shocked patients were more likely to have a blunt mechanism of injury (56% vs 32%, $p < 0.01$) and had a 20% mortality (32/159). Half of these deaths occurred in the operating room (OR). Patients that died were more severely injured (injury severity score 35 (IQR 24–50) vs 25 (IQR 16–36), $p = 0.01$) and had a greater degree of shock at hospital arrival (Base deficit 13.0 (IQR 7.7–18.1) vs 6.3 (3.2–11.1), $p < 0.01$). Processes of care were equivalent or better among non-survivors, with a higher proportion of patients that died undergoing laparotomy within 90 min of arrival in the emergency department (54% vs 26%, $p = 0.01$) and a lower proportion receiving crystalloid in the OR (29% vs 75%, $p < 0.01$). However, delays to achieving definitive haemorrhage control and delivering balanced blood transfusion ratios were observed among both survivors and non-survivors.
Conclusions: Damage control resuscitation principles are followed most closely in patients that die. Despite better processes of care, 1 in 5 shocked patients died in this study justifying the continued search for novel therapeutic approaches. Pre-operative temporary haemorrhage control and pharmacological mitigation of the effects of shock may be productive avenues of research to improve patient outcomes.

O 42

The effect of surgical stabilisation of rib fractures on patient perceived pain scores: a retrospective study at a Level 1 Regional Major Trauma Centre

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Introduction: The indications for surgical stabilisation of rib fractures (SSRF) has been the subject of recent debate [1]. Poor analgesic control is used as one indicative measure in our centre [2]. We examined the effect of SSRF on patient perceived pain scores pre and post-operatively.
Materials and methods: We conducted a retrospective study of 87 patients admitted January 2016 and August 2019 who underwent SSRF with pre-operative pain scores, first post-operative and final post-operative pain scores (scale 0–10) used as primary end points. Paired two-tailed T-tests were used to determine statistical significance.
Results: 59 male and 28 female with a mean age of 62.9 were identified. The mean time (days) from admission to pre-operative review = 1.11; admission to surgery = 2.15; surgery to first post-operative review = 1.36 and first post-operative to final review 5.14. The mean pre-operative pain score (n = 45) at rest was 4.62 and on movement 8.35 (difference = 3.76; $p < 0.05$). At rest, the mean difference between pre-operative and post-operative scores were 0.98 ($p = 0.064$) on first review and 1.66 ($P < 0.05$, n = 38) on final review. On movement (n = 46), the mean difference was 2.02 ($p < 0.05$) on first review and 3.35 ($p < 0.05$) on final review.
Conclusions: SSRF appears to significantly improve patient perceived pain scores. We routinely place surgical chest drains intraoperatively as part of our post-operative management of these patients and would be in situ on day 1 post-operatively. This may contribute towards the lack of statistical significance initially post-operatively.
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O 43

Intramuscular uptake of tranexamic acid during haemorrhagic shock in a swine model

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Introduction: Tranexamic acid (TXA) has been shown to reduce mortality in bleeding trauma patients, with greater effect if administered early. Normally administered intravenously, TXA can also be administered intramuscularly, which could be advantageous in low resource and military settings. Intramuscular use has only been tested in healthy patients, and it is likely that shock will reduce intramuscular uptake.
Materials and methods: In a prospective experimental study Norwegian landrace pigs (40–50 kg) utilised in a surgical course in haemostatic emergency surgery were subjected to various abdominal and thoracic trauma. After 1 h of surgery the pigs were injected with 15 mg/kg TXA either intravenously or intramuscularly. Blood samples were drawn at 0, 5, 15, 25, 35, 45, 60 and 80 min. The samples were centrifuged and analysed with liquid chromatography-mass spectrometry (LC–MS/MS).
Results: Preliminary results from 3 animals in the intramuscular and 2 animals in the intravenous group. Mean plasma concentration with SD of TXA as a function of time is shown in figure 1. Plasma concentration in the intramuscular group was near 10 ug/mL 15 min after administration, and rose above 14 ug/mL after 60 min.
Conclusions: Plasma concentrations reported to inhibit fibrinolysis in vitro is 10 – 17.5 ug/ml (1,2). If this extrapolates to the clinical situation intramuscular administration would yield plasma levels within the lower end of therapeutic range after 15 min. In ongoing haemorrhagic shock plasma concentrations of TXA after intramuscular administration were considerably lower than after intravenous administration, but within therapeutic range .
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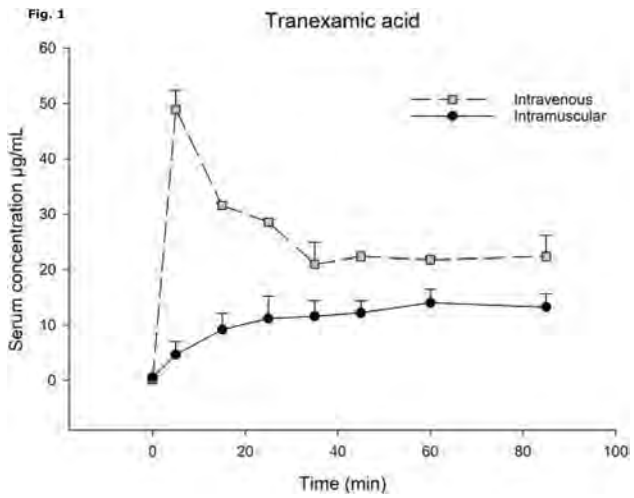

O 44

Emergency laparotomy outcomes in the era of national audit: are we making a difference?

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Introduction: The National Emergency Laparotomy Audit (NELA) in England and Wales aims to outline and benchmark individual trust practice against national standards since December 2012 for patients undergoing an emergency laparotomy [1, 2]. This study aims to evaluate the quality of care at a tertiary trauma centre in the North West of England.
Method: A prospective database of all emergency laparotomies conducted at our hospital between 2014 and 2019 was interrogated. Primary outcomes analysed were crude mortality rates; and secondary outcomes were length of stay, critical care stay, and time for transfer to theatre.
Results: 956 patients underwent an emergency laparotomy over the 5 year period. Crude mortality was 19.5% in 2015, 15.3% in 2016, 12.1% in 2017, 11.6% in 2018 and 12.3% in 2019 (9 months). Consultant Surgeon presence intraoperatively was 62% in 2014, 74% in 2015, 77% in 2016, 73% in 2017, 86% in 2018 and 85% in 2019 between 8am and 5 pm on weekdays. During unsociable hours the consultant presence increased from 59% to 76% between 2015 and 2019. In cases calculated to be high risk the mean transfer time to theatre following a decision to operate was 13.2 h in 2017, 5.86 h in 2018 and 4.25 h in 2019. For patients with a mortality risk of greater than 10%, 66.2% had critical care admissions in 2017, 78.2% in 2018 and 96.7% in 2019. Mean length of inpatient stay annually shortened from 22.9 days in 2014 to 18.1 days in 2019.
Conclusion: Utilisation of a national audit has proven to improve patient outcomes for emergency laparotomy in our institution, by allowing the component parts of the laparotomy pathway to be analysed for focused change.
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O 45

Routine postoperative radiograph after an osteosynthesis of distal radius and ankle fractures are not needed: a prospective, randomized controlled trial

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Introduction: Distal radius and ankle fractures are one of the most common operatively treated fractures. To date, there is no consensus concerning the need for a standard postoperative radiograph. If standardized intraoperative radiographs have been obtained, it is questionable if these postoperative radiographs are necessary and will lead to changes in the treatment strategy. The primary aim of this study is to evaluate if there is a need for routine postoperative radiographs after an osteosynthesis of a distal radius or ankle fracture.
Materials and methods: In a prospective, randomized controlled, open label trial based on a non-inferiority design, we enrolled 332 patients. The control group was treated according to our current, standard protocol in which all patients received a standard anterior–posterior and lateral radiograph on the first postoperative day. Patients randomized to the intervention group were treated without a standard postoperative radiograph. All patients (n = 332) had a routine clinical and radiographic control after 6 weeks in the outpatient clinic. Primary outcome is a change in treatment plan, defined as either additional imaging or a reoperation based on the intraoperative or postoperative imaging.
Results: The trial started in August 2016 and ended in September 2018. 445 patients were screened, 332 were included. In the control group 4 out of 155 (2.6%) had an additional imaging or reoperation, in the intervention group 8 out of 164 (4.9%) had a change in treatment plan. Statistically there is a non inferiority of the intraoperative radiographs compared to the additional postoperative radiographs.
Conclusions: Our findings prove that there is no need of postoperative radiographs if the intraoperative radio-graphs are adequate. This may lead to a strong reduction in radiation exposure and health care costs.
References: Tufescu T. Working toward reducing postoperative fracture radiographs: a survey of Canadian surgeons.

O 46

Validation of a clinical coagulation score for research in trauma induced coagulopathy by thromboelastography

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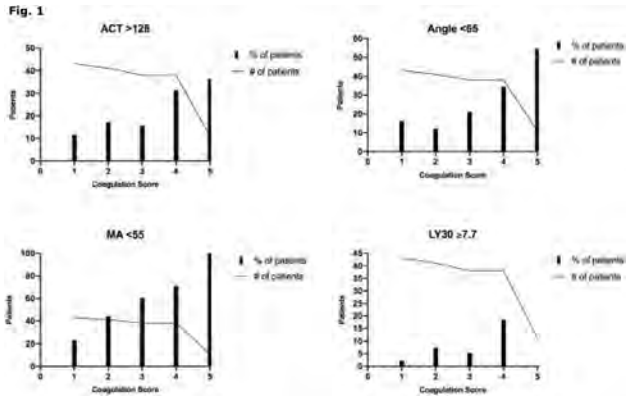
Introduction: The lack of a unifying clinical definition of coagulopathy severity is a major barrier to communication among trauma investigators. The NIH-funded Trans-Agency Consortium for Trauma-Induced Coagulopathy (TACTIC) investigators developed a clinical coagulation scoring system, based on a Likert scale, to stratify trauma patients by their degree of clinically observable coagulopathy. We hypothesize that these scores will correlate with laboratory measures of coagulation.
Materials and methods: Adult trauma activations from 2014–2018 in a Level I urban trauma center were included. Patients with isolated head injury were excluded. Foreach patient, an OR coagulation score was determined by an attending trauma surgeon who was blinded to research lab results. This score ranged from 1 to 5. A score of 1 corresponds to normal hemostasis, 2: mild bleeding requiring direct pressure, 3: bleeding requiring surgical maneuvers including electrocautery,4: coagulopathy requiring adjunctive blood component therapy or systemic therapeutics,and 5: diffuse bleeding from multiple sites. The relationship of the coagulation scores to the rapid thromboelastogram (r-TEG) drawn in the OR was examined with Pearson's Chi squared test. Significance was set at $p < 0.05$.
Results: The study included 171 patients, 57% sustaining blunt injury, median age 32.2 (18–77), 78% male, and median ISS 27 (4–66). Increased coagulation scores were associated with abnormal TEGs. The incidence of abnormal ACT (> 128 s, $p = 0.0126$), Angle (< 65 deg, $p = 0.002$) and MA (< 55 mm, $p < 0.0001$) increased with increasing score, however the incidence of abnormal LY30 ($\geq$ 7.7, $p = 0.1025$) did not show a significant association.
Conclusions: A clinically observable coagulation score is correlated with TEG in the setting of TIC. This scoring system may be useful as an observable measure of coagulopathy and can inform interventional trials when used as an outcome and to evaluate novel laboratory measures of coagulation.

Fig. 1



O 47

High volume low concentration intraperitoneal bupivacaine study in emergency laparoscopic cholecystectomy: a randomized clinical trial

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Introduction: Fallowing laparoscopic cholecystectomy(LC), patients suffer from postoperative pain, especially in the abdomen. Intraperitoneal local anesthesia (IPLA) reduces pain after laparoscopic cholecystectomy(LC). Acute cholecystitis(AC)-associated inflammation, increased gallbladder wall thickness, dissection difficulties, and a longer operative time are several reasons for assuming a benefit in pain scores in urgent LC with IPLA application. The aim was to determine the postoperative analgesic efficacy of high-volume low-dose intraperitoneal bupivacaine in urgent LC.

Materials and methods: Fifty-seven patients, American Society of Anesthesiologists(ASA) physical status I or II were randomly assigned to receive either normal saline(Group A) or intraperitoneal bupivacaine(Group B) at the beginning or at the end of the surgery in urgent LC. The primary outcome was the scores of postoperative pain by visual analogue scale score (VAS) after surgery.

Results: Postoperative VAS scores at 1st and 4th hours were significantly lower in group B than group A ($p < 0.001$). Postoperative VRS scores at 1st, 4th and 8th hours were significantly lower in group B than group A ($p < 0.001$, p:0.002, p:0.004). Anelgesic use was significantly higher in group A at 1st postoperative hour than group B ($p < 0.001$). Shoulder pain was significantly lower in group B than in group A ($p < 0.001$). Patient satisfaction was significantly higher in group B than in group A ($p < 0.001$).

Conclusions: High-volume low-concentration intraperitoneal bupivacaine instillation resulted in better postoperative pain control along with reduced incidence of shoulder pain and analgesic consumption in comparison to control group in urgent LC.

References: Gurusamy KS1, Nagendran M, Guerrini GP, Toon CD, Zinnuroglu M, Davidson BR. Intraperitoneal local anaesthetic instillation versus no intraperitoneal local anaesthetic instillation for laparoscopic cholecystectomy. Cochrane Database Syst Rev. 2014 Mar 13;(3)

Table 1. Demographic characteristics of patients

Variables	Control Group A	Bupivacaine Group B	*p* value
Age (years)	46.17±14.51	46.57±15.69	0.921
Gender (f/m)	20/9	20/8	0.756
BMI (kg/m2)	27.5±3.9	28.5±5.25	0.417
ASA (I/ II)	12 / 17	10/18	0.872
Comorbidity (N/Y)	12/17	10/18	0.872
Smoker (N/Y)	10/19	11/17	0.922
ALT	27.66±26.97	29.43±25.48	0.544
AST	30.10±25.22	34.64±32.46	0.844
GGT	65.31±92.32	64.43±84.97	0.817
T. Bilirubine	0.83±0.41	0.74±0.53	0.219
WBC	14027.59±4014.61	13432.14±4607.08	0.393
CRP	6.64±9.91	6.75±11.31	0.792

Fig. 1

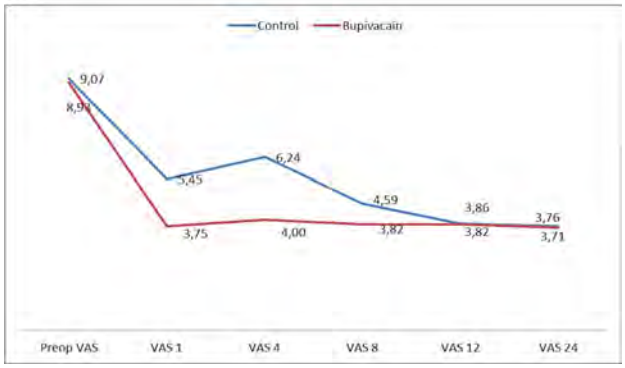

Fig. 2

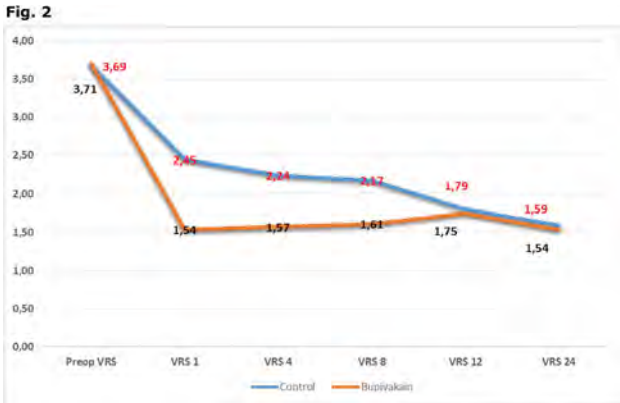

Table 2. Operative results of groups

Variables	Control Group A	Bupivacaine Group B	p value
Operation duration(min)	79.06±15.04	78.21±16.47	0.756
Bile spilt (No/<20 mL/>20 mL)	16 / 10 / 3	16 / 8 / 4	0.840
Blood spilt (No/<20 mL/>20 mL)	7 / 16 / 6	7 / 14 / 7	0.908
Drain (N/Y)	21 / 8	19 / 9	0.707
Time of hospital admission (h)	8.31±1.58	8.42±1.93	0.874
Time to mobilize (h)	8.28±1.22	7.39±1.26	0.016
Time to eat (h)	6.76±1.21	6.39±1.1	0.257
Respiratory rate/min in recovery	14.69±0.97	14.71±0.98	0.914
Respiratory rate/min on the ward	15.93±1.07	15.39±0.99	0.083
SaO2 in recovery (%)	94.62±2.74	94.32±2.9	0.657
SaO2 on the ward (%)	96.93±2.1	97.36±2.09	0.250
Postoperative stay (h)	2.93±0.84	3.07±0.72	0.439
Shoulder pain (n) (%)	14(48.28)	2(7.14)	<0.001
Patient Satisfaction	2,93±0,8	4,61±0,57	<0.001

O 48

Prehospital resuscitative thoracotomy after penetrating thoracic injuries: the resource use for necessary training does not seem justified in Norway

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Introduction: In-hospital resuscitative thoracotomy is an established procedure for patients with penetrating cardiac injuries. The survival rate is dismal in patients with cardiac arrest prior to admission. Prehospital resuscitative thoracotomy (pRT) was introduced by the London HEMS with the highest published survival rate of 18%. We aimed to identify the number of patients who could potentially benefit from pRT in our major trauma center catchment area.
Materials and methods: Data from 2010 to 2017 were collected from the institutional Trauma Registry and electronic records. We included patients > 17 years, with penetrating cardiac injury, or penetrating chest trauma and cardiac arrest, or penetrating chest trauma and sBP < 70 mmHg. Commonly used criteria for pRT are tamponade with cardiac arrest lasting < 10 min at the time of ambulance arrival and with > 10 min remaining transportation time to hospital.
Results: Cardiac injury was found in 25 of 54 included patients. Of these 25, 14 arrived at the hospital with signs of life and survived. 8 of the 11 patients who died had tamponade. Criteria for pRT were not met in 6 of 8 patients with tamponade. Two patients could have been eligible for pRT. One patient was found in Oslo with cardiac arrest lasting 10 min. The patient had multiple stab wounds to the chest and had several perforations of the right atrium, not technically manageable in a prehospital setting. The second patient was injured outside our primary catchment area and arrested with prehospital personnel present. pRT was performed and the tamponade relieved, but compression of the aorta was necessary. The patient was declared dead shortly after hospital admission.
Conclusions: In 8 years in a population of 1.6 million, two patients met London HEMS criteria for pRT. pRT was performed in one patient who was declared dead shortly after hospital admission while one patient suffered from injuries which are unmanageable in a prehospital setting.

O 49

Isolated tissue injury leads to fibrinolytic shutdown, TPA resistance and alterations in clot structure in a porcine model

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Introduction: Trauma-induced coagulopathy includes a spectrum of hypo- to hypercoagulable phenotypes with differing levels of fibrinolysis and tPA sensitivity. Fibrinolysis shutdown is associated with increased late mortality and shown in small animal studies to be driven by tissue injury. Utilizing a novel method of clot structure analysis, we hypothesize that isolated tissue injury provokes fibrinolysis shutdown, tPA resistance and is associated with altered clot structure resulting in enhanced clot stability.
Materials and methods: All male pigs (n = 13) underwent anesthesia, intubation, femoral artery cannulation and mini-laparotomy. Tissue injury (n = 9), was inflicted with bilateral chest wall muscular cutdowns and bilateral femoral fractures using a captive bolt pistol. Mean arterial pressure was maintained at > 50mmHG. Timed blood samples analyzed using tPA challenged and citrated native TEG to evaluate tPA resistance and fibrinolytic shutdown respectively. After 3 mm punch biopsy induced splenic injury, clot was collected, washed, and chemically fractioned by strong cation exchange chromatography. Tandem mass spectrometry and bioinformatic analysis were used to evaluate clot structure and factor XIIIa cross-linking patterns and covalently associated proteins.
Results: Tissue injury pigs showed increased tPA resistance (change tPA-TEG LY30: − 39.1% vs − 10.1% p = 0.0028) and a trend of fibrinolytic shutdown evidenced by TEG compared to control (Fig. 1). Splenic clot structure analysis demonstrated altered clot structure (Fig. 2) and identified elevated levels of protease inhibitors such as alpha 2 macroglobulin and alpha 2 antiplasmin at 6 h post tissue injury compared to baseline.
Conclusions: In a porcine model, isolated tissue injury provokes fibrinolysis shutdown and tpa resistance resulting in altered clot structure with an increased incorporation of anti-protease proteins resulting in enhanced clot stability.

Fig. 1

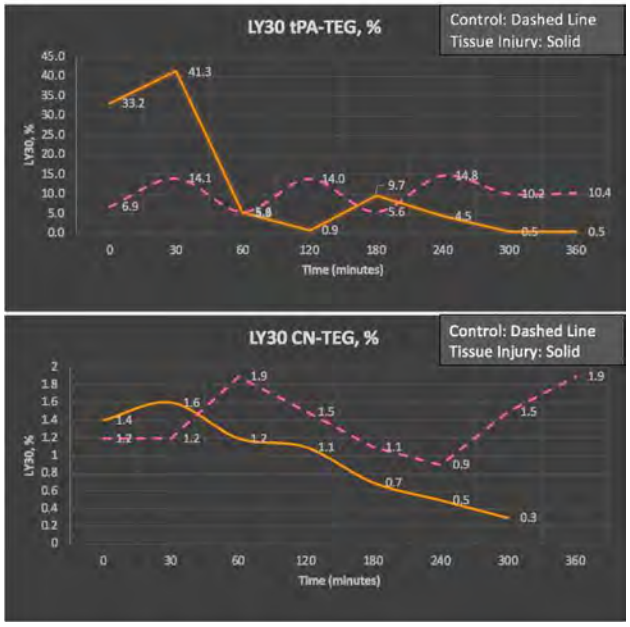
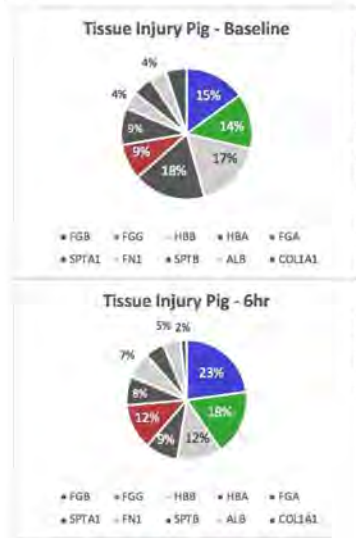


Fig. 2



#	Identified Proteins (279)	Gene
1	Fibrinogen beta chain	FGB
2	Fibrinogen gamma chain	FGG
3	Hemoglobin subunit beta	HBB
4	Hemoglobin subunit alpha	HBA
5	Fibrinogen alpha chain	FGA
6	Spectrin Alpha, Erythrocytic 1	SPTA1
7	Fibronectin	FN1
8	Spectrin beta chain	SPTB
9	Serum albumin	ALB
10	Collagen 1 Alpha 1	COL1A1
11	Ankyrin 1	ANK1
12	Keratin 1	KRT1
13	Keratin 10	KRT10
14	N-myosin-9	MYH9
15	von Willebrand factor	VWF
16	Collagen 3 Alpha 1	COL3A1
17	Filamin A, alpha	FLNA
18	Catalase	CAT
19	Anion exchange protein	SLC4A1
20	Biliverdin Reductase B	BLVRB
21	Collagen 1 Alpha 2	COL1A2
22	Serotransferrin	TF
23	Actin, beta	ACTB
24	Keratin 5	KRT5

O 50

There is a high incidence of rotational malalignment after intramedullary nailing of tibial shaft fractures: a prospective cohort series of 155 patients

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Introduction: Intramedullary nailing (IMN) is the treatment of choice for most tibial shaft fractures due to its minimalistic surgical approach, superior fracture healing, and rapid recovery. However, an iatrogenic pitfall is rotational malalignment (RM). The aim of this prospective cohort study was to determine the incidence of RM and to evaluate the efficacy of protocolled bilateral postoperative computed tomography (CT) assessment of rotational tibial alignment.

Materials and methods: Between 2009 and 2016 we prospectively included 155 patients (111 male (72%)), with a mean age of 41 years, with a unilateral tibial shaft fracture. As per hospital protocol, patients underwent a routine low-dose bilateral postoperative CT to assess RM. Forty-two patients (27%) suffered open injuries; 29 (19%) were involved in a multi-trauma sustaining more than one injury. According to the AO/OTA classification, there were 95 simple (61%), 35 wedge (23%), and 25 complex fractures (16%). Fracture location within the tibial shaft varied with six patients (4%) being within the proximal third, 47 (30%) middle third, and 90 (58%) distal third. There were 11 segmental (7%) fractures that involved more than one third of the tibia.

Results: Fifty-five patients (35%) had post-reduction RM including 46 patients (30%) between 10°–19°, seven patients (5%) with a RM between 20°–29°, and two patients (1%) with a RM greater than 30° when compared to the uninjured side. Of the patients with RM, the tibia was externally malrotated in 29 patients (53%). Three patients (2% of cohort or 5% of those with RM) underwent revision surgery to correct the RM as detected on CT scan.

Conclusions: This study reveals a high incidence of RM following tibial nails (35%) with a surprisingly low revision rate (5% of those with RM). A subsequent study should aim to assess clinical relevance of RM in terms of functional outcome and gait analysis. For now CT-rotational-profiling provides a platform for early recognition and correction of RM secondary to tibial IMN.

Level of evidence: Therapeutic Level II – Prospective Cohort Study.

TRAUMA SYSTEMS, EPIDEMIOLOGY AND OUTCOMES

O 51

Aintree Major Trauma Study 2011–2018, Liverpool: levels, causes, patterns, trends and implications

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Introduction: The effects of centralisation of trauma services in England are described in the Trauma Audit and Research Network (TARN) reports. Aintree Major Trauma Centre (MTC) is a central axis of Cheshire and Mersey Major Trauma Centre Collaborative (MTCC), also known as Liverpool MTCC. It provides a trauma service for a population of 2.3 million in North West England and Isle of Man. We have conducted an overview of major trauma activities at Aintree MTC from 2011 to 2018.

Materials and methods: The TARN database was analysed retrospectively to quantify the number of trauma team activations, patients with major trauma (MT), causes of injury, and subspecialty-specific trauma procedures. Crude and risk-adjusted mortality rates, observed to expected (O/E) mortality ratio, and risk-adjusted rates of survival from MT were also calculated.

Results: The number of trauma team activations has risen by a factor of 5. The predominant injury mechanism that resulted in MT was a fall from less than 2 m. There has been a fivefold increase in the overall number of trauma surgical procedures. Orthopaedic surgeons have performed 84% of trauma procedures, followed by

neurosurgeons, oral and maxillofacial surgeons, and visceral trauma surgeons. The rate of trauma laparotomies per consultant fluctuated between 0.4 and 0.8 per month. A fall from less than 2 m, road traffic accident and a fall from more than 2 m were the three leading causes of death from MT. The overall O/E mortality ratio was 1.1.
Conclusions: Aintree Trauma profile has significantly changed since 2011. This change highlights the potential need for a review of how MT services are offered at Aintree to reduce the O/E mortality ratio. This may be achieved through more co-ordinated provision of trauma care, prevention, audit and research programmes. The role of visceral trauma surgery should be reconsidered within the context of the surgical patients' needs and demands, and fundamental requirements of the profession.

O 52

Inter-hospital variation in surgical intensity for trauma admissions: a multicenter cohort study

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Introduction: Guidelines for trauma patients are increasingly moving away from surgical management towards less invasive procedures but there is a knowledge gap on how these recommendations are influencing practice. We aimed to assess inter-hospital variation in surgical intensity for trauma patients and identify determinants of surgical intensity.
Materials and methods: We conducted a retrospective multicenter cohort study based on the 57 trauma centers of an inclusive Canadian provincial trauma system. We included adults admitted for major trauma between 2007 and 2016. Analyses were stratified for orthopedic (n = 17,001), neurological (n = 12,888) and thoracoabdominal surgery (n = 9816). Surgical intensity was quantified with the number of surgical procedures during the first 72 h. Inter-hospital variation was assessed with the intra-class correlation coefficient (ICC) from multilevel Poisson regression models. Relative risks (RR) were generated to identify determinants.
Results: Moderate inter-hospital variation was observed for orthopedic surgery (ICC = 14.4%, 95% confidence interval [CI]: 12.1–20.4) whereas variation was low for thoracoabdominal surgery (ICC = 2.7%, 95% CI: 1.7–3.1) and neurosurgery (ICC = 0.8%, 95% CI: 0.8–1.2). Level IV centers had similar surgical intensity for thoracoabdominal injuries (RR: 1.20, 95% CI: 0.65–2.25) but lower intensity for orthopedic injuries (RR = 0.31, 95% CI: 0.17–0.57) than level I/II centers. During the study period, we observed a decrease in intensity for neurosurgery (RR for 2015–16 versus 2007–09: 0.76, 95% CI: 0.68–0.84) and thoracoabdominal surgery (RR = 0.74, 95% CI: 0.63–0.87).
Conclusions: The observed inter-hospital variation in risk-adjusted surgical intensity suggests that there may be opportunities for quality improvement in surgical care for injury admissions. A better understanding of how surgical intensity influences clinical outcomes is needed to inform quality improvement activities.

O 53

Pre-hospital injury diagnosis

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Introduction: Accurate pre-hospital diagnosis of a patient's injuries may improve care by facilitating effective intervention at the scene and reducing time to definitive treatment in hospital[1]. We sought to assess the diagnostic accuracy of injuries by London's Air Ambulance (LAA) clinicians and identify conditions in which clinical accuracy may deteriorate.
Materials and methods: A retrospective review was undertaken of all patients conveyed to the Royal London Hospital by LAA from October 2017 for six-months. Pre-hospital injury scores, coded using the abbreviated injury score (AIS) were compared to hospital discharge AIS. Patient outcomes were evaluated in the case of underscored injuries.
Results: During the study period 688 patients were seen and 177 met eligibility. Mean clinical sensitivity and specificity was 62% and 93% respectively. Chest injury identification was most sensitive (77%) and pelvic injury least sensitive (41%). The relative risk (RR) of underscored injuries to the chest, abdomen and pelvis increased with decreasing Glasgow Coma Scale (GCS) peaking at 1.7 (IQR 1.3–2.0). The average accuracy of injury identification was 88% with a negative predictive value of 90%. No overt patient morbidity resulted from a missed, or under-scored injury. All missed injuries were subsequently identified in the Emergency Department.
Conclusions: The pre-hospital diagnosis of injuries has reasonable sensitivity and excellent specificity. Accurate pelvic injury diagnosis is more challenging than chest or abdomen. With decreasing GCS, the risk of missing injuries increases. Clinicians should be aware of the potential for error when treating trauma patients with impaired conscious levels.
References: Chen X, Guyette FX, Peitzman AB, Billiar TR, Sperry JL, Brown JB. Identifying patients with time-sensitive injuries: association of mortality with increasing prehospital time. Journal of trauma and acute care surgery. 2019;86(6):1015–22.

O 54

Comorbidities, injury severity and complications predict mortality in severe thoracic trauma: a retrospective analysis from the Norwegian national trauma registry

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Introduction: Thoracic trauma accounts for 25–50% of all deaths after trauma. Little is known about the epidemiology of thoracic trauma in Norway. Moreover, studies on predicting factors for mortality are scarce. Aim of this study was therefore to give an overview

of epidemiology, clinical factors and risk factors for mortality of patients with thoracic injuries.

Materials and methods: Adult patients treated for severe thoracic trauma (injury severity AIS $\geq$ 3), between 2009 and 2016 at Haukeland University hospital were included. Data were extracted from (1) the Haukeland University hospital local trauma registry, and (2) the Norwegian trauma registry. Additional data on comorbidities and complications was collected from patient records. The factors age, gender, comorbidities [Charlson Comorbidity Index (CCI)], anticoagulant use, injury severity [Revised Trauma Score (RTS)], [Injury Severity Score (ISS)] and complications [Clavien-Dindo Scale (CDS)] were analyzed for being predictive of in-hospital mortality. Multivariate logistic regression analyses with backward selection methods were used.

Results: Data of 399 patients were analyzed, of which 55 (14%) patients died. Median ISS was 34 in the non-survivors (IQR 22, 43) and 17 (IQR 13, 25) in survivors (p = <0.001). Data of 282 patients were used in the risk factor for mortality analysis. Two or more comorbidities measured by CCI (OR: 7.02, p = 0.006), injury severity measured with the RTS (OR: 0.41, p = < 0.001), and grade $\geq$ 3 complications on the CDS (OR: 7.66, p = 0.001) were significant predictors for mortality.

Conclusions: Severe comorbidities significantly decreased the chances of survival after thoracic trauma. Injury severity was also found to be a significant predictor of mortality. Physiological injury severity, measured by RTS, appeared to be a stronger predictor of mortality than ISS after thoracic trauma. Finally, severe complications led to considerably higher risk of mortality following thoracic trauma.

O 55

The psychosocial impact of e-bike accidents and changing values of older patients in the Netherlands, a qualitative study

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Introduction: The mechanical impact of e-bike accidents, increasingly used by older persons, has shown to be higher compared to regular bike accidents. However, the psychological impact of e-bike accidents in older trauma patients, their experiences in emergency and follow-up care, and the possible change in values and beliefs in response to the accident is still unknown.

Materials and methods: We used a qualitative design and included older patients (65 + years) with a variety of (severe) injuries, who were admitted to the emergency department after an e-bike accident (n = 12) and their relatives (n = 11). They were interviewed within one month (T1) and after three months (T3) of the date of accident. Interviews were transcribed verbatim and analyzed via a thematic analysis approach using an ethical perspective.

Results: Many patients required (in)formal care after hospital discharge. In general patients were satisfied with the provided emergency surgical care, although some patients reported limited and insufficient information on rehabilitation and homecare support. The analysis yielded impaired physical condition, anxiety, increased vulnerability and dependency of care givers as psychosocial impact. Freedom impairment, shifting relational autonomy, and confrontation with vulnerability and mortality were reported changes in values. Central values as mobility and freedom, vitality and health, social participation and recreation were put under pressure and needed to be negotiated again after the accident in order to decide whether to use the e-bike again.

Conclusions: Follow-up information of surgeons and emergency physicians after initial hospital care for older trauma patients with an e-bike accident shows room for improvement, with more specific consideration for the psychological impact of trauma and changes in values after e-bike accidents.

References: Eur J Trauma Emerg Surg. 2018. https://doi.org/10.1007/s00068-018-1033-5.

O 56

Traumatic subaxial cervical fractures: functional prognostic factors and survival analysis

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Introduction: The main goal of this study is to identify the risk factors for poor functional outcomes and to analyze the overall survival (OS) and complications rate in patients with traumatic cervical spinal cord injury (SCI) and subaxial cervical fracture (SACF) treated with open surgical fixation.

Materials and methods: The authors retrospectively reviewed sixty-five consecutive patients from one single center with traumatic unstable SACF and associated SCI treated surgically between 2010 and 2017. We exclude cervical fractures with concomitant severe head injury, brachial plexus injury, lumbar plexus injury, superior or inferior limb fractures and patients who were lost during the follow-up period. Statistical analysis using a Chi square test, Student's t-test and Logist regression were used to identify factors associated with poor functional outcomes after surgical treatment. OS analyses were performed using Kaplan–Meier curves.

Results: The 5-year survival rate was 81.8%. Four patients died in the first 30 days after surgery and 6,7% need a reoperation. The median time from injury to surgery was 3.6 days. The complication rate was 62%, being respiratory failure the most common one. Preoperatively, 64% had an ASIA < C. About 57% of the patients with ASIA between A-D had improve one or more ASIA grades. Logistic regression analysis show that older age, SACF above C5, ASIA < C pre-surgery and long time from injury to surgery were related with poor prognosis. The OS rate was higher in patients with neurological improvement, without signs of neurogenic shock at presentation and in SACF bellow C4.

Conclusions: Our results suggest that SACF should be treated as soon as possible in order to improve the OS rates and functional outcomes. Older patients, lower ASIA at presentation and SACF above C5 are related with worst functional outcomes.

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O 57

Misdiagnosed vertebral bodies fractures in children

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Introduction: Compression fractures of multilevel vertebral bodies are common in children. Due to segmental plasticity, several adjacent vertebral bodies are compressed to a lesser degree at each body. Plain AP and lateral X-ray is the first diagnostic examination in the Emergency Department (ED), but a proper diagnosis is often delayed or missed.

Materials and methods: This is a retrospective, monocentric study in children falling on their back who showed up at the Orthopedic ED, between December 2017 and September 2019. Nine children (4F, 5 M) with an average age of 11.1 years were included. Trauma occurred playing games and doing sports in all cases. All children were subjected to X-ray, followed by MRI scans for doubtful findings on the plain X-ray or persistent mild pain (T1, T2, T2-STIR sequences).

Results: Cuneiform vertebral fracture or vertebral body height reduction was diagnosed with X-ray in five vertebrae while MRI showed fractures in 32 vertebrae including compression and edema of adjacent vertebrae in the T2-STIR sequence. Therefore only 15.6% vertebral fractures have been detected by plain X-ray. The injured vertebral bodies were so distributed: T3 n = 1, T4 n = 2, T5 n = 3, T6 n = 4, T7 n = 3, T8 n = 3, T9 n = 4, T10 n = 3, T11 n = 2, T12 n = 2, L1 n = 2, L3 n = 1, S4 n = 1, S5 n = 1. The most involved spine section was between T3 and T10 with 20 fractures.

Conclusions: Vertebral fractures are not always related to hyperflexion or forward hinging mechanism. MRI showed vertebral compression fractures and the T2-STIR sequence showed edema as post-traumatic evidence that had not been detected by X-ray. In absence of a radiologically visible lesion, the persistence of pain should be investigated by performing MRI scans. The middle thoracic spine level appeared to be the most involved one in pediatric vertebral fractures.

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O 58

Percutaneous occipitocervical fixation optimal choice to obtain best cervical pedicles screws accuracy

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Introduction: Occipitocervical fixation (OCF) is an effective surgical method to treat various craniovertebral junction (CVJ) pathologies. A rigid fixation achieved from OCF displaces other techniques of CVJ stabilization unfortunately during procedure deep and wide wound is performed. Aim of this study is to share our experience in OCF and lately performed percutaneous OCFs with intraoperative CT guided navigation system.

Materials and methods: Of 34 patients who underwent OCF 6 were performed percutaneously. O-arm CT scans were used to illustrate and measure radiologic parameters. Screws were implanted in C1 lateral masses (2), isthmus of C2 (68) and C3 pedicles (68) and assessed according Gertzbein Robbins (GR) in modification of Bredow classification from A to E.

Results: A total 138 screws were implanted, 114 of them was performed in open surgery and 24 percutaneously. Outcome in GR classification for screws implanted in open surgery was: A 58 (50,88%), B 22 (19,3%), C 16 (14,04%), D 9 (8,77%) and E 9 (7,02%) while in percutaneous: A 21 (87,5%) and B 1 (12,5%). In open surgery one screw was revised.

Conclusions: Percutaneous occipitocervical fusion seems to be a good option to achieve desirable effect in cervical pedicle screws implantation. During procedure whole nuchal muscles are preserved. CT guided surgery and microscope view are necessary to perform percutaneous OCF.

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Fig. 1

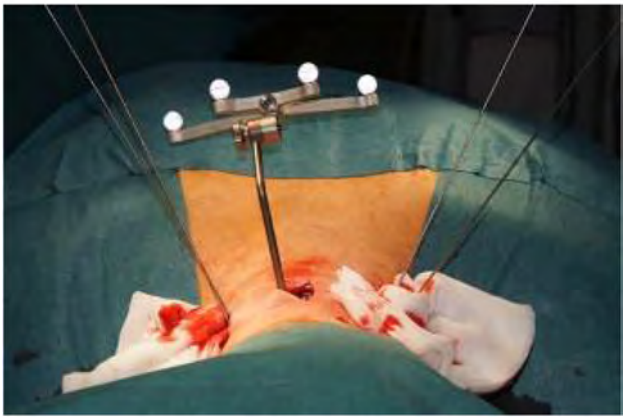

Fig. 2

Fig. 3

O 59

Geographical risk of fatal and non-fatal injury among adults in Norway

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Introduction: Studies have found higher risk of traumatic deaths in rural areas in Norway combined with a paradoxically decreased prevalence of severe, non-fatal injuries (1). This study investigates the risk of fatal and non-fatal injuries among all adults in Norway in the period 2002–2016.
Materials and methods: All traumatic injuries and deaths among persons with residential address in Norway from 2002–2016 were included. Data was collected from the Norwegian Patient Registry and the Norwegian National Cause of Death Registry. All cases were stratified according to six groups of centrality based on Statistics Norway's classification of centrality 2017. Mortality- and injury rates was calculated per 100,000 inhabitants per year.
Results: The mortality rate differed significantly according to the levels of centrality ($p < 0.05$). The mortality rate in the most urban group (1) was 64.2 and in the most rural group (6) 78.6. The lowest mortality rate was found in centrality group 2 (57.9). There was an increased risk of death between centrality group 1 and group 6 with a relative risk of 1.23 (CI: 1.0–1.5, $p < 0.05$). The most common cause of death was transport injuries, self harm, fall injury and other external causes. The highest urban–rural gradient was seen in transport injuries with a relative risk of 3.0 (CI 1.7–5.3, $p < 0.001$) comparing group 6 to group 1. Group 2 had the lowest risk of non-fatal injuries (1531) and group 6 the highest (1803). The risk of non-fatal injuries increased with higher grade of rurality, comparing group 1 and 6 revealed a relative risk 1.07 (KI 1.02–1.11, $p < 0.001$).
Conclusions: The more rural the higher risk of traumatic deaths and non-fatal injuries. Transport injuries had the highest urban–rural gradient.
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O 60

Virtual thoracolumbar fracture clinics are a safe and effective alternative to traditional clinic models

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Introduction: Virtual fracture clinics (VFCs) are an alternative to conventional fracture clinics for management of musculoskeletal injuries. They have been shown to be a safe and effective model for upper and lower limb injuries. There is limited data to support their use for specialist thoracolumbar fracture follow-up.
Materials and methods: Lean methodology including process mapping was applied to identify a safe virtual alternative for the pathway. First cycle analysis of 100 consecutive referrals to a traditional specialist thoracolumbar fracture clinic. Second cycle analysis of 100 consecutive referrals six months after introduction of a VFC.
Results: Mean time to first outpatient review in first cycle was 84 days. Referrals led to 240 booked outpatient appointments and 66 were missed (28% non-attendance). 54% of referrals had 3 or more scheduled appointments. 82/100 were AO type A1–3 and all of these received non-operative treatment. 9/100 were AO type A4 or B and 8 of these received non-operative treatment. 1 patient received operative stabilisation (AO type B). Process mapping identified two pathways—virtual review with advice letter and physiotherapy referral (outcome A—AO type A1–3) or face to face review (outcome B—AO type A4 or B). Mean time to outpatient review in second cycle was 10 days. 79/100 received outcome A. 8/79 (10%) made a telephone call for advice and only 2/79 (3%) asked for a face to face appointment. 19/100 received outcome B and all were discharged after one visit. 0 patients in cycle 2 required operative stabilisation. Statistically significant reduction in number of scheduled face-to-face reviews (240 versus 19; $p < 0.001$) and mean time to first review (84 days versus 10 days; $p < 0.001$).
Conclusion: Virtual thoracolumbar fracture clinics are a safe and clinically effective alternative to traditional fracture clinic models. Lean methodology can be uses to extend virtual clinic pathways to specialist trauma clinics.

PELVIC AND HIP FRACTURES

O 61

Treatment prognosis of 340 cases of fragility fracture of pelvis

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Introduction: The number of cases of fragility fracture of pelvis in the elderly has been increasing in recent years, but there are still not enough reports of surgical treatment as a treatment method, but there is still no certainty how to treat. So we investigated prognosis of 340 cases of fragility fracture of pelvis.

Materials and methods: Subjects were 340 fragility fracture of pelvis treated at a single center from April 2012 to April 2019, 40 males, 300 females, average age 82 ± 9.5 years. Only cases that had CT scan were included. We examined Rommens classification, the presence of injury, presence of hip implants, functional prognosis, and 1-year mortality.
Results: The breakdown of Rommens classification is type Ia 78 cases, Ib 2 cases, IIa 14 cases, IIb 74 cases, IIc 51 cases There were 32 cases of IIIa, 3 cases of IIIc, 1 case of IVa, 50 cases of IVb, and 4 cases of IVc. Surgical treatment was indicated in 16 cases (4.7%) (IIc 1 case, IIIa 7 cases, IVb 5 cases, IVc 3 cases) There were 28 cases (8.2%) with no injury mechanism and 61 cases (18%) with hip implants. 109 cases (32%) were able to follow up for more than 1 year including telephone surveys, and 42.3% of them did not recover to functional level before injury. The one-year mortality rate was 10.2%.
Conclusions: In the 340 cases studied here, 16 cases (4.7%) were indicated for surgery. The prognosis and mortality rate are almost the same as those reported overseas, and as with proximal femoral fractures, there is a possibility that it may be greatly involved in ADL decline in the elderly. We think that further study is needed in the future.
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O 62

The effect of anticoagulation in patients after hemiarthroplasty of the hip following a femoral neck fracture

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Keywords: Hip fracture, Femoral neck fracture, Hip hemiarthroplasty (HA), Coumarin anticoagulants, Thrombocyte aggregation inhibitor, Clinical outcomes Running title: FAMMI
Introduction: In the geriatric hip fracture population a lot of anticoagulation therapy is used. The aim of this study is to see the impact of anticoagulation in perioperative planning and outcome.
Materials and methods: Data were extracted from a prospective hip fracture database and completed by retrospective review of the hospital records at two level II trauma hospitals.
Results: 907 patients were included, of which 415 (45.8%) used a form of anticoagulation. The median age was 84 years (IQR 78–88 years), 67.8% was female. An ASA score ≥ 3 was reported in 56.2% of the patients, with median NHFS of 5 (IQR 4–6). Gender, ASA score and the NHFS did differ statistically significant between both groups. Patients with anticoagulation drugs were older, had a lower NHFS, and less were female. The most frequently used anticoagulation was a salicylate acid (23.5%), followed by vitamin K antagonists (15.5%). Time to surgery between patients with and without anticoagulation was found(19.6 h (IQR 13.4–24.6) vs 21.5 h (IQR 15.3–30.6), p = 0.721). Patients using anticoagulation developed more frequently a postoperative hematoma (19.5% vs 11.4%, p = 0.001). A mean loss of hemoglobin points of 1.53 mmol/L without anticoagulation versus 1.64 mmol/L was found (p = 0.05). More packed red blood cells were supplemented for patients with anticoagulation use (0.33 (0.88%) vs 0.15 (0.61%), p = 0.0002). No differences in 30-day mortality and one-year mortality were found between both groups.
Conclusions: Patients with a femoral neck fracture who received a hip hemiarthroplasty and used anticoagulation had no significant longer delay to surgery and had a higher mean loss of hemoglobin points. As a clinical consequence of this, more packed cells were supplemented. Also more postoperative hematomas were found in the population with anticoagulation. No differences were found in mortality rates at 30-days and one year.

O 63

Patient-reported physical functioning and quality of life after pelvic ring injury: a systematic review of the literature

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Introduction: Pelvic ring injuries are one of the most serious traumatic injuries with large consequences for the patients' daily life. During recent years, the importance of the patients' own perception of their health condition following injury has increasingly received attention. This systematic review reports on self-reported physical functioning and quality of life after all types of pelvic ring injuries.
Materials and methods: The online databases MEDLINE-PubMed and Ovid-EMBASE were searched for studies published between 2008 and 2019 to identify published evidence of patient-reported physical functioning and quality of life after which they were assessed for their methodological quality.
Results: Of the 2577 articles, 46 were reviewed in full-text, including 3049 patients. Most studies were heterogeneous, with small cohorts of patients, a variety of injury types, treatment methods and use of different, often non-validated, outcome measures. The overall methodological quality was moderate to poor. Nine different PROMs were used, of which the Majeed Pelvic Score (MPS), SF-36 and EQ-5D were the most widely used. Mean scores respectively ranged from 75–95 (MPS), 53–69 (SF-36, physical functioning) and 0.63–0.80 (EQ-5D).
Conclusions: Physical functioning and quality of life following pelvic ring injuries seem fair and tend to improve during follow-up. However, differences in patient numbers, injury definition, treatment strategy, follow-up duration and type of PROMs used between studies hampers to elucidate the actual effects of pelvic ring injuries on a patient's life. Therefore, we recommend that physicians and researchers should use valid and reliable PROMs on large cohorts of patients with properly defined injury types to truly evaluate physical functioning and quality of life after pelvic ring injuries.

O 64

Prognostic factors and quality of life after pelvic fractures. The Brabant Injury Outcome Surveillance study

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Introduction: Pelvic fractures might have long-term consequences on Health-related-Quality-of-Life. The main purpose of this study is to provide insight into short-term HRQoL in the first year after pelvic

injury and identify short-term prognostic factors of decreased outcome.

Methods: This is a prospective, observational, multicenter, follow-up cohort study in which HRQoL and functional outcome was assessed during 12 months follow-up within injured adult patients admitted to 1 of 10 hospitals in the county Noord-Brabant, the Netherlands. Data was collected by self-reported questionnaires at 1 week (including preinjury assessment), and 1, 3, 6 and 12 months after injury. EuroQoL-5D (EQ-5D), Visual Analog Scale (VAS), Merle d'aubigne Hip score (MAH) and the Majeed Pelvic Score (MPS) score were used. Multivariable mixed models were used to examine the course of HRQoL, prognostic factors for a decreased HRQoL and functional outcomes over time.

Results: 184 patients with pelvic fractures were identified between 2015–2016; 71 Tile A, 44 Tile B and 10 Tile C fractures, and 59 acetabular fractures. At pre-injury, 1 week, 1, 3, 6 and 12 months after injury, the mean EQ-5D Index was respectively 0.90, 0.26, 0.45, 0.66, 0.77 and 0.80 and the mean EQ-VAS was respectively 83, 45, 57, 69, 75 and 75. At 6 and 12 months after injury ceiling effects were noticed regarding the different MPS and MAHS dimensions. The pre-injury score was an important prognostic factor for a decreased HRQoL. Females and patients with a higher ISS were associated with a lower score on the EQ-5D VAS ($\beta = -6.66$), ($\beta = -7.09$).

Conclusions: Patients with pelvic fractures experience a reduction of their HRQoL. Most patients do not achieve their pre-injury state of HRQoL within 1 year after trauma. Prognostic factors for decreased HRQoL are a low pre-injury score, higher ISS and female gender. We do not recommend the MAHS and MPS in the mid/long-term follow-up of pelvic fractures.

O 65

Reoperation rates are acceptably low in undisplaced femoral neck fractures of the elderly, but unacceptably high in displaced fractures

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Introduction: Reoperation after internal fixation (IF) of femoral neck fracture is common. Our aim was to determine the reoperation rate and explore associated risk factors for reoperation.

Materials and methods: Methods A follow-up study including 128 patients aged 65 + years that were surgically treated with either cancellous screws or dynamic hip screw between 1st of January 2010 and 31st of December, 2017. We retrospectively obtained data from our patient database and telephone survey related to reoperation: sex, age, BMI, ASA, fracture classification (Garden, AO), type of implant, quality of IF, dwelling, and pre-fracture mobility.

Results: Twenty reoperations due to failure of fixation (15x), avascular necrosis (4x), and posttraumatic osteoarthritis (1x) were identified. The reoperation rate was 15.6% (20/128). Fracture dislocation was associated with reoperation risk (Garden I vs Garden III HR 10.72, 95% CI: 3.99–28.83, P = < 0.001). The reoperation rate was 7.8% in undisplaced and 52.2% in displaced fractures.

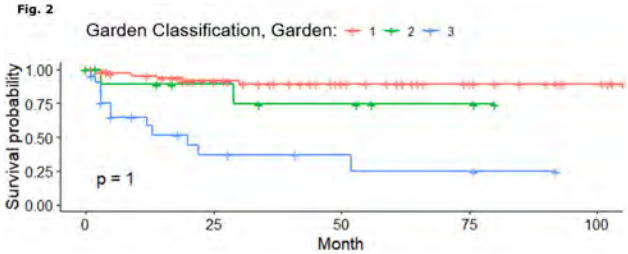
Conclusions: Screw fixation is a reasonable option in elderly patients with undisplaced fractures. In displaced fractures reoperation is high, hence primary prosthetic replacement should be recommended. Sex, BMI, ASA, type of implant, quality of IF, dwelling, and pre-fracture mobility were not associated to reoperation.

Fig. 1

Table 2. Description of reoperation cases

	N=20 (100%)
Reason for reoperation	
Failure of fixation	15 (75%)
Garden I (3x)	
Garden II (1x)	
Garden III (11x)	
Avascular necrosis	4 (20%)
Garden I (2x)	
Garden II (1x)	
Garden III (1x)	
Posttraumatic osteoarthritis	1 (5%)
Garden I (1x)	
Year of reoperation	
2011	1 (5%)
2012	1 (5%)
2013	3 (15%)
2014	5 (25%)
2015	5 (25%)
2016	2 (10%)
2017	1 (5%)
2018	2 (10%)
Procedure at reoperation	
Total hip replacement	11 (55%)
Hemiarthroplasty	7 (35%)
Girdlestone	2 (10%)
Further operations	
yes	2 (10%)
no	18 (90%)

Fig. 2



O 66

EASY (endoscopic approach to the symphysis): first experiences with an endoscopic approach for plate osteosynthesis of the anterior pelvic ring

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Introduction: Minimally invasive surgical approaches can reduce approach related complications. While general surgeons are used to the endoscopic visualization, pelvic trauma surgeons still rely on open approaches for anterior pelvic ring injuries.

Materials and methods: We established the EASY-approach based on the extraperitoneal approach for inguinal hernia repair (TEP) and the modified Stoppa approach. The EASY-approach was applied on eight patients with an anterior pelvic ring injury requiring surgery in two german level 1 trauma centers.

Results: On all eight patients the EASY-approach was applied without adverse events. In four cases the plate osteosynthesis was done completely endoscopically with excellent results for the patients regarding pain relief and scar development. In the remaining four cases the endoscopic stabilization was not performed for the following reasons: In the first overall case primarily only the endoscopic approach was planned. In the fourth overall case, ventilation showed high end-expiratory CO2-levels after endoscopic situs preparation, so we converted to the open plating. In the fifth overall case, the EASY-approach was applied to evacuate a retrosymphyseal hematoma in a patient with a stable pubic rami fracture. In the eighth overall case, the anterior pelvic ring injury was a bilateral multifragmentary pubic rami fracture in combination with a disruption of the symphysis. After endoscopic situs preparation with clipping of the corona mortis vessel, reduction of the displaced symphysis could not be done endoscopically.

Conclusions: We demonstrated that the endoscopic plate osteosynthesis of the anterior pelvic ring is feasible with existing standard laparoscopic instruments. The evaluation of the EASY-approach in the clinical setting is going on, while the development of suitable reduction tools is one major goal of future studies.

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

O 67

The morphological analysis of the pelvis about the feasibility of the retrograde pubic ramus screw insertion; computed tomography study

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Introduction: Retrograde intramedullary pubic ramus screw fixation is less invasive method and biomechanically stable compared to the plate fixation. The purpose of this study is to examine the feasibility of screw insertion using computed tomography (CT).

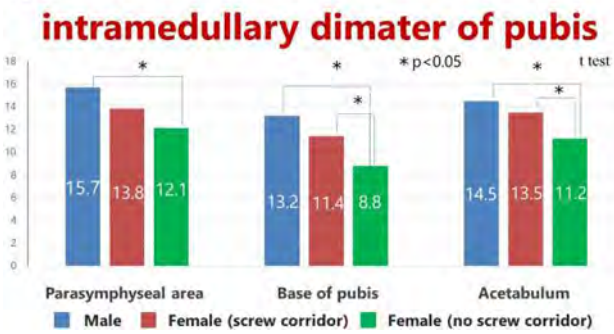
Materials and methods: We analyzed sixty CT data (30cases in male and female each). By using CT analyzing software, the virtual column with 6.5 mm diameter was inserted so that we analyzed the feasibility of the screw insertion. And the intramedullary diameter of the pubic ramus at the parasymphyseal area, base, and acetabulum were measured.

Results: The virtual 6.5 mm diameter screws could be inserted in 100% (30/30) in male and 23.3% (7/30) in female. The cause that screws insertion was impossible was penetration to the hip joint in all cases. The screw inserting point was 19.2 mm and 21.5 mm from the medial border of the pubic symphysis and 11.5 mm and 9.8 mm from the upper border of the pubic symphysis in male and female respectively ($p > 0.05$). The intramedullary diameter of pubic ramus was 15.7 mm, 13.8 mm and 12.5 mm at parasymphyseal area, 13.2 mm, 11.4 mm and 9.4 mm at the base of pubis, and 14.5 mm. 13.5 mm and 11.7 mm at the acetabulum in male, female who had the screw corridor and female who didn't have the screw corridor respectively. The diameter of the pubic ramus of the female who didn't have the screw corridor was significantly small compared to male and pubic ramus in three measuring points ($p < 0.05$).

Conclusions: The morphological analysis of the pelvis revealed that male has enough space in the pubic ramus to insert the retrograde pubic ramus screw. On the other hand, 75% of the female doesn't have the screw corridor. Preoperative analysis of the feasibility of pubic ramus screw insertion is mandatory in female cases.

Fig. 1

Fig. 2



O 68

Factors affecting the prognosis of patients with traumatic pelvic bone fractures with hemodynamic instability: multi-center study

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Introduction: We analyzed the effect of hemorrhage control methods on the mortality of pelvic fracture patients with hemodynamic instability, and investigated independent risk factors of mortality of these patients.

Materials and methods: From Jan 2013 to Oct 2017, 97 pelvic fracture patients with hemodynamic instability were enrolled from two institutions. They were classified into survival and non-survival groups based on '28 day mortality' and 'Acute hemorrhagic mortality', and their clinical data including hemorrhage control methods

were collected. Through statistical analysis of the collected clinical information, the effect of each hemorrhagic control methods on mortality was analyzed. Multivariate logistic regression was performed to determine the independent risk factors for the mortality of these patients.

Results: Among enrolled patients, 28 day mortality was 37, and acute hemorrhage mortality was 28. Difference in hemorrhage control method had no significant effect on the mortality of these patient. However, there was a significant difference in mortality between groups with and without any of the hemorrhage control methods (p = 0.032). Multivariate logistic regression analysis revealed that age of patient (p = 0.002), TRISS (p = 0.022), transfusion amount (24 h) (p = 0.016) were independent factors for 28 day mortality. With same statistical analysis, age of patient (p = 0.006), transfusion amount (24 h) (p = 0.007), GCS (p = 0.026) and SBP (p = 0.025) were revealed as independent factors for acute hemorrhage mortality.

Conclusions: Hemorrhage control methods such as angiography, PPP, EF can help to reduce acute hemorrhage mortality in hemodynamically unstable patients by pelvic fracture, however, there was no significant difference in mortality according to difference in hemorrhage control methods. Old age, high transfusion requirements, low TRISS score, low GCS, and low SBP are independent risk factors for mortality of pelvic fracture patients with hemodynamic instability.

Table 1. Baseline characteristics of patients

	Mortality (28 day)			Mortality (Acute hemorrhage)		
	Survival (n = 60)	Non survival (n = 37)	*P* value	Survival (n = 69)	Non survival (n = 28)	*P* value
Age, years, mean ± SD	50.72 ± 20	66.27 ± 21.6	<0.001	53.91 ± 20.8	63.39 ± 23.4	0.053
Sex, n (%)			0.286			0.141
Male	29 (48.3)	22 (59.5)		53 (47.8)	18 (64.3)	
Female	31 (51.7)	15 (40.5)		36 (52.2)	10 (35.7)	
Medications, n (%)						
Aspirin	0 (0)	4 (12.1)	0.006	3 (4.3)	1 (4.2)	0.97
Clopidogrel	0 (0)	3 (9.1)	0.018	2 (2.9)	1 (4.2)	0.762
Injury mechanism, n (%)			0.549			0.673
MVA (pedestrian)	27 (45)	20 (54.1)		32 (46.4)	15 (53.6)	
MVA (passenger)	9 (15)	3 (8.1)		10 (14.5)	2 (7.1)	
Motorcycle accidents	18 (30)	8 (21.6)		19 (27.5)	7 (25)	
Falls	5 (8.3)	4 (10.8)		5 (7.2)	4 (14.3)	
Others	1 (1.7)	2 (5.4)		3 (4.3)	0 (0)	
Transfusion amount (24Hr)	10.9 ± 7.1	19.1 ± 13.7	0.002	11.5 ± 7.9	20 ± 14.3	0.000
Pelvic binder	37 (61.7)	23 (60)	0.871	40 (58)	18 (69.2)	0.316
Combined laparotomy	10 (16.7)	10 (27)	0.221	11 (15.9)	9 (32.1)	0.074

SD=Standard Deviation, MVA=Motor Vehicle Accident, Hr=Hour

Table 2. Comparison of trauma related scores of patients

	Mortality (28 day)			Mortality (Acute hemorrhage)		
	Survival (n = 60)	Non survival (n = 37)	*P* value	Survival (n = 69)	Non survival (n = 28)	*P* value
AIS, mean ± SD						
Head and neck	1.13 ± 1.54	1.46 ± 1.76	0.339	1.12 ± 1.5	1.61 ± 1.87	0.178
Face	0.38 ± 0.8	0.57 ± 1.02	0.325	0.39 ± 0.79	0.61 ± 1.1	0.351
Chest	1.8 ± 1.51	1.95 ± 1.63	0.174	1.85 ± 1.5	1.96 ± 1.71	0.241
Abdomen	1.75 ± 1.56	1.7 ± 1.41	0.881	1.75 ± 1.53	1.68 ± 1.44	0.824
Extremities	4.58 ± 0.53	4.78 ± 0.53	0.076	4.61 ± 0.52	4.79 ± 0.57	0.145
External	0.46 ± 0.54	0.38 ± 0.55	0.483	0.43 ± 0.53	0.43 ± 0.57	0.986
ISS, mean ± SD	34.4 ± 10.1	41 ± 12.9	0.006	34.5 ± 9.8	42.6 ± 14	0.008
RTS, mean ± SD	6.369 ± 1.924	4.681 ± 2.574	0.001	6.325 ± 1.852	4.247 ± 2.742	0.001
TRISS, %, mean ± SD	67.61 ± 31.14	34.45 ± 31.15	<0.001	64.57 ± 31.44	31.27 ± 32.21	<0.001
APACHE II, mean ± SD	16.4 ± 9	37.7 ± 7.1	<0.001	17.4 ± 9.4	41.3 ± 5.3	<0.001

AIS=Abbreviated Injury Scale, SD=Standard Deviation, ISS=Injury Severity Score, RTS=Revised Trauma Score, TRISS=Trauma and Injury Severity Score, APACHE =Acute Physiology And Chronic Health Evaluation

Table 3. Comparison of clinical parameters between groups

	Mortality (28 day)			Mortality (Acute hemorrhage)		
	Survival (n = 60)	Non survival (n = 37)	*P* value	Survival (n = 69)	Non survival (n = 28)	*P* value
Vital sign, mean ± SD						
SBP	96.6 ± 30.4	70.5 ± 40.9	0.001	94.4 ± 29.9	67.6 ± 45.3	0.007
DBP	56.1 ± 18.1	42.8 ± 27.9	0.005	54.6 ± 18.5	42.3 ± 30.5	0.054
HR	98 ± 25.4	89.7 ± 47.1	0.325	99 ± 27.2	84.6 ± 49.1	0.153
RR	18.6 ± 14.9	17.3 ± 10.1	0.642	18.8 ± 13.9	16.4 ± 11.5	0.429
BT	36.1 ± 0.9	34.7 ± 5.8	0.068	36.1 ± 0.9	34.3 ± 6.8	0.188
GCS, mean ± SD	11.9 ± 4.7	9.1 ± 4.9	0.007	11.9 ± 4.5	8.2 ± 5.1	0.001
ABGA, mean ± SD						
pH	7.34 ± 0.109	7.264 ± 0.197	0.045	7.342 ± 0.11	7.241 ± 0.208	0.024
pCO2	32.8 ± 8.8	35.5 ± 17.4	0.404	32.5 ± 8.9	36.8 ± 18.8	0.287
pO2	120.7 ± 66.3	106.2 ± 59.6	0.300	120.8 ± 65.1	102.2 ± 60.3	0.206
Sat	92.9 ± 15.6	88.1 ± 20.3	0.213	93.3 ± 14.7	85.9 ± 22.3	0.12
BE	-6.8 ± 4.6	-10.1 ± 6.4	0.012	-6.9 ± 4.6	-10.7 ± 6.7	0.013
Lactate	4.3 ± 3	6.6 ± 3.2	0.001	4.4 ± 3	7 ± 3.2	<0.001

SBP=systolic blood pressure, DBP=diastolic blood pressure, HR=heart rate, RR=respiration rate, BT=body temperature, GCS=glasgow coma scale, ABGA=arterial blood gas analysis, BE=base excess

Fig. 4

Table 4-1. Effect of each hemorrhage control methods on mortality of patients

	Mortality (28 day)			Mortality (Acute hemorrhage)		
	Survival (n = 60)	Non survival (n = 37)	*P* value	Survival (n = 69)	Non survival (n = 28)	*P* value
Angiography	33 (55.9)	14 (38.9)	0.107	37 (54.4)	10 (37.0)	0.127
Angio. + Embolization	23 (38.3)	9 (24.3)	0.154	25 (36.2)	7 (25)	0.286
PPP	26 (43.3)	19 (51.4)	0.442	33 (47.8)	12 (42.9)	0.657
EF	14 (23.3)	5 (13.5)	0.237	18 (26.1)	1 (5.3)	0.011
Angio. or PPP or EF	49 (81.7)	27 (73)	0.313	58 (84.1)	18 (64.3)	0.032

Angio.=Angiography, PPP= Preperitoneal Pelvic Packing, EF= External fixation

Table 4-2. Comparison of hemorrhage control methods for mortality in patients

	Mortality (28 day)			Mortality (Acute hemorrhage)		
	Survival (n = 49)	Non survival (n = 27)	*P* value	Survival (n = 58)	Non survival (n = 18)	*P* value
Hemorrhage control methods			0.259			0.350
Angio. alone	19 (38.8)	6 (22.2)		19 (32.8)	6 (33.3)	
PPP alone	9 (18.4)	12 (44.4)		13 (22.4)	8 (44.4)	
EF alone	1 (2)	0 (0)		1 (1.7)	0 (0)	
Angio. + PPP	7 (14.3)	4 (14.8)		8 (13.8)	3 (16.7)	
Angio + EF	3 (6.1)	2 (7.4)		5 (8.6)	0 (0)	
PPP + EF	6 (12.2)	1 (3.7)		7 (12.1)	0 (0)	
Angio + PPP + EF	4 (8.2)	2 (7.4)		5 (8.6)	1 (5.6)	

Angio.=Angiography, PPP= Preperitoneal Pelvic Packing, EF= External fixation

Fig. 5

Table 5-1. Multivariable regression analysis for risk factor for 28 day mortality

Characteristics	Univariate analysis		*P* value	Multivariate analysis	*P* value
	Survival (n = 60)	Non survival (n = 37)		OR(95% CI)	
Age	50.72 ± 20	66.27 ± 21.6	<0.001	1.056 (1.020, 1.093)	0.002
Transfusion amount (25Hr)	10.9 ± 7.1	19.1 ± 13.7	0.002	1.084 (1.015, 1.156)	0.016
TRISS (%)	67.61 ± 31.14	34.45 ± 31.15	<0.001	0.976 (0.956, 0.997)	0.022
BE	-6.8 ± 4.6	-10.1 ± 6.4	0.012		
Lactate	4.3 ± 3	6.6 ± 3.2	0.001		
GCS	11.9 ± 4.7	9.1 ± 4.9	0.007		
SBP	96.6 ± 30.4	70.5 ± 40.9	0.001		

OR=Odd ratio, CI=Confidentce Interval, TRISS=Trauma and Injury Severity Score, Hr=Hour, BE=Base Excess, GCS=Glasgow Coma Score, SBP=Systolic Blood Pressure

Table 5-2. Multivariable regression analysis for risk factor for acute hemorrhage mortality

Characteristics	Univariate analysis		*P* value	Multivariate analysis	*P* value
	Survival (n = 60)	Non survival (n = 37)		OR(95% CI)	
Age	53.91 ± 20.8	63.39 ± 23.4	0.053	1.050 (1.014, 1.087)	0.006
Transfusion amount (25Hr)	11.5 ± 7.9	20 ± 14.3	0.006	1.094 (1.025, 1.169)	0.007
TRISS (%)	64.57 ± 31.44	31.27 ± 32.21	<0.001		
BE	-6.9 ± 4.6	-10.7 ± 6.7	0.013		
Lactate	4.4 ± 3	7 ± 3.2	<0.001		
GCS	11.9 ± 4.5	8.2 ± 5.1	0.001	0.852 (0.740, 0.981)	0.026
SBP	94.4 ± 29.9	67.6 ± 45.3	0.007	0.978 (0.960, 0.997)	0.025

OR=Odd ratio, CI=Confidentce Interval, TRISS=Trauma and Injury Severity Score, Hr=Hour, BE=Base Excess, GCS=Glasgow Coma Score, SBP=Systolic Blood Pressure

O 69

Retrograde trans-pubic screw osteosynthesis: a reliable minimal-invasive technique

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Introduction: Anterior lesions occur in 80% of patients with pelvic ring fractures. Operative stabilization of the anterior ring enhances its stability at about 30%.
Materials and methods: Patients treated with a retrograde trans-pubic screw in a Level I trauma center from 2003–2017 were included. Fracture mechanism was classified as high-energy or fragility fracture of the pelvis (FFP). Assessed were: implant loosening, sub-optimal positioning, peri-implant infection, hematoma, neurovascular damage, operative revision. Nonunion was defined as radiographic lack of union after 6 months.
Results: 158 retrograde trans-pubic screws were used in 128 patients, half were in FFP, half in high-energy trauma. Mean age was 64 ± 21 years, 83 females and 45 males. 63% of the screws reached the supraacetabular region. Early implant-associated complications occurred in 10% (suboptimal positioning, peri-implant infection, hematoma), 5% of the screws were revised. There were no neurovascular or urologic complications. Radiographic nonunion was observed in 10% with a minimum follow-up of 6 months, this correlated with a peri-implant infection (p 0.001), operation > 6 months after trauma (p 0.02) and non-significantly with implant loosening (p 0.076). There was no correlation of nonunion with patient's age, the fracture mechanism or a non-excellent reduction. In total, 12.5% of the patients were re-operated, in 5.1% a re-osteosynthesis was conducted.
Conclusions: Retrograde trans-pubic screws show good clinical results with lower or similar complication rates compared to alternative methods as plate fixation or external fixator. Fracture union did not depend on fracture mechanism or age. Hence, this minimal-invasive method is especially attractive in elderly patients with an FFP. Because it is an internal fixation of the superior pubic ramus with relative stability, an anatomic open reduction is not necessary to achieve fracture union.

O 70

The need for extraperitonal pelvic packing - finally confirmed to be vanishing?

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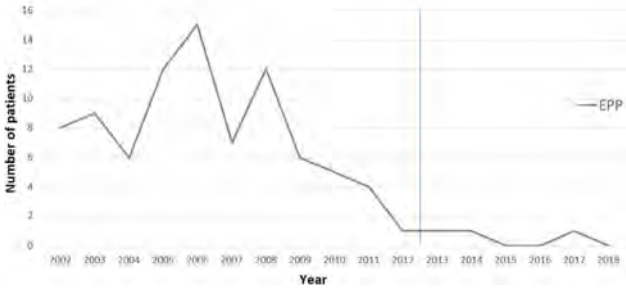
Introduction: Extraperitoneal pelvic packing (EPP) was introduced at Oslo University Hospital (OUH) in 1994. However, we have published that the need for EPP decreased dramatically in our institution after optimization of resuscitation strategies with introduction of a formal massive haemorrhage protocol in 2007 (1). We aimed to explore whether this trend has continued in the years after 2012.
Materials and methods: Retrospective analysis of data from the OUH Trauma Registry for the period 2013–2018 was performed. All trauma patients admitted with pelvic fracture were included.
Results: A total of 772 patients were included. The rate of severe pelvic fractures (AIS ≥ 3) was 54% (415/772). A total of 158/772 (20%) of patients were in need of transfusions in the ED. The overall mortality rate was 7,2%. During the 6-year period three patients required primary EPP in our hospital. Annual numbers of EPP over the study period (before 2013) and in the trend analysis (after 2013) are visualized in Fig. 1.
Conclusions: The need for EPP for pelvic injuries has almost vanished after the introduction of optimized resuscitation and transfusion strategies.
References: 1. Gaski IA, Barckman J, Naess PA, et al. Reduced need for extraperitoneal pelvic packing for severe pelvic fractures is associated with improved resuscitation strategies. J Trauma Acute Care Surg. 2016;81(4):644–51.

Fig. 1



CHEST INJURIES AND TRAUMA CRITICAL CARE

O 71

Cerebral venous thrombosis in traumatic brain injury (CVT in TBI): a cause of secondary insults and added mortality

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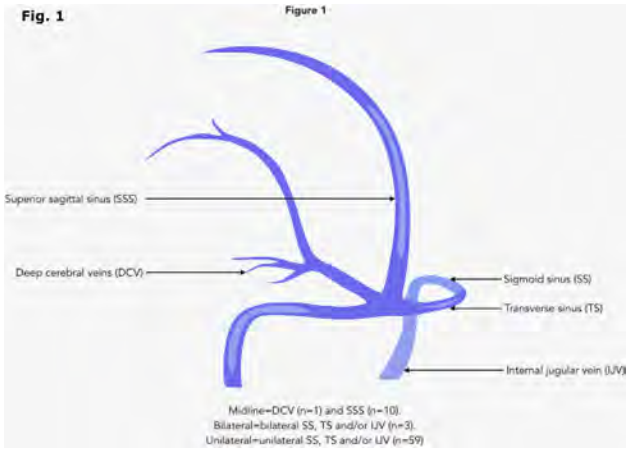
Introduction: The presence of cerebral venous thrombosis (CVT) is increasingly recognized in traumatic brain injury (TBI), but its complication rate and effect on outcome remains undetermined. In this study, we characterize the complications and outcome-effect of CVT in TBI patients.
Materials and methods: In a retrospective, case–control study of patients included in the Oslo University Hospital trauma registry and radiology registry from 2008–2014, we identified patients with CVT (cases) and without CVT (controls). Groups were matched regarding abbreviated injury severity (AIS) head region score 3–6. Cases were identified by AIS or ICD-code for CVT and a CT/MR venography confirmed to be positive for CVT, whereas controls had no AIS or ICD-code for CVT and a CT/MR venography confirmed to be negative for CVT. Risk of mortality was assessed using multivariate logistic regression adjusting for initial GCS, ISS and Rotterdam score. Results are also reported for subgroups according to CVT location (Fig. 1).
Results: The CVT group (n = 73) and control group (n = 120 patients) were well matched regarding baseline characteristics. In the CVT group 18% had venous infarction, 11% had ICH and 19% had oedema, all secondary CVT. Unadjusted 30-day mortality was 16% in

the CVT group compared to 4% in the no-CVT group (p = 0.004), however the difference was no longer significant in the adjusted analysis (OR 2.241, 95% CI 0.625–8.032, p = 0.215). Subgroup analysis by CVT location showed an unadjusted 30-day mortality of 50% for midline/bilateral CVT, 8% for unilateral CVT compared to 4% for no-CVT (p < 0.001). The adjusted analysis showed a significantly higher mortality in the midline/bilateral CVT group when compared to the no-CVT group (OR 8.061 (95% CI 1.540–42.186, p = 0.013).

Conclusions: There is a significant rate of complications from CVT in TBI patients leading to secondary brain insults and midline and bilateral CVT is associated with increased 30-day mortality in TBI patients.

Fig. 1



O 72

Nationwide US trends in rib fixation for traumatic flail chest

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Introduction: For traumatic flail chest, in addition to aggressive pulmonary support, surgical rib fixation is utilized in selected cases. The purpose of this study was to identify the nationwide trends in rib fixation, outcomes and optimal timing.

Methods: Patients with traumatic flail chest were identified from the American College of Surgeons National Trauma Data Bank 2007–2016. Exclusions included transfers from an outside hospital and death < 24 h. Two groups (nonoperative vs fixation group) were matched 1:1 with propensity score modeling based on age, SBP, HR, GCS, ISS, Hemothorax, lung contusion and need for chest drain. Univariate analysis was used to compare demographics and injury data. Multivariate logistic regression compared outcomes (mortality, prolonged ventilation) between groups.

Results: During the study time frame, out of 1,886,707 injured patients, 7816 (0.4%) flail chest patients were identified. Median age 56 [44–66], 75% male. Most common mechanism of injury was motor vehicle collision (61%). In total, 4% (n = 324) underwent rib fixation. An increasing trend in rib fixation from 2014–2016 was demonstrated (0.6–7.3%). After matching, there was a statistically significant difference in mortality between fixation and nonoperative group (2% vs 7%, p-value 0.002). On multivariate analysis, rib fixation was associated with improved mortality (OR 0.289 [95% CI 0.103–0.814], p-value 0.019). Early fixation within 72 h improved hospital LOS, ICU LOS, ventilator days and need for tracheostomy. Late fixation was associated with significantly prolonged ventilation days (OR 9.490 [95% CI 1.093–82.432], p-value 0.041).

Conclusions: Rib fixation in flail chest patients has increased over time. Rib fixation was associated with an improvement in mortality with repair < 72 h being optimal. Further prospective evaluation is warranted.

Reference: Moya M, et al. Rib fixation: who, what,when? Trauma Surg Acute Care Open. 2017;2:1–4.

Fig. 1

Table 4 Baseline characteristics after propensity score matching

	Patients (N=634)		
	Nonoperative group (N=310)	Fixation group (N=324)	P-value
AGE, median (IQR)	51 (37-60)	48 (37-60)	0.191
GENDER, MALE	228 (74%)	242 (75%)	0.743
CLINICAL DATA			
SBP	130 (112-151)	130 (108-145)	0.598
HR	105 (85-124)	114 (92-130)	0.140
RR	20 (16-26)	22 (18-28)	0.005
Oxygen saturation	96 (91-99)	95 (90-98)	0.215
GCS at ED	10 (3-14)	14 (6-15)	<0.0001
BLUNT INJURY	303 (98%)	321 (99%)	0.042
MECHANISM OF INJURIES			0.131
MVC	231 (75%)	218 (67.3%)	
FALL	45 (14%)	52 (16%)	
FIREARM	0	2 (0.6%)	
OTHER	34 (11%)	52 (16%)	
ISS	38 (29-46)	35 (24-45)	<0.0001
CHEST AIS	4 (3-4)	4 (3-4)	0.018
HEAD AIS MEDIAN (IQR), %	3 (2-4)	2 (2-3)	<0.0001
ABDOMINAL AIS MEDIAN (IQR), %	3 (2-4)	2 (2-3)	0.588
PNEUMOTHORAX	150 (48%)	135 (42%)	0.089
HEMOTHORAX	47 (15%)	59 (18%)	0.304
PNEUMOHEMOTHORAX	120 (39%)	147 (45%)	0.090
LUNG CONTUSION	89 (29%)	43 (13%)	<0.0001
Need for chest drain	213 (69%)	260 (80%)	0.001

Fig. 2

Table 5 Outcomes after propensity score matching

	Patients (N=634)		
	Nonoperative group (N=310)	Fixation group (N=324)	P-value
MORTALITY	23 (7%)	7 (2%)	0.002
HOSPITAL LOS, DAYS	28 (19-39)	19 (13-28)	<0.0001
ICU LOS, DAYS	22 (15-30)	13 (7-19)	<0.0001
VENTILATOR DAYS	18 (12-25)	8 (4-14)	<0.0001
COMPLICATIONS			
Pneumonia	69 (22%)	22 (6.7%)	<0.0001
ARDS	37 (12%)	16 (5%)	0.001
Unplanned ICU admission	3 (1%)	2 (0.6%)	0.618
NEED FOR TRACHEOSTOMY	222 (72%)	60 (19%)	<0.0001

Continuous variables presented as median (interquartile range). Categorical variables presented as n (%).
LOS, length of stay; ARDS, acute respiratory distress syndrome

Fig. 3

Table 6 Multivariate Analysis of Independent Risk Factors for In-hospital mortality after propensity score matching

	Mortality		
	Adj p-value	OR	95%CI
Age	0.257	1.016	(0.988 – 1.046)
Systolic blood pressure	0.002	0.981	(0.969 – 0.993)
Heart rate	0.946	0.999	(0.984 – 1.015)
Respiratory rate	0.320	0.972	(0.918 – 1.028)
Hemothorax	0.110	0.185	(0.023 – 1.466)
Pneumohemothorax	0.969	1.017	(0.0432 – 2.397)
ARDS	0.004	4.279	(1.576 – 11.617)
Lung contusion	0.789	0.879	(0.343 – 2.257)
Need for chest drain	0.412	0.688	(0.282 – 1.681)
Rib fixation	0.019	0.289	(0.103 - 0.814)

Test for multicollinearity was performed prior to multivariate analysis. AUROC= 0.813 (95% CI= 0.749-0.935). OR, odds ratio; CI, confidence interval

Fig. 4

Table 7 Outcomes of early rib fixation

	Rib fixation Patients (N=324)		
	Early within 72 H (N= 144)	Late >72 H (N=180)	P-value
Mortality	3 (2%)	4 (2.2%)	0.932
Hospital LOS, days	14 (10-22.5)	21 (15-29.75)	<0.0001
ICU LOS, days	9 (5-14.5)	15 (10-22)	<0.0001
Ventilator Days	6 (3-8.5)	10.5 (6-16)	<0.0001
Prolong ventilation (>7D)	10 (6.9%)	40 (22.2%)	0.001
Complications			
Pneumonia	65 (45%)	70 (39%)	0.257
ARDS	2 (1.4%)	14 (7.8%)	0.008
Unplanned ICU admission	1 (0.7%)	1 (0.6%)	0.874
Need for tracheostomy	15 (10.4%)	45 (25%)	0.001

Continuous variables presented as median (interquartile range). Categorical variables presented as n (%). LOS, length of stay; ARDS, acute respiratory distress syndrome

Fig. 5

Table 8 Multivariate Analysis of Independent Risk Factors for prolong ventilation in rib fixation patients

	Mortality		
	Adj p-value	OR	95%CI
Age ≥65	0.069	1.021	(0.996 – 1.045)
ARDS	0.408	1.715	(0.478 – 6.149)
Pneumonia	0.026	3.147	(1.146 – 8.642)
Lung contusion	0.159	1.880	(0.781 – 4.522)
Timing of rib fixation			
within 24 hr	REF		
1-3 d	0.585	1.830	(0.209 – 16.017)
7. D	0.235	3.602	(0.435 – 29.834)
>7 d	0.041	9.490	(1.093 – 82.432)

Test for multicollinearity was performed prior to multivariate analysis. AUROC= 0.732 (95% CI= 0.651-0.814). OR, odds ratio; CI, confidence interval; SBP, systolic blood pressure; HR, heart rate; BPM, beat per minute; AIS, abbreviated injury scale; ED, emergency department

O 73

Fragile neutrophils in the circulation of surgical patients are associated with adverse clinical outcomes

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Introduction: The number of non-viable neutrophils is routinely measured by the hematology analyzer during every blood analysis, as quality check of timely analysis. Under normal conditions, these cells do not circulate in the peripheral blood. However, we incidentally found non-viable neutrophils after surgery in blood samples of critically ill patients. These cells became non-viable after standardized lysing of red blood cells and we therefore referred to these cells as "fragile neutrophils". It remains unknown how often fragile neutrophils are present in the circulation of surgical patients and what the relation is with clinical outcomes.
Materials and methods: Surgical patients ≥ 18 years of age who admitted between 2013 and 2017 were retrospectively included. Patients were excluded if they used clozapine, cytotoxic or immunosuppressive medication. After inclusion, the original flow cytometric data files of the Cell-Dynn Sapphire hematology analyzer were obtained and analyzed for the presence of fragile neutrophils. The incidence of fragile neutrophils after surgery was determined. In addition, clinical outcomes of patients with fragile neutrophils were analyzed.
Results: In total, 11,872 patients were included, of whom 75 (0.63%) had fragile neutrophils during hospitalization. Patients with fragile neutrophils were slightly older than other surgical patients (median age of 62 vs 65, $p = 0.011$) and had a significantly longer hospital stay (median of 3 days versus 30 days, $p < 0.001$). Of these patients, 75.7% developed an infection, 70.3% was admitted to the ICU and 31.3% died during hospitalization.
Conclusions: The presence of fragile neutrophils after surgery is very rare. If these cells are present in the blood, this is associated with severe clinical deterioration and a high mortality rate.

O 74

Recovery trajectories in patients with mild traumatic brain injury: a prospective multicentre cohort study

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Introduction: The aims of this prospective cohort study were (I) to identify trajectories of recovery in patients with mild traumatic brain injury (mTBI) during the first two years after trauma and (II) assess patients and injury characteristics for these trajectories.
Materials and methods: All adult trauma patients with mTBI (AIS-severity 1 or 2 and an injury severity score < 9) who were admitted to

a hospital in a region of the Netherlands from August 2015 to November 2016 were asked to complete questionnaires. The questionnaires could be completed at 1 week, and 1, 3, 6, 12 and 24 months and included the EuroQol-5-D for health status, including a cognition dimension, the Hospital Anxiety Depression Scale (HADS-D and HADS-A for symptoms of depression and anxiety respectively) and the Impact of Event Scale (IES) (for post-traumatic stress symptoms). Latent class trajectory analysis was used to determine trajectories of recovery in LatentGold 5.1, patient and injury characteristics of the classes were assessed in IBM SPSS 24.0.

Results: A total of 1027 patients (47% of total) completed at least one follow-up questionnaire. The number of classes (trajectories) ranged from 3 for cognition to 11 for depression. Poor recovery classes of cognition and health status consisted of mostly females, patients with low education, higher age, longer length of stay at the hospital and frail patients. The class with full recovery consisted of young patients, with most recovery occurring during the first six months after injury. Patients who reported poor health status before injury scored significantly lower health status after injury and showed no recovery over time.

Conclusions: Different recovery patterns were present in patients with mild traumatic brain injury. Especially frail elderly patients who reported poor health status before injury have poor outcome up to 24 months after injury.

Fig. 1

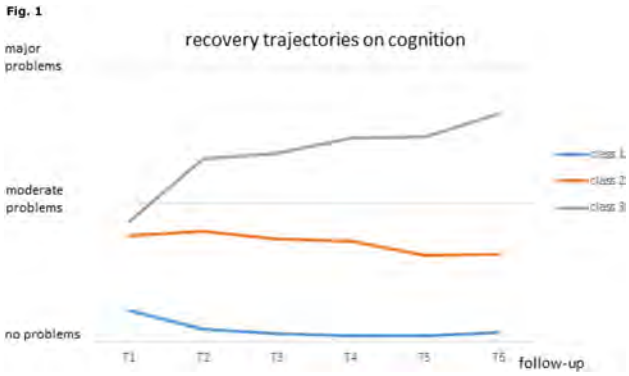
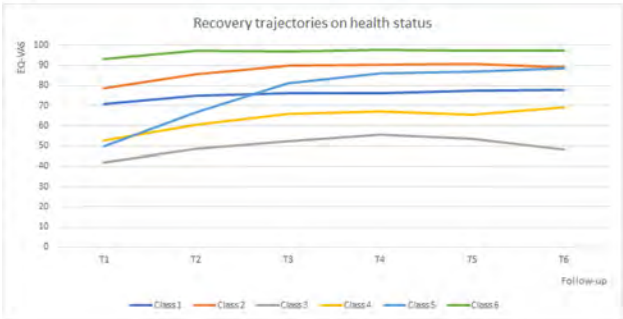


Fig. 2



O 75

Post-concussive symptoms in children and adolescents with traumatic brain injury: a CENTER-TBI study

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Introduction: Post-concussive symptoms are frequent in patients with traumatic brain injury (TBI)0.1 While various efforts have been made to develop clinical prediction models for a post-concussive syndrome (PCS) in adult TBI, data on this condition in children or adolescents is scarce. We therefore aimed to develop a set of clinical predictors which would allow to identify pediatric or adolescent TBI patients with a high risk for PCS.

Materials and methods: The multicenter prospective CENTER-TBI database was screened and only patients < 25 years with available Rivermead Post-Concussion Questionnaire (RPQ) at 6-months were included. PCS was dichotomized and defined as having at least three of the sixteen symptoms included in the RPQ Potential predictors were selected based on existing literature and regression analysis with the least absolute shrinkage and selection operator (LASSO) method was performed to select a multivariate model with the most important determinants predicting PCS. Model performance was assessed using bootstrap validation.

Results: 424 eligible young TBI patients were identified (median age 19 (IQR 16–22) years, 70% males). Age, gender, history of psychiatric illness, GCS score at admission, abnormality on CT imaging, post-traumatic amnesia, loss of consciousness, and ICU admission were found to be the strongest predictors for PCS after LASSO model selection. This model displayed reasonable discrimination (AUC of 0.70) but explained only 16% of the variance in outcome after bootstrap validation.

Conclusions: A set of 8 eight clinical factors easily obtainable in the emergency room is predictive for PCS in children and adolescents. Using these predictors might help to identify young patients that would benefit from early follow-up appointments. However, these factors only explain a small part of the variation in outcome after TBI and additional variables such as biomarkers might be needed to improve outcome prediction.

References: 1. Voormolen DC, Cnossen MC, Polinder S, et al. Prevalence of post-concussion-like symptoms in the general population in Italy, The Netherlands and the United Kingdom. Brain Inj [Internet] 2019 [cited 2019 Oct 5];33(8):1078–86.

O 76

The evaluation of pulmonary function after rib fixation for multiple rib fractures and flail chest: a retrospective study and systematic review of the current evidence

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Introduction: The primary aim of this retrospective cohort study was to evaluate the pulmonary function after rib fixation for patients with multiple rib fractures and flail chest. Secondary, a systematic review was performed to give an overview of the current literature and to allow comparison with our results.

Methods: All adult (≥ 18 years) patients who underwent rib fixation for multiple rib fractures or flail chest between 2010 and 2018 and who received a control pulmonary function test during the postoperative follow-up at our level-1 trauma center were retrospectively

reviewed. Secondary, the PubMed, EMBASE and Cochrane databases were searched to identify studies reporting on the pulmonary function after rib fixation. The primary outcome parameters were the forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), FEV1/FVC ratio, maximum vital capacity (VCmax), total lung capacity (TLC), residual volume (RV), and RV/TC ratio.
Results: Of the 103 patients who underwent rib fixation, a total of 61 (59%) patients underwent a pulmonary function test in our hospital and were ultimately included. Overall, all pulmonary function parameters fell within the normal range of the reference values three months after surgery and there was no evidence of a restrictive or an obstructive pulmonary impairment. Patients with multiple rib fractures had better recovery compared to those with a flail chest. The systematic review included a total of 15 studies and showed comparable results.
Conclusion: The present study demonstrates that rib fixation for multiple rib fractures or flail chest results in adequate recovery of the pulmonary function within three months after surgery. In addition, based on the current literature, further gradual improvement to maximum pulmonary values appears to occur during the first 12 months after rib fixation.

O 77

Mortality of adult respiratory distress syndrome in trauma patients: a systematic review over a period of four decades

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Introduction: Acute respiratory is associated with high morbidity and mortality. In addition, its etiologies are heterogeneous and the outcome depends on the underlying cause. The aim of the present study is to analyze, whether the mortality of posttraumatic ARDS is affected (1) over time, (2) attributable to geographic distribution, (3) related to the used definition and (4) depending on the injury severity.
Materials and methods: We selected studies by searching PubMed using the key words "acute respiratory distress syndrome", "mortality" and "trauma". All studies that reported mortality rates for polytrauma patients with ARDS were selected. There have been analyzed differences between several decades of patient recruitment (1980 to 1989 [decade 1], 1990 to 1999 [decade 2], 2000 to 2009 [decade 3] and 2010 to 2018 [decade 4]), geographic location (North America, Europe), and the definition used in the different studies (AECC, Berlin Definition).
Results: Twenty-three studies between 1980 and 2018 were included in the analysis. There was a wide variation in mortality rates among the studies (4–39%). The mean mortality over the last four decades was similar between decade 1 (25.8%), decade 2 (20.6%), decade 3 (20.7%) and decade 4 (22.5%). Geographical observations comparing Europe and North America revealed no difference (Europe (22.1%) and North America (21.7%)). The ARDS mortality in publications using the Berlin Definition (23%) was comparable to the mortality rate in publications using the American European Consensus Conference (22.9%). The mortality rate based on the injury severity showed no alteration (ISS $\leq$ 25; 22.6%, ISS $>$ 25; 22.6%).
Conclusions: In this systematic review, there was neither a change in the mortality rate over the last decades, nor a geographical difference within western societies, nor dependence on the used ARDS definition, nor association with injury severity.

O 78

Global mortality rates in polytrauma patients admitted to ICU: the era of change

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Introduction: Many factors of trauma care have changed in the last decades. This review investigated the effect of these changes on overall and cause-specific mortality in polytrauma patients admitted to the intensive care unit (ICU). Moreover, changes in trauma mechanism over time and differences between continents were analyzed.
Materials and methods: A systematic review of literature on overall mortality in polytrauma patients admitted to the ICU was conducted. Overall and cause-specific mortality rates were extracted as well as the trauma mechanism of each patient. Linear regression on changes in overall and cause-specific mortality rates was performed.
Results: Thirty studies, which reported mortality rates for 83,502observed patients, were included and showed a decrease of 0.4% in overall mortality per year (Fig. 1). Brain-related death has become more common over the years, whereas multiple organ dysfunction syndrome (MODS), acute respiratory distress syndrome and sepsis became less prevalent (Fig. 2). MODS was the most common cause of death in North America and brain-related death was the most common in Asia, South America and Europe (Fig. 3a). Penetrating trauma was most often reported in North and South America and Asia (Fig. 3b).
Conclusions: Overall mortality in polytrauma patients admitted to the ICU has been decreasing as a result of the improvements in trauma care. A shift from MODS to brain-related death could be observed. More research on preventative measures for the latter is required to ensure a further decline in mortality. Moreover, we have shown geographical differences in cause-specific mortality, which may provide learning possibilities between similar trauma centers resulting in improvement of trauma care.
References: 1. Lansink KW, Leenen LP. Eur J Trauma Emerg Surg. 2013;39:3–7.
2. Trunkey DD. Trauma. Sci Am. 1983;249:28–35.

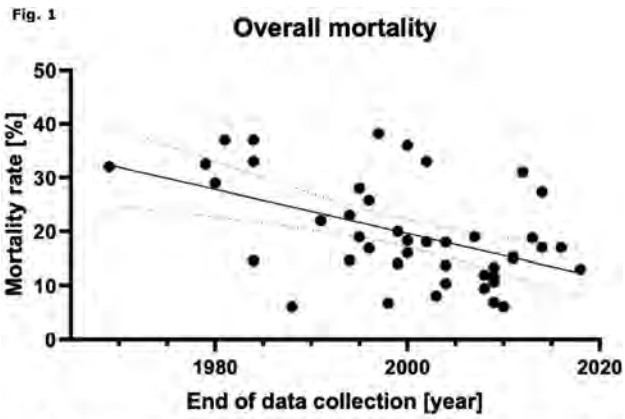

Fig. 1 Changes in overall mortality since 1969. Linear regression showed a decrease in mortality of 0.5% per year (CI: -0.69 – -0.27, p<0.0001, R^2 = 0.385)

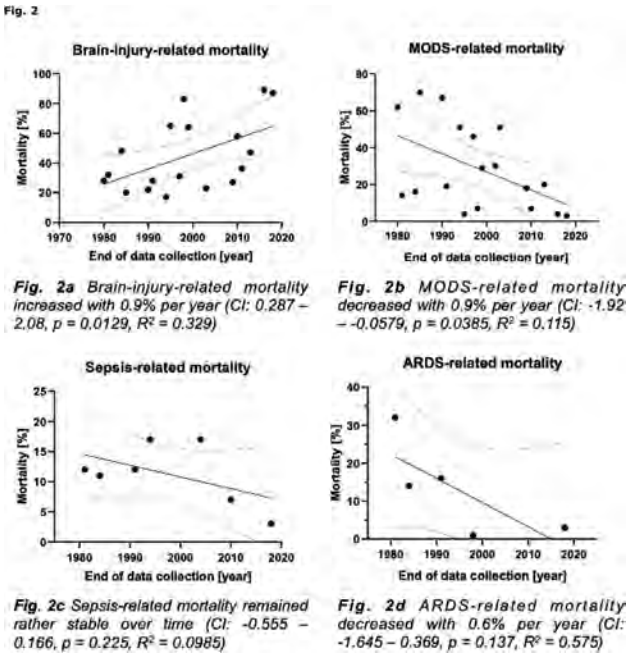

Fig. 2a Brain-injury-related mortality increased with 0.9% per year (CI: 0.287 – 2.08, p = 0.0129, R^2 = 0.329)

Fig. 2b MODS-related mortality decreased with 0.9% per year (CI: -1.92 – -0.0579, p = 0.0385, R^2 = 0.115)

Fig. 2c Sepsis-related mortality remained rather stable over time (CI: -0.555 – 0.166, p = 0.225, R^2 = 0.0985)

Fig. 2d ARDS-related mortality decreased with 0.6% per year (CI: -1.645 – 0.369, p = 0.137, R^2 = 0.575)

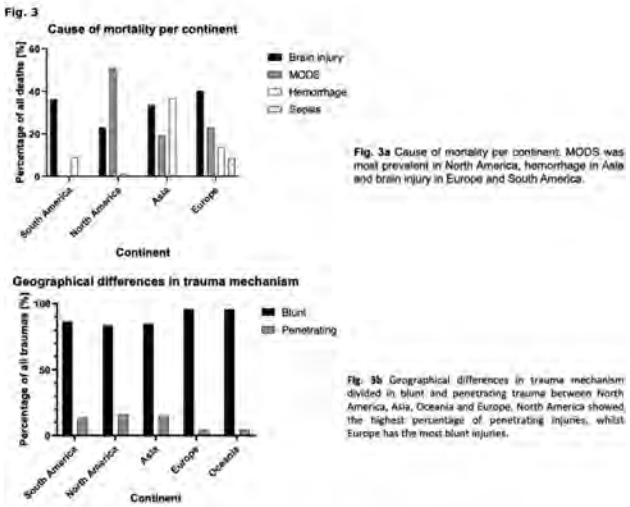

Fig. 3a Cause of mortality per continent: MODS was most prevalent in North America, hemorrhage in Asia and brain injury in Europe and South America.

Fig. 3b Geographical differences in trauma mechanism divided in blunt and penetrating trauma between North America, Asia, Oceania and Europe. North America showed the highest percentage of penetrating injuries, whilst Europe has the most blunt injuries.

O 79

Effect of treatment with open abdomen and negative pressure system in a pig abdominal sepsis model

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Introduction: This study investigated the effect of open abdomen and negative pressure system on physiologic parameters in an experimental abdominal sepsis in pigs.

Materials and methods: Sepsis was induced with fecal peritonitis in 10 anesthetized and mechanically ventilated pigs. Resuscitation was started 8 h after peritonitis induction. Five pigs were then randomized for a treatment with open abdomen and negative pressure system (ABThera, KCI, US) (VAC-group) and compared to five septic controls without open abdomen treatment. Resuscitation was maintained over the entire study period of 72 h. Mean arterial pressure (MAP), vasopressor administration and kidney function (urine output, blood flow in the right kidney artery) were followed for 72 h with a standardized protocol and compared between the two groups.

Results: Baseline median MAP of the ten pigs was 78.3 mmHg (IQR 70.9–83.5 mmHg). After sepsis induction, the MAP decreased to 62.7 mmHg [(IQR 46.6–72.3 mmHg); $p = 0.05$]. During the following resuscitation period theMAP of VAC-group was 72.0 mmHg (IQR 67.0–73.3 mmHg) versus 69.0 mmHg (IQR 64.1–70.3 mmHg) in the controls ($p = 0.173$). There was a strong trend towards lower maximal and total norepinephrine administration in the VAC-group compared to the controls [0.30 mcg/kg/min (IQR 0.20–1.27) vs 1.88 mcg/kg/min (IQR 0.35–2.74), $p = 0.251$, and 9532.10 mcg (IQR 6590.1–88,057.6) vs 160,591 mcg (IQR 12,941.70–209,717.04), $p = 0.251$]. Moreover, during the resuscitation period, there was a trend towards increased total urine output and blood flow in the kidney artery when comparing the VAC-group with the controls [3877 mL (3055–6016) vs 3407 mL (IQR 3052–3854), $p = 0.602$, and 355.1 ml/min (IQR 198.9–542.0) vs 233.0 ml/min (IQR 183.3–326.6), $p = 0.347$].

Conclusions: The treatment with open abdomen and negative pressure device seems to decrease the need for vasopressors and may have resulted in an increase in kidney perfusion and urine output in this experimental pig abdominal sepsis model.

O 80

Association between trauma patient volume of the intensive care unit and in-hospital mortality: a retrospective registry-based cohort study

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Introduction: Aim of the current study was to assess an association between trauma patient volume of the intensive care unit and in-hospital mortality.

Materials and methods: From data of the Japan Trauma Databank, this retrospective cohort study selected adult (≥ 16 y) trauma patients hospitalized in the intensive care unit with the injury severity score of ≥ 9. After applying a multiple imputation on all the study variables, a logistic regression generalized estimating equation after adjustment for age, sex, mechanism of trauma, and the injury severity score as covariates and hospitals as a cluster assessed an association between quartile of patient volume in intensive care unit and hospital mortality.

Results: Of 361,706 trauma patients registered in the Japan Trauma Databank from the year 2004 to 2019, 184,242 severely injured trauma patients hospitalized in the intensive care unit were selected. Of these, 45776 (166 hospitals), 46053 (35 hospitals), 45958 (26 hospitals), and 46455 (14 hospitals) patients hospitalized in the intensive care unit with the 1st (0–81 patients/year), 2nd (82–136 patients/year), 3rd (137–199 patients/year) and 4th (200 + patients/year) quartile of the annual patient volume, respectively. Crude in-hospital mortality was 12.5%, 10.6%, 9.7%, and 8.3% in patients in the 1st, 2nd, 3rd, and 4th quartile, respectively. In reference to patients in the 1st quartile, the adjusted relative risk

for in-hospital mortality was significantly lower in patients in the 2nd (0.92, 95% CI [0.88, 0.97]), 3rd (0.90, 95% CI [0.86, 0.94]) and 4th (0.78, 95% CI [0.75, 0.82]) quartiles.
Conclusions: The current study demonstrated that increased trauma patients volume negatively associated with in-hospital mortality in Japan after adjustment for trauma severity.
References: Endo A, Shiraishi, A, Fushimi K, Murata K, Otomo Y. Increased severe trauma patient volume is associated with survival benefit and reduced total health care costs. Ann Surg. 2018;268:1091–6.

UPPER EXTREMITY INJURIES

O 81

Health care utilization and related cost of midshaft clavicle fracture treatment in belgium

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Introduction: The debate regarding the economic impact and cost effectiveness of surgical midshaft clavicle fracture treatment is ongoing. Variations exist between health care systems in terms of financing, provider payment mechanism and the role of the government in all of this. Currently no information exists about the treatment costs of midshaft clavicle fractures in Belgium.
Materials and methods: A total of 345 patients with a midshaft clavicle fracture were included in the study. We selected 17 clinical variables and 5 cost categories were defined. 3 multivariate linear models were built to determine which parameters drive the costs.
Results: The median total healthcare cost for non-operatively treated patients was €367 and the median total cost for operatively treated patients was €3296. The length-of-stay was the most important variable that predicted the total cost. The clinical variables Number of fracture fragments, Delayed Stage Surgery, Revision Surgery and Infection most influenced the length-of-stay.
Conclusions: The initial health care utilization cost of operatively treated midshaft clavicle fractures is larger than that of non-operatively treated fractures. The length-of-stay is the most important parameter that drives the cost and is predominantly influenced by patients age, fracture complexity and complications requiring a surgical re-intervention.
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O 82

Promising results of anterior bridge plating for humeral shaft fractures through minimally invasive plate osteosynthesis (MIPO) technique

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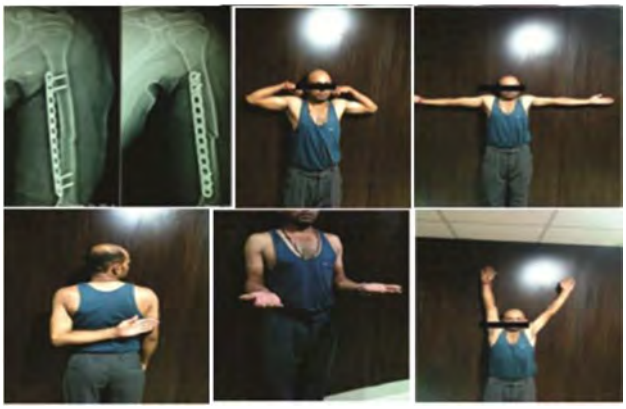
Introduction: Adult humeral shaft fractures are common, and most of them have been historically treated conservatively, with the use of hanging casts, or U-slaps [1–3]. Due to concerns about soft tissue dissection required for ORIF, a less invasive technique, that allows indirect reduction and bridge plating of the humerus, has been developed. We conducted this prospective study to evaluate the clinical, radiographic and functional outcomes, using anterior bridge plating by MIPO technique, for humeral shaft fractures, over a minimum follow up of 1 year.
Materials and methods: This study included a prospective cohort of 43 patients, managed with anterior bridge plating, using a minimally invasive plate osteosynthesis [MIPO] technique. Out of these 43 patients, one patient died of sudden death (probably MI), two and a half months after sustaining his humeral fracture. Also, two patients were lost in follow-up. Therefore, follow up of 40 patients was complete for evaluation of results and analysis.
Results: Union was observed in 38 (95%) fractures. Two fractures did not unite at 6 months follow up, and required bone grafting. Among the 38 patients, time taken for union was found to be less than 12 weeks in 3 (7.5%) fractures, between 12–16 weeks in 33 (82.5%) fractures, and higher than 16 weeks in 2 (5%) fractures. Final shoulder functional outcome, 33 patients (82.5%) had excellent result, and 7 patients (17.5%) had good shoulder function, on UCLA score. With regard to the final elbow function, 31 patients (77.5%) had an excellent outcome, 6 patients (15%) had a good outcome, 2 patients (5%) had a fair outcome, and 1 patient (2.5%) had a poor outcome.
Conclusions: Anterior humeral bride plating using MIPO technique yields high rates of union, minimal biological disruption of the soft tissue envelope, and better cosmesis, along with a fast and good functional recovery of patients with humeral shaft fractures.

Fig. 1

Fig. 2



O 83

Treatment of deep wound defects in trauma surgery: use of a collagen–elastin–matrix and split-thickness skin grafts in one-step procedure

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Introduction: The treatment of deep skin defects is very difficult, especially when they occur in highly strained regions like joints or tendons. Especially in trauma surgery wound defects close to joints result in bad functional outcome due to scar contractures. Clinical studies show that the use of a collagen-elastin-matrix with a split-thickness skin graft (STSG) can prevent this.
Materials and methods: 18 patients with traumatic defect wounds (free tendons, joints or bare bone surface) of the extremities were treated with a collagen-elastin-matrix and STSG in a one-step procedure. Prospective assessments were taken one week after surgery, two weeks and two months after discharge. Five of the 18 patients are currently in the follow-up-process. Take in time, graft survival, skin quality and self-estimation were evaluated.
Results: The graft survival was 16/18, two patients had a wound infection and for that an operative revision. The uptake was between 70–100%. The graft quality was good and only one patient showed contractures compared to the opposite site. Though time of surface remodeling seemed to be prolonged.
Conclusions: The use of collagen dermis-matrix and STSG offers a good outcome in highly strained regions. Also graft survival and the function were very good. Complex procedures like flaps can be avoided.

O 84

Functional recovery after treatment of extra-articular distal radius fractures in the elderly using the IlluminOss® System (IO-Wrist); a multicenter prospective observational study

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Introduction: Distal radius fractures account for approximately 17% of all fractures diagnosed. High redislocation rates and functional disability remain a significant problem after nonoperative treatment. The IlluminOss® System is a patient-conforming and percutaneous fracture fixation system. Because IlluminOss® allows for early mobilization, functional recovery might be fast. This study aimed to examine outcome in elderly with an extra-articular distal radius fracture treated with IlluminOss®.
Materials and methods: This multicenter, prospective, case series enrolled 50 patients (60 years or older and independent in activities of daily living) with a unilateral, displaced, extra-articular distal radius fracture treated with IlluminOss®. Follow-up data were acquired at two and six weeks, and three, six, and twelve months after surgery. The primary outcome measure was the DASH score. Secondary outcome measures included the PRWE score, radiological outcome (Lidstrom score), time to ADL independence, and complications.
Results: The 50 enrolled patients had a median age of 73 years and 94% was female. Six weeks after surgery the DASH score was 18 and the PRWE score was 38. Three months after surgery these values had decreased to 8 and 13 respectively, and subsequently stabilized. All fractures healed and 87% scored good or excellent on the Lidstrom score after one year. Forty out of 50 patients were independent in ADL within two weeks after surgery. After one year two patients were still not independent in ADL, which in one patient was partly due to distal radius fracture related factors. A total of nine complications occurred in five patients. One reintervention was necessary because of a traumatic refracture.
Conclusions: This study showed that IlluminOss® is a suitable option for treating extra-articular distal radius fractures, with excellent functional and radiological outcomes and an acceptable complication rate.

O 85

Reamed Irrigation-Aspiration (RIA) is associated with enhanced fracture hematoma immune cell viability and decreased neutrophil maturation/activation in standardized porcine intramedullary nailing

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Introduction: Quality and content of early fracture hematoma (FH) dictate the healing process in long bone fractures. Different reaming protocols for intramedullary nailing (IMN) are available. However, the impact of reaming strategies on immune cell characteristics of early fracture hematoma is unclear. We hypothesized that the application of reaming irrigation and aspiration (RIA) techniques optimizes cellular content of fracture hematoma.
Materials and methods: Twenty-four pigs underwent standardized femur fracturing. Then, animals were exposed to different protocols of IMN. Group A underwent no reaming prior to IMN. Group B was treated with conventional reaming plus IMN and group C composed of animals treated with RIA and subsequent nailing. Fracture hematoma was collected 6 h after reaming. FH-immune cells were isolated and studied by flowcytometry. Cell viability was tested by Annexin-V-labelling. Neutrophil activation was determined by Mac-1/CD11b-cell surface expression levels, whereas FcyRIII/CD16-receptor expression was utilized to investigate neutrophil maturation.
Results: All animals survived the observation period. Proportions of white blood cell subtypes in FH did not differ between conditions. However, the percentage of viable fracture hematoma immune cells was significantly higher in the RIA-group, compared with conventional reaming (respectively mean 86.7% vs. 96.5%, $P = 0.04$). Additionally, both neutrophil CD16-expression (− 35%) and CD11b-expression (− 61%) were significantly lower in those animals treated with RIA compared with the conventional reaming condition.
Conclusions: This experimental study reveals that reamed irrigation-aspiration (RIA) prior to IMN is associated with increased immune cell viability and less neutrophil senescence/activation in early fracture hematoma. This underlines the important role of IMN in optimizing local cellular immune homeostasis during the formation-phase of early fracture hematoma.

O 86

Temporary external fixation versus direct ORIF in complete displaced intra-articular radius fractures

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Introduction: It is common practise to use either direct definitive plate fixation or temporary external fixation as a bridge to definitive surgery in complex distal radius fractures (DRF). It is however unclear which is better with regard to functional and radiological outcomes. The hypothesis of this study was that the two-staged principle results in better outcomes.
Materials and methods: This prospective observational study included patients presenting with AO OTA C2 or C3 DRF (1) between January 2011 and January 2018. Patients were categorized into two groups according to the received treatment: Patients who underwent direct definitive osteosynthesis (Group ORIF) and patients who received an external fixator followed by definitive fixation (Group Fx-ORIF). Primary outcome was the PRWE measured at one year follow-up. Secondary outcomes included Range of Motion (ROM) and radiologic parameters [ulnar variance, radial inclination and volar tilt (1)].
Results: A total of 187 patients were included in Group ORIF with a mean age of 55.6 years (SD 17.2), of which 112 had a C2 and 75 a C3 fracture. The Fx-ORIF group consisted of 66 patients with a mean age of 53.7 years (SD 20.4 years), of which 30 patients had a C2 and 36 had a C3 fracture. There was no significant difference in median PRWE between de Group ORIF (12.0, IQR 2.0–20.0) and Fx-ORIF group (12.2, IQR 5.5–23.4) ($p = 0.189$). After corrections for C2/3 and open/closed fractures the difference remained insignificant. The ROM and radiologic parameters did not show any significant differences.
Conclusions: No differences were found in clinical and radiological outcomes between the one or two staged surgical technique. Both management options have their own inherent advantages and disadvantages. Further research needs to be done to explore the balance of better planning and analgesia versus the higher costs and impact of a second operation.
References: 1. Meinberg EG et al., 2018.
2. Hodel S et al., 2019.

O 87

PROSPECT-study: functional results of the reverse shoulder fracture prosthesis vs conservative treatment in displaced multipart proximal humerus fractures

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Introduction: Despite the PROFHER-trial that proposes conservative treatment for all proximal humerus fractures (PHFs), the optimal treatment for displaced PHFs remains controversial, especially complex fractures with 3 or 4 displaced parts.1,2 PROFHER did not distinguish complex PHFs from mildly-displaced fractures, and furthermore complex three- and four-part fractures were underrepresented. Sound evidence guiding us in the treatment of complex displaced multipart PHFs is therefore still required.1 Our hypothesis is that the Reverse Shoulder Arthroplasty (RSA) reduces pain and increases functional results in comparison to conservative treatment in displaced multipart PHFs.
Methods: In this case–control study patients were included with a multipart PHF that were treated with an RSA. At one year follow-up, three questionnaires were administered: the Constant Shoulder Score (CSS), the Oxford Shoulder Score (OSS) and the Disability of the Arm, Shoulder and Hand (DASH) score. Pain was assessed through the Visual Analogue Scale (VAS). Patients were matched to patients treated conservatively for morphologically similar fractures (based on the Neer classification) and matched for age and comorbidities.
Results: Forty-five patients are eligible for inclusion. Until now, 35 patients had a 1 year follow-up and were included. The mean pain score was 2.8; mean flexion 101.7° (95% CI 87.62–116.79); exorotation 16.1° (95% CI 9.53–23.00), and abduction 86.6° (95% CI 73.48–101.16). The mean score of CSS was 29.5, the DASH score was mean 36.2 and the OSS 36.5.
Conclusion: Initial results of the study to the optimal treatment of complex, displaced PHFs are promising. To put results in perspective, the above mentioned patient cohort will be enlarged to 45 patients and matched to patients treated conservatively in this ongoing study. These results will be presented at ESTES.
References: 1. Handoll HHG, et al. Cochrane 2015;11:CD000434.
2. Rangan A, et al. JAMA. 2015;313(10):1037–47.
This research was performed as a shoulder fracture project by an unrestricted grant by Mathys Medical Ltd.

O 88

Delivery disease: a new perspective study on occupational injuries of delivery employees

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Introduction: The study and determination of the traumatic pattern in bicyclists-delivery employees. The recording of personal protective equipment and evaluation of the selection criteria of their self protection.
Materials and methods: A total of 22 patients (21 men and 1 woman) with mean age of 33.8 years (18 - 52 years) were included over a study period from January 2017 to March 2019. Twenty-one patients admitted to the hospital with a total of 26 injuries treated operatively, whereas 15 injuries were treated conservatively. We recorded and evaluated the use of adequate personal protective equipment of these delivery employees.
Results: The mean hospitalization time was 7.6 days (2–12 days). A total of 2 thoracic injuries, 3 traumatic brain injuries, 6 spine injuries, 25 lower extremity injuries and 5 upper extremity injuries were recorded. Surgical treatment concerned 3 patients with upper extremities and 18 patients with lower extremities injuries and the anatomic regions involved were the distal radius (3), pelvic ring injury (1), femoral fractures (6), tibial plateau fractures (4), patella fractures (2), diaphyseal tibial fractures (6), and ankle fractures (4).
Conclusions: The lack of an adequate personal protective equipment due to their low financial status in combination with the absence of driving professional education among workers in this category of delivery employees results in lower extremity injuries with the majority requiring hospitalization and surgery. Further investigation

is needed, as well as constant training and setting right criteria for the pursuit of such employment.

O 89

Plate fixation versus nailing for humeral shaft fractures: a meta-analysis and systematic review of randomised clinical trials and observational studies

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Background: This meta-analysis aims to compare open reduction internal fixation with a plate versus nailing for humeral shaft fractures in terms of non-union, re-intervention, radial nerve palsy, time to union, operation duration and functional outcomes. Secondarily, effect estimates from observational studies are compared to estimates of randomised clinical trials (RCT).
Methods: PubMed/Medline/Embase/CENTRAL/CINAHL were searched for both RCT's and observational studies comparing plate fixation with nailing for humeral shaft fractures.
Results: A total of nine RCT's (462 patients) and the sixteen observational studies (4245 patients) were included. The pooled non-union rate did not differ significantly between both treatment groups (risk difference: 0%; OR 0.98, 95% CI 0.68–1.42). More patients treated with nailing required re-intervention (risk difference: 2%; OR 2.11, 95% CI 1.09–4.08) with shoulder impingement being the most predominant indication. More patients treated with pate fixation developed radial nerve palsy compared to nailing (OR 0.43, 95% CI 0.31–0.61). Notably the absolute risk difference is small (2%) and during follow-up the palsy resolved spontaneously in the majority of patients. Nailing lead to a faster time to union (mean difference: 2.5 week, 95% CI 3.1–1.8), lower infection rate (risk difference: 2%, OR 0.48, 95% CI 0.31–0.75) and shorter operation duration (mean difference: 20 min, 95% CI 32.0–9.4). Functional scores were comparable in both groups (standardised mean difference: − 0.13, 95% CI − 0.46 to 0.19). There was no difference between effect estimates form observational studies and RCT's.
Conclusion: There appears to be no difference between plate fixation and nailing for humeral shaft fractures with regard to non-union rate and functional outcome. Patients treated with plate fixation have a higher risk for infection and radial nerve palsy, but lower risk for re-intervention. The absolute differences, however, are small. Nailing does differ significantly from plate fixation in terms of shorter operation duration and time to union. The pooled estimates from randomised clinical trials did not differ significantly from estimates obtained from observational studies.

O 90

Post-traumatic complications are more often after medial clavicle injuries compared to lateral clavicle injuries

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Introduction: Medial clavicle injuries (MCI) are widely unexplored, especially in contrast to lateral clavicle injuries (LCI). Current research concerning MCI assumes a higher severity of MCI, e.g. concerning concomitant injuries. Our aim is to evaluate by big data analysis if these rare injuries would also lead to a higher number of post-traumatic complications.
Materials and methods: We focused on the MCI subgroup consisting of medial clavicle fracture and sternoclavicular joint dislocation. The lateral clavicle fracture and the acromioclavicular joint dislocation were summarized to the subgroup of LCI. The midshaft clavicle fracture was analyzed for comparison. The data are based on ICD-10 codes of all German hospitals as provided by the German Federal Statistical Office. Anonymized patient data from 2012 to 2014 were evaluated. The retrospective analysis addresses the fracture healing in dislocation, delayed union and non-union.
Results: The proportion of all patients suffering from complications was 3.1%, which were attributed to one of the three post-traumatic complications. Each complication rate for the single injury and the single complication was rather low with a maximum of 1%. MCI were more likely to be affected by post-traumatic complications than LCI with a ratio of 2.7 to 3.3 times ($p < 0.005$). The midshaft clavicle fracture was similarly frequently affected by complications with 41.6% of all complications as the MCI (44.2%). The LCI accounted for the smallest proportion at 14.2%.
Conclusions: We proved that MCI are more often associated with post-traumatic complications than injuries of the other parts of the clavicle. This is another hint that MCI appear to be more complex than LCI. This could be due to a missing standard procedure and the higher number of concomitant injuries in MCI. Further representative clinical studies are required since miscoding is a frequent issue in research concerning clavicle injuries, especially in a big data analysis.

TRAUMA SYSTEM OUTCOME AND TRAINING

O 91

Quantification of trauma center accessibility using GIS-based technology

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Introduction: There is no generally accepted methodology to asses trauma system access and optimal geographical trauma center distribution. The goal of this study is to determine the influence of trauma center(TC) distribution during high and low traffic density using Geographical-Information-System(GIS)-technology.
Methods: Using ArcGIS-PRO, we calculated differences in transport time (TT) and population coverage in seven scenarios with 1, 2, or 3 TCs during rush [R]- and low traffic [L] hours in a densely-populated region with 3TCs in the Netherlands (Fig. 1).
Results: In the seven scenarios, the population that could reach the nearest TC within (<) 45 min, varied between 96–99% (Fig. 2) In the three-TC-scenario, roughly 55% of the population could reach the nearest TC < 15 min in [R] and [L]. The hypothetical scenarios with

two geographically well-spread TCs showed similar results as the current three-TC-scenario. In the one-TC-scenarios, the population reaching the nearest TC < 15 min decreased by 23–36% in both [R] and [L] compared to the three-TC-scenario. In the three-TC-scenario the average TT increased with about 1.5 min to almost 21 min in [R], in comparison to 19 min during [L] (Fig. 3). Similar results were seen in the scenarios with two geographically well-spread TCs. In the one-TC-scenarios and the geographically close two-TC-scenario the average TT increased by 5–8 min [L] and 7–9 min [R] in comparison to the three-TC-scenario.

Conclusion: This study shows that a GIS-model for trauma center access offers a quantifiable and objective method to evaluate trauma system configuration in areas with different geography and demography. Applying this technology to one of the most densely populated areas in the Netherlands shows that the transport time from accident to trauma center would remain acceptable if the current situation with three trauma centers would be changed to a scenario with two geographically well-spread centers.

Fig. 1

Figure 1. The region of Trauma Center West Netherlands with its population density and the location of the three trauma centers. The 7 scenarios for trauma center distribution are presented at the bottom.

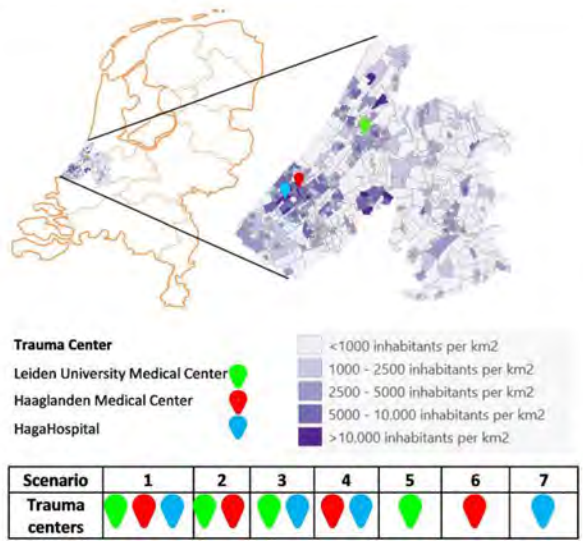


Fig. 2

Figure 2. Percentage of TCWN population that can be brought to the closest trauma center in the seven scenarios during rush hour (R) and low traffic hours (L) within 15, 30, 45 and 60 minutes.

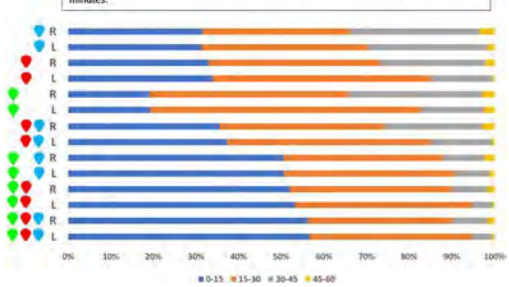
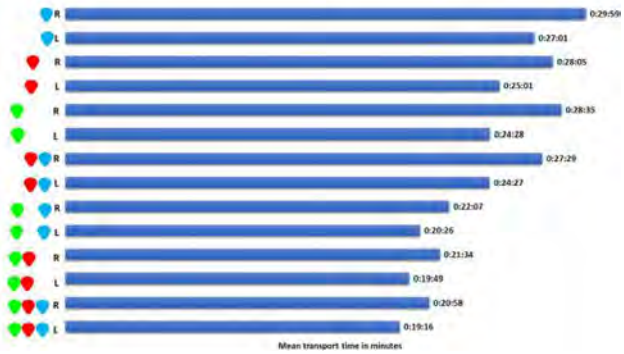


Fig. 3

Figure 3. Mean transport times to closest trauma center in different models during rush hour (R) and low traffic hours (L)



O 92

Classifying posttraumatic stress disorder courses in physical trauma patients: an observational prospective cohort study

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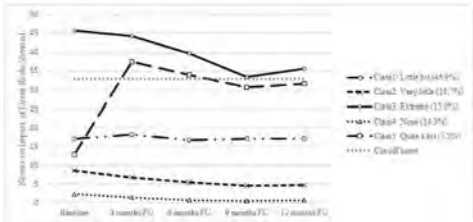
Introduction: The aim was to identify different courses of posttraumatic stress disorder (PTSD) in physical trauma patients. Then, to examine whether these classes could be characterized by sociodemographic, clinical, psychological, and personality outcomes.

Methods: Patients completed the Impact of Event Scale-Revised (IES-R), M.I.N.I.-Plus after inclusion, 3, 6, 9, and 12 months after injury to examine different courses. The Hospital Anxiety and Depression Scale, NEO-Five Factor Inventory, State-Trait Anxiety Inventory-Trait, and the WHOQOL-Bref were completed after inclusion only. Latent class analysis, Chi square tests, and ANOVA were performed to analyze the aims.

Results: In total, 267 patients were included. The mean age was 54.1 (SD = 16.1) and 62% were male patients. The IES-R (see Figure 1) and the M.I.N.I-Plus had five classes (1: moderately, 2: little bit, 3: worse, 4: none, 5: quite a bit of PTSD symptoms). Patients in class 3 are diagnosed with PTSD (cut-off score $\geq$ 33). On both questionnaires, patients (proportion $\approx$ 11%) in class 3 or 5, scored higher on anxiety, depressive symptoms, neuroticism, and trait anxiety compared to the other classes over 12 months after trauma. Lower scores on all domains, except for social domain on the IES-R, were found compared to the other classes (IES-R; physical domain: class 3 vs. 4 (mean $\pm$ SD): 10.4 $\pm$ 3.3 vs. 14.8 $\pm$ 2.4, P-value = < 0.001). Psychological and personality outcomes were significantly different on all courses. Also, patients in class 3 or 5 were younger compared to the other classes (IES-R; class 3 vs. 4: 43.5 $\pm$ 15.4 vs. 59.1 $\pm$ 14.8, P-value = < 0.001). No medical outcomes for PTSD were found.

Conclusions: About 11% suffer from PTSD symptoms 12 months after trauma. Different courses were defined by sociodemographic, psychological, and personality characteristics. Professionals can, short after trauma, recognize patients at risk for PTSD when they focus on these characteristics. Then, an intervention can be offered.

Fig. 1



O 93

Six meter, the criterion for severe adult trauma to falls from heights in CDC field triage needs to be lowered

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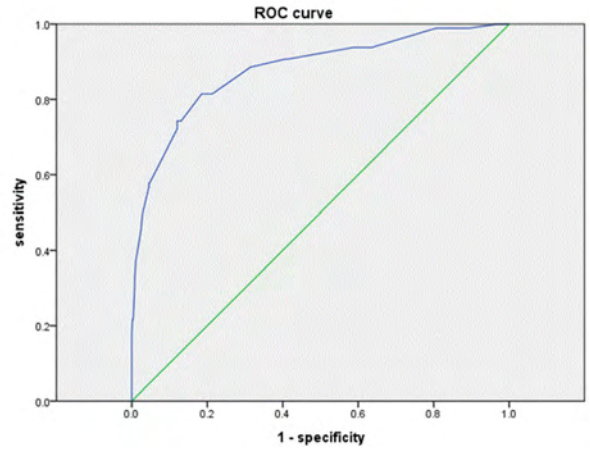
Introduction: Trauma is one of major public health care issue which is costly to society. Differences vary from region to region, but blunt trauma accounts for a large part of the total trauma, and the rates of the falls from heights among the blunt trauma is getting higher. It is serious that falls from heights is often accompanied by severe multiple trauma. Therefore, authors studied the relationship between the height of the fall/other related factors and outcomes including hospital stay/mortality.
Materials and methods: Retrospective cohort study of the 670 adult falls-from-heights patients visited a regional trauma center for 4 years (from 2014.01.01 to 2017.12.31).
Results: Of total 670 patients, the number of D.O.A patients were 69. The height from falls of the deceased patients was statistically significantly higher than that of the survived patients. (19.4 ± 15.3 m vs. 4.3 ± 4.2, $p < 0.001$) The AUC of the ROC curve of the height from fall to mortality was 0.879. (Figure) The sensitivity of 3.75 m was 90.7% and 6.5 m was 81.4%, respectively. The traumatic brain injury, pelvis fracture, visceral organ injury, age, and the height from fall were statistically significant risk factors in multivariate analysis for mortality (p = < 0.001, 0.11, 0,001, 0.004, and 0.03 respectively).
Conclusions: The height from the fall is closely related with mortality. We think the current height for the severe fall injury in CDC field triage for trauma is high and needs to be lower to 3.5 m with about 90% sensitivity for survival.
References: Khadjibaev et al. Features of patients associated with falls from heights admitted to republican research center of emergency medicine. J Trauma Injury. 2015;28(4).
Heimer et al. Thoracic trauma in fatal falls from height—traumatic pneumopericardium correlates with height of fall and severe injury. For Sci Med Pathol. 2018;14:188–93.

Fig. 1



O 94

Improving perioperative communication in trauma surgery: role of combined DSTC, DATC and DpNTC courses in multidisciplinary team training

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Introduction: Operative management of severe trauma is a team effort, requiring excellent communication skills. Surgeons, anesthesiologists and nurses need to coordinate effectively in order to ensure an excellent clinical outcome. The Definitive Surgical Trauma Care (DSTC), Definitive Anesthesia Trauma Care (DATC) and Definitive Perioperative Nurses Trauma Care (DpNTC) courses provide an excellent opportunity to train efficient teamwork. We aimed to study the impact of the joint DSTC-DATC-DpNTC courses in candidates' perceptions and skills in perioperative communication.
Materials and methods: Study population of 39 candidates (18 surgeons, 10 anesthesiologists and 11 nurses) participating in a joint DSTC-DATC-DpNTC course in Coimbra, Portugal. Median age of 32 years (range 27 – 52). Female gender in 26 (67%) of cases. All participants attended joint lectures, case discussions and surgical skills session, emphasizing intraoperative communication. Post-course survey on several aspects of peri-operative communication, with responses on a Likert scale. Participants were also asked which aspects of intraoperative communication they valued the most. Statistical analysis with SPPS, 25.0 (Wilcoxon signed rank test, significance with p-value < 0.05).
Results: All participants responded to the survey. Results displayed an increase in the self-assessed importance of team briefing and intraoperative communication, particularly routine periodic communication, rather than only at critical moments ($p < 0.05$).

Postoperative team debriefing was also valued as highly relevant. Closed-loop and direct, by-name communication were highly rated ($p < 0.001$). Self-reported communication skills improved significantly during the course ($p < 0.001$).
Conclusions: Joint training in the DSTC-DATC-DpNTC courses provides a unique opportunity to improve candidates' self-awareness and skills in intraoperative communication.

O 95

A public health approach to knife related trauma in liverpool: a geospatial study

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Introduction: Liverpool is a city that has undergone recent rapic socioeconomic change. Despite reductions in overall deprivation, incidents of stabbings have increased by 64% in the last 7 years. This study will describe the trend in knife crime, drawing on governmental data and policies to conclude the reasons behind the trend.
Materials and methods: A retrospective cohort study of patients presenting to North-West ambulance service (NWAS) with a penetrating injury in Liverpool between 2012 and 2018. Data collected included patient demographics, geography and timing of incidents and correlation to datasets of multiple indices of deprivation and knife crime prevention outreach education programmes.
Results: Incidents of stabbings have increased by 64% between 2012 and 2018. Victims were more likely to be males (82%) between the ages of 20 and 24 (13%). The peak rate was between 20:00–21:00 (7.9%) and trough between 08:00–09:00 (1.3%). There is a spike in incidents of stabbings of 15–19 year olds from 15:00 to 21:00, correlating with school closure. There appears to be statistically poor correlation between deprivation of lower super output areas and stabbings ($r^2 = 0.11$, 0.29 and 0.18 for 2010, 2015 and 2019 respectively). However, when the data is split into larger areas, middle super output areas (MSOAs), deprivation appears to be a further risk factor. This study has identified certain geographical areas as high risk.
Conclusions: This study allows for targeted public health interventions at populations most at risk of knife trauma, including geographical mapping of high-risk areas, so that interventions can be distributed appropriately.
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Vulliamy P, et al. Temporal and geographic patterns of stab injuries in young people: a retrospective cohort study from a UK major trauma centre. London: BMJ; 2018.

Fig. 1

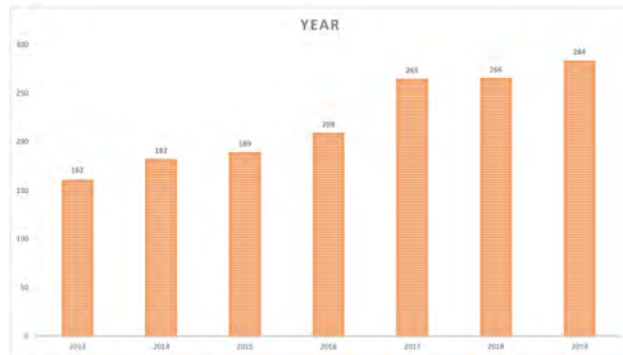


Fig. 2

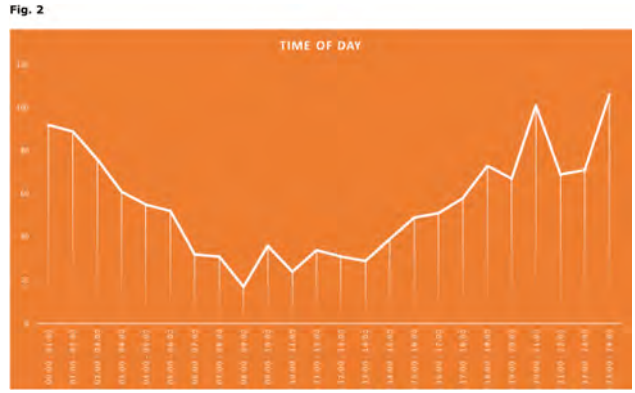


Fig. 3

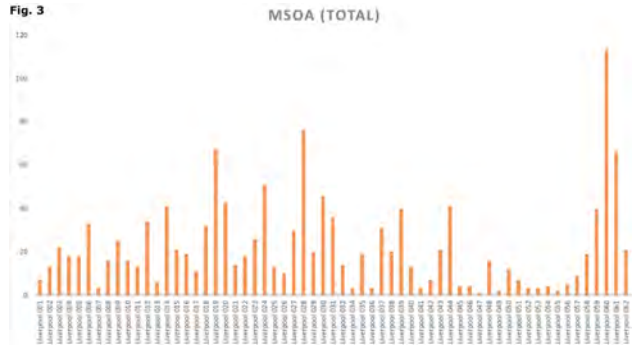


Fig. 4

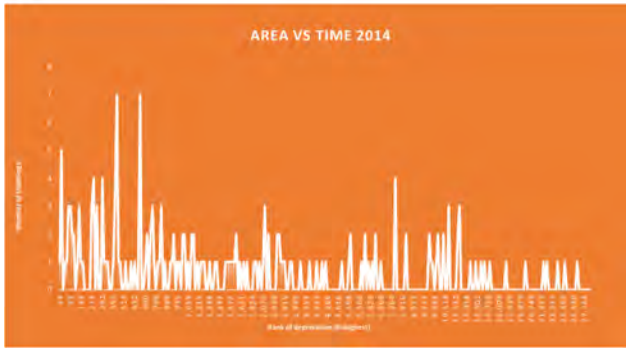
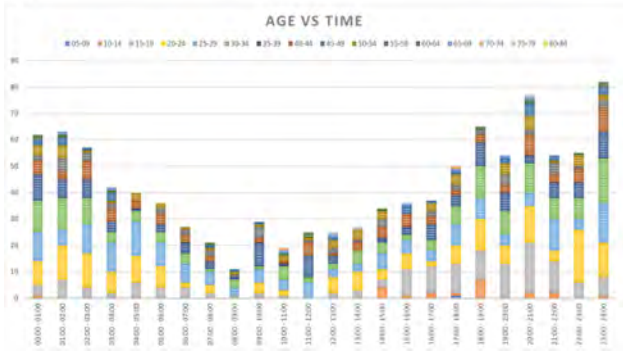


Fig. 5



O 96

Fire-fighting for surgical teams: the Manchester Trauma Course—a multidisciplinary approach to trauma training

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Introduction: Trauma teams treat complex patients with injuries posing significant resuscitative and management challenges. Effective teamwork is essential to optimise patient outcomes and improve survival, with failure contributing to adverse events [1]. The role of multidisciplinary (MDT) trauma training has been demonstrated by the Military Operational Surgical Training Course (MOST) [2]. It is imperative that civilian trauma training adopts similar methodology to optimise team work.
Materials and methods: The three-day multidisciplinary trauma course comprised cadaveric-based skills teaching supplemented by lectures and real-life scenario discussion. Delegates were senior surgical and anaesthetic registrars and consultants, alongside trauma team leaders (TTL), scrub staff and operating department practitioners (ODP). Pre- and post-course questionnaires assessed perceptions of multidisciplinary trauma simulation and confidence in specialty specific skills.
Results: All delegates reported MDT simulation clarified each role, including their own, in the trauma team. Post-course, scrub staff and ODPs felt confident gaining intraosseous access ($p < 0.0002$), surgical delegates had improved confidence performing all skills ($p < 0.01$), with anaesthetists and TTLs more confident in haemorrhage control and performing resuscitative thoracotomy ($p < 0.02$).
Conclusions: MDT trauma training improves team understanding of role and effectively teaches skills. MDT courses with experienced faculty are one way of improving MDT trauma team function. Further careful evaluation is required to assess performance of trauma teams in real scenarios.
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2. Woolley T, Round JA, Ingram M. Global lessons: developing military trama care and lessons for civilian practice. BJA. 2017;119(S1):i135–42.

O 97

Trauma prevention analysis of psychological predictors behind attitudes to knife carrying in school boys

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Introduction: Despite a dramatic rise in youth knife crime, the factors associated with it remain underexplored, especially in the critical pre-college years, which hinders effective counter-knife carrying interventions. The current research is the first to addresses this deficit.
Materials and methods: 161 British male school students (mean age = 13.48, SD = 1.061) coming from four different schools completed a short 15-min survey. They indicated their standing on a number of dimensions (school-adapted and shortened-scale-based predictors) derived from theories of violence, developmental psychology and related research (i.e. Violence Acceptance, Need for Respect, Belief in Self-defence, Belief in a Just World, Narcissism, Psychopathy, Impulsivity, Sensation Seeking, and Need for Closure).
Results: For perceived knife harmfulness (i.e., the knife's assumed value in inflicting injury and death)—the total variance explained by the model was 8.7%, $R2 = 0.087$; $F(10, 167) = 2.585$. The only statistically significant predictors were: *Right-wing Authoritariamism* ($\beta = 0.242$, $p = 0.005$) and *Need for Respect* ($\beta = 0.192$, $p = 0.026$). The other factors were not statistically significant. For the perceived value of knife defence (i.e., its assumed defensive worth in violent confrontations) -the total variance explained by the model was 26.5%, $R2 = 0.265$; $F(10, 167) = 7.032$, pViolence Acceptance ($\beta = 0.208$, $p = 0.007$), followed by *Need for Closure* ($\beta = 0.202$, $p = 0.005$), *Narcissism* ($\beta = 0.194$, $p = 0.011$) and *Psychopathy* ($\beta = 0.177$, $p = 0.034$).
Conclusions: This study provides evidence for future knife-carrying prevention interventions, such as talks in schools or social media videos, to focus more on how to increase self-esteem, stimulate empathy for and better understanding of other people, and approach problems from multiple (rather than just two) perspectives, emphasizing the ultimate superiority of the human intellect over brute force.

O 98

A review of the effectiveness of the physician's response unit

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Introduction: The Physician's Response Unit (PRU) is a novel service that operates from the Royal Gwent Hospital's Emergency Department (ED), in Newport, South Wales. It involves an Emergency Medicine Consultant and a Paramedic responding to 999 calls in a Rapid Response Vehicle. Their aim is to treat and, hopefully, discharge patients at the scene, reducing ED admissions. The PRU can also refer patients on to other departments, e.g. the Medical Assessment Unit, allowing patients to bypass the ED.
Methods: The author spent six weeks out in the PRU and in the ED to observe and speak to patients. To assess whether ED admissions were reduced, the dispositions of patients seen by the PRU were recorded on a daily log sheet. The service users' satisfaction with the PRU was evaluated using simple questionnaires. This included both patients and Paramedics, who can request the PRU for support with a patient.
Results: The PRU saw 245 patients during the project's timeframe. 64% (n = 156) of these patients were discharged at scene, while 16% (n = 38) were sent to the ED. 100% (n = 32) of patients asked described the care they received from the PRU as equal to or better than care they have received previously. 94% (n = 30) of patients rated their overall satisfaction with the PRU as 10/10.
Conclusions: The PRU is very well received by both patients and Paramedics and has been shown to reduce the number of patients attending the ED. This system excellently implements the principles of prudent healthcare.
References: 1. PRU Daily Log Sheet. Alice Lethbridge, Cardiff University, and Dr. Greg Cranston, Emergency Medicine Consultant, Royal Gwent Hospital; 2018.
2. Royal Gwent Hospital's Activity Data. Royal Gwent Hospital's Emergency Department. 2017 and 2018.
3. "Emergency Department in Your Lounge" Story Board Entry Form. Dr. Tim Rogerson, Emergency Medicine Consultant, Royal Gwent Hospital; 2015.

Fig. 1

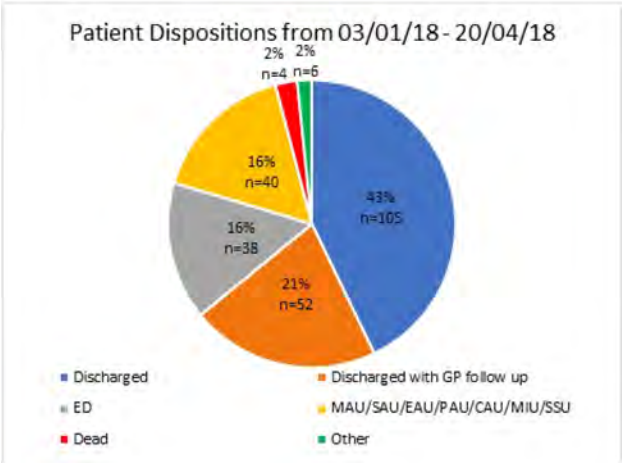


Fig. 2

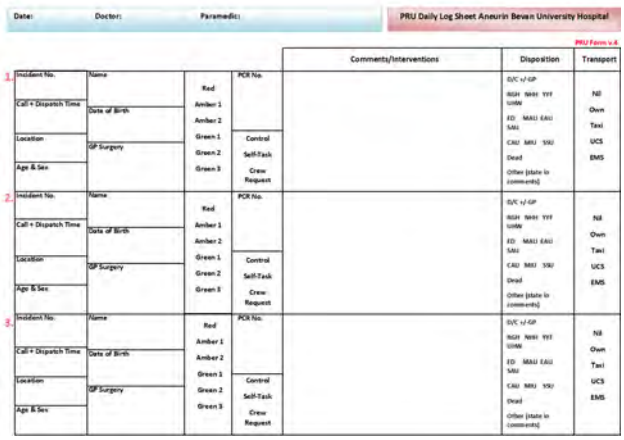
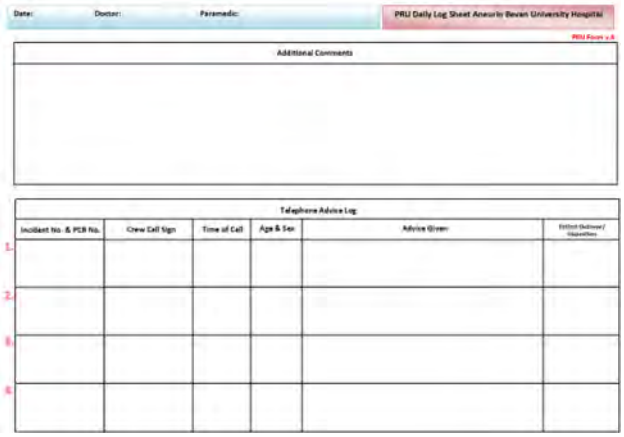


Fig. 3



O 99

Preventing risk related trauma in youth: a program evaluation in two major hospitals

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Introduction: In Germany reducing alcohol related harms in youth is still a priority, because adolescents and young adults still have the highest accident risk in road traffic. Therefore, the P.A.R.T.Y.-project aim to increase awareness of alcohol and risk-related issues. The purpose of this study was to analyse the risk behaviour of adolescents before and after a prevention project in two different hospitals in Germany.
Materials and methods: During a one-day prevention project, young people within the age of 13 to 17 years got an overview of the route an accident victim go through from the ambulance until the rehabilitation. Before and after the prevention day, a structured written survey was completed by the adolescents.

Results: 799 students participated in the P.A.R.T.Y. program between 2013 and 2018. The gender distribution of the participating students were balanced. The average age of the adolescent was 15 years. According to the program, the risk assessment and risk behaviour improved through the project significantly (< 0.05). The evaluation of the students' satisfaction was rated as good. The majority of students prefer to repeat the project day after 2 years.
Conclusions: The prevention program shows that the program increase for short-term the awareness for risk related trauma in youth. Nevertheless, long-term studies are necessary to receive data regarding the long-lasting effect.
References: The present study is funded by the Ministry for Energy, Infrastructure and Digitization of the country Mecklenburg-Vorpommern, Germany.

O 100

Development of a claims-based risk adjustment model for trauma

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Introduction: Trauma is an unplanned condition with high mortality. Registry-based risk adjustment is the current gold-standard for benchmarking trauma center (TC) performance, limiting metrics to TCs. We aimed to develop a risk adjustment model applicable to all hospitals.
Materials and methods: Analysis included patients ≥ 65 years treated in Pennsylvania in 2013–2014 and recorded in the Pennsylvania Trauma Outcomes Study (PTOS) registry or with claims from the Centers for Medicare and Medicaid Services (CMS) that met registry inclusion criteria. An existing PTOS registry model [1] was compared to 2 CMS models. Model 1 used proxies for registry variables, comorbidities, and demographics; model 2 used model 1 + diagnosis codes associated with in-hospital death identified by machine learning (ML). Receiver operating characteristic curves evaluated model performance. Predicted probabilities of death were estimated for all cases, summed by hospital, and compared as observed-to-expected (O:E) ratios.
Results: 29,063 PTOS patients and 103,621 from CMS met eligibility. Area under the curve was 0.84 (0.81–0.86) for PTOS, 0.75 (0.73–0.77) for CMS, and 0.85 (0.84–0.86) for ML models. The CMS model vs PTOS overestimated mortality in 10/15 TCs (67%). Overall, O:Es ranged from 0.31–2.20, 6/27 TCs (22%) had higher than expected mortality, and 7 TCs (26%) lower (1). Five of 87 non-TCs (6%) had higher than expected mortality and 22 (25%) had lower. The ML model underestimated O:E values in 14/15 (93%) TCs (2).
Conclusions: We developed 2 risk adjustment models using claims data to create generalizable methods for benchmarking TC and non-TC performance. Our CMS model overestimated O:E mortality while the ML model underestimated mortality compared to registry data. In order to benchmark injury outcomes at TCs and non-TCs, ongoing model calibration and validation is required.
References: 1. Wiebe D, et al. The Pennsylvania Trauma Outcomes Study risk-adjusted mortality model. Am Surg. 2017.

Fig. 1

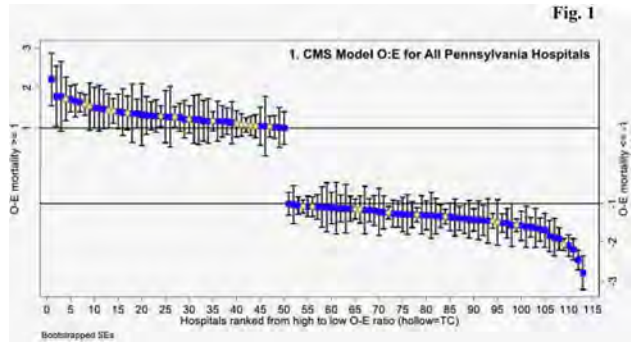
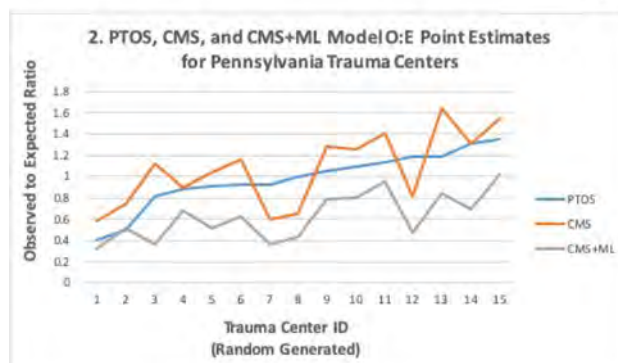


Fig. 2



Poster Presentations

ABDOMINAL TRAUMA

PR 1

Factors associated with inability to perform delayed primary fascial closure in patients with open abdomen in trauma

D. K. Bagaria[1], H. Aggarwal[1], A. Gupta[1], S. Kumar[1], B. Mishra[1], A. Kumar[1], N. Choudhary[1], P. Priyadarshini[1], S. Sagar[1]

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Introduction: Leaving the abdomen open after laparotomy has both its cons and pros. It is advised that we should never hesitate in leaving the abdomen open when required, however, once stabilized we should close it as soon as possible. However, the factors which would hamper delayed primary fascial closure(DPFC) are not well studied
Materials and methods: A retrospective 5-year analysis of patients with an open abdomen was done. Patients were divided into 2 groups: Those in which DPFC was possible and those in whom it was not. A comparative analysis of epidemiological, clinical and resuscitative parameters was performed of the 2 groups.
Results: Out of 58 patients, 10 patients underwent DPFC, while in 48 patients DPFC could not be performed. Coagulopathy and acidosis at admission were not significantly associated with the inability to perform DPFC. Quantum of fluid resuscitation at 48 h was not associated with DPFC, while the institution of more of blood products than crystalloids during intra-operative period favored DPFC. Blood Stream Infections(BSIs), Ventilator-Associated Pneumonia (VAP), Intra-Abdominal Sepsis(IAS) and Hollow Viscus Injuries (HVIs) precluded DPFC.
Conclusions: Treating surgeons should have a low threshold for closing the open abdomen(OA) whenever feasible. Early definitive control of bleeding and damage control resuscitation contributed to DPFC in patients with OA. Infections in the chest, blood and abdomen should be ruled out before attempting DPFC in OA.
References: 1. Goussous N, Jenkins DH, Zielinski MD. Primary fascial closure after damage control laparotomy: sepsis vs haemorrhage. Injury. 2014;45(1):151–5.
2. Stawicki SP, Brooks A, Bilski T, Scaff D, Gupta R, Schwab CW, et al. The concept of damage control: extending the paradigm to emergency general surgery. Injury. 2008;39(1):93–101.
3. Coccolini F, Ceresoli M, Kluger Y, Kirkpatrick A, Montori G, Salvetti F, et al. Open abdomen and entero-atmospheric fistulae: an interim analysis from the International Register of Open Abdomen (IROA). Injury. 2019;50(1):160–6.

PR 2

Delayed diagnosis of high grade duodenal injuries: characteristics and outcomes

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Introduction: Duodenal injury is rare. The diagnosis requires a high index of suspicion which might result in delayed treatment. There is limited data on the delayed diagnosis group, especially high grade duodenal injuries. The purpose of this study is to determine the characteristics and outcomes of delayed high grade duodenal injuries.
Materials and methods: Charts of all patients from 2008–2018 who had history of small bowel injuries are reviewed. The inclusion criteria were age between 15–80 years old, diagnosis with duodenal injuries at least grade 3 with delayed operation at least 6 h after injuries. Baseline characteristics and postoperative outcomes were recorded.
Results: Of the 212 small bowel injuries, 32 (15%) were duodenal injuries. The overall mortality was 6%. Delayed diagnosis more than 6 h with at least grade 3 of duodenal injuries were 9 cases. The overall in-hospital mortality rate of the delayed group was 22.2% (2/9) who had concomittent hemorrhagic shock and low initial systolic blood pressure. 4 cases (44.4%) were diagnosed within 72 h and had better outcomes without leakage. They could step diet within 14 days and had shorter length of hospital stay (mean = 18 days). 3 patients (33.3%) presented with delayed diagnosis more than 72 h (the maximum was 408 h after injuries). All these 3 patients had anastomosis leakage and need reoperation. They had initial low level of serum albumin (mean 2.5 mg/dl), high white blood cell count, low serum bicarbonate and presented with preoperative acute kidney injury.
Conclusions: Delayed diagnosis and surgical treatment of high grade duodenal injuries lead to poor outcome. Low initial blood pressure associated with mortality and delayed treatment more than 72 h had higher morbidity.
References: Gary SA, Frederick AM, Charles SC, et al. Delayed diagnosis of blunt duodenal injury: an avoidable complication. ACS Meeting. 1998;187(4):393–9.

Fig. 1

Status	Case no.	Type/cause of injury	Duodenal injury grading	Time to surgery/ diagnosis (hr)	Associated injuries	Operation
Death	1	Blunt/car accident	Gr3 (75%D1 and 50%D3)	7	Liver, gallbladder	Primary repair duodenum, packing, aortic cross clamp
	2	Blunt/body assault	Gr3 (100%D3)	24	Liver, transverse colon	Primary repair duodenum, packing, ligate transverse colon
Alive						
Without leakage	3	Blunt/motorcycle accident	Gr3 (50%D2)	67		Primary repair duodenum, pyloric exclusion, gastrojejunal anastomosis, feeding jejunostomy
	4	Gunshot/body assault	Gr3 (50%D2)	91	Pancreas, stomach, branch of IVC	Primary repair duodenum and stomach. Ligation branch of IVC
	5	Penetrate/body assault	Gr3 (50%D2)	13	Infrarenal IVC	Primary repair duodenum, IVC
	6	Blunt/motorcycle accident	Gr3 (50%D2)	42	Transverse colon, thoracic spine (T12)	Primary repair, pyloric exclusion, gastrojejunal anastomosis, feeding jejunostomy
With leakage	7	Blunt/motorcycle accident	Gr3 (50%D2)	192	Pelvic fracture (V5)	Primary repair, pyloric exclusion, gastrojejunal anastomosis, feeding jejunostomy
	8	Blunt/fall	Gr3 (50%D2)	90		Primary repair, pyloric exclusion, feeding jejunostomy
	9	Blunt/body assault	Gr3 (50%D2)	408	Jejunum	Primary repair, feeding jejunostomy

PR 3

Routine follow-up imaging has no advantage in the non-operative management of blunt splenic injury in adult patients

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Introduction: To date, limited evidence exists regarding follow-up imaging during the non-operative management (NOM) of blunt splenic injury (BSI), especially concerning ultrasound as first-line imaging

modality. The aim of this study was to investigate the incidence and time to failure of NOM as well as to evaluate the relevance of follow-up imaging.
Materials and methods: All adult patients with BSI admitted to our level I trauma center, including two associated hospitals, between 01/01/2010 and 31/12/2017 were retrospectively analyzed. Demographic data, Injury Severity Score, splenic injury grade, modality, results and consequences of follow-up imaging were retrospectively analyzed.
Results: A total of 122 patients with a mean age of 43.8 ± 20.7 years (16–84 years) met inclusion criteria. 20 patients (16.4%) underwent immediate intervention. 102 patients (83.6%) were treated by NOM. Failure of NOM occurred in 4 patients (3.9%). Failure was significantly associated with active bleeding (OR 33.75, 95% CI 3.1, 363.2, p = 0.004), and liver cirrhosis (OR 197, 95% CI 7.4, 5265.1, p = 0.001). 80 patients (78.4%) in the NOM-Group received follow-up imaging by ultrasound (US, n = 51) or computed tomography (CT, n = 29). In 57 cases, routine imaging examinations were conducted (43 US and 14 CT scans) without prior clinical deterioration. 55 (96.4%) of these imaging results revealed no new significant findings. Every failure of NOM was detected following clinical deterioration.
Conclusions: To our knowledge this study includes the largest monocentric patient cohort undergoing ultrasound as first-line follow-up imaging modality in the NOM setting of BSI in adult patients. The results indicate that a routine follow-up imaging, regardless of the modality, has no therapeutic advantage. Indication for radiological follow-up should be based on clinical findings. If indicated, a CT scan should be used as preferred imaging modality.

PR 4

The Association between BMI and mortality of renal injuries in adult trauma patients

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Introduction: The role of body mass index (BMI) on solid organ injuries remains debatable. While some studies have shown no association between BMI and hepatic or splenic injuries, others have reported that severe hepatic injuries were more common in pediatric patients with BMI > 30. The aim of this study is to examine the association of BMI and mortality, as well as any significant differences between operative vs. non-operative management.
Materials and methods: This was a retrospective study using the 2016 American College of Surgeons-Trauma Quality Improvement Program database to identify all adult patients (ages 18 to < 65) with traumatic renal injuries. The primary analysis showed a different pattern of mortality between patients with BMI < 29 and those with BMI ≥ 29 kg/m^2. Then, the study population was divided into patients with BMI < 29 and those with BMI ≥ 29 kg/m^2. Multivariable logistic regression was conducted to assess any association of mortality with age, gender, BMI, and injury severity score (ISS).
Results: 3782 adult trauma patients were identified. A greater proportion of males (75.2%) and females (24.8%) had BMI < 29 kg/m^2 (p = 0.5). The average age of patients with BMI < 29 kg/m^2 was 32.3 (SD = 12.7) years which was significantly younger than that in patients with BMI ≥ 29 kg/m^2, 37.8 (SD = 13.6) years (p = 0.001). Patients with BMI < 29 kg/m^2 were found to have a significantly higher mortality rate of 6.5% vs. 4.4% in patients with BMI ≥ 29 kg/m^2 (p = 0.02). However, there was no significant difference in type of operative or non-operative management between patients with BMI < 29 vs. BMI ≥ 29 kg/m^2. After multivariable logistic regression, mortality was associated with age, BMI and ISS. No effect modification of sex was observed in the relationship of mortality and BMI.
Conclusions: Adult patients with renal injuries and BMI < 29 kg/m^2 have significantly higher rates of mortality compared with adult patients with renal injuries and BMI ≥ 29 kg/m^2.

PR 5

Trends in trauma surgery: what the future may hold

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Introduction: Trauma is an ever-evolving surgical discipline. Trauma remains a major source of global mortality. The operative and non-operative options for trauma patients has steadily increased. The development of trauma protocols, advancement in transport to trauma centres and radiological techniques has seen a shift in trauma surgery caseload. Observing and understanding this shift from operative management to an increasing non-operative management of trauma cases will better prepare the acute medical team in this setting.
Materials and methods: Prospective trauma registry data was collected and analysed retrospectively. Patients presenting to a tertiary referral hospital between Jan 2011 to Dec 2015 with an injury severity score of > 15 were reviewed. Patients who were transferred to another facility for management were excluded. The demographic data and surgical outcome data were collected and analysed. Trend analysis of the operative cases performed for each specialty.
Results: 2162 major trauma patients presented to the John Hunter Hospital between January 2011 to Dec 2015. There was a non-statistically significant increase in the number of presentations (389 pt in 2011 vs 494 in 2015, p = 0.1625). There was a decreasing rate of operations performed for trauma patients (60% in 2011 vs 43% in 2015, p < 0.0001). There was an increasing rate of orthopaedic surgery cases and operative time compared to other specialties (178 in 2011 vs 246 in 2015, p < 0.001). General surgical major trauma operating cases noted a significant decline over the study time (82 in 2011 vs 33 in 2015, p < 0.001).
Conclusions: There is a sizeable shift in the caseload of different surgical specialties in regard to major trauma patients over the course of 5 years from 2011 to 2015. Orthopaedics has seen a significant increase in operative caseload and surgical time required to adequately manage major trauma presentations. The workload and experience of general surgical teams will likely be affected by these changes. The distribution of resources needs to be reflected in the changing work demands of each surgical subspecialty.

PC 6

Traumatic internal hernia with delayed small bowel strangulation after pelvic ring injury

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Case history: A 81-years old woman was admitted in Emergency Department after a pedestrian accident.
Clinical findings: She was alert, orientated and vital signs recorded were normal. Pain and abrasions were seen on the pelvic area. The other abdominal quadrants were soft and non-tender.
Investigation/results: An abdominal computed tomography (CT) showed lateral compression type II pelvic fracture without extravasation of contrast material. She was admitted ward. Three days after

hospitalization, follow up abdomen CT checked. There was no other specific change than increased thigh hematoma. Eight days after hospitalization, CT was re-examined due to abdominal pain with abdominal distraction. An CT showed peritonitis with pneumoperitoneum and small amount of ascites. Small bowel herniation through right pubic bone fracture site with ischemic change also noted.
Diagnosis: Diagnosis was traumatic pelvic hernia with delayed small bowel strangulation.
Therapy and progressions: An emergency operation was performed. Ileal loop was hernitated and perforation was found. Emphysematouns change and fluid collection was exsited at perineal area and left high. After small bowel loop segmental resection, wound vac was applied at thigh area.
Comments: Traumatic pelvic hernia is rare. Diagnosis is challenging in the acute setting and often delayed due to lack of awareness. When diagnosed, efforts should be made to look for other serious injuries as traumatic pelvic hernia usually associated with concomitant intra-abdominal injuries. The optimal management of Traumatic hernia should be individualised based on the mechanism and severity of injury, presence of concomitant injuries, size of defect, and presence of incarceration. Delayed treatment may read to fatal outcomes. Careful inspection of the patient is important.
References: Vincent K, Cheah SD. Traumatic abdominal wall hernia—a case of handlebar hernia. Med J Malaysia. 2018;73(6):425–6.

PR 7

Angio-embolization in pediatric trauma patients with blunt splenic injury: a systematicreview

T. Nijdam[1], *R. Spijkerman*[1], *L. Hesselink*[1], *T. Hardcastle*[2], *L. Leenen*[1], *F. Hietbrink*[1]

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Introduction: Non-operative management (NOM) for children with blunt splenic injury (BSI) is nowadays a commonly used treatment in pediatric trauma departments. In adult trauma departments the addition of splenic angio-embolization (SAE) is suggested to decrease the failure rate of NOM in high grade splenic injuries. However, the use of SAE in pediatric trauma departments is very uncommon and it is unknown if SAE is of additional value in pediatric trauma patients. Therefore, the aim was to analyze the available literature on SAE in pediatric trauma patients with BSI.
Materials and methods: A literature search was performed to find eligible studies that analyzed SAE in pediatric patients with BSI. The primary outcome was failure of treatment in these patients. Secondary outcomes were the success rate of SAE, length of stay and mortality. The relative risk (RR) was calculated to compare primary outcome between study groups.
Results: In total 219 studies were identified through the search, a total of 6 studies matched our inclusion criteria and were selected for this review. Studies included a total of 12.310 pediatric patients, of whom 539 underwent SAE. Patient age ranged from <1 year to 18 years, mean age was 12.1 years. Both injury severity score and spleen injury grade were higher in the SAE group compared to the NOM group. Failure rate of SAE was 8%. No spleen related morality was observed in the SAE group.
Conclusions: The literature suggests that SAE might be of added value in a very selective group of pediatric trauma patients with high grade splenic injures. However, since limited evidence is available concerning the use of SAE in pediatric trauma patients with BSI, no firm conclusions can be drawn about safety and effectiveness.

Fig. 1

Figure 1: The PRISMA flow diagram for study inclusion

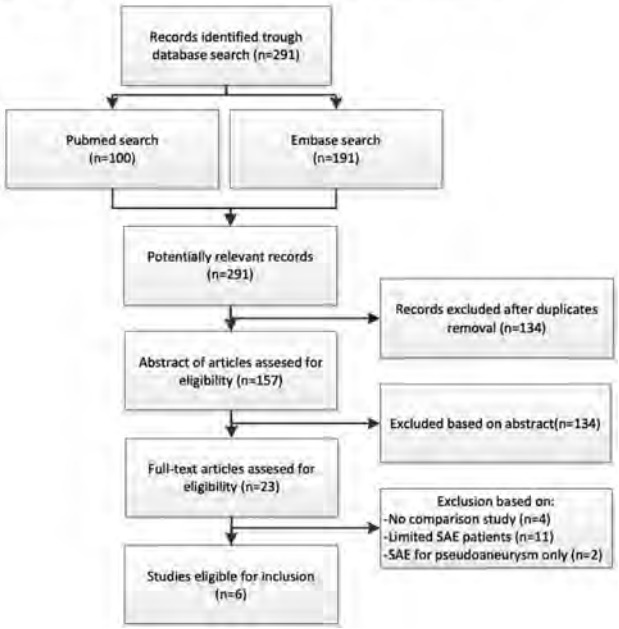
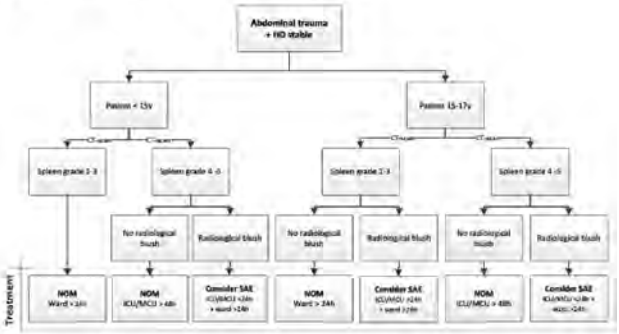


Fig. 2

Figure 2: Pediatric blunt splenic injury treatment protocol



Abbreviations: BSI = Blunt splenic injury; HD = hemodynamic; NOM = non-operative management; SAE = splenic angio-embolization; ICU = Intensive care unit; MCU = Medium care unit.

PR 8

Outcomes after small bowel and colonic trauma: a trauma centre experience

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Introduction: The management algorithms for trauma have changed with the development of specialised trauma centres. The aim of this study was to review the management and outcomes of patients with traumatic small bowel (SB) and colonic injuries.
Material and methods: Patients treated for SB and colonic injuries between 2008–2018 at Aintree University Hospital (Liverpool) were identified using the prospective Trauma Audit and Research Network

database. The management and outcomes of the patients included were analysed.
Results: 44 patients sustained SB and colonic injuries. There were 29 (65.91%) SB injuries and 21 (47.73%) colonic injuries (6 patients had a SB and colonic injury). 17 patients (38.64%) of injuries were due to knife stabbing wounds, 14 (31.82%) patients were due to gunshot wounds, and 13 (29.55%) patients were due to road traffic accidents/ blunt blows. Damage control surgery was performed in 7 (15.91%) patients. Colonic injuries included 6 (28.57%) haematomas and 15 (71.43%) perforations. A resection and stoma (RS) procedure was performed in 9 patients (42.86%), primary repair (PR) in 8 patients (38.10%) and resection with anastomosis (RA) in 4 patients (19.05%). SB injuries included 6 (20.69%) haematomas and 23 (79.31%) perforations. PR was performed in 19 (65.52%) cases and RA in 10 (34.48%) cases. The overall complication rate after SB and colonic injury was 50% (22 patients) with a significant complication rate (7 patients, p value = 0.017) for patients undergoing RS in colonic trauma. The 30-day mortality rate was 2.27% (1 patient).
Conclusions: PR in SB and colonic injuries appears safe. In our dataset, RS appeared to have a higher complication rate. Our study highlights that such injuries are uncommon with a high complication rate. Surgeons need to provide individualised treatment.
References: Shazi B, Bruce JL, Laing GL, Sartorius B, Clarke DL (2017) The management of colonic trauma in the damage control era. Ann R Coll Surg Engl 99(1):76–81.

PR 9

The additional value of follow-up tests in the assessment of splenic function after blunt splenic injury in pediatric trauma patients

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Introduction: Nowadays, patients with high grade BSI are preferably treated using spleen preserving treatments (SPT). It is assumed that patients with low grade BSI treated with SPT have a good splenic function after recovery. However, there is no consensus on splenic function after high grade BSI. In several institutions, asplenic/hyposplenic infection prevention protocol will be executed in all patients who had SPT after high grade BSI, where other institutions evaluate splenic function first. Scintigraphy is believed to be the best flow/activity test to approximate splenic functionality. The aim of the study was to analyze whether spleen injury grade is associated with diminished splenic function. Secondarily, we aimed to evaluate whether splenic function testing is necessary in pediatric patients after BSI.
Material and methods: A retrospective study was performed from January 1998 to January 2018. In our institution patients with BSI grade IV of V are assumed hyposplenic and will receive a splenic function test. We included all patients with a minimum follow-up test period of 5 days. All tests were analyzed by the radiology specialist. For each patient we furthermore collected clinical data, including the date of trauma, gender, age, mechanism of injury, AIS of splenic injury and ISS.
Results: 33 patients consisted of 23 male and 10 female, with a median (IQR) age of 11.8 (7.3–13.5). Median ISS was 16.0 (13–30.5) and the median spleen AIS was 4 (3–4). NOM was used in 26 patients, SAE in five patients and two patients were treated with surgical mesh technique. The median follow-up time of all performed tests was 59 (22–75) days. A total of 20 patients (61%) had a grade IV or V splenic injury. Scintigraphy was utilized to test most patients. A total of 32 out of 33 patients had an adequate splenic function, including all SAE patients.
Conclusions: Even high grade splenic injuries show adequate splenic function in the follow-up of pediatric trauma patients after BSI. Therefore routine diagnostic follow-up by scintigraphy is not necessary in this specific patient group.

PR 10

Evaluation of abdominal injuries treated at stavanger university hospital: occurrence, severity and mortality

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Introduction: Abdominal injuries account for 8–9% of all trauma patients. This study aims to investigate demographic and clinical patterns, including mortality of patients with abdominal injuries treated at Stavanger University Hospital during a 15-year time period.
Material and methods: Retrospective evaluation of data recorded prospectively in the hospital's Trauma Registry between January 2004 and December 2018. Patients with Abbreviated Injury Scale (AIS) code for abdominal injury were included. Descriptive analyzes are presented for demographic data, injury type, mechanism, and severity, as well as 30-days mortality.
Results: A total of 449 patients with abdominal injuries were included (6.2% of all trauma patients). 70% where men. Median age was 31. The injury mechanism was blunt in 91%. Transport accidents were the most frequent cause of injury (57%). Median ISS was 21, and median NISS 25. Overall 30-days mortality was 12.5%, with a median Trauma Injury Severity Score (TRISS) of 0,07. Multiple abdominal injuries were recorded in 44% of the patients. 86% had associated injuries in other body regions, most frequently in the thoracic region (65.5%). Solid organ injury occurred in 83% of the patients, with liver injury (38%), splenic injury (33%), and kidney injury (23%) encountered most frequently. An AIS score $\geq$ 3 was found in 56% of liver injuries, 65% of splenic injuries, and in 43% of patients with kidney injuries. Hollow viscus injuries were found in 20% of the patients. Injuries to the small intestine (8%) and colon (6%) were most frequent. Abdominal vessel injuries were encountered in 15%, and 94% of these had an AIS score $\geq$ 3.
Conclusions: Abdominal injuries are dominated by solid organ injuries following blunt injury mechanism and are often associated with concomitant thoracic injury. Patients who dies within 30 days from admission are characterized by a low probability of survival shown by TRISS.

PR 11

Pancreatic trauma management in a third level centre

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Introduction: Pancreatic trauma is still a challenge and involves high morbidity and mortality due to the difficulty in its diagnosis and

management. The aim of the study is to review the management and describe the most frequent complications of pancreatic trauma in our centre.

Material and methods: Observational study with prospective collection of data, from March 2006 to March 2019. Inclusion criteria: trauma patients older than 16 admitted to the emergency department who were admitted to ICU or died before admission. Demographic data has been collected, also vital signs, ISS, mechanism of action, mortality, complications, and lesions.

Results: Between 2006 and 2019, 1798 polytraumatic patients were registered. Only 17 had pancreatic trauma (0.95%). The male: female ratio was 11:6; with an average age of 47.7 years (SD 13.4). Mean ISS of 24.5 (SD 15.1), mean AIS of 2.1 (SD 0.97) and mortality of 23.5% (4 patients). The most frequent pancreatic lesion was at the head of the pancreas (9 patients; 52.9%), followed by body-tail (6 patients; 35.3%) and two patients with full section (11.7%). 64.7% of patients were treated with non-operative management. Five patients required urgent surgery (29%), requiring corporocaudal pancreatectomy in 2 cases and drainage in 3 patients. An embolization of a gastroduodenal artery aneurysm was performed in 1 patient. Respiratory complications were the most frequent. 4 patients developed a pancreatic fistula (23.5%), although in surgical patients this complication was much higher (60% in our series). One of them required Puestow pancreaticojejunostomy and 1 patient developed necrotizing pancreatitis (5.8%).

Conclusions: Pancreatic trauma is very uncommon. Its management can be difficult, depending on the degree of injury (AAST), with a high rate of complications. Therefore, combined management and monitoring by the surgery and intensive care team will be very important.

References: Girard E, Abba J, Arvieux C, Trilling B, Sage PY, Mougin N, et al. Management of pancreatic trauma. J Visc Surg. 2016;153:259–68.

PR 12

A retrospective comparative study between conservative and surgical treatment of blunt traumatic hepatic injuries

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Introduction: The aim of this retrospective study was to evaluate and compare the clinical outcomes of conservative versus surgical treatment in a series of patients with liver injury.

Material and methods: Between 2005–2017, there were included 128 patients. According the treatment chosen, the patients were subdivided in two groups. Non-operative management was considered in hemodynamically stable patients. The failure of conservative treatment was defined as need to resort to operative management after a period of strict monitoring when the reason was related to the liver or associated injuries or need for late angioembolization. All hemodynamically unstable patients were subjected surgical treatment.

Results: Conservative treatment was selected for 101 patients and only in 8 of them was failed due to associated delayed bleeding and small bowel injury. 27 patients underwent emergent surgery which included packing, lobectomy and splenectomy. Operative findings revealed grade III liver injuries in 71% and grade IV in 28%. Pneumonia, sepsis and ARDS were the most frequently associated complications. The overall mortality rate was 8.6%. In 19 patients of conservative group, non-surgical treatment failed with surgery being required. The mortality in the group of patients who underwent emergent laparotomy on admission was of 6 patients.

Conclusions: Conservative treatment of blunt traumatic hepatic injuries is applicable in patients presenting hemodynamic stability with mild hepatic injuries and it could be successful even in high graded injuries with low morbidity and mortality. Surgical treatment is indicated in grade V injuries. Nevertheless, failure of conservative treatment does not necessarily lead to an increase in the incidence of complications or mortality.

References: 1. Kaptanoglu L, Kurt N, Sikar HE. Current approach to liver traumas. Int J Surg. 2017;39:255–9.
2. Suen K, Skandarajah AR, Knowles B, Judson R, Thomson BN. Changes in the management of liver trauma leading to reduced mortality: 15-year experience in a major trauma Centre. ANZ J Surg. 2016;86(11):894–9.

Fig. 1

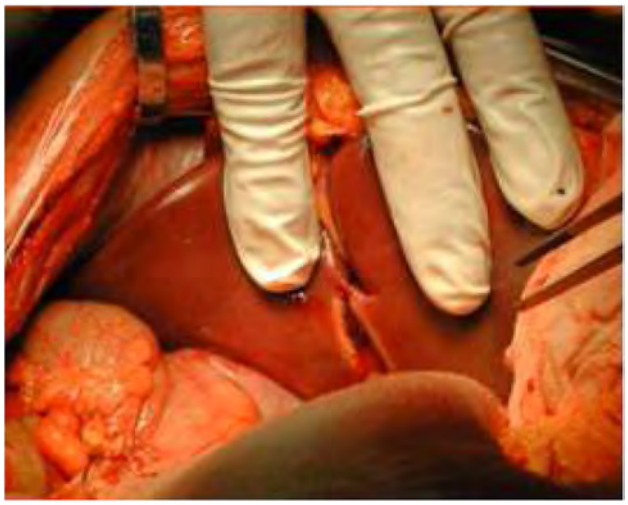
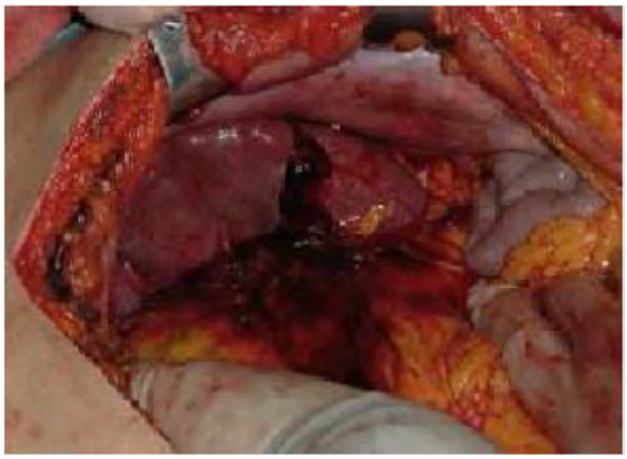


Fig. 2



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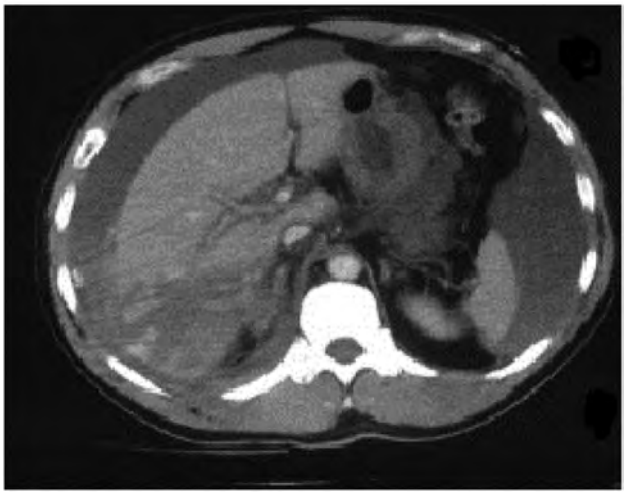

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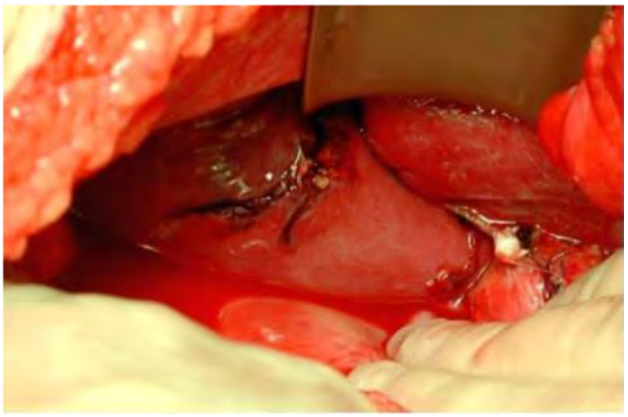

PR 13

A vanishing act: trauma laparotomies following road traffic accidents—a 10-year national study

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Introduction: Road traffic accidents (RTAs) management remains important. In 2017 there were 25407 fatalities in the European Union. With the trend towards more conservative management strategies, surgeons' exposure to laparotomies for blunt injuries in RTAs has decreased. The aim of this study was to examine surgeons' exposure to laparotomies following blunt trauma which remains important to maintain low patient morbidity and mortality rates.
Material and methods: Data was collected for adult patients admitted to Mater Dei Hospital (Malta) following RTAs with CT-proven intrabdominal injuries between January 2008 and January 2018.
Results: 114 patients (74 (64.91%) males vs. 40 (35.09%) female (p value < 0.05), mean age = 36.66 years) were included in the study. 88 patients (77.19%) were car occupants whilst 26 patients (22.81%) were pedestrians. 94 (82.46%) patients had single intraabdominal organ injury, whilst 20 (17.54%) had multiple intra-abdominal organ injuries. The 30-day mortality rate was 11.40% (13 patients). Liver injuries occurred in 57 (42.54%) patients, splenic injuries occurred in 50 (37.31%) patients, kidney injuries in 18 (13.41%) patients and other organs were injured in 9 (6.72%) patients. Conservative management was followed in 81 (71.05%) patients, angioembolisation was utilised in 12 (10.53%) patients and operative management was performed in 19 (16.67%) patients during the 10-year period. This resulted in 2 trauma laparotomies following RTAs per year.
Conclusions: Only a minority of patients require operative management after RTAs. Surgeons in small countries have limited exposure to complex RTA's. In view of the low exposure to emergency laparotomies following RTAs, changes to our local training programme was done. Trauma courses, lectures and fellowships in EU have been implemented to maintain surgical skills to an optimal level.
References: European Commission, Annual Accident Report. European Commission, Directorate General for Transport June 2017.

PC 14

An emergency splenectomy post-elective colonoscopy

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Case history: A 61 year old female presented to the Accident and Emergency department 10 h post colonoscopy with complaints of left sided abdominal pain. This colonoscopy was requested under a 2-week wait for a history of chronic diarrhoea. This was a complete and uneventful examination ath the time, with random colonic and ileal biopsies taken. She attended A + E with left sided abdominal pain increasing in severity.
Clinical findings: She was found to have an exquisitely tender abdomen, experienced more in the left upper quadrant. She was clinically shocked with a marked hypotension and tachycardia.
Investigation/results: A CT of her abdomen and pelvis showed free fluid within the abdomen and pelvis, with active bleeding and large haematoma adjacent to the spleen. The grade of splenic injury however was not commented upon by the reporting radiologist. Interventional radiological embolism was considered but unfeasible as patient not stable haemodynamically.
Diagnosis: She was diagnosed with a splenic injury post-colonoscopy, with internal bleeding and haemodynamic instability.
Therapy and progressions: She underwent an emergency splenectomy overnight and was transferred to the Intensive Care Unit for postoperative care. She recovered well, was stepped down to ward level care and was discharged with post splenectomy protocols, including all necessary vaccinations.
Comments: Splenic rupture post-colonoscopy is a very rare event, with less than 115 cases reported worldwide since 1974. However, it still should be considered as a cause of A + E presentation in patients with upper abdominal pain and haemodynamic instability after recent colonoscopy. We wanted to present this rare case to the international audience of ESTES congress to raise awareness of this rare complication.
References: Feola A, Niola M, Conti A, et al. Iatrogenic splenic injury: review of the literature and medico-legal issues. Open Med. 2016;11(1):307–15.

PC 15

A case of severe hepatic injury with traumatic cardiac arrest successfully treated by damage control surgery and transcatherter areteriol embolization

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Case history: A 46-year-old woman injured while snowboarding was transferred to a local hospital. Computed tomography (CT) revealed grade V right lobe hepatic laceration. She was transferred to our hospital while being transfused uncrossmatched type O red blood cells.
Clinical findings: Hemorrhagic shock and consciousness disorder were observed. Her abdomen was distended, and she was intubated in the emergency room.
Investigation/results: CT revealed massive intra-abdominal bleeding.
Diagnosis: Massive intra-abdominal bleeding due to hepatic laceration.
Therapy and progression: Damage control surgery (DCS) and transcatheter arterial embolization (TAE) were performed. She was transported to a hybrid operating room. She experienced cardiac arrest before operation. Cardiopulmonary resuscitation was immediately initiated, resulting in the return of spontaneous circulation. Laparotomy with perihepatic packing (PHP) was performed, but she experienced two more episodes of cardiac arrest during operation. Then, TAE was performed for right hepatic artery extravasation. After physiological function restoration, including rewarming, coagulopathy correction and hemodynamic stabilization in the intensive care unit. She gradually became hemodynamically stable. However, incomplete hemostasis was obtained at second-look laparotomy 18 h later. Because of bleeding, we repeated PHP. We performed cholecystectomy and abdominal closure after confirming complete hemostasis (46 h post-accident). She was discharged ambulatory without neurological deficit (day 82).
Comments: Prognosis of traumatic cardiac arrest is generally poor, and survival without considerable neurological deficit is very rare. We reported a surviving patient with severe hepatic laceration. Sharing of strategies and tactics, such as blood transfusion, TAE, trauma team approach to surgery, early decision of DCS improves outcome of patients with severe abdominal trauma.
References: Resuscitation. 2010;10:1400–33.

PR 163

Blunt splenic injury: trends in the treatment in a single institution

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Introduction: The spleen is the most commonly injured organ after blunt trauma. Non operative treatment (NOM) of splenic injuries has gained wide acceptance. Transcatheter embolization of the splenic artery is considered a useful adjunct in AAST lesions ≥ 3 without active bleeding. We report a retrospective review of all patients admitted to a level 1 Trauma Center with blunt splenic injury from 2012 to 2019 and compare their treatment and outcome with a previous series from 2007 to 2011, when angioembolization was performed only in case of contrast blush at CT scan.
Patients and results: From 2012 to June 2019, 59 patients with blunt splenic injuries were admitted to the ED of a Level 1 University Hospital in Milan, Italy. Men to female ratio was 5:1,the mean age 44.9 $\pm$ 20 years (range 16–90), and the ISS 22 $\pm$ 11.5(range 2–57). Eight patients (13.6%) underwent emergent splenectomy due to hemodynamic instability. Of the 51 stable patients treated with NOM, those with AAST lesions ≥ 3 (N = 25) were submitted also to angiography and 23 to embolization of the spleen (45%), either proximally (12) or distally (11). Two NOM failed, and the patients were submitted to splenectomy or distal embolization. The median hospital stay was 13.1 $\pm$ 11.5 days. The total spleen salvage rate was 96%. No associated abdominal injuries were missed in the NOM group. In the previous series of 31 patients (mean age 34.7 $\pm$ 15.4 years, range 17–88, ♂:♀ = 7:1, ISS 18 $\pm$ 7, range 4–38), 4 underwent emergency splenectomy (13%), and 27 (87%) were treated conservatively, with only 7 embolization (25,9%) in case of AAST ≥ 3 at CT scan. Failure of NOM were 2, and the spleen salvage rate 80.6%.

PC 164

Liver injury following multiple cardiopulmonary resuscitations

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Case history: This is a case of a 44 year old woman who presented to the emergency department (ED) due to worsening dyspnea complicated by two lengthy cardiac arrests. After the first resuscitation and return to spontaneous circulation (ROSC), echocardiography was done and showed severely dilated right ventricle with strain, suggestive of massive pulmonary embolism, for which rTPA was given. Arrest occurred again, and post ROSC, heparin was started and the patient was transferred to the ICU. Extracorporeal membrane oxygenation (ECMO) was initiated but complicated by severe hemodynamic instability and a third cardiac arrest, so cardiopulmonary resuscitation (CPR) was performed till ROSC and massive transfusion protocol was started for suspected intraperitoneal bleeding.
Clinical findings: After ECMO cannulation, abdominal distention was noted with a severe drop in hemoglobin and an increased intra-abdominal pressure (25 mmHg). Abdominal bedside ultrasound showed significant amount of dense free fluid. The decision for an urgent exploratory laparotomy was made and the patient was taken to the operating room.
Therapy and progressions: Deep liver laceration over the right hepatic dome with rupture of the capsule and an estimated hemoperitoneum of 3 L were found intra-op. Controlling the bleeding was difficult due to the laceration site and the patients coagulopathic status, so packing was done and the patient was transferred to ICU for correction of the coagulopathy and re-evaluation in 48 h. The liver was unpacked after 48 h, bleeding sites were cauterized and sutured and the liver was wrapped with a mesh with an attempt for a tamponade effect. The patient's stay in ICU was complicated with kidney injury requiring chronic dialysis but otherwise recovered well.
Comments: Liver injury is a rare but serious complication after CPR that should be considered in case of persistent hemodynamic instability along with bedside findings. This case is intriguing due to the right sided liver injury with no overlying rib fractures.

PC 165

Blunt renal trauma after electrical injury: a series of curious events.

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Case history: A 25 yr old patient was referred to the emergency department (ED) of our hospital from a primary health center after sustaining an electrical injury (220 V AC). The patient experienced loss of consciousness (LOC) and promptly fell to the ground in a supine position. The patient arrived approximately 3 h after the incident.
Clinical findings: Vital signs: BP: 90/45 mmHg, HR: 110 bpm. The patient's major complaint was left flank and abdominal pain. No obvious thermal injuries were observed or any other signs of external trauma. A left abdominal mass developed which was evident on physical examination. In addition, examination of urine revealed gross hematuria.
Investigation/results: EKG monitoring documented sinus tachycardia without evidence of cardiac arrhythmias. FAST indicated the presence of a massive retroperitoneal hematoma. The FAST exam indicated the left kidney as the probable source of hemorrhage. The initial hematocrit (Hct) from the primary health facility was 44% while results from the ED recorded a Hct of 22%.
Diagnosis: Grade V renal trauma.
Therapy and progressions: A massive transfusion protocol was initiated. The patient underwent an emergency laparotomy and a left nephrectomy was performed. Subsequent imaging did not reveal other injures.
Comments: The history of electrical injury could have misdirected investigation efforts towards cardiogenic shock. This case suggests that even in the absence of a high energy impact, sustained hemodynamic instability should always be attributed to hemorrhagic shock until disproven. In addition, the management of Grade V renal trauma in blunt injury remains a controversial topic, however we believe that in cases of class IV shock, surgical management is imperative.
References: Morey AF, Brandes S, Dugi DD 3rd, et al. Urotrauma: AUA guideline. J Urol. 2014;192(2):327. Epub 2014 May 20.
ACS committee on Trauma. ATLS Student Course Manual, 9th ed, American College of Surgeons, Chicago 2012.

Fig. 1

Fig. 2

PC 166

Damage control in esopagheal perforation

L. Garciafilia Cabrera[1], *L. Martín Román*[1], *S. Kayser Mata*[1], *M. D. Pérez Díaz*[1], *F. J. Turégano Fuentes*[1]

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Case history: 56 y.o. female with a history of Chagas' disease of 30 years duration and esophageal involvement in the last few months. She's admitted for a first endoscopic balloon dilatation due to dysphagia, which is performed according to protocol, and a tear of the mucosa layer is observed during it.
Clinical findings: She's stable for the first 36 h but with continuous thoracic pain of moderate intensity according to the GI specialist. On the second day there's a general worsening of the patient's condition, with dyspnea, fever, desaturation and tachycardia.
Results and diagnosis: She develops leukopenia and elevations of acute phase reactants, and a CT scan reports a distal esophageal perforation with free extravasation of contrast in the mediastinum and bilateral pleural effusions.
Therapy and progressions: Emergency surgery is performed through a midline supraumbilical laparotomy which shows peritonitis around the epigastric area. After opening the hiatus, a very long transmural esophageal tear with devitalized tissues and severe contamination are observed. A trans-hiatal esophagectomy was decided and, given the hemodynamic stability, a gastroplasty is performed and brought up to the neck without anastomosis, along with a terminal cervical esophagostomy and feeding jejunostomy. The patient did well in the postop period. We were able to do the esophagogastric anastomosis in the neck 14 days later, during the same admission.

Comments: The surgical technique in esophageal perforation depends mainly on the time elapsed since the perforation, and on the condition of the patient. Esophagectomy is sometimes unavoidable, and a gastroplasty can be brought up to the neck at the same time in selected cases, with reconstruction of the upper GI tract during the same admission.

References: Biancari F, D'andrea V, Paone R, et al. Current treatment and outcome of esophageal perforations in adults: systematic review and meta-analysis of 75 studies. World J Surg. 2013;37:1051–9.

Fig. 1

Fig. 2

Fig. 3

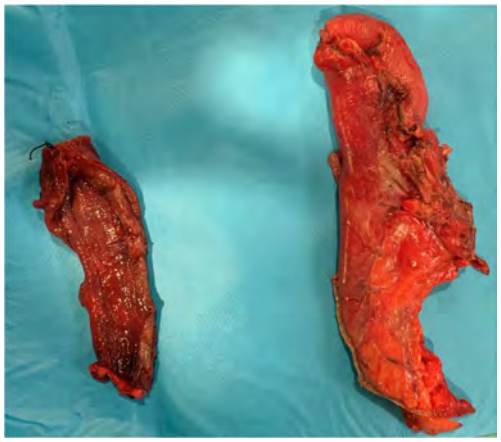

Fig. 4

Fig. 5

PR 167

Splenic trauma approach: review of a portuguese trauma center

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Introduction: The spleen is one of the most frequently injured abdominal organ. The anatomy of the lesion defines the degree according to AAST, ranging from grade I to V in increasing complexity. The diagnosis of splenic trauma may be difficult, as 40% of patients may show no signs or symptoms at primary survey. The approach involves two main strategies: conservative or surgical. The strategy should take into account four aspects: hemodynamic status, anatomy of the lesion, associated injuries and organizational structures of the evaluation site. This study aims to evaluate the type of approach performed on different degrees of splenic trauma during 7 years in a portuguese trauma center.
Material and methods: We conducted a retrospective study including all patients diagnosed with splenic trauma during a period of seven years. By consulting the patient's clinical files we evaluated and compared: demographic data, trauma kinetics, degree of splenic injury and the approach taken as well as morbidity and mortality.
Results: Of the 119 patients studied, most were male with blunt trauma. In 58 patients the inicial approach was surgery and in 61 the option was conservative treatment. In grade III or IV lesions conservative treatment failed in 16% of patients. Patients in whom the surgical approach was first chosen had predominantly grade IV lesions, with total splenectomy being the preferred approach. In grade III lesions, the option was mainly conservative surgery of the spleen.
Conclusions: The initial approach of splenic trauma results essentially of the experience of emergency teams and support structures for surveillance and intervention (intervention radiology and 24-h operating room availability). The attempt to try conservative strategy is increasing over time.
References: Harbrecht BG. Is anything new in adult blunt splenic trauma? Am J Surg 2005; Wahl WL, et al. Blunt splenic injury: operation versus angiographic embolization. Surgery 2004.

PR 168

Characteristics of Helicopter Emergency Medical Services (HEMS) cancelled missions during a 6-year period in the Netherlands: a retrospective study

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Introduction: For decades, Helicopter Emergency Medical Services (HEMS) contribute greatly to prehospital trauma patient's care by performing advanced medical interventions on scene. Unnecessary dispatches, resulting in cancellations, cause these vital resources to be temporarily unavailable. These cancellations contribute to overtriage and provide additional costs to society. An earlier study showed a cancellation rate of 44% in our trauma region. However, little empirical knowledge exists about reasons for cancellations for different mechanisms of injury (MOI) and type of dispatch. This study aims to examine the current cancellation rate in our trauma region over a 6-year period. Additionally, insights in cancellation reasons for different MOI and type of dispatch are evaluated.
Methods: A retrospective study was performed, using data derived from the HEMS database of Trauma region North West Netherlands, between April 1st 2013 and April 1st 2019. Information regarding patient's characteristics, date and time of day, MOI, type of dispatch, and cancellation reason were compared.
Results: In total, 18,639 patients were included. HEMS was cancelled in 54.5% of dispatches. The majority of dispatches (76.1%) were cancelled because the patient was physiologic- and neurologically stable. Dispatches simultaneously activated with EMS were cancelled 58.3% of times, compared to 15.1% when HEMS assistance was additionally requested by EMS on scene. No differences were found between day- and night-time dispatches. Trauma related dispatches were cancelled more frequently compared to non-trauma related dispatches.
Conclusions: This study found a considerable- and increased cancellation rate compared to previous research. An explanation for this finding could be better adherence to dispatch protocols. Furthermore, a great variety in cancellation rates was found among different MOI's. Therefore, continuous critical evaluation of HEMS triage is important and dispatch criteria should be adjusted if necessary.

PC 169

Bucket-handle mesenteric injury: conservative versus emergency operative management

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Case history: Two separate cases of high speed road traffic collision. The first is 31 years old female without significant past medical history. The second is 28 years old male who had short extremitis due to history of spastic quadriplegic cerebral palsy alongside congenital kyphosis and postural scoliosis.
Clinical findings: On examination the first patient was hemodynamically stable with soft abdomen and bruising over the left pelvic area. The second patient had left side neck and right side chest bruises; furthermore, he was tachycardic with normal blood pressure, but he was generally pale, getting clammy and significantly sweaty.
Investigation/results: FAST scan for both patients showed free fluid in the abdomen and CT scan was uncertain of the source in the first patient. In the second, a large mesenteric haematoma was evident on CT with contrast extravasation with corresponding significant drop in hemoglobin and raised lactate levels.
Diagnosis: Case 1: hemodynamically stable blunt abdominal trauma. Case 2: hemodynamically unstable blunt abdominal trauma.
Therapy and progressions: The first patient was managed conservatively initially but worsened overnight with a drop in haemoglobin and increase in lactate mandating emergency laparotomy. Hemoperitoneum and 60 cm of ischaemic bowel with tear in the mesentery was found. She had an uneventful recovery after resection and primary anastomosis. The second patient underwent immediate emergency Laparotomy. There was evidence of hemoperitoneum (3 L) and similar mesenteric tear with ischemia involving 50 cm of the terminal ileum. Resection with end to end anastomosis was done. Patient was then transferred to ITU; However, he developed chest infection which prolonged hospital stay.
Comments: Hemodynamic instability is a major factor in mandating urgent exploratory laparotomy in BAT and bucket-handle injury is not uncommon following road traffic accidents.

Fig. 1

PR 170

Incisional hernias: a systemative review and meta-analysis of repair techniques & rates of recurrence

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Introduction: Incisional hernias are one of the most common complications post-abdominal surgery, affecting between 10–25% of patients undergoing a laparotomy. A number of risk factors are associated with their development such as age, BMI, type of surgery and co-morbidities. These risk factors also affect their levels of recurrence which is why the technique undertaken to repair these is of such interest. The primary purpose of this meta-analysis was to examine which repair technique is associated with the lowest level of recurrence whilst a secondary aim was to examine whether the frequency of common complications was dependent on the type of repair utilised.
Material and methods: This systematic review and meta-analysis was conducted by both co-authors. The following information sources were utilised; Cochrane/EMbase/Google scholar/Pubmed/Scopus. In relation to the eligibility criteria- papers that were published from 1990 onwards and in the English language were included with any length of follow-up. Study selection was as per the inclusion/exclusion criteria below and only cohort studies/RCTs/systematic reviews/meta-analyses and case control studies were included.
Inclusion criteria: Abdominal incisional hernias, all types of repair-mesh/open/laparoscopic/sutured repair/primary repair etc. In terms of the exclusion criteria-any hernia repair that was not incisional was excluded.
Results and conclusions: In terms of the primary question posed by this repair, meta-analysis shows that there is a significant difference between open vs laparoscopic technique and recurrence rates in relation to the primary question posed by this paper whilst the use of mesh impacts negatively on post-operative wound infection rates. This invites an interesting debate on the merits of each technique whilst demonstrating the need for a multicentre randomised controlled trial.

PC 171

Laparoscopic approach in penetrating abdominal trauma: case study and review of the literature

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Introduction: Laparoscopy(LS) has greatly improved surgical outcomes in many elective abdominal procedures. The use of LS in acute care is becoming widely accepted. However, a number of safety issues have limited its application in abdominal trauma. Notwithstanding with the reports and studies of the past decade proving its safety and accuracy, LS is slowly replacing the need for exploratory laparotomies.
Case report: A 34 yo male sustained with penetrating stab wound on the left flank. He was hemodynamically stable. CT confirmed intraperitoneal positioning of the knife, without free fluid or air nor any evidence of organ injury. An exploratory LS was performed and confirmed the intraperitoneal positioning of the knife. Abdominal exploration revealed a jejunal transfixating lesion about 1 m from Treiz's angle that was manually closed. The patient maintained a favorable PO evolution and was discharged on the 4thPO day.
Discussion/conclusion: A number of concerns have limited the use of LS in abdominal penetrating trauma. Initially, it resulted in high rates of missed injury, mainly of the small bowel, generating considerable criticism. The development of systematic abdominal explorations in LS, as described by Choi and Kawahara, resulted in a rate of missed injuries close to zero. Moreover, direct visualization using LS has shown superior specificity and sensitivity in identifying peritoneal penetration, hollow viscus injuries and diaphragmatic lesions when compared to CT. In the case reported here, CT didn't show any image suspected of perfuration such as free air or fluid, and yet LS showed a small bowell injury. Besides its advantages as a diagnostic tool avoiding negative laparotomies in more than 50% of the cases, thanks to evolving techniques and improved practice, it may also be therapeutic and allow safe definitive treatment for many types of injuries as described here.

PR 172

Failure risk factor for non-operative management of splenic trauma

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Introduction: Splenic trauma is a common reason for admission due to blunt abdominal trauma. The objective of this study is to identify the risk factors for failure of non-operative management (NOM) in splenic trauma.

Method: This is a monocentric retrospective study from a database entered prospectively. All patients admitted to the University Hospital in Nice with splenic trauma between 01/01/2006 and 01/06/2018 were included. The primary endpoint was performing splenectomy as a failure of a NOM.

Results: 290 patients were included in our study. The majority of splenic lesions were severe grades, that is to say greater than 3. In total, 83 splenectomies were performed urgently, i.e. 29% of patients; 88 angio-embolizations were performed, i.e. 31% of patients with a success rate greater than 80%; 14.7% of 136 patients who had not anterior angio-embolization required secondary splenectomy; 19.7% of the 61 patients who had anterior angio-embolization required secondary splenectomy. In the patient group with successful angio-embolization, the mean age was 44 years vs 37.5 years in the NOM failure group (p = 0.15). A decrease in hemoglobin between admission and 6 h after admission was found in the NOM failure group compared with the successful embolization group (p = 0.064).

Conclusion: Hemoglobin monitoring in the hours following admission of a patient with splenic trauma may be an important factor in the surveillance of hemodynamically stable patients. Prospective studies could confirm these results.

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Capecci LM, Jeremitsky E, Smith RS, Philp F. Trauma centers with higher rates of angiography have a lesser incidence of splenectomy in the management of blunt splenic injury. Surgery. 2015;158(4):1020–4.

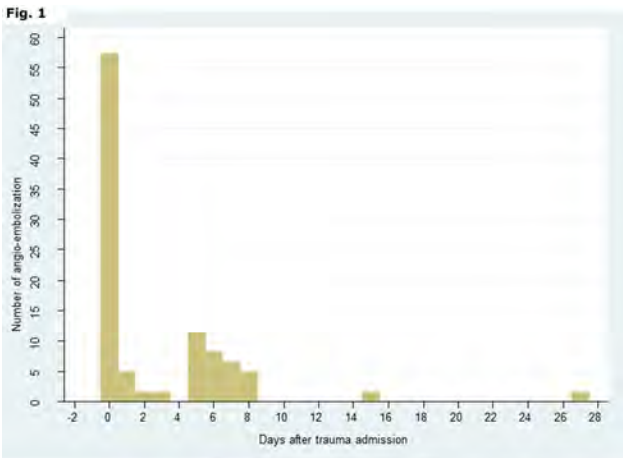

Figure 1: day of angio-embolization

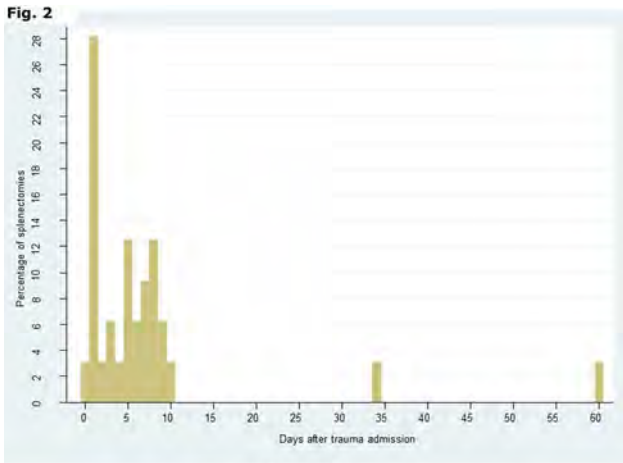

Fig 2: day of splenectomy

PR 173

Missed ureteric injuries in gunshot injuries of the abdomen: how to avoid?

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Introduction: Traumatic Ureteral injuries are uncommon. Penetrating rather than blunt trauma is the most common cause of ureteral injuries. The aim of this study is to make a strategy to avoid missing ureteric injuries in gunshot injuries of the abdomen.

Material and methods: 765 patients were operated in our hospital in 3 years period. All patients were managed according to ATLS guidelines. For stable patients, full radiological work up was done, while hemodynamically unstable patients were shifted to OR immediately for laparotomy and exploration. All patients demographic and clinical data were recorded these include :patient age, sex, mechanism of injury, hemodynamic state on arrival to the RR, anatomical site of gunshot injury, associated injuries, ureteric injuries detected early or late, early repair, delayed presentation and morbidly associated with delayed discovery.

Results: Ureteric injuries were found in 12 patients out of 765 patients who underwent laparotomy for gunshot injuries had ureteric injury in an incidence of 1.5%. Ureteric injuries were missed in the first laparotomy in 3 patients. Associated injuries of other abdominal viscera include; colon injuries affecting ascending and descending colon in all the patients.

Conclusions: CT and pyelogram are the modalities of choice in stable patient but in unstable patients the early recognition of ureteric injuries depends on high index of suspicion leading to surgical exploration of the ureter along its course.

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2. Fraga GP, Borges GM, Mantovani M, Ferreira U, Laurito TL, Netto NR, Jr. Penetrating ureteral trauma. Int Braz J Urol. 2007;33:142–8.

No thing to be disclosed.

Fig. 1

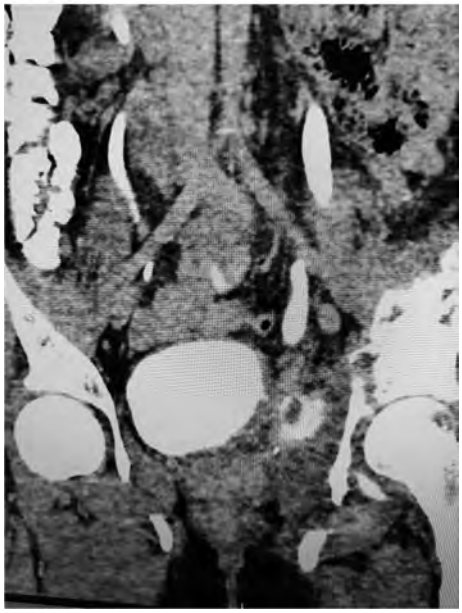


Fig. 2

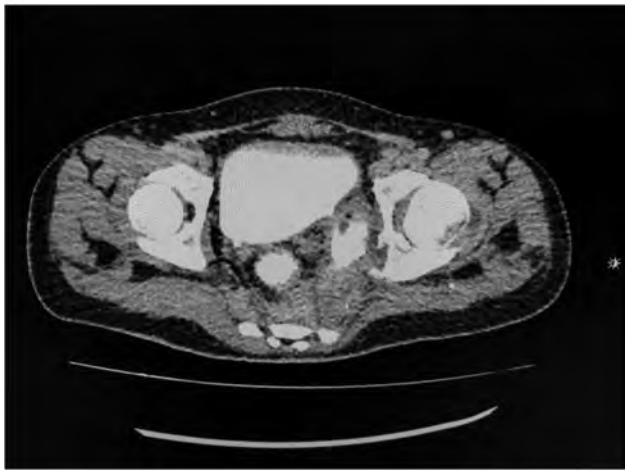
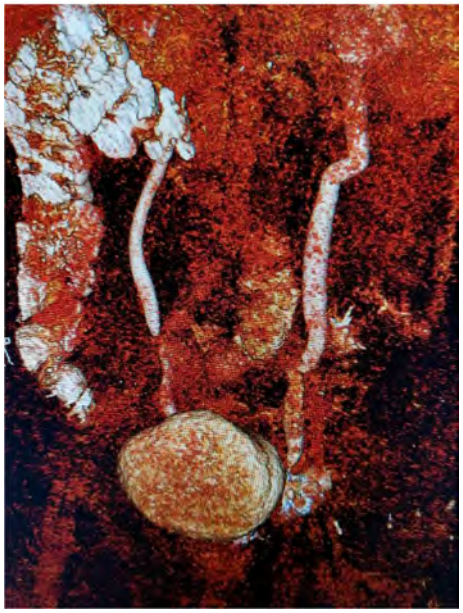


Fig. 3



PC 174

A case of an injury of the abdominal wall and small intestine from an agricultural machine: reconstruction of the abdominal wall with the use of a double-sided mesh

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Case history: We present a case of a 72 year old man, who was injured by his agricultural machine in the abdomen.
Clinical findings: He was transferred in the emergency department and he was hemodynamically stable. He had several traumas in his abdominal wall. From the largest one, in the left iliac fossa, omentum, transverse colon and loops of the small intestine were protruded out of the abdominal wall. The small bowel was ischemic and ruptured.
Investigation/results: Computed tomography investigation, revealed small amounts of liquid and air in the abdominal cavity.
Diagnosis: The patient was immediately operated. The destroyed loop of the small bowel was resected with the use of a stapler and the field was washout. Then with a midline incision the abdomen was opened. There were no other injuries inside the abdomen cavity. There was an extensive injury with a creation of a large gap in the anterolateral abdominal wall. It was impossible to identify the left rectus abdominis muscle as also the lateral muscles (external and internal oblique and transversus abdominis).
Therapy and progressions: A side to side entero-enteric anastomosis was created and a meticulous observation and washout of the

abdomen were performed. For the closure of the abdominal wall a double-sided mesh from polypropylene coated with silicone on one side (20 × 25 cm) was placed and the operation was completed. All the other wounds of the abdominal wall were closed with loop nylon stitches No 1. A closed suction drain was placed above the mesh. The patient had a very good postoperative course. He was dismissed from the hospital after 15 days in a very good condition.

Comments: The usage of mesh was very useful for the reconstruction of the abdominal wall.

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There is no conflict of interest.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

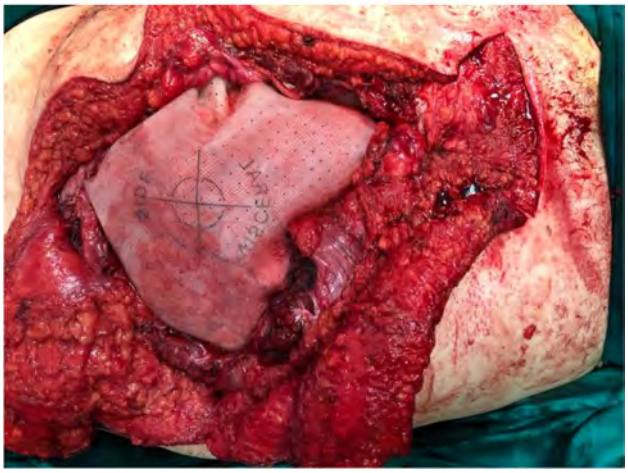

Fig. 5

PR 175

Strategy shift from damage control surgery to primary radical surgery improve the outcome of blunt hepatic injury involving inferior vena cava

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Introduction: Blunt hepatic injuries involving inferior vena cava (BHIVC) are associated with high mortality, and their optimal surgical strategy remain controversial. We gradually shifted the strategy for BHIVC from damage control surgery (DCS)[1] to primary radical surgery (PRS) over the past 15 years. DCS aims for temporally hemostasis with minimum delay by emergency room laparotomy (ERL) and/or gauze packing (GP). Whereas, PRS aims for definite hemostasis in the initial surgery by hepatectomy and/or hepatorraphy and IVC repair with or without total hepatic vascular exclusion (THVE). Objective of the study is to evaluate the impact of the strategy shift on outcomes of BHIVC cases.
Material and methods: Retrospective chart review of 21 consequent cases (13 males and 8 females), who were diagnosed BHIVC and underwent surgery in Saitama Medical Center between 2005 and 2019. Median [range] of age and ISS were 29 [1–76] and 35 [16–66].
Results: 1 of 6 cases survived after DCS (including 2 ERL) in 2005–2011. 1 of 4 cases survived after incomplete PRS and conversion to DCS in 2009–2012. 10 of 11 cases survived after complete PRS in 2009–2019. 4 of 5 recent cases survived after IVC repair with THVE. The death after PRS was attributable to severe head injury. All but 2 ERL cases underwent whole body enhanced CT scan prior to the operation. Massive transfusion protocol (MTP) was applied to necessary cases in 2014 and later.
Conclusions: Strategy shift from DCS to PRS was associated with significant improvement in outcome of BHIVC cases. Prerequisites of PRS include early correction of coagulopathy by MTP and precise assessment of the injuries and the bleeding points by whole body enhanced CT scan.
References: 1. Rotondo MF, Schwab W, MacGonigal MD, Phillips GR, Fruchterman TM, Kauder DR, Latenser BA, Angood PA, 'Damage control': an approach for improved survival in exsanguinating penetrating abdominal injury. J Trauma. 1993;35(3):375–82.

PR 176

Abdominal blunt trauma: outcome following non operative management related to fast advanced rescue and hospital trauma team organization

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Introduction: Fast advanced rescue is the most important step in traumatized patients (golden hour), abdominal solid organ injuries are one of the most important causes of hemorrhage and death; Our prehospital system (ambulances and helicopters) in Aosta Valley, Italy, ensures hospitalization in 20 min after the trauma with advanced medical team assistance; In this way non operative management (embolization, icu observation) by hospital trauma team is possible.
Material and methods: We analyze the outcome of abdominal traumatized patients (non operative/operative management) related to early treatment due to fast rescue, radiology operative service and ICU availability.
Results: From 2002 to 2019 more then 120 traumatized patients with abdominal trauma were observed and treated, 83% with Nom (90% after stable operative radiological service). Mortality is 1.5%, complications rate 4%.
Conclusions: Fast advanced rescue, rapid treatment, operative radiology, Icu and blood availability are the most important factors in current treatment of abdominal traumatized patients.
References: Corn S, et al. Outcomes following blunt traumatic splenic injury treated with conservative or operative management. J Med. 2019;12(3):83–8. eCollection 2019 Aug.
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PR 177

Modern principles in the management of abdominal trauma with interest in parenchymal organs

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Introduction: The diagnosis of abdominal trauma is a real challenge even for surgeons experienced in trauma. Clinical findings are usually unreliable, and abdominal examination is made up of various factors. Diagnostic tools that help the attending physician make critical decisions, such as the need for laparotomy or conservative treatment, are mandatory if we propose a favorable outcome.
Material and methods: The study was performed in the Clinic I Surgery, the County Clinical Emergency Hospital Craiova, between 2014–2018 and analyzed a number of 70 abdominal traumas hospitalized, investigated and treated in the clinic. The methods of paraclinical diagnosis are evaluated comparatively, the study analyzing the evolution and the tendencies during the studied period, from 2014, to 2018.
Results: The study allowed an evaluation of the diagnosis and treatment methods compared to the data in the literature.
Conclusions: Thus CT scan remains the standard criterion for detecting solid organic lesions. In addition, a CT scan of the abdomen may reveal other associated lesions. FAST ultrasound is an important and valuable alternative for diagnosing abdominal trauma, especially

for patients who are hemodynamically unstable and cannot be mobilized. There is a tendency in the treatment of abdominal trauma, as evidenced by the literature data on the use of conservative versus surgical treatment for a larger number of cases.

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BLEEDING AND RESUSCITATION

PR 16

Results of the application of a guideline on management of pharmacological induced coagulopathy in emergent surgery

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Introduction: Antiplatelet agents and anticoagulant drugs are widely used in prevention of cardiovascular incidents, which poses a challenge in surgical emergencies. The drafting of a multidisciplinary protocol for the treatment of pharmacological induced coagulopathy in patients who require urgent surgery standardizes management and increases patients' perioperative safety.

Material and methods: Aims of the study were to describe the results from the protocol implementation. A retrospective study was conducted by examining reports of every patient presenting pharmacological induced coagulopathy and undergoing emergent surgery, recorded in our center from 2012 to 2017 inclusive. Different algorithms used were explained and data such as need of transfusion, reintervention rate and perioperative complications were analyzed.

Results: Data from 169 patients were analyzed, median age of 79, 100 (59%) men. 107 patients (63%) used anticoagulant drugs. Fresh frozen plasma transfusion and/or prothrombin complex concentrates were used according to the guideline. 73 (43%) patients used antiplatelet agents. 77% of them underwent a delayed 48 h surgery directly. Tirofiban therapy was established in 7 patients on dual therapy due to medium–high risk of cardiovascular event. Regarding surgical approach, 59 (35%) were laparoscopic, 96 (57%) open and conversion occurred in 14 (8%) cases, but only 1 of them due to intraoperative hemorrhagic complication. Only 2 cases of postoperative hemorrhagic complications led up to reintervention and only one isolated case of thrombotic complication was reported. Finally, 7 (4%) mortality cases were reported, but none was caused by hemorrhagic nor thrombotic complications.

Conclusions: Establishment of a guideline on management of pharmacological induced coagulopathy in emergent surgery is crucial in all surgical emergency units and has proven to be effective and safe.

PR 17

Utility of arterial embolization in gastrointestinal bleeding: single center experience

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Introduction: Digestive haemorrhage is a frequent pathology. Most of the episodes are self-limited, but in some cases massive haemorrhage occurs, leading to a 10% mortality rate. Severe problems occurs when endoscopic treatment is not effective, requiring emergent surgery with poor prognosis. The aim of this study is to evaluate the implementation of interventional radiology techniques on short-term results.

Methods: A retrospective descriptive study was performed reviewing patients who underwent radiological embolization after failure of endoscopic conventional treatment between 2015–2019 in our hospital. A total of 41 patients were included.

Results: 22 patients were male. 24 cases were from lower GI track and 17 were from the upper GI with a similar death rate between them, with a higher rebleeding rate in upper GI (35.2% vs 12.5%). 29% of the arteriographies did not show any bleeding site, 4 of them developed a new bleeding episode. Overall patients who undergo embolization, urgent surgery was avoided in 8 of the 11 patients diagnosed as upper GI haemorrhage and in 15 of the 19 patients diagnosed as lower GI haemorrhage. 5 patients died, those death occurred later on the recovery of the acute bleeding episode and embolization, all of them related to patients comorbidities.

Conclusions: Arterial embolization has become an important tool in order to treat massive haemorrhages of the gastrointestinal tract. It seems to decrease the mortality and morbidity rate, but some complications can be associated such as rebleeding or bowel ischaemia.

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PR 19

Massive transfusion protocol with early administration of platelet and fresh-frozen plasma along with packed red cells in the initial phase of resuscitation is associated with improved outcomes

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Introduction: Massive transfusion (MT) in a ratio of 1:1:1 (PRBC:Platelet:FFP) is the standard of care in hemorrhaging trauma patients. The aim of our study was to compare the outcomes of patients who receive near balanced resuscitation (NBR) compared to

unbalanced resuscitation (UBR) during the initial phase of resuscitation.

Material and methods: We performed a 4-year analysis of the ACS-TQIP. All adult patients (age > 18) who received MT (defined as transfusion of PRBC ≥ 10 units in 24-h) were included. Patients were stratified into two groups: NBR defined as PRBC:Platelets:FFP in 1: > 0.5: > 0.5 and UBR (1: < 0.5: < 0.5) in the first 4 h of resuscitation. Primary outcome measure was mortality. Secondary outcome measures were complications, and hospital length of stay. Propensity matching was performed to match the two groups.

Results: A total of 10,321 patients received MT. Mean age was 40 ± 12 years, median ISS was 29 [22–41]. Overall 24 h mortality was 27.9%. Only 36% patients received NBR while 74% received UBR in the first 4-h. Using propensity score matching, patients were matched for demographics, ED vitals, ISS, AIS and injury parameters. Patients who received NBR in the early resuscitation phase had lower mortality (23% vs. 31%, p = 0.01), lower overall complications (38% vs. 55%, p = 0.01), with no difference in hospital length of stay (17 days vs. 16 days, p = 0.53) compared to the UBR group.

Conclusions: Only one-third of patient receiving massive transfusion receive PRBC, FFP and platelet in a ratio closer to 1:1:1 in the initial 4-h and they have lower mortality and complications compared to patients with unbalanced resuscitation.

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PR 20

Netherlands vs. Europe and the world 'Massive transfusion in the Netherlands'

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Introduction: Massive transfusion protocols (MTP) may improve survival in patients with uncontrolled haemorrhage. An MTP has been introduced in the Dutch military in 2007, in the Dutch transfusion guidelines in 2011, in the 9th edition of the Advanced Trauma Life Support (ATLS) and in the 3rd version of the European guideline. This is the first survey on MTPs in Dutch trauma centres and the Ministry of Defence.

Material and methods: The goal is to assess MTP strategies in level-1 trauma centres in the Netherlands and compare these with each other and (inter) national guidelines. A trauma surgeon or anaesthesiologist involved in compiling the MTP in each level-1 trauma centre in the Netherlands and Dutch Ministry of Defence was approached to share their MTP and comment on their protocol in a survey or oral follow-up interview.

Results: All eleven level-1 trauma centres responded. Content of the packages and transfusion ratio (red blood cells/plasma/platelets) was 3:3:1, 5:5:1, 5:3:1, 2:3:1, 4:4:1, 5:2:1, 2:2:1 and 4:3:1. Tranexamic acid was used in all centres and an additional dose was administered in eight centres. Fibrinogen was given directly (n = 4), with persistent bleeding (n = 3), based on Clauss fibrinogen (n = 3) or ROTEM® (n = 1). Standard coagulation monitoring are used in all centres, but most hospitals use also rotational thromboelastometry (ROTEM®) (n = 6), thromboelastography (TEG®) (n = 1) or both (n = 1). All centres used additional medication for patients using anticoagulants, but its use was ambiguous.

Conclusions: MTPs in Dutch level 1 trauma centres differs from (inter) national guidelines in transfusion ratio and additional medication, which could be explained by misinterpretation of the 1:1:1 ratio, changes in components and following an outdated Dutch national guideline. Whether these differences in MTPs actually leads to different patient outcomes will follow from data that is currently being collected.

This study is sponsored by the Dutch Ministry of Defence.

PR 21

Anastomotic bleeding after colorectal surgery: incidence, management and complications

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Introduction: Postoperative anastomotic bleeding (PAB) is a frequent minor complication (1–9%) that usually resolves by a conservative approach. Hemodynamic instability and anemization may develop requiring urgent management. The aim of our study is to describe PAB and its treatment.

Material and methods: Observational retrospective cohort study of patients with PAB collected between July 2014 and September 2019. PAB was defined as an episode of lower GI bleeding after colorectal surgery with at least one anastomosis. Characteristics of patients, surgery, length of hospital stay, morbidity and mortality, and management of PAB were reviewed.

Results: A total of 38 (5.5%) patients with PAB was collected. Median age was of 75 years (IQR 64–80), with a median estimated ASA grade of 3. The most common procedure was a right hemicolectomy (50%), followed by sigmoidectomy (24%). 95% of surgeries were laparoscopic. Only 2 cases were converted to an open approach. 37% of patients had the first episode of PAB during the first 24 h after surgery, while 32% after the third postoperative day. PAB was treated conservatively in 84% of the cases. The remaining 16% required urgent endoscopic management identifying the bleeding through the anastomosis line, using clips in 5 patients and hemospray in 1 patient to control it. No complications were recorded after endoscopic treatment. Just 1 case required surgical reintervention. A total of 12 (32%) patients required blood transfusion with a median of 2 (IQR 2–3.75) units. Length of hospital stay was 6.5 (IQR 4.75–11) days. No mortality related to PAB was registered.

Conclusions: PAB is a mild complication after colorectal surgery. Most of the patients respond to conservative management. Urgent endoscopic treatment seems to be effective and safe to control PAB even during the first postoperative day.

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PR 22

Regional circulatory changes in various body regions associated with reperfusion injury during hemorrhagic shock

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Introduction: Hemorrhagic shock and associated reperfusion injuries are davastating situations during the treatment of polytrauma patients. The aim of this study was to analyze and compare alterations of the local circulatory changes of various body regions during hemorrhagic shock and after fluid resuscitation.
Material and methods: This study was conducted on male pigs. They suffered a standardized polytrauma including femoral fracture, blunt thoracic trauma and liver laceration. Further, the suffered a hemorrhagic shock for 1 h (aimed MAP 25 mmHg). Fluid resuscitation with three times drawn blood volume after hemorrhagic shock. Retrograde nailing for femoral fracture and chest tube in case of pneumothorax liver packing. Measuring circulation at liver, colon, stomach, and extremity.
Results: Inclusion of 27 animals. Local circulation at the extremity decreased significantly compared to baseline values during hemorrhagic shock (82.3 A.U. versus 31.7 A.U., $p < 0.001$). After resuscitation the Flow rate at the extremity was comparable to baseline values. The stomach was least sensitive to hemorrhagic shock, whereas the oxygen delivery rate at the colon decreased during shock phase and remained decreased during fluid resuscitation ($p < 0.001$).
Conclusions: Different body regions react differently to hemorrhagic shock. The colon appears to be most vulnerable to changes based on hemorrhage. The delayed improvement of circulation in liver, colon, and extremities may represent a trigger for systemic hyperinflammation and subsequent SIRS and sepsis.
None of the authors have any conflicts of interest to declare.

PR 23

Massive transfusion in penetrating trauma: the search for a specific prediction system

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Introduction: Prediction systems of massive transfusion (MT) were developed from cohorts with a small proportion of penetrating trauma. Some of them required laboratory tests. We aimed to evaluate ABC score and to identify independent predictors of MT in a cohort of torso penetrating trauma (TPT)
Material and methods: Adults with TPT, managed in a level-I trauma center, who received one or more packed red blood cells (PRBC), were included. Variables obtained during the evaluation in the trauma bay were registered prospectively. The ability to predict MT was evaluated with simple, multiple logistic regressions and ROC curves.
Results: We included 162 patients; 88.9% were male, and 84.6% received fire-arm wounds. Twenty-one (13%) received MT. MT patients were intubated more frequently in the pre-hospital, had lower SBP, higher HR, lower GCS, and received more frequently vasopressors ($p < 0.05$) when compared with the no-MT patients. Trauma mechanism, number or localization of the wounds, and positive FAST could not discriminate MT ($p > 0.05$). Hypotension, tachycardia, and alteration of the Glasgow Coma Scale or its motor response behaved as independent predictors of MT. Models created with these variables showed better discriminative ability than ABC score, with adequate goodness to fit.
Conclusions: Prediction models of MT, based on heart rate, systolic blood pressure, and neurologic alteration outperformed ABC score in a TPT cohort.
References: Cotton BA, Dossett LA, Haut ER, et al. Multicenter validation of a simplified score to predict massive transfusion in trauma. J Trauma. 2010;69 Suppl 1:S33.
Brockamp T, Nienaber U, Mutschler M, et al. Trauma Register DGU. Predicting on-going hemorrhage and transfusion requirement after severe trauma: a validation of six scoring systems and algorithms on the Trauma Register DGU. Crit Care. 2012;16(4).
Callcut R, Cotton B, Muskat P, et al. Defining when to initiate massive transfusion. J Trauma. 2013;74:59.

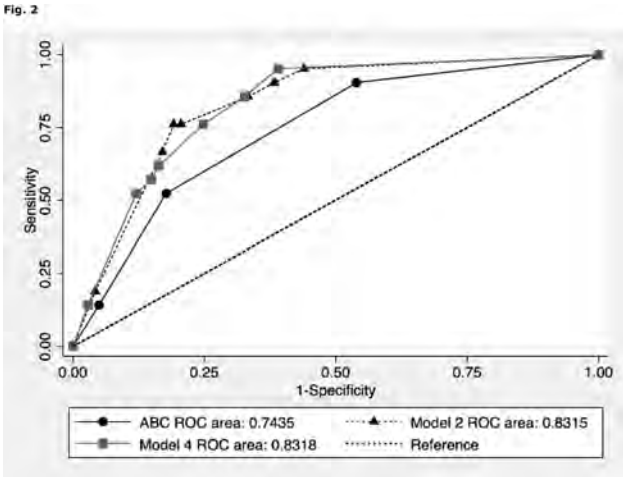
Fig. 1

Model	AUROC (95% C.I.)	Goodness of fit p
ABC system	0.7435 (0.64199 - 0.84501)	0.3291
Model 1. SBP (mm Hg) +HR (beats/min) +GCS	0.8207 (0.73790 - 0.90344)	0.9614
Model 2. SBP ≤90 mm Hg + HR≥120 beats/min + GCS≤14	0.8315 (0.75062 - 0.91233)	0.5011
Model 3. SBP (mm Hg) + HR (beats/min) + Best Motor Response	0.8237 (0.74121 - 0.90621)	0.9639
Model 4. SBP ≤90 mm Hg + HR ≥120 beats/min + Best Motor Response ≤5	0.8318 (0.75200 - 0.91163)	0.3139

AUROC Area under the ROC curve SBP Systolic Blood Pressure HR Heart Rate
GCS Glasgow Coma Scale

Table. Comparison of prediction models of massive transfusion in torso penetrating trauma

Fig. 2



PR 24

Evaluation of patients with rectus sheath hematoma: a 10-year single-center retrospective study

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Introduction: Rectus sheath hematoma presents with abdominal pain and anterior abdominal wall mass. It can be followed conservatively and rarely causes mortality (1). In this study we aimed to review rectus sheath hematoma cases consulted to our department and to present our management.
Material and methods: The data of 35 patients admitted with rectus sheath hematoma between 2009 and 2018 was collected using hospital database. Treatment modalities, demographic data and complications were reviewed retrospectively.
Results: All the cases presented with abdominal pain and/or with a palpable abdominal mass. 82.8% of the patients (n = 29) were receiving anticoagulant therapy at the time of admission. The mean INR value was 2.34. 28 patients were followed up with ES&FFP transfusion and conservative treatment. 3 patients not eligible for conservative care underwent inferior epigastric artery embolization and hematomas in 2 patients were evacuated via a percutaneous drainage catheter. 1 patient went through laparotomy for an infected hematoma and one patient underwent laparotomy plus packing. The patient who had laparotomy plus packing died due to intraabdominal hematoma and sepsis.
Conclusions: Rectus sheath heamatoma is a rare cause of acute abdominal pain. The patients diagnosed early and have suitable indications can be treated conservatively (2). Rectus sheath hematoma should be considered in the differential when a patient with a history of anticoagulant drug use presents with acute abdominal pain in order to prevent unnecessary surgery and complications.
References: 1. Hatjipetrou A, Anyfantakis D, Kastanakis M. Rectus sheath hematoma: a review of the literature. Int J Surg. 2015;13:267–71.
2. Changal KH, Saleem S, Ghous G. Rectus sheath haematoma: a rare masquerader for abdominal pain. BMJ Case Rep. 2017;2017:bcr-2017.

PR 25

Massive transfusion scores validation in a nationwide trauma registry

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Introduction: An early delivery of blood products when massive transfusion protocols (MTP) are triggered is mandatory to improve trauma patients survival. Scores predicting massive transfusion (MT) have already been described (1). The aim of our study is to compare scores for predicting MT and identify the best trigger for MTP.
Material and methods: Multicentric retrospective study from the Trauma Registry of the Spanish Surgeons' Association. Severe trauma patients (Injury Severity Score [ISS] $\geq$ 15), admitted to 18 different Level 1 Trauma Centers, from January 2017 to September 2019 were included. Demographic and clinical information was recorded, and predictive scores for MT were assessed.
Results: 1113 patients were included. Medium age was 47.1 $\pm$ 19.6 years, 861 (77.4%) were male. Median ISS was 22 (IQR 13). In 4% of the patients a MT (defined as $\geq$ 10 units of packed RBC) was necessary, while a MTP was triggered in 13.6%. Surgery was performed in 55.8%. The overall mortality was of 9.9%. Predictive scores for MT were compared: GAP (Glasgow Coma Scale, Age, systolic blood Pressure), Shock Index (SI), Assessment of Blood Consumption (ABC) and mABC (modified ABC). AUROC for GAP was 0.735 $\pm$ 0.037, SI 0.907 $\pm$ 0.016, ABC 0.881 $\pm$ 0.034 and mABC 0.882 $\pm$ 0.036, showing differences between GAP (the worst score) and the others, $p < 0.01$. No differences were found between SI, AB and mABC. Best cut-off points were calculated. SI $\geq$ 0.8 better predicts MT with a sensitivity 100%, specificity 63.4%, positive and negative predictive values 10.3% and 100%.
Conclusions: SI, ABC and mABC are all good scores for predicting MT in our population. Appealing by its simplicity, we recommend SI as the best trigger for MTP. Protocols should be standardized to improve the accuracy of MTP activation for trauma patients.
References: 1. Shih AW et al. Systematic reviews of scores and predictors to trigger activation of massive transfusion protocols. J Trauma Acute Care Surg. 2019;87(3):717–29.

PR 26

The impact of knife crime on the blood bank: a retrospective review in an urban UK Major Trauma Centre

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Introduction: The prevalence of knife-related offences is rising in the UK. Successful management of trauma patients requires the co-ordinated response of specialist services, including transfusion. We aimed to assess the impact of knife-crime on transfusion support within a UK adult major trauma centre (MTC).
Material and methods: Retrospective review of patients admitted to a UK MTC following knife injuries resulting from interpersonal violence during a three-year period (May 2015–April 2018). Source material included electronic patient records, TARN database and Massive Transfusion Protocol (MTP) logbook. Patient characteristics, resource utilisation including transfusion, MTP activation and outcome were collated.
Results: 540 patients were identified, 502 (93%) were male. Median age was 27 years. 237 (44%) were under the age of 25. 245 patients (45%) presented with circulatory compromise (SBP < 110). 97 patients (18%) had attended our hospital previously for violence-related trauma. 71% arrived at hospital between 1900 h to 0700 h. 346 (64%) required one or more surgical procedures. Median length of stay was 3 days. 95 patients (18%) received blood transfusion. Median units transfused were 4 PRBC, 2FFP, 1 platelets (ATD).

Mean component use was 6 PBRC (range 1–61), 3.8 FFP (0–36), platelets 0.6 (0–12), Cryoprecipitate 0.6 (0–14). Annual MTP activations increased from 99 to 157 during the study period (total 360). Stabbings accounted for 25.4% of these (99 patients), of which 70 (78%) were transfused.

Conclusions: Knife crime presents a burden to blood transfusion, accounting for a quarter of MTP activations. Patients typically present out of hours with implications for service planning and delivery. Patient profile together with repeat healthcare attendance and surgery requiring transfusion has implications for red cell allo-immunisation. We recommend timely baseline blood grouping and triage to optimise the safe use of RhD positive cellular components.

PR 27

A rare complication of anticoagulant therapy: retrospective evaluation of 15 cases with spontaneous intramural small bowel hematoma

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Introduction: Spontaneous intramural small bowel hematoma is a very rare complication of anticoagulant therapy. Nowadays, the prevalence is increasing due to the widespread use of computerized tomography and the increasing number of patients receiving anticoagulant therapy.

Material and methods: 15 patients admitted to our center between January 2010 and June 2019 and treated with the diagnosis of intramural hematoma were retrospectively evaluated.

Results: The median age of the patients was 69 years (44–84) and 9 (60%) were male. At the time of appeal, Warfarin intoxication was present in 14 cases (93%) and the median INR was 7.25 (5–14). One patient had known Factor 7 deficiency. Diagnosis was made by computerized tomography in all cases. One intramural hematoma was localized in the duodenum (6.7%), nine in the jejunum (60%), and five in the ileum (33.3%) Six patients (40%) had ileus findings. All patients underwent fresh frozen plasma replacement due to high INR levels and bleeding. Median TDP transfusion was 3 units (2–7). Only 3 patients (20%) required erythrocyte suspension replacement. All cases were followed up conservatively and there was no need for intensive care. The median hospital stay was 4 (3–10) days.

Conclusions: Due to the limited number of studies in the literature with a large number of cases, retrospective evaluation of 15 single-center cases may be helpful. Spontaneous intramural small bowel hematoma should be considered in the elderly population under Warfarin therapy who present with abdominal pain, especially if INR values are above therapeutic limits Spontaneous regression is seen in the majority of cases. Non operative management and correction of coagulopathy with fresh frozen plasma replacement is the preferred approach.

References: Abbas MA, et al. Spontaneous intramural small-bowel hematoma: clinical presentation and long-term outcome. Arch Surg. 2002;137(3):306–10.

Fig. 1

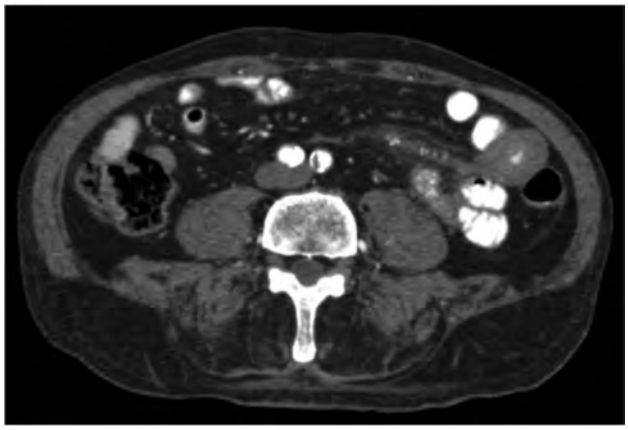

Fig. 2

PR 28

Pre-hospital decision-making: Identifying the challenges assessing and managing traumatic haemorrhage and coagulopathy

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Introduction: How expert pre-hospital clinicians make decisions about bleeding and trauma-induced coagulopathy (TIC) is not well known. This study aimed to understand the factors that influence

expert pre-hospital clinicians in making decisions about the diagnosis and treatment of patients with major haemorrhage and suspected TIC.
Methods: Semi-structured interviews were conducted with 10 senior pre-hospital consultants from London's Air Ambulance and Air Ambulance Kent, Surrey and Sussex. Interviews probed clinicians on how they make decisions relating to the pre-hospital assessment of major haemorrhage and TIC and subsequent blood product transfusion. The interviews were analysed using descriptive thematic analysis.
Results: All clinicians agreed that identifying and treating major haemorrhage was vital. Half of the clinicians reported making no conscious assessment for TIC and six reported TIC should be managed in a hospital setting. Four broad themes were identified: collation of information, weighing utility of different approaches, influence of experience and evaluation of unknowns. Collating information from multiple sources drove clinical decision-making. Decisions on blood product transfusion were made after weighing potential benefits (e.g. improve microvascular perfusion) against harms. Clinical experience was reported as key to nuance clinical assessment, detect subtle signs and identify patterns. Uncertainty complicated clinical decision-making in two domains; incomplete knowledge of a patient's injury and uncertainty of best clinical practice.
Conclusion: The pre-hospital identification and treatment of major haemorrhage was recognised as challenging and fundamental. Necessity of pre-hospital TIC diagnosis and treatment divided opinion. Identifying these four themes allows for a greater understanding of the factors involved in making these decisions and will guide the creation of more accurate decision support tools to aid pre-hospital clinicians.
Nothing to declare.

PR 29

Poor accuracy of different definitions of massive transfusion in trauma patients: is it time for a new definition?

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Introduction: Massive transfusion (MT) is defined as the administration of ≥ 10 packed red blood cells (PRBC) in 24 h. Alternative definitions have been proposed; however, there is little understanding about the discriminative ability of different MT definitions with regards to mortality and multiorgan failure (MOF). We aim to assess and compare the discriminative ability of different definitions of MT concerning mortality and MOF.
Material and methods: We included patients who arrived to the emergency department and required trauma team activation at a Level I trauma Center in the city of Cali, Colombia between 2014–2018. Demographics and trauma characteristics were evaluated. The following MT definitions were measured: 50 units of blood products in 24 h (T50), 10 u PRBC in 24 (T10–24), 6 u PRBC in 6 h (T6–6), 10 PRBC in 6 h (T10–6), the combination of t10–24 and t6 (T-combi), 5 PRBC in 4 h (T5–4), 4 PRBC in 1 h (T4–1) and 3 units of pRBCs in 60 min. The operative characteristics were calculated for each definition. MOF was defined as a SOFA score of ≥ 6 points.
Results: We included 394 subjects, 88.6% male. Trauma mechanism was penetrating in 87.3%. The median and interquartile range (IQR) of age was 28 years IQR (22–37) and of ISS 25 (16–26). Lesions were located in the torso in 42.4% of patients, and 47.2% had a positive ABC score. A total of 264 (67%) received at least 1 unit of PRBC. Tables 1 and 2 presents the operative characteristics of 10 definitions of MT with respect to mortality and MOF, respectively.
Conclusions: Although all definitions showed an association with higher odds with the outcomes of interest, none of them showed an accurate diagnostic capacity regarding MOF and mortality. Thus, we advise caution when relying on the classical definition of MT (> 10 RBC units in 24 h) to guide the flow of care of severely injured patients.

Fig. 1

	No.	Deaths n (%)	Sensitivity	Specificity	LR+	LR-	% Correct classification	OR (CI)
MT50-24	23	16 (69.57%)	27.12%	96.62%	8.02	0.75	81.20%	10.63 (3.80-32.11)
MT10-24	40	24 (60%)	40.68%	92.27%	5.26	0.64	80.83%	8.19 (3.71-18.14)
MT6-6	73	37 (50.68%)	62.71%	82.61%	3.61	0.45	78.20%	7.99 (4.02-15.93)
MT10-6	27	21 (77.78%)	35.59%	97.10%	12.27	0.66	83.46%	18.51 (6.57-58.88)
MTcombi	78	38 (48.72%)	64.41%	80.68%	3.33	0.44	77.07%	7.55 (3.82-15.02)
MT5-4	75	36 (48%)	61.02%	81.16%	3.24	0.48	76.69%	6.74 (3.43-13.29)
MT4-1	107	42 (39.25%)	71.19%	68.60%	2.27	0.42	69.17%	5.40 (2.75-10.84)
CAT1	174	49 (28.16%)	69.49%	44.44%	1.25	0.69	50.00%	3.21 (1.50-7.50)
CAT2	68	30 (44.12%)	50.85%	81.64%	2.77	0.6	74.81%	4.60 (2.36-8.85)
CAT3	32	21 (65.62%)	35.59%	94.69%	6.7	0.68	81.58%	9.85 (4.10-24.32)

50 units of blood products in 24 hours (MT50-24), 10 units of PRBC in 24 (MT10-24), 6 units of PRBC in 6 hours (MT6-6), 10 units of PRBC in 6 hours (MT10-6), the combination of MT10-24 and MT6-6 (MTcombi), 5 units of PRBC in 4 hours (MT5-4), 4 units of PRBC in 1 hour (MT4-1), 3 units of PRBC in 1 hour in the first 24 hours (CAT1), CAT + in 2 occasions in the first 24 hours (CAT2), CAT + in 3 occasions in the first 24 hours (CAT3). Likelihood ratio + (LR+), Likelihood ratio - (LR-), Odds ratio (OR), Confidence interval (CI).

	No.	MOF n (%)	Sensitivity	Specificity	LR+	LR-	% Correct classification	OR (CI)
MT50-24	23	13 (56.52%)	12.75%	100%	-	0.87	59.17%	-
MT10-24	40	19 (47.5%)	18.63%	98.28%	10.8	0.82	61.01%	13.05 (2.98-117.45)
MT6-6	73	35 (47.94%)	34.31%	91.38%	3.98	0.71	64.68%	5.54 (2.46-13.29)
MT10-6	27	11 (40.74%)	10.78%	100%	-	0.89	58.26%	-
MTcombi	78	39 (50%)	38.24%	91.38%	4.44	0.68	66.51%	6.56 (2.94-15.66)
MT5-4	75	39 (52%)	38.24%	92.24%	4.93	0.677	66.97%	7.36 (3.21-18.29)
MT4-1	107	49 (45.79%)	48.04%	78.45%	2.23	0.66	64.22%	3.36 (1.80-6.35)
CAT1	174	78 (44.83%)	68.63%	54.31%	1.5	0.58	61.01%	3.36 (1.81-6.33)
CAT2	68	32 (47.06%)	31.37%	90.52%	3.31	0.76	62.84%	4.36 (1.97-10.19)
CAT3	32	15 (46.88%)	14.71%	100%	-	0.85	60.09%	-

50 units of blood products in 24 hours (MT50-24), 10 units of PRBC in 24 (MT10-24), 6 units of PRBC in 6 hours (MT6-6), 10 units of PRBC in 6 hours (MT10-6), the combination of MT10-24 and MT6-6 (MTcombi), 5 units of PRBC in 4 hours (MT5-4), 4 units of PRBC in 1 hour (MT4-1), 3 units of PRBC in 1 hour in the first 24 hours (CAT1), CAT + in 2 occasions in the first 24 hours (CAT2), CAT + in 3 occasions in the first 24 hours (CAT3). Likelihood ratio + (LR+), Likelihood ratio - (LR-), Odds ratio (OR), Confidence interval (CI).

Table 2. Comparison of different definitions of massive transfusion, regarding multi-organic failure

PR 30

Trauma and coagulation: trends in coagulation factors in the severely injured trauma patient

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Introduction: Trauma-induced coagulopathy (TIC), affects about 25–30% of the major trauma patients. In the past, TIC was considered as a consequence of the coagulation factors' dilution after a high-volume colloid administration. Today TIC is seen as a phenomenon that can arise after trauma; the first event is the C-protein activation by the tissue damage and hypoperfusion, resulting in the subversion of the hemostatic process.
Material and methods: The 40 patients of the 2018 pilot study "Trauma and Coagulation" run in IRCCS San Raffaele Scientific Institute have been reviewed and analyzed using a suite of experimental coagulation factors including ROTEM parameters, activated protein C (aPC), thrombomodulin, endothelial protein C receptor, thrombin-antithrombin complex (TAT), plasminogen activator inhibitor 1 (PAI-1), sESelectin, interleukin-8 (IL-8), interleukin-10 (IL-10), D-dimer (XDP), antithrombin III (ATIII), and prothrombin

fragment F1 + 2 (F1 + 2). New 15 patients have been enrolled to validate the results of the pilot study.
Results: There is a statistically significative correlation between clinical scores of severity of trauma and risk of massive transfusion (ISS, ABC and TASH) and some of the experimental coagulation factors analyzed.
Conclusions: His study adds interesting insights to the understanding of the pathophysiological mechanisms that links severe trauma and coagulopathy.
References: Cohen MJ, et al. Coagulopathy of trauma. Crit Care Clin. 2017;33:101–18. https://doi.org/10.1016/j.ccc.2016.08.003.
Frith D, Brohi K, et al. Definition and drivers of acute traumatic coagulopathy: clinical and experimental investigations. J Thromb Haemost. 2010;8:1919–25. https://doi.org/10.1111/j.1538-7836.2010.03945.x.
Maegele M, et al. Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients. Injury Int J Care Injured. 2007;38:298–304. https://doi.org/10.1016/j.injury.2006.10.003.

CHEST INJURIES

PC 31

Open chest management of acute empyemas with negative pressure therapy in critically ill patients

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Case history: To evaluate the role of negative pressure wound-care systems applied to the pleural cavity in case of severe acute empyemas and frail patients not amenable to conventional surgery.
Clinical findings: We report the case of a 67 yrs old male critically ill patient suffering from complications of cardiac surgeries who developed a severe right empyema with broncho-pleural fistula through the site of a previous pulmonary hernia.
Investigation/results: We review the actual indications of negative pressure therapy in thoracic surgical emergencies especially in septic patients unfit for surgery. In our case the repeated application of negative pressure with dedicated dressings through the initial thoracotomy was the chosen damage control approach because of the sepsis and poor conditions.
Diagnosis, therapy and progressions: Air leaks were later found to originate from a subsegmentary branch of middle lobe bronchus. Subsequent video-assisted debridement procedures followed by negative pressure therapy managed to (1) control the infection, (2) reduce the thoracotomy incision into a thoracoscopic access and (3) heal the pleural cavity, restoring eventually better general conditions of the patient. The closure of the bronchial fistula required further procedures after the acute phase when sepsis was overcome.
Comments: Negative pressure systems can be applied to the pleural cavity with many advantages in selected critically ill patients. They allow to contain, treat and resolve infections both of chest wall and pleural cavity in case of severe empyemas reducing also wound pain and eliminating the need of chest drains. Air leaks may also be managed by negative pressure therapy with adequate indications and particular attention to its settings.
References: Sziklavari Z. Mini-open vacuum-assisted closure therapy with instillation for debilitated and septic patients with pleural empyema. Eur J Cardiothorac Surg. 2015.

Fig. 1

Fig. 2

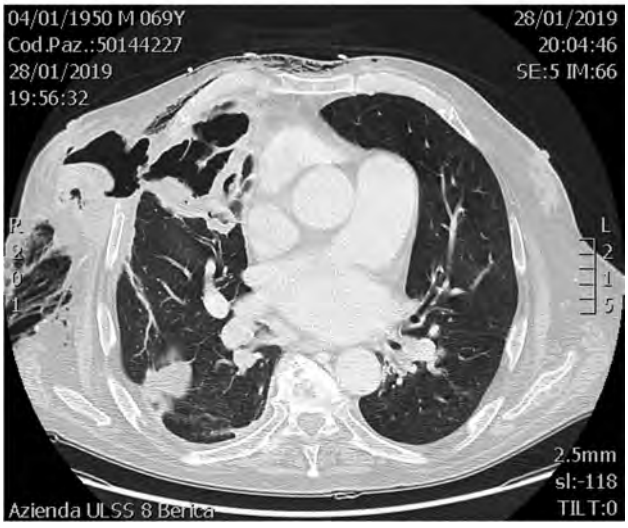

Fig. 3

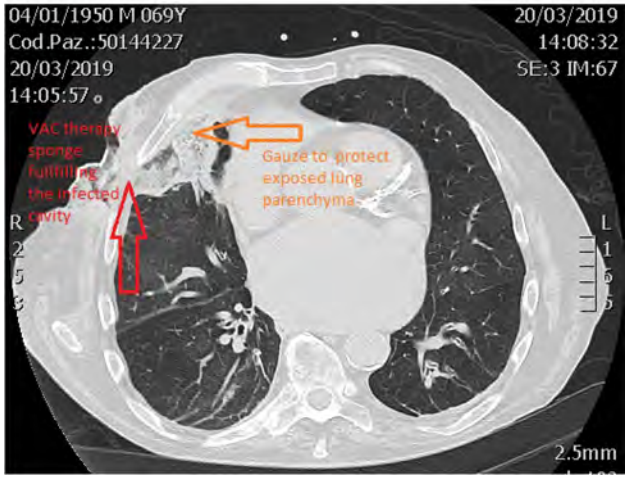

Fig. 4

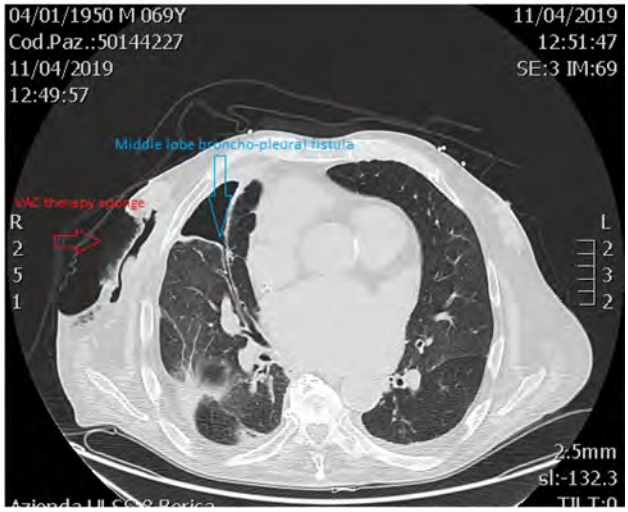

Fig. 5

PC 32

Flail chest: the renaissance of rib osteosynthesis

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Case history: We present the clinical case of a male patient of 79 years old. Injury mechanism: fall from his own height over the right hemithorax.
Clinical findings: 5 rib fractures with flail chest and significant displacement of bone edges. Symptoms: intense thoracic pain.
Diagnosis: Rib fractures with flail chest.
Therapy and progressions: Multimodal analgesia. On the 4th day, he presented a tension pneumothorax. After adequate intercostal drainage, the pneumothorax relapsed. On the 8th day, he underwent a right posterolateral thoracotomy, open reduction and internal fixation of 3 ribs with plates and screws and intercostal drainage. Evolution: he received respiratory kinesiotherapy and was discharged on the 8th pos op day. Follow-up at 1st and 5th months, without functional impairment and with preservation of quality of life.
Comments: Rib fracture is the most common injury in the setting of thoracic trauma and is associated with a higher morbimortality. In the last 60 years, positive pressure mechanical ventilation was the first line treatment of respiratory insufficiency caused by rib fractures. However, severe complications associated with prolonged mechanical ventilation, have elicited the rising implementation of open rib reduction and internal fixation techniques. The most consensual indications are: flail chest with fracture of at least 3 ribs, significant displacement of bone edges or uncontrolled pain. Rib osteosynthesis is a simple method but requires clinical experience in thoracic approaches and handling of specific instruments and material. Its implementation in non-ventilated patients reduces the need for mechanical ventilation, pain, length of stay and allows preservation of quality of life.
References: Wijffels MME, et al. Early fixation versus conservative therapy of multiple, simple rib fractures (FixCon): protocol for a multicenter randomized controlled trial. World J Emerg Surg. 2019.

Fig. 1

Fig. 2

Fig. 3

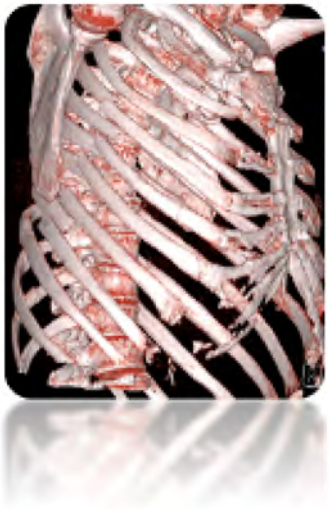

Fig. 4

Fig. 5

PR 33

Emergency department thoracotomy in a Japanese trauma center: what's improved?

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Introduction: Although Americans and Europeans report emergency room thoracotomy (ERT) is of value in penetrating trauma patients, most of ERT is performed for blunt trauma in Japan. After the establishment of the local government-directed major trauma center in the City of Yokohama, the unexpected trauma survivor rate increased in the single center study. We report our experience in ERT and surveyed the effect of the establishment.

Material and methods: Patient characteristics (backgrounds, mechanism of injury, indication for ERT, anatomic injuries, interventions and survival) of those who underwent emergency thoracotomy compliant with the guideline of Western Trauma Association, between October 2012 and September 2019 were analyzed.

Results: Fifty-eight patients (42 males) underwent emergency thoracotomy. Median age was 39.8 (5–85) years. Fifty-seven were performed for blunt trauma (98%) and only 1 for penetrating injuries. Twenty-three patients presented with cardiac arrest on arrival, while thirty-five had deep and refractory hypotension. Overall, survival rate improved from 0 (0/14) to 14% (6/44) ($p = 0.18$) after the establishment of the trauma center. Of patients presenting with cardiac arrest, only one survived.

Conclusions: The establishment of major trauma center seemed to affect the survival rate of the patient EDT was performed.

References: Burlew CC, Moore EE, Moore FA, et al. Western Trauma Association critical decisions in trauma: resuscitative thoracotomy. J Trauma Acute Care Surg. 2012;73(6):1359–63.

PR 34

Chest trauma patients with simultaneous cerebral trauma benefit from surgical rib stabilization

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Introduction: More than 45% of polytrauma events involve chest injuries. One third of these patients sustain thoracic instability due to serial rib fractures. Thanks to numerous innovations in implant development several approaches currently exist for surgical rib stabilization (SRS). However, no consensus exists regarding patient selection for SRS to date.
Material and methods: Retrospective single center cohort analysis in trauma patients. Serial rib fracture was defined as three consecutive ribs confirmed by chest CT. Cohort includes 243 patients that were treated conservatively and 34 patients that underwent SRS by plate osteosynthesis. Demographic patient data, trauma mechanism, injury pattern, Injury Severity Score (ISS), Glasgow Coma Scale (GCS) and hospital course were analyzed. Two matched pair analyses stratified for ISS (32 pairs) and GCS (25 pairs) were performed to minimize selection bias.
Results: The majority of patients was male (74%) and aged 55 ± 20 years. Serial rib fractures were located left/right/bilateral in 46%/36%/19% of cases. Other thoracic bone injury included sternum (18%), scapula (16%) and clavicula (13%). Visceral injury consisted of pneumothorax (51%), lung contusion (33%) and diaphragmatic rupture (2%). Average ISS was 22 ± 7.3. Overall hospital stay was 15.9 and ICU stay 7.4 days. In hospital mortality was 13%. SRS did not improve hospital course or postoperative complications in the complete study cohort. However, patients undergoing SRS had significantly reduced GCS (7.6 ± 5.3 vs 11.22 ± 4,8; $p = 0.006$). Matched pair analysis stratified for GCS showed a reduced need for blood substitution and shorter ICU stays (9 vs 15 days; $p = 0.005$) including shorter respirator time (143 vs 305 h; $p = 0.003$) and reduced in hospital mortality (4 vs 12%).
Conclusions: Patients with serial rib fractures and simultaneous severe cerebral injury benefit from surgical rib stabilization.

PC 35

Tracheal and bilateral recurrent laryngeal nerve disruption injury secondary to accidental strangulation by *Dupatta*

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Case history: 18 year old female brought to trauma emergency with a/h/o accidental strangulation injury with dhupatta at farm field while working with thresher machine after 6 h of injury. Patient had severe dyspnoea, dysphagia, paining neck
Clinical findings: Primary survey revealed threatened airway with extensive surgical emphysema, RR- 29/min, SPO2-80% on high flow oxygen mask, hemodynamically stable, and had no neurological deficits. Patient was immediately intubated, however ventilation could not be maintained and surgical emphysema worsened hence immediate tracheostomy was established.
Investigation/results: Computed tomography (CT) head and CT angiography of neck with venous phase study of neck and chest with CT esophagogram revealed complete disruption of cricotracheal junction with extensive cervical and upper thoracic surgical emphysema and no other injuries.
Diagnosis: Disruption of trachea from cricoid cartilage with crushed trachea with loss of approximately 4 cm, cricoid and thyroid cartilage fracture, complete avulsion of bilateral recurrent laryngeal nerves and serosal tear of esophagus.
Therapy and progressions: Neck exploration with debridement of tracheal margins and anastomosis between trachea and cricoid cartilage with repair of cricoid, laryngeal cartilage and esophageal serosal repair was performed.
Comments: Post-operatively patient underwent fibreoptic bronchoscopy and revealed paramedian location of vocal cords. At present patient is with tracheostomy tube in situ undergoing speech therapy and is able to generate comprehensible sounds. Further laryngeal framework surgery is being planned.
References: 1. Moonsamy P. Management of laryngotracheal trauma. Ann Cardiothorac Surg. 2018;7:210–6.
2. Kim CW, et al. The surgical outcome for patients with tracheobronchial injury in blunt group and penetrating group. J Trauma Injury. 2016;29:1–7.

Fig. 1

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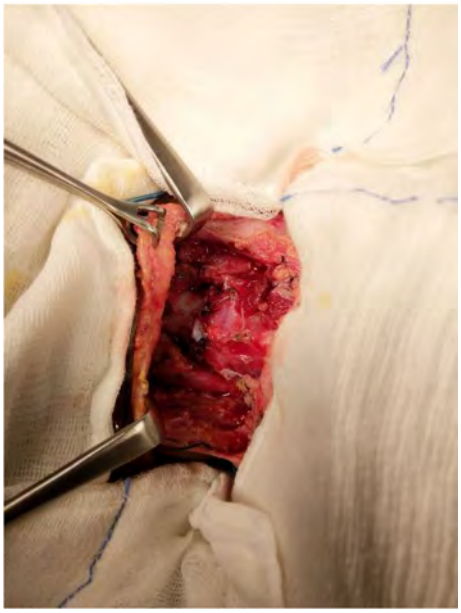

PR 36

A critical appraisal of emergency resuscitative thoracotomy in a western European level 1 trauma centre: a 10-year experience

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Introduction: Emergency Resuscitative Thoracotomy (ERT) is a lifesaving procedure in selected patients and it is often considered a controversial "last chance" method of resuscitation. Objectives of ERT are to resolve pericardial tamponade, to repair heart injuries, to perform an open cardiac massage, to cross-clamp the aorta to redistribute blood flow to the myocardium and brain, to control intrathoracic bleeding and air embolism in the bronchial venous system. Outcome mostly in blunt trauma is believed to be poor.
Material and methods: We retrospective reviewed 32 patients $\geq$ 18 years who underwent ERT at San Camillo-Forlanini Hospital (Rome, Italy) between January 2009 and September 2019 with traumatic arrest for blunt or penetrating injuries.
Results: Of 32 ERT, 7 (21.9%) were for blunt trauma, 25 (78.1%) were for penetrating trauma. 65.6% of patients were male. The collectively reported overall survival was 59% (n = 19). When including ERTs designated as done in the emergency department for blunt mechanism, only 1 patient survived (14.3%). Survival after ERTs for penetrating trauma was 72% (18 of 25).
Conclusions: Our experience suggests that ERT is a technique that should be utilized for patients with critical penetrating injuries. The reported outcome after ERT in European civilian trauma populations is favorable with an overall survival of 43%. Multicenter, prospective, observational data are needed to validate the modern role of ERT in blunt or penetrating trauma.

References: Narvestad JK, et al. Emergency resuscitative thoracotomy performed in European civilian trauma patients with blunt or penetrating injuries: a systematic review. Eur J Trauma Emerg Surg. 2016;42(6):677–85.
Seamon MJ, et al. Emergency department thoracotomy: survival of the least expected. World J Surg. 2008;32:604–12.
Joseph B, et al. Improving survival after an emergency resuscitative thoracotomy: a 5-year review of the Trauma Quality Improvement Program. Trauma Surg Acute Care Open. 2018;3(1):e000201.

PC 37

A case of laparoscopic repair of diaphragmatic injury covered with falciform ligament using extracorporeal knot tying method

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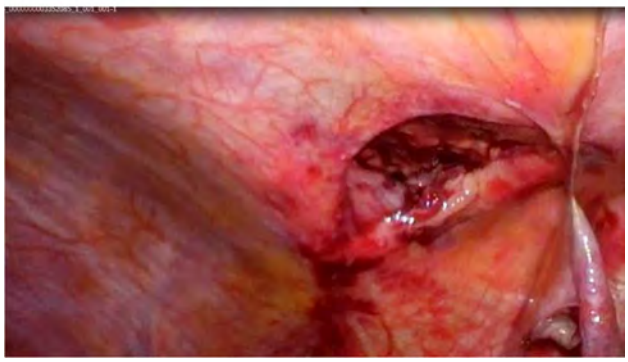
Case history: An 81-year-old male driving a car collided with a wall at a speed of 40 km/h and was brought to a hospital near the scene. He was diagnosed with right multiple rib fractures and hemopneumothorax, and transferred to our emergency center for definitive care.
Clinical findings: The patient's consciousness was clear and his heart rate, blood pressure, respiratory rate, and O_2 saturation (room air) on arrival were 60/min, 120/74 mmHg, 23/min, and 90%, respectively. Subcutaneous emphysema was identified on the right side of his chest and his right breathing sound decreased on auscultation. There was no tenderness and rebound on abdominal examination.
Investigation/results: An enhanced whole-body computed tomography scan revealed a small disruption on the right diaphragm behind the sternum and free air in the abdomen.
Diagnosis: The diagnosis was right traumatic diaphragmatic injury, sternum fracture, and right multiple rib fractures with pneumohemothorax. There was free air in the abdomen but without evidence of perforation of the digestive tract as there was no finding of peritonitis on physical examination. Thus, pneumoperitoneum from the thorax was strongly suspected.
Therapy and progressions: Laparoscopic observation revealed a 1.5 cm-length of disruption on the diaphragm in the right sternocostal triangle. This was covered with falciform ligament using extracorporeal knot tying method because there was little seam allowance in front of the disruption on the sternum side, and direct suture was not possible. Prognosis was good following surgery, and the chest drain was removed on postoperative day 3 and the patient was discharged on postoperative day 4.
Comments: Laparoscopic repair of the diaphragm using extracorporeal knot tying method is often used for retrosternal (Morgagni) hernias. However, the method was also useful in this case because the diaphragmatic injury occurred in the sternocostal triangle.

Fig. 1



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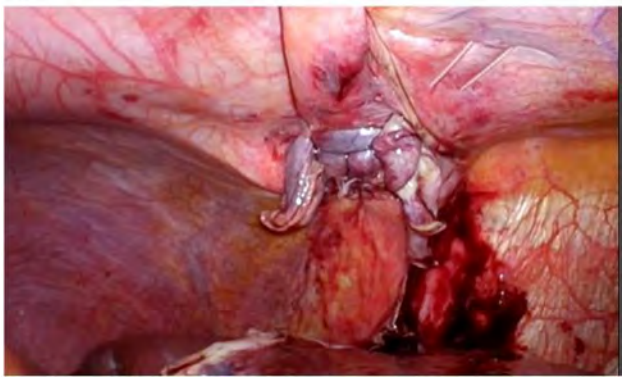

PR 38

Rib fractures associated with pneumo- and/or hemothorax; does everyone need a chest tube?

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Introduction: Pneumo- and/or hemothorax are often seen in trauma patients with rib fractures (RFs). Standard treatment for pneumothorax (PTX), hemothorax (HTX) and hemopneumothorax (HPTX) is tube thoracostomy (TT). However, a non-operative approach can be applied in selected patients. We wanted to assess our practice in patients with rib fractures and associated PTX, HTX or HPTX.
Material and methods: All adult patients ($\geq$ 18 years) with RF, admitted by a trauma team at Oslo University Hospital in 2017 were identified retrospectively and those with associated PTX, HTX or HPTX were then included in the study. Patients who underwent TT prior to arrival and those who died were excluded. SPSS v25 was used for statistical analysis.
Results: Of the 241 patients with RFs, a total of 90 patients had PTX, HTX or HPTX. Fifty-one percent (46/90) of these patients were treated with TT and 85% (39/46) of the patients underwent TT within 6 h after arrival. The presence of opacification ($p < 0.01$), chest wall deformity ($p < 0.01$) and pneumothorax size ($p < 0.01$) were significantly higher on chest X-ray in the TT group compared to the non-operative group. Intubation at arrival was also significantly more common in patients treated with TT ($p < 0.01$). There was no difference in the presence of subcutaneous emphysema between the groups. The TT group was sicker than the non-operative group (had a significantly lower systolic blood pressure, a lower GCS and a higher lactate on arrival). Oxygen saturation, heart rate, respiratory rate, pH and hemoglobin did not differ significantly between the groups.
Conclusions: In trauma patients with RF concurrent PTX, HTX or HPTX should be suspected. In our study only half of these patients were treated with TT, and 85% of tubes were inserted within 6 h after admission. Size of the PTX, radiological presence of opacification and deformity of the chest wall should be addressed when choosing treatment strategy.

PR 39

Emergency department thoracotomy: who would and who would not perform it—a pilot survey of European surgeons

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Introduction: Emergency department thoracotomy (EDT) is a potentially life-saving surgical procedure performed in the emergency department (ED) in patients presenting with cardiac arrest following penetrating thoracic trauma. However, it is not clear if all surgeons are prepared or motivated to perform this procedure. Furthermore, not all institutions are equipped, either in terms of logistics or team training, to perform EDT. Our purpose was to perform a pilot study in a cohort of Polish surgeons of various specializations, in order to ascertain who would and who would not (and why) perform EDT in their departments.
Material and methods: Study population of 69 surgeons (27 specialists, 42 residents) from various hospitals in Poland, mean age: 31–40 years, 55.1% men, 43.5% women. Study respondents were asked to fill in a questionnaire on the indications and motivation to perform EDT in their clinical practice.
Results: Most respondents (n = 54, 78%) correctly recognized the indications to perform EDT. However, only 35 (51%) declared they would perform it. The reasons for not performing EDT were: lack of team training (63.7%); lack of equipment (58%); lack of motivation among ED personnel (40.6%); the ED is not prepared (27.5%); the respondent is not prepared (26%). Only 6 participants (8.7%) declared that their institutions had the EDT protocol.
Conclusions: This survey demonstrates that, although most surgeons agree on the indications for EDT, the level of preparedness in its execution is lacking. The main reasons are the lack of team training, the lack of equipment and the lack of motivation among ED personnel. Other relevant reasons were the lack of preparation of either a surgeon or a department. These results demonstrate that improvements in institutional logistics as well as in team and individual training can translate into improved care. We strongly advise the performance of a pan-European survey on EDT to address other unrecognized issues.

PC 40

Mediastinum widening: how to manage it?

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Case history: A 23-year old male was admitted to our emergency department as a polytrauma code, because of a gunshot wound in the neck.
Clinical findings: His airway was compromised with expansive cervical hematoma. Intubation was difficult. He was hemodynamically unstable with cervical bleeding, in which manual compression was applied.
Results: Chest X-ray showed mediastinal widening without pneumo or hemothorax.
Diagnosis: Urgent sternotomy while maintaining manual compression on the cervical bleeding, followed by left antero-lateral cervicotomy. Injuries: section of left jugular vein and left carotid artery, lesions of unnamed vein. Free cervical chylous fluid. Left pleura and pericardium were opened without identifying major injuries.
Therapy and progressions: Jugular vein was repaired with continuous suture and carotid artery with patch sutured. Unnamed vein was sectioned between ligatures. Thoracic duct was ligated. After surgery, CT scan showed cervical and mediastinal hematomas without signs of active bleeding, and correct permeability of the vessels, with no cranial lesions. The patient was admitted to the intensive care unit. Tracheostomy was performed. Fibrobronchoscopy, fibrogastroscopy and esophagogastricoduodenal discarded airway and esophageal lesions. He presented the following complications:

- Small mediastinal collection
- Right diaphragmatic paralysis.
- Paralysis of VI left cranial nerve (mononeuritis of vascular origin).

The patient was discharged on the 30th postoperative day.
Comments: In this kind of trauma is essential the airway management with intubation when necessary. It is important that mediastinal widening visualized in the chest x-ray in a traumatic patient, should be an indication of surgery. In our case, it was essential to start it with sternotomy while maintaining manual neck compression, and in a second time, perform the cervical approach since that prevented the patient from suffering a greater blood loss.
References: Shiroff AM, et al. Penetrating neck trauma: a review of management strategies and discussion of the 'No Zone' approach. Am Surg. 2013;79(1):23–9.

PR 41

Is computed tomography a reliable tool to predict pneumonia in polytraumatized patients?

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Introduction: Pulmonary lung injury (PLI) is considered as a risk factor of pneumonia in polytraumatized patients. Thus, with regard to the implementation of preventive measures, the objective of our study was to investigate, if the extent of PLI as shown by computed tomography (CT), which is performed no later than on day 2 after trauma, may predict pneumonia.
Materials and methods: In 130 polytraumatized patients (mean age, 41.3 years; mean ISS, 31.9) a CT-scan was performed at admission and on day 2 after trauma. PLI-volume was measured using volumetric analysis. Statistical calculations based on the occurrence of pneumonia were computed.
Results: Pneumonia developed in 41 patients (31.5%). They had a higher ISS (35.9 versus 30.1; $p = 0.005$), a higher rate of prehospital intubation (80.5% versus 40.4%; $p = 0.002$) and of prehospital chest tube insertion (24.4% versus 5.6%; $p < 0.0001$) and had to be ventilated longer than those without this complication (14 days versus 1 day; $p < 0.0001$). Whereas no difference in the initial relative PLI-volume (8.13% versus 3.53%, $p = 0.251$) could be detected, relative day 2-PLI-volume was higher in patients developing pneumonia (17.38% versus 8.62%; $p = 0.033$); it was identified as a predictor for pneumonia with an AUC of 0.653, 95% CI [0.521, 0.785], and a cut off of 12.3% with a sensitivity of 0.609 and a specificity of 0.638.
Conclusions: Undoubtedly, our findings do not justify a follow-up-CT-scan solely for identifying patients at risk for pneumonia. Nevertheless, if the CT-scan it performed to gain insights for other imperative reasons, it may also indicate the necessity of lung-protective measures.

PC 42

ECMO catheter related bloodstream infection in traumatic blunt chest injuries

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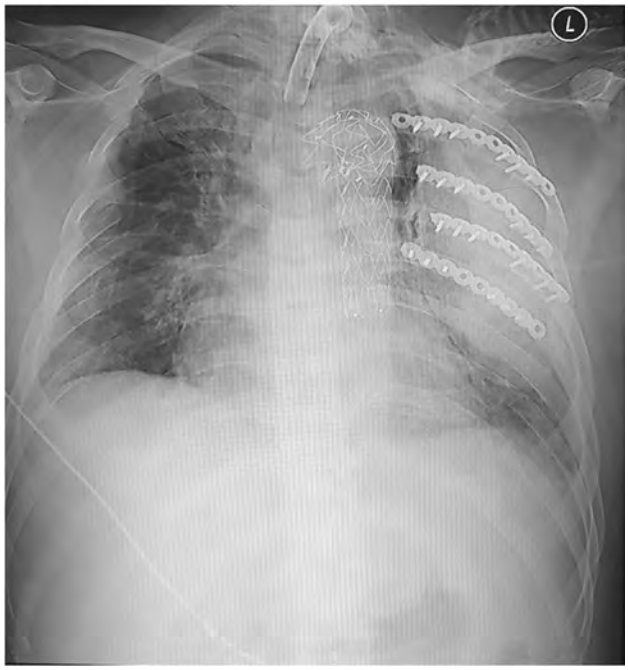
Case history: A 40 years old man without underlying disease, he presented with history of MVA. Traumatic thoracic aortic injuries and multiple displaced rib fractures with lung contusion were diagnosed. TIVA was performed with rib fixation.
Clinical findings: Intubation was done since the first day of injuries. Protective lung strategies was given with sedation. Severe hypoxemia (PF ratio 80) with severe respiratory acidosis (pH 7.1, paCO2 90 mmHg), VV-ECMO was performed via right internal jugular v and right femoral v. Patient was improved with better oxygenation and ventilation. However, there's fever and increase need of ECMO flow to maintain oxygenation.
Investigation/results: Septic workup was done and found positive *A. baumannii* from hemoculture. We found that ECMO venous catheter was positive culture prior to post-membrane and peripheral and central line for more than 2 h. After intravenous colistin administration and all lines changed, there was no improvement on sepsis.
Diagnosis: ECMO catheter related *A. baumanii* infection.
Therapy and progressions: We removed both inflow and outflow catheter as well as changing membrane. We also cannulated new catheter in right internal jugular vein (new site) and left femoral vein. The same dose of colistin was still given by infectious medicine. After ECMO catheters were removed. Improvement in oxygenation with decrease of ECMO flow and downward trend of wbc were noted. The patients can off ECMO and wean off ventilator until discharge home without other complications.

Comments: In patients on V-V ECMO with suspected catheter related bloodstream infection, changing the cannulas is not feasible due to the high risk of potentially lethal complications and limited venous access. Precised diagnosis and prompt treatment are crucial.

References: C Fisser. Infection and colonisation in V-V ECMO—not a predictor of poor outcome. J Thorac Dis. 2018;10(Suppl 17):S2045–7.

Fig. 1

Fig. 2



PC 43

A new pattern of childhood clavicular injury

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Background: Clavicular fracture is very common in childhood. Otherwise, the medial third of the clavicle is the less affected. The current report describes a new pattern of clavicular injury, in which a medial third clavicular fracture and posterior sternoclavicular joint (SCJ) dislocation occur together in a skeletally immature patient.
Clinical findings: An 8-year-old boy sustained a direct impact to his left shoulder resulting from the fall of a sofa. At admission, he complained of severe pain in the clavicular and shoulder associated with functional limb impotence. Physical examination revealed deformity of the proximal third clavicle, with swelling and tenderness to palpation along the medial left clavicle. No signs of skin pression or neurovascular impairment were found. The anteroposterior radiograph of the left clavicle showed a fracture of the proximal third shaft and an asymmetry of the SCJ. Computed tomography confirmed the association of a greenstick fracture of the proximal third clavicular shaft, accompanied by a mild posterior SCJ dislocation.
Therapy and progressions: The left limb was immobilized with a sling during 3 weeks, after which physical therapy was initiated to improve range of motion using active and gentle active-assisted exercises. At the 2 months medical consultation, he presented asymptomatic, with good bone healing, full range of motion of the shoulder and absence of relevant aesthetic deformity.
Comments: In the immature skeleton, SCJ dislocation and epiphyseal fracture of the proximal clavicle are very rare entities due to the multiple strong ligaments that stabilize the SCJ. trauma in the proximal third of the clavicle typically results in fractures in the region of the physis and only more rarely culminate in dislocations of the SCJ. These injuries warrant a high index of suspicion, and early CT scanning is recommended. Although treatment may be conservative, in situations of major displacement, surgery should be considered.

PR 44

Use of rib fracture scoring systems in a UK major trauma unit: a retrospective audit and lessons learnt

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Introduction: Rib fractures are detected in 10% of trauma patients [1]. Significant morbidity and admission to intensive care units (ITU) is common [1]. Rib fracture scores do not have strong validity as a predictor, but are a useful screening tool to identify patients at higher risk, of morbidity. The aim of this study was to audit the use of rib fixation scores in a single major trauma centre.

Material and methods: A retrospective audit of trauma patients with rib fractures presenting to a single major trauma centre over a 1-year period subsequently admitted to ITU was performed. Demographics, length of ITU stay, Rib Fracture Score (RFS) and RibScore were recorded and comparisons made between patients who had surgical rib fixation and those who did not.
Results: 86 patients with traumatic rib fractures were admitted to ITU over 1-year, 19 of whom had rib fixation. Mean age of patients undergoing surgery was 74 compared to 52 in the non-surgical cohort. Average RFS was higher in the surgical cohort (14 vs 6; $p = < 0.001$), as was average RibScore (3 vs 1; $p = < 0.002$). Incidence of flail segment was higher in surgical cohort (37% vs 10%; $p = < 0.001$), as was number of rib fractures (9 vs 5; $p = < 0.001$) and incidence of 1st rib fracture (20% vs 8%, $p = < 0.289$). Rib fractures treated surgically had a longer ITU stay (12.3 days vs 5.31; $p = < 0.001$).
Conclusions: Surgical rib fixation patients were older and had longer ITU stay. Higher rib fracture scores correlated with need for surgical intervention. This highlights the need for careful patient selection for rib fixation, as they appear to fall in a more vulnerable patient demographic. There is a need for a score combining RibScore and RFS, ensuring the nature of fractures and presence of flail segments are interpreted in the context of patient age, to ensure this vulnerable patient group undergoes surgical fixation only when necessary.
References: 1. May L, Hillermann C, Patil S. Rib fracture management. BJA Educ. 2016;16(1):26–32.

PC 45

A case report on lumbar artery pseudoaneurysm accompanied by burst fracture of the lumbar spine treated by endovascular aneurysm repair surgery

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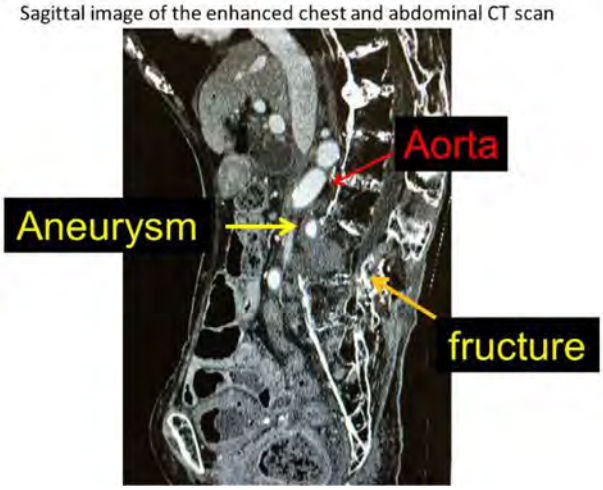
Case history: An 82-year-old female individual hurt her back while walking during a hospital rehabilitation program after experiencing a brain stroke. Her hemoglobin level gradually decreased to 6.0 g/dL on the 5th day after injury. A non-enhanced abdominal CT scan revealed a burst fracture of the lumbar spine. The patient was brought to our emergency center for a thorough examination.
Clinical findings: Her vital signs on arrival were GCS: E4V4M6, HR: 79, BP: 135/75, RR: 19, and BT: 36.3. Her back presented a severe kyphotic spine. The palpebral conjunctiva was anemic and there were no injuries on her surface. No abnormalities were detected upon auscultation of the thorax and no tenderness and rebound was detected upon physical examination of the patient's abdomen.
Investigation/results: Hemoglobin level was 5.9 g/dL and lactate 2.8 mmol/L on arrival. An enhanced chest and abdominal CT scan revealed a burst fracture of the 5th lumbar spine, a large hematoma around it, and a pseudoaneurysm of the lumbar artery.
Diagnosis: A pseudoaneurysm of the lumbar artery and a burst fracture of the 5th lumbar spine was diagnosed.
Therapy and progressions: The angioembolization of the lumbar artery was abandoned because the distance between the abdominal aorta and the aneurysm was < 5 mm. Endovascular aneurysm repair (EVAR) was finally performed. After the successful completion of the surgery, the patient was discharged on the 11th day after EVAR.
Comments: Slight injury caused the fracture of the lumbar spine, possibly yielding pseudoaneurysm of the lumbar artery. Such pseudoaneurysms are rare and employing EVAR for its treatment is equally rare. Blunt lumbar artery injury may be a differential diagnosis for the elderly patients who present burst spine fractures with extreme anemia or shock, even if it results from a minimal injury.
References: Vashisht S, et al. Lumbar artery pseudoaneurysm following blunt trauma: a case report and literature review. Trauma Case Rep. 2019;23:100232.

Fig. 1
Sagittal image of the enhanced chest and abdominal CT scan



PC 343

Total pneumonectomy following hilar bronchial disruption after blunt chest trauma

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Case history: A 23 year old co-driver was hit by another car on her side. Air rescue found the patient with GCS 3 and right tension pneumothorax. Oral intubation, decompression with chest tube and transportation to the nearest level one trauma center was undertaken.
Clinical findings/investigation/results: On presentation in the emergency room the patient was hemodynamically instable with free fluid in eFAST-sonography and a haemoglobin of 2.2 g/dl. She was immediately taken to the operation room where laparotomy was performed. Liver rupture and right diaphragm rupture was found.
Diagnosis: Right hilar bronchial disruption.
Therapy and progressions: Despite packing of the liver the patient remained instable. Due to continuous bleeding from diaphragm rupture side right anterolateral thoracotomy was performed. Bronchial

disruption close to the hilus was detected leading to total pneumonectomy. After surgery the patient recovered under intensive care. Six weeks after initial trauma the patient presented with ileus. A gastric tube was placed without complications. Chest X-ray was performed showing intrathoracal displacement of the gastric tube. In an emergency operation the insufficient bronchus trunk was covered with an intercostal muscle flap.

Comments: This case shows the rare necessity of total pneumonectomy after blunt chest trauma and its typical complication with insufficiency of the bronchial trunk. After total pneumonectomy surgery covering the bronchial trunk should be performed as soon as possible to prevent insufficiency. In these patients gastric tubes should only be placed under endoscopic vision. Because of the high complication rate total pneumonectomy should only be performed as a last resort procedure in the context of damage-control surgery.

References: Matsushima K, et al. Surgical outcomes after trauma pneumonectomy: Revisited. J Trauma Acute Care Surg. 2017;82(5):927–32.

Phillips B, et al. Trauma pneumonectomy: a narrative review. Int J Surg. 2017;46:71–4.

PR 344

Effects of a resuscitative thoracotomy training program at an adult major trauma centre

M. Yeung[1], M. Fitzgerald[2,1], S. Marasco[3], J. Mathew[2,4,1], M. Young[3], A. Zimmet[3], K. Martin[1], D. V. Smit[4], G. Tan[4,1]

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Introduction: The objective of this study was to report the procedural incidence and patient outcomes after the introduction of the targeted training and credentialing program for resuscitative thoracotomy in 2009.

Material and methods: A retrospective cohort study was conducted on patients that underwent RT from 2009 to 2017.

Results: There were 12,399 major trauma patients that presented to The Alfred Emergency and Trauma Centre during the study period. Among these, there were 7657 patients with major thoracic trauma and 315 presented with a systolic blood pressure < 70 mmHg. There were 32 RTs performed after training and credentialing, with an incidence of 0.4% (95% CI 0.3–0.6) among patients with major thoracic trauma and 10.2% (99% CI 7.3–13.4) among patients with major thoracic trauma and SBP < 70 mmHg). There were 8 (25%; 95% CI 13.2–42.1) survivors to hospital discharge and there was no late mortality (mean follow-up 2.8 years). Survival was significantly associated with the procedure performed early (within 30 min of arrival; OR for death at hospital discharge 0.09; 95% CI 0.01–0.67) while mortality was associated with the procedure being performed in the setting of traumatic cardiac arrest (OR 18.3; 95% CI 2.4–140.4).

Conclusions: A formal training and credentialing program for Emergency Physicians, General Surgeons and Emergency Nurses in ultrasound targeted RT at a Level 1 Adult Trauma Centre was associated with a low incidence of the procedure, even among patients in severe hemorrhagic shock. A survival rate of 25% was comparable to other reported literature.

References: Rhee PM, et al. Survival after emergency department thoracotomy: review of published data from the past 25 years. J Am Coll Surg. 2000;190(3):288–98.

Narvestad JK. Emergency resuscitative thoracotomy performed in European civilian trauma patients with blunt or penetrating injuries: a systematic review. Eur J Trauma Emerg Surg. 2016;42(6):677–85.

Fig. 1

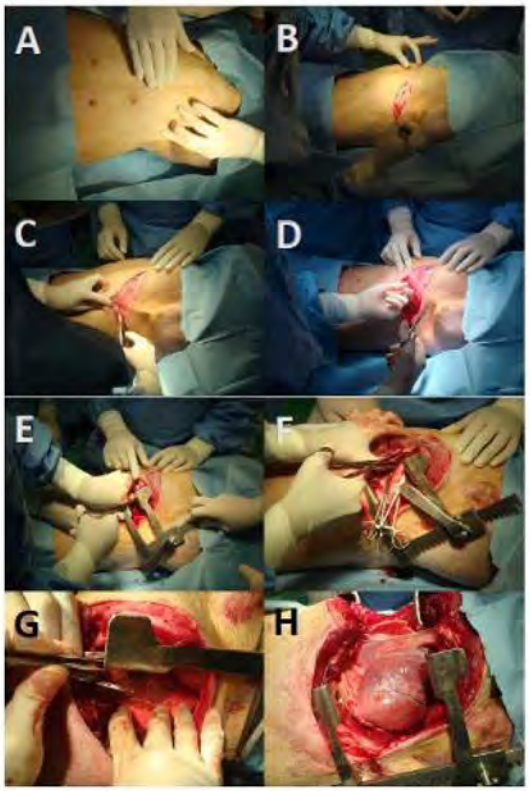

Figure 1. Porcine model for Training in RT.

A: Preparation and draping; B: Skin incision; C: Breaching parietal pleura; D: Incision through intercostal muscles; E: Exposure using a Finochietto retractor; F: extending the incision if required; G: Opening the pericardium parallel to the left phrenic nerve; H: Delivering the heart for wound control and open cardiac massage if required. Photographs taken at the 1st Alfred resuscitative thoracotomy for pericardial decompression workshop on 25th August 2009.

5

Fig. 2

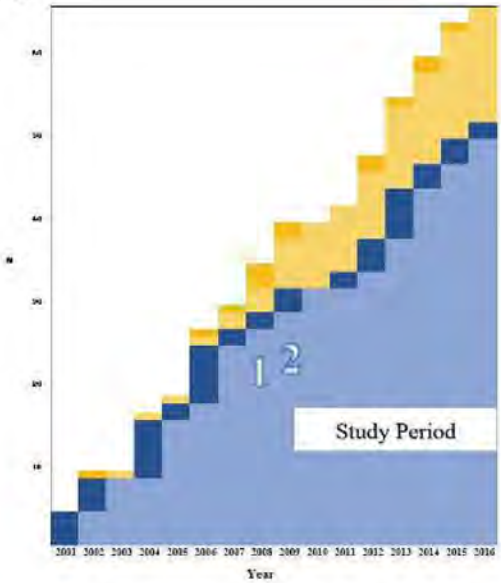

Figure 2. Resuscitative Thoracotomy Cumulative Annual Incidence 2001 16
Survivors in yellow and non-survivors in blue (darker shades indicate new cases in that year).
1 - E&TC Thoracotomy guideline and EP credentialing for ERT Jan 2008
2 - First Thoracotomy lab Aug 2009 and commencement of study period
The Study Period presented in this manuscript is indicated.

Fig. 3

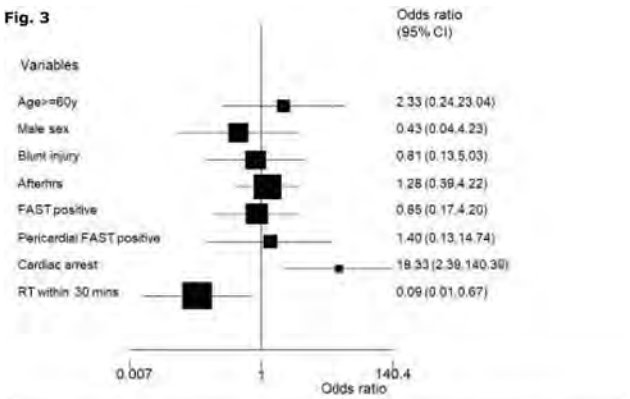

Figure 3. Univariable associations with death at hospital discharge

Fig. 4

	Survivor (n=8)	Dead (n=24)	p-value
Age (years)			0.94
- <30	3	6	
- 30-39	2	6	
- 40-59	2	6	
- ≥60	1	6	
Male sex	7	1	0.65
Time to RT after presentation	21 (8-39.5)	9 (3.5-14)	0.19
After-hours presentation	6	10	0.22
Blunt trauma	6	17	0.61
Penetrating trauma	2	7	
Cause			0.40
- MVC	4	14	
- Pedestrian	0	2	
- Fall	1	2	
- Gunshot / Stabbing	3	4	
Positive FAST any region	4	11	0.99
FAST positive for pericardial fluids	4	1	0.99
Massive transfusion	7	22	0.03
Thoracic injuries			
- RV	1	2	
- LV	1	0	
- Lung	2	4	
- Vessels	4	2	
- Atria	0	2	
TBI	2	8	0.99
ISS	42 (33-46.5)	44 (27-52)	0.74

Table 1. Patient demographics
(MVC: Motor vehicle crash; RV: Right ventricle; LV: Left ventricle; TBI: traumatic brain injury; ISS: Injury Severity Score)

PR 345

Mechanism of respiratory failure in fatal crowd accidents using a thoracoabdominal compression model of traumatic asphyxia

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Introduction: Traumatic asphyxia is a major cause of death in fatal crowd disasters, but the relationship between compression site, load magnitude, load time, and the medical event remains unclear. This study sought to estimate thoracoabdominal compression conditions (load magnitude, load time) resulting in respiratory failure in adults.
Material and methods: A total of 8 load patterns—A (chest load: 0 kg, abdomen load: 10 kg), B (0, 20), C (10, 0), D (10, 10), E (10, 20), F (20, 0), G (20, 10), H (20, 20)—were applied in 14 healthy adult female subjects. Blood pressure, heart rate, respiratory rate, SpO2, tidal volume, vital capacity, respiratory phase, and modified Borg dyspnea score were measured over time. The Breathing Intolerance Index (BITI) was also calculated.
Results: Vital capacity decreased in patterns C, D, E, F, G, and H. BITI reached the critical range of ≥ 0.15, where respiratory failure occurs about 45 min later, after 14 min in pattern G and 2 min in pattern H. Vital capacity ≤ 1.85 L and modified Borg scale score ≥ 8.3 corresponded to BITI ≥ 0.15 and were regarded as equivalent

to reaching the critical range. Furthermore, the change in chest load was positively correlated with BITI when abdominal load was kept constant.

Conclusions: In human women, respiratory failure could occur within 1 h due to respiratory muscle fatigue even when the total thoracoabdominal load is only about 60% of the body weight. Vital capacity $\leq$ 1.85 L and modified Borg scale score $\geq$ 8.3 can be considered as indices for predicting respiratory failure.

Part of this research is funded by scientific research (18H01669).

PC 346

Delayed presentation of traumatic diaphragmatic rupture with intra-thoracic herniation of colon: a case report

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Case history and clinical findings: An 18-year-old male presented to the emergency department following a road traffic accident complaining of chest pain and shortness of breath. Clinical examination and chest X-ray confirmed left-sided pneumothorax which was managed by immediate insertion of a chest drain. Contrast-enhanced CT scan of chest, abdomen and pelvis showed no evidence of other injuries. The patient was admitted to the hospital because he developed a severe episode of post-traumatic psychosis. However, 3 days later, he complained of dyspnoea and symptoms of intestinal obstruction.

Investigation/results: CT abdomen and chest revealed large bowel obstruction secondary to a loop of transverse colon herniating into the thoracic cavity through a large defect in the left hemidiaphragm (Figs. 1, 2, 3).

Diagnosis: Traumatic rupture of left hemidiaphragm.

Therapy and progressions: Urgent exploratory laparotomy was performed. A segment of viable transverse colon and part from stomach fundus were found to be herniating into the chest through a 5 cm defect in left hemidiaphragm. Displaced intestinal loops were reduced into the abdominal cavity and diaphragmatic defect was repaired with PDS suture. The patient condition improved dramatically on the first postoperative day and he was discharged home on the third postoperative day.

Comments: Traumatic injuries of the diaphragm are rare, yet underestimated; therefore, a high index of suspicion is needed for timely diagnosis. Surgeons should be aware of the possibility of diaphragmatic hernia in patients with abdominal trauma which can be missed on early CT scan.

References: 1. Rodriguez-Morales G, Rodriguez A, Shatney CH. Acute rupture of the diaphragm in blunt trauma: analysis of 60 patients. J Trauma. 1986;26(5):438–44.

2. Testini M, Girardi A, Isernia RM, et al. Emergency surgery due to diaphragmatic hernia: case series and review. World J Emerg Surg. 2017;12:23.

Fig. 1

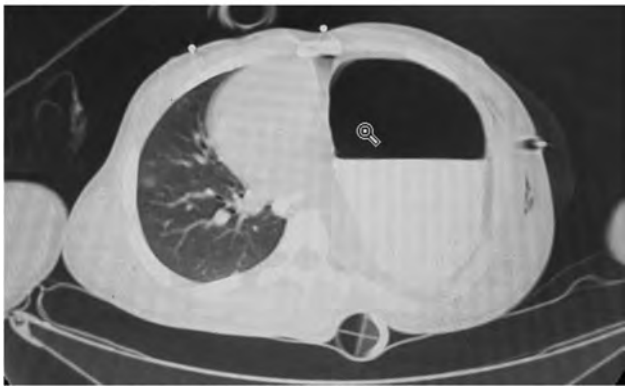

Fig. 2

Fig. 3

PR 347

Serratus plane block improves pulmonary function of patients with multiple rib fractures

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Introduction: Multiple rib fractures continue to be a challenging problem as the associated pain leads to a compromise in respiration. Proper analgesia is required for physiotherapy, and to prevent development of respiratory failure. Ultrasound-guided serratus plane block (SPB) has recently been described as a regional anesthetic technique to provide analgesia to a hemithorax by blocking the lateral branches of the intercostal nerves.
Material and methods: From Sept 2018 we applied the serratus plane block for pain control in 12 patients with multiple rib fractures. We administered 0.25–0.125% bupivacaine solution with Easypump for 5–8 days, The infusion rate was 5 ml/h. After admission we measured pulmonary function of patients and recorded the forced vital capacity (FVC). We repeated the test after the catheter insertion on the 2–5–10 days. In our control group (14 patients) we used our multimodal pain regimen.
Results: SPB has increased the FVC from 61.5 to 89.11% on the tenth day, and the pain decreased from 6.51 to 0.89 on pain VAS. In the control group the FVC increased from 58 to 73.11%, and pain decreased from 6.33 to 2.37.
Conclusions: SPB is a simple and effective technique for providing pain relief in unilateral multiple rib fractures. SPB has improved the FVC of the patients significantly.
References: Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. Anaesthesia. 2013;68:1107–13.

PR 349

Operative versus nonoperative treatment of multiple simple rib fractures: a systematic review and meta-analysis

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Introduction: Surgical rib stabilization in flail chest appears beneficial over nonoperative treatment in terms of rate of pneumonia, Intensive Care (IC) length of stay (ICLOS), and mechanical ventilation days [1]. This systematic review and meta-analysis aimed to evaluate the effect of operative versus nonoperative treatment on the occurrence of pneumonia and other relevant clinical outcome measures in patients with multiple simple rib fractures.
Material and methods: A search was performed in Embase, Medline Ovid, Cochrane Central, Web of Science, and Google Scholar. Outcome measures were the occurrence of pneumonia (primary), duration of mechanical ventilation, ICLOS, HLOS, mortality, and wound infections. Meta-analysis was performed using RevMan.
Results: The search resulted in 592 unique records, of which 14 manuscripts were included. The rate of patients without flail chest ranged from 54 to 100%. Meta-analysis showed a significant decrease of the occurrence of pneumonia (relative risk, RR = 0.66; 95% confidential interval [CI] 0.49 to 0.90; $p = 0.008$) and mortality (RR = 0.32; 95% CI 0.19 to 0.54; $p < 0.001$) in favor of operative treatment. No statistically significant effect of operative treatment was found for the duration of mechanical ventilation (standardized mean difference, SMD = − 0.37 day; 95% CI − 1.31 to 0.57; $p = 0.44$), ICLOS (SMD = − 0.29 days; 95% CI − 0.82 to 0.24; $p = 0.29$), and HLOS (SMD = − 0.78 days; 95% CI − 1.83 to 0.27; $p = 0.14$). The pooled rate of postoperative wound infection was 6.8% (95% CI 0.8 to 60.2%).
Conclusions: Operative treatment of multiple simple rib fractures may result in a significant reduction of pneumonia and mortality. However, a reducing effect of treatment on the duration of mechanical ventilation, ICLOS, and HLOS was not demonstrated.
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PR 350

Blunt thoracic trauma and predictors of respiratory complications

R. Gracia-Roman[1], *S. Montmany-Vioque*[1], *M. Andreu-Magarolas*[2], *P. Rebasa-Cladera*[1], *A. Campos-Serra*[1], *A. González-Costa*[1], *R. Lobato-Gil*[1], *S. Navarro-Soto*[1]

[1]Hospital Universitari Parc Taulí, General and digestive surgery, Sabadell, Spain, [2]Parc Tauli Hospital Universitary, Radiology and imaging, Sabadell, Spain

Introduction: Rib fractures are the most frequent injury after blunt thoracic trauma. It is very important to choose the most appropriate interventions to minimize or prevent complications. But who will benefit most of those interventions remains a challenge.
Material and methods: A retrospective study with a prospective data collection from March 2006 to December 2018. There have been included all traumatic patients older than 16 years old, that were admitted to the ICU or who were died before the admission and had a plain chest radiograph (CXR) and thoracic or thoraco-abdominal scan (CT scan) in the first 72 h. Demographic data has been collected, vital signs, ISS, mechanism of action, need of ventilation or intubation, lesions, complications, cause of death. A total of 553 CXR were re-evaluated by one general surgeon (one of the authors) and one radiologist, who were blinded to the results of the subsequent chest CT scan, the written radiology report and the patient's outcome. Rib fractures, pneumothorax, hemothorax, pulmonary contusion, laceration and atelectasis were described.
Results: Attending to the number of fractures, the Kappa between the radiologist, the surgeon and the CT report is very low: surgeon-CT $k = 0.18$, radiologist-CT $k = 0.2$, and radiologist-surgeon $k = 0.46$. Both radiologist and surgeon under-diagnosed rib fractures. We tried to predict respiratory failure and pneumonia using the number of fractures, and scores (Chest Trauma Score, RibScore and Rib Fracture Score). Results are shown on the table.
Conclusions: Plain radiography seems not to be a good diagnostic method for rib fractures. Both radiologists and surgeons under-diagnosed rib fractures. Scores based on radiography seem un-useful given that this under-diagnoses rib fractures; but with a precision of 71% by the surgeon evaluating CXR and using a score like RFS perhaps it is enough to decide which patients require a CT scan or more specific treatment in the ICU.

Fig. 1

Area Under the Curve to predic respiratory failure			
	CXR-radiolgist	CXR-surgeon	CT scan
Number of fractures	64%	67.6%	73.8%
Chest Trauma Score	70%	70%	73%
RibScore	55%	62%	74%
Rib Fracture Score	61%	71%	74%

PR 351

Surgical experience of Traumatic diaphragm injury in a single regional trauma center for 5 years

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Introduction: This study is a retrospective review of the experience with the management of traumatic diaphragm injury in our trauma center from 2014 to 2018.
Material and methods: We identified a total of 31 patients with the traumatic diaphragm injury coded from the institutional trauma registry. We reviewed the radiographic finding of radiologists and the electronic medical record (EMR).
Results: The mean of injury severity score (ISS) was 30.3 ± 13.7. Except for 1 case, the plain chest X-ray was evaluated in the patients before surgery, only 3 patients were revealed positive finding for diaphragm injury (n = 3/30, 10%). The computed tomography (CT) was performed for 22 patients, the positive finding was 31.8% (n = 7/22). According to the clinician impression before surgery, the diagnosis for diaphragm injury was showed 48.4% (n = 14/31). Approaches were laparotomy in 14 patients (45.2%), thoracotomy in 9 (29.0%), thoracoscopy in 3 (6.5%), laparoscopy in 1 (3.2%), open conversion after thoracoscopic or laparoscopic exploration in 2 (6.5%), median sternotomy in 2 (6.5%). The occurrence of herniation was 10 (32.3%). The mean of the calculated rupture size in the operation field was 5.8 ± 3.8 cm. In our study, the herniated peritoneal organ was observed in more than 3 cm size rupture of the diaphragm. 6 patients were performed surgical management of diaphragm rupture after 24 h.
Conclusions: Without herniation of organs, the radiologic evaluation was difficult to detect diaphragm injury. And, detect of diaphragm injury with herniation of organ, the injury of the diaphragm was predicted a larger than 3 cm.
References: 1. Lim KH, Park J. Blunt traumatic diaphragmatic rupture: Single-center experience with 38 patients. Medicine (Baltimore). 2018;97(41):e12849.
2. Okur MH, et al. Traumatic diaphragmatic rupture in children. J Pediatr Surg. 2014;49(3):420–3.

PC 352

Successful management of main pulmonary artery gunshot wound and a retained intramyocardial bullet

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Case history and clinical findings: A 44-year-old man presented to the emergency room with a single self-inflicted left chest gunshot wound at the level of 2nd rib. On arrival patient was conscious, with systolic blood pressure 100 mmHg and heart rate 120 bpm. Extremities were pale, cold. Jugular veins distended.
Investigation/results: FAST scan was negative. Chest radiograph revealed a metal foreign body with the size of 4 × 5 mm at the projection of heart. A CT scan of chest and abdomen demonstrated bullet inside the dorsal wall of the left ventricle and blood in pericardium and left pleural cavity (Figs. 1, 2).
Therapy and progression: Patient was taken to the operation room for median sternotomy. Due to severe deterioration of patient's condition, 30 ml of blood was aspirated from the pericardium prior to sternotomy. During subsequent pericardiotomy 500 ml of blood was evacuated. Main pulmonary artery wall gunshot injury was detected above the pulmonary valve. The wound was sutured, after which the hemodynamics stabilized. Cardiac surgeon was consulted about the air gun bullet inside the myocardium. It was decided that removal of the bullet is not indicated. The patient was observed in the ICU for the next 36 h, later transferred to the thoracic surgery ward. The postoperative course was uneventful. An echocardiogram demonstrated a perforation of the anterior leaflet of mitral valve with a mild to moderate regurgitation, otherwise no abnormalities. Patient was discharged on day 10. Patient has been followed up on an annual basis for the last 2 years. Patient's exercise tolerance and cardiac function according to repeated echocardiography remains unchanged with no evidence of dyskinesia or other abnormalities. Bullet is retained in the same location (Fig. 3).
Comments: This case illustrates a successful management of usually lethal injury of main pulmonary artery and reflects that retained myocardial foreign body does not necessarily cause any complications.

Fig. 1

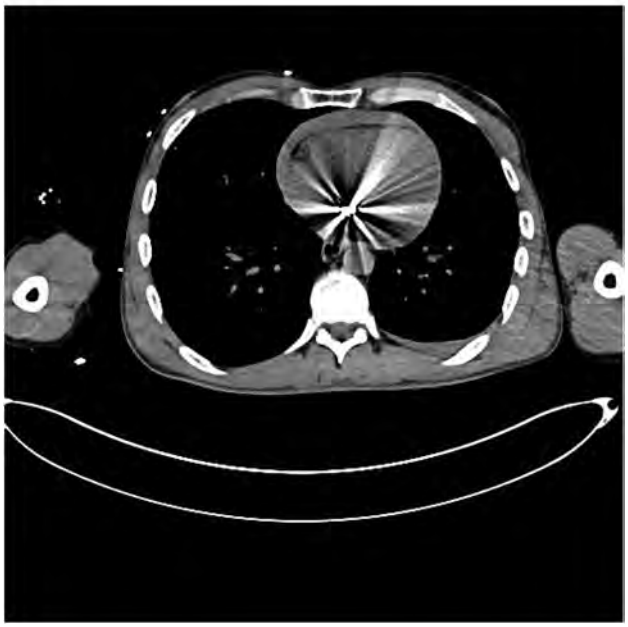
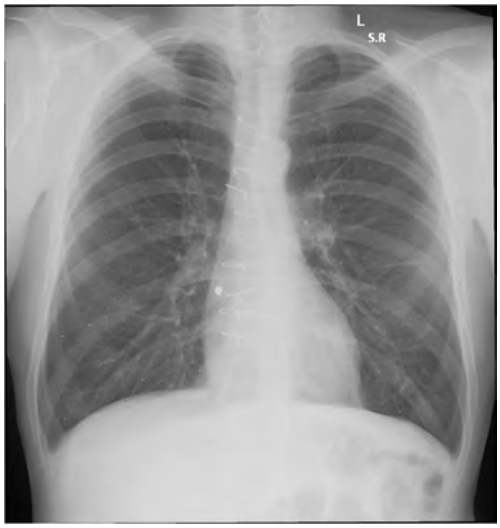


Fig. 2

Fig. 3



PR 353

Profile of penetrating chest injuries in hostile environment: a three year study

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Introduction: Penetrating chest injuries are one of the leading causes of death and major morbidity in operations involving high energy weapon systems. This study aimed at assess the profile of penetrating chest injuries suffered during armed combat operations in a hostile environment over a three year period.

Material and methods: A retrospective and prospective, non-randomized study designed to assess the profile of Chest injuries in armed combat operations over 3 years. All patients with penetrating chest injuries were included in the study.

Results: There were 967 trauma cases out of which 111 patients suffered penetrating chest injuries. The age range of patients was 20–46 years and all were male. A total of 15 casualties were brought dead (14.73%). There were 11 lung injuries and two diaphragmatic injuries. Thoracotomy was required in 7 patients (7.27%) and Intercostal chest drainage (ICD) in 29 patients (23.64%). Average blood loss was 440 ml and duration of hospital stay ranged from 4 to 62 days.

Conclusions: Ballistic injuries to the chest are frequently fatal due to injuries to the heart, major vessels and tracheobronchial tree. Prompt and efficient pre hospital treatment, expedient evacuation to a surgical facility and swift management by critical care specialists and surgeons can be instrumental in reducing mortality and morbidity. The cornerstone of management is bedside Intercostal chest drain insertion as a formal thoracotomy is seldom needed. Penetrating chest injuries can be managed by general surgeons with training in thoracotomy and repair of intra-thoracic structures.

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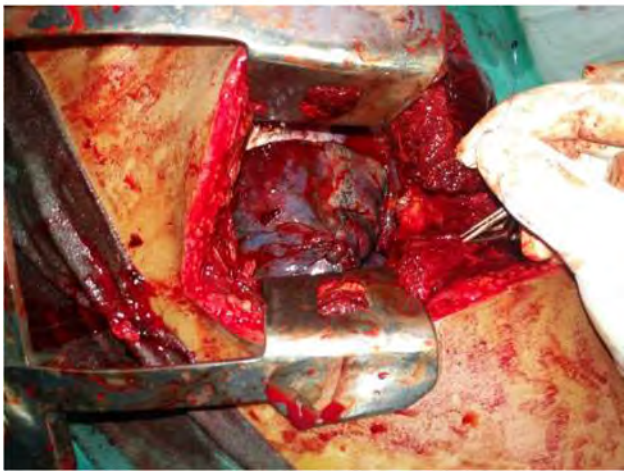
Fig. 1

Fig. 2

Fig. 5

Fig. 3

Fig. 4



PR 354

Does the number of a- or low symptomatic but intervention requiring complications justify regularly chest X-ray controls after less than 3 rib fractures?

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Introduction: Fractures of less than 3 ribs may still cause delayed complications (1). The aim of this retrospective study is to determine whether standardized control imaging in a- or low symptomatic patients reveals a significant number of intervention requiring complications and therefor should be recommended.
Material and methods: All patients with less than 3 rib fractures presenting in our emergency department after any trauma mechanism in the study period of 3 years (2015–2017) and available for follow up were included retrospectively in the study.
Results: We included 249 patients in this study, 137 (55.0%) of which were male, 112 female (45.0%), with a median age of 64.2 ± 24.8 years. In 150 patients (60.2%) 1 rib was affected, in 99 patients (39.8%) 2, the fractured ribs being true ribs (1–7) in 72 cases (28.9%), false ribs (8–12) in 151 cases (60.6%) and both in 26 cases (10.4%). The affected thorax half was the left side in 124 cases (49.8%), the right side in 121 cases (48.6%) and both thorax halves in 4 cases (1.6%). The trauma mechanisms were falls at home, traffic accidents, sporting accidents, work accidents, fighting related and minor trauma in 172 (69.1%), 30 (12.0%), 19 (7.6%), 18 (7.2%), 6 (2.4%) and 4 (1.6%) cases, respectively. The median follow up time was 9 ± 4 days. 4 patients (1.6%) required delayed intervention: 1 case of hemopneumothorax and 3 cases of pneumothorax all treated with chest tube.
Conclusions: Planned chest X- ray controls seem not to be necessary. Symptom triggered reappearance for patients after rib fractures in

hospitals seems to be sufficient and more economical compared to regularly re-imaging (2).

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PR 355

Is computed tomography a first line modality in stable blunt chest trauma elderly patients?

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Introduction: Adult older, patients aged > 65 years, represent up to 20–25% of all trauma patients admitted to the trauma centers. Chest trauma in older patients have been recognized to strongly influence mortality. The estimated of 20% mortality and pneumonia rate for these patients was observed (1, 2). Based on low diagnostic accuracy of CXR, interpretation difficulties due to aging chest wall deformities, we hypothesized that CT chest should be the first imaging modality in stable elderly blunt chest trauma patients.

Patients and methods A retrospective analysis of all blunt trauma admissions at Emek Medical Center between 2014–2018 years was performed in order to identify patients with blunt chest trauma. Only stable trauma patients with Abbreviated Injury Score (AIS).

Results: Among 473 patients that met inclusion criteria, there were 289(61%) patients aged 18–64 years old and 184 (39%) patients aged ≥ 65. In the first group of patients (18–64), 240 had CT chest on arrival. In the second group of patients (aged ≥ 65), there were 18 (9.7%) patients with missed injuries. In this group, patients who had CT chest on arrival, 7 of 130 (5.4%) patients had missed injuries. Eleven of 54 (20%) patients who had no CT chest on arrival, diagnosed with missed injuries (p-0.014). Readmission rate in the first group of patients (18–64) was 5 of 240 (2%) who had CT chest on arrival, and 2 of 49 (4%) who had CXR on arrival only (p-0.3). In the second group (≥ 65), readmission rate was 5 of 130 (3.8%) patients with CT chest on arrival, and 7 of 54 who had CXR on arrival only (13%) (p-0.051).

Conclusions: Based on our study result we conclude that CT chest should be a first imaging tool in stable elderly patients with blunt chest trauma.

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2. Bulger EM, Arneson MA, Mock CN, et al. Rib fractures in the elderly. J Trauma. 2000;48:1040–6.

No disclosures.

PR 356

Efficacy and safety of small-bored tube thoracotomy for chest trauma: large-bored chest tubes will no longer be needed

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Introduction: Tube thoracostomy drainage is an important treatment for traumatic pneumothorax and hemothorax. Traditionally, large-bored chest tubes have been recommended for successful drainage and prevention for clogging by clots. However, there is little evidence that large-bored tubes are more effective than smaller ones. In consideration of invasiveness, in our emergency room (ER), we use 20 Fr chest tube for all trauma patients when chest thoracotomy is indicated. The aim of our study is to investigate the efficacy and safety of small-bored tubes for chest trauma patients.

Material and methods: We conducted a retrospective observational study. We included the adult patients (> 18 years old) who had undergone tube thoracostomy with 20 Fr chest tubes for chest trauma during the 5 years from October 2013 to September 2018 in our ER. The patients with cardiopulmonary arrest on contact or on arrival were excluded. We evaluated tube-size related complications defined as obstruction and worsening of pneumothorax/hemothorax due to ineffective drainage.

Results: There were 102 eligible patients, 77% were male, mean age was 59.6 and the average Injury Severity Score was 17.8 (± 9.6). Sixty-six tube thoracostomies were performed by emergency physicians and 38 were performed by thoracic surgeons. The average duration of tube placement was 3.86 days (± 1.8). There were not any tube-size related complications nor any patients who required additional tube insertion.

Conclusions: No complications related to small-bored tubes were detected. Tube thoracostomy using small-bored chest tubes can be a treatment option because it is effective, safe and less invasive to the patient.

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PC 357

Laparoscopic evaluation for penetrating thoracoabdominal trauma: Port placement considerations

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Case history, clinical findings: 4 different stable hemodynamic cases with thoracoabdominal penetrating trauma and negative FAST evaluation were enrolled in study. Subsequent hemo/pneumothorax was managed initially by tube thoracostomy.

Investigation/results: Hence laparoscopic investigation is an effective method for evaluation of diaphragmatic injuries in thoracoabdominal penetrating trauma, patients underwent diagnostic laparoscopy. In case 1, classic approach was done by open technique 10 mm port insertion in sub umbilical. Two 5 mm ports inserted in lower abdomen at the level of midclavicular line. Then 10 mm port was added in subxiphoid area and by introducing zero-degree camera through it a better exposure was obtained. In case 2, 10 mm sub umbilical port, 5 mm port in subxiphoid and another 5 mm working port at the level of umbilicus and right midclavicular line were applied. A 30-degree camera used. Exposure, working space and exploration maneuvers were much easier to perform in compare with case 1. In case 3, port placement was identical to case 2 but zero-degree camera was used. Due to poor exposure, subxiphoid port was replaced by a 10 mm one and used for camera insertion, then an acceptable exposure was obtained. In case 4, port placement of case 3

was used by using 30-degree camera which resulted in a great exposure.

Diagnosis, therapy, progressions: Patients tolerated the operation well and underwent appropriate management according to their intra operation findings; post-op courses passed without any complications.

Comments: In patients with suspicious diaphragmatic injury and according to available facilities in our centers, in unilateral injuries we suggest that a 5 mm port in subxiphoid area can be used instead of contralateral midclavicular 5 mm port. In bilateral injuries, if enough exposure doesn't achieve, a 5 mm port in subxiphoid can be added. In absence of 30 degree cameras, 10 mm port use in subxiphoid can give surgeons better exposure.

DISASTER AND MILITARY SURGERY

PR 46

Hemodynamic instability in patients with extremity injuries: motor vehicle accidents and shot wounds vs. explosions

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Introduction: We previously reported that hemorrhagic instability (HS) was a complication of extremity injuries in as many as 1 of 7 of patients treated in one medical center following explosions. The objective of this study was to evaluate whether the prevalence of HS in patients with other high energetic injuries such as motor vehicle accidents and shot wounds (MVA/SW) is different or not.

Material and methods: Victims following MVA/SW with extremity injuries and HS treated in one medical center during 2017 were identified with the aid of the National Trauma Registry and the center's blood bank. HS was defined as tachycardia (pulse > 100/min) and/or hypotension (systolic pressure < 100 mmHg) in need of blood transfusions to reverse instability. Patients in whom HS could be attributed to injuries other than the extremity injury were excluded. These were compared to patients treated following bomb explosions (1994–2005).

Results: Included were 328 patients: MVA-226; SW-45, explosion 57. When compared to victims following MVA/SW, more victims following explosions were in need of blood units transfusion during the first 24 h (26.3% vs. 1.5%; relative risk 5.81, 95% CI 4.03, 8.36; $p < 0.001$), more units were transfused during the first 24 h (111 units vs. 23 units; 1.95 ± 4.88 units/patient vs. 0.08 ± 0.96 units/patient; $p = 0.002$), and more patients had HS (15.8% vs. 1.1%; relative risk 4.94, 95% CI 3.25,7.50, $p < 0.001$).

Conclusions: The proportion of patients in need of blood transfusion is much higher in patients whose extremity injury was caused by an explosion. The relative risk for HS is almost 5 times higher in these patients.

PR 47

New technologies in soft tissue wound management limit reconstruction complexity and enhance recovery

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Introduction: Large soft tissue losses are associated with infection, increased morbidity and mortality, increased costs and poor outcome functionality. The purpose of this study was to evaluate the efficacy of a combination treatment of combined TopClosure® Tension Relief System (TRS) and administration of regulated oxygen and antibiotic irrigation negative pressure-assisted wound therapy (ROI-NPT) in the treatment of patients suffering from significant soft tissue loss.

Material and methods: Patients with open abdomen, large infected wounds, and extensive soft tissue loss treated with TRS and ROI-NPT.

Results: Full wound closure was achieved in > 100 patients treated without skin grafts or flaps. Primary failure was successfully followed with secondary closure with the same system. The TRS system allowed early postoperative physiotherapy with good to excellent functional results. Limitations and complications will be discussed.

Conclusions:

1. TRS is a novel device for stretching, and securing wound closure, applying stress relaxation and mechanical creep for primary closure of large skin defects that otherwise would have required closure by skin grafts, flaps or tissue expanders.
2. Irrigation may accelerate the evacuation of infectious material from the wound and may provide a novel method for antibiotic administration.
3. Supplemental oxygen to the wound reverses reduced O2 levels in the wound's atmosphere inherent to the conventional negative pressure-assisted wound therapy restricting vacuum use in anaerobic contamination.

Moris Topaz is the inventor and patent holder of the TopClosure® and Vcareα®.

PR 48

Extremity bleeding workshop and tourniquet assessment study onboard the Spanish Armada Ship "Juan Sebastian Elcano"

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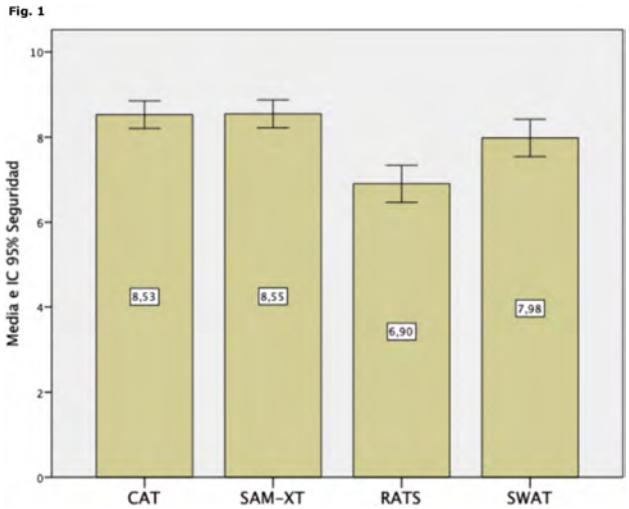
Introduction: The "Juan Sebastian Elcano" (JSE) is a training sail ship of the Spanish armada commissioned in 1928, aboard which cruise members receive seamanship and navigation training along a six-month journey. During its 2019 voyage, the authors issued an onboard extremity bleeding workshop. Attendees' perceptions about tourniquet safety use aboard, easiness of application, and preference among four devices tested assessed.

Material and methods: The descriptive study design assessed employing a post-seminar survey, participants' perceptions of tourniquet safety use, application easiness, and preference among the four devices tested (CAT, SAM-XT, SWAT-T, and RATS). The first two variables measured on a one-to-ten scale (being ten the easiest or safest, and one the least easy or least safe), while preference was measured by frequency count, with only one device to select as the preferred. Frequencies and percentages for categorical variables and averages calculated and compared using the Anova test ($p < 0.01$).

Results: A total of 51 sailors, 12 (24%) females, and 39 (76%) males, aged between 20 and 21, participated in the workshop and completed the survey. The mean for the perception of safety regarding onboard usage was 7.5. As for application easiness, CAT and SAM-XT ranked equally high (8.5), followed by SWAT (7.9) and RATS (6.9), and the only statistical difference found was for RATS ($p < 0.01$). CAT was reported as preferred by 38 participants (74%), followed by SAM-XT 10 (20%), SWAT-T 2 (4%), and RATS 1 (2%).
Conclusions: JSE crewmembers (non-medical personnel) considered safe the use of tourniquets on board. Of the four devices assessed, CAT and SAM-XT were regarded as equally easy to use and RATS the least of all. CAT was reported as preferred by almost three out of every four respondents.
References: Heldenberg E, et al. Evaluating new types of tourniquets by the Israeli Naval special warfare unit. Disaster Mil Med. 2015;1:1.

Fig. 1



PR 49

Flexible surge capacity

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Introduction: Surge capacity is the ability to manage the increased influx of critically ill or injured patients during suddenly onset crisis, like a mass-casualty incident (MCI) or disaster. During such an event all ordinary resources are activated and used in a systematic, structured and planned way. There are, however, situations where conventional healthcare means are insufficient and additional resources must be summoned. This study investigates the possibility of using community resources such as primary health care centers, nonmedical professionals and non-standardized facilities together with educational initiatives to increase surge capacity in a flexible manner.
Purpose: To investigate the possibility of an increased and flexible surge capacity during a crisis, disaster or mass casualty incident (MCI) by examining the main components of Surge Capacity (SC) (Staff, Stuff, Structure, and System) in the Västragötaland Region of Sweden.
Method: This thesis uses a mixed methods research approach with an explanatory sequential design. A literature search was performed by using standard search engines utilizing relevant keywords, questionnaires and semistructured interviews were used for data collection from primary health care centers, dental and veterinary clinics, schools, hotels and sports facilities to determine capabilities, barriers, limitations and interest to be included in a flexible surge capacity system.
Results: Preliminary findings indicate that there is interest, capacity and capability in the investigated municipalities to partake in a FSC-plan: Primary healthcare centers can be toned up with drills and exercises, civilians can be educated in advanced first aid procedures (immediate responders) and focused leadership (scene management), schools, hotels and sports facilities can be prepared with advanced first aids kits and be used as alternative care facilities. These alternatives together represent the concept of Flexible Surge Capacity.
Conclusion: Flexible Surge Capacity can be a possible approach to create extra resources in disaster situations, MCI's, or whenever supporting infrastructure is not intact. New educational initiatives, drills and exercises, laymen empowerment and organizational and legal changes might be needed to realize a Flexible Surge Capacity.
Keywords: Flexible, Surge, Capacity, Contingency, Civilian, Military, Resources, Mass Casualty Incident, Disaster Medicine, Disaster Management.

PR 50

Hospital evacuation plan

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Introduction: A hospital may need partial or total evacuation because of internal or external incidents, such as in natural disasters and or armed conflicts. An evacuation aims either to transport a large number of patients to other medical facilities or to prepare enough space to receive a large number of victims. Despite many publications and reports on successful and unsuccessful evacuations, and lessons learned, there is still no standardized guide for such an evacuation, and many hospitals lack the proper preparedness. We aimed to analyze the preparedness of hospitals for a total evacuation by looking into some key parameters necessary for a successful performance.
Material and methods: A literature search was performed by using the standard search motors in the related fields, and by using relevant keywords. Eleven questions were sent to representatives from 15 EU- and non-EU countries.
Results: Our findings indicate that there is neither a full preparedness nor a standard guideline for evacuation within the EU or other non-EU countries included in this study. Some countries did not respond to our questions due to the lack of relevant guidelines, instructions, or time.
Conclusions: Hospitals are exposed to internal and external incidents and require an adequate evacuation plan. There is a need for a multinational collaboration, specifically within the EU, to establish a standardized evacuation plan.
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PR 51

Do we need military healthcare system?

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Introduction: The importance of and the need for medical management during any armed conflict is a fact. Many medical achievements have been accomplished due to wars and armed conflicts. The world is, however, divided into countries with and without related military healthcare services. There is a need for joint structure with the civilian in the former, while in the latter the civilian healthcare is responsible for offering services to the military. This study aims to identify the needs of military healthcare system and military medicine as an independent specialty.
Material and methods: A literature search was performed by using the standard search motors in the related fields, and by using relevant keywords. Relevant professionals were asked about the pros and cons of having established military healthcare. The data was collected and analyzed.
Results: Although our findings indicate a need for military medicine/healthcare as a professional specialty, the organizational divisions between military and civilian healthcare systems seems to be changing. The current security issues worldwide, the pattern of injuries and resource scarcity indicates a need for improved collaboration and maybe a fusion between these entities.
Conclusions: New security threats, modern technology, the pattern of medical injuries, and the lack of adequate surge capacity may indicate a very close collaboration between military and civilian healthcare systems. Such a close collaboration may develop to fusion and a total defense healthcare system that can act both in peace and during conflicts.
References: Ringel JS. The elasticity of demand for health care. A review of the literature and its application to the military health system. https://apps.dtic.mil/docs/citations/ADA403148
Khorram-Manesh, A. Facilitators and constrainers of civilian–military collaboration: the Swedish perspectives. Eur J Trauma Emerg Surg. 2018. https://doi.org/10.1007/s00068-018-1058-9.

PR 52

Alternative methods of mandibular comminuted fracture fixation in severe maxillofacial injured patients

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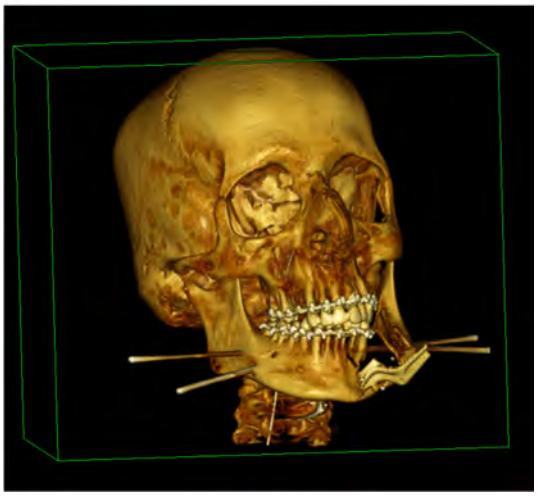
Introduction: Severe maxillofacial injuries refer to significant facial trauma with communitive bony fractures and soft tissue loss. They result in violent trauma as firearm injuries (wartimes injuries, terrorist attack, suicide attempt) and high velocity motor vehicle accidents. The initial management consist of fighting hemorrhage, fighting asphyxia, wounds debridement and suture, and fractures stabilization, especially mandibular fracture stabilization. Our study aims to share thoughts on the alternative methods of comminuted mandibular fracture fixation within the context: kind of injury, multitrauma patients, mass-casualty situation, precarious situation or hostile environment.
Material and methods: Based on our experience (clinical cases), on senior surgeons questioning and on medical literature data, we sought to identify, to evaluate and to compare the different available methods to stabilize comminuted mandibular fractures in severe facial injured patients.
Results: Open reduction and stable internal fixation (using macro plate), external pin fixation and closed reduction with maxillo-mandibular fixation are the methods of treatment which are the most classically used and described. However, some methods using Kirschner wires are reported: in cross extrafocal pinning (Fig. 1), external fixation and handmade splints. All these methods differ in their complexity of use, in their availability, and in their possibilities to treat one kind of mandibular fracture or another.
Conclusions: The stabilization method of comminuted mandibular fracture will be choose depending on material availability, on surgeon's abilities, on the time available (mass-casualty situation) and on the patient's overall condition. Even if stabilization methods using wires are less commonly used, they appear to us to be useful in the initial management of the severe maxillofacial injured patient with comminuted mandibular fracture, especially in austere conditions.

Fig. 1



PR 53

Causes of combat casualties' death at medical treatment facilities (MTF) in modern conflicts: Russian experience

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Introduction: Studying the epidemiology of death at MTF after combat injury is vital to combat casualty care performance improvement.

Material and methods: Data including mechanism of injury, physiologic and laboratory variables, staged surgical treatment and cause of death were obtained from the Combat Trauma Registry of the Kirov Military Medical Academy War Surgery Department. The Combat Trauma Registry includes 5581 Russian wounded in military conflicts over the past decades, 451 of them (8.1%) dead of wounds (DOW) at the MTF.
Results: 50.3% of the total DOW number died at the Role II field medical units, 17.3% died at the forward military Role III hospitals, and 32.4% died at the Role IV hospitals. The causes of DOW patients delivered to the MTF were nonsurvivable traumatic brain wound (19.7%), life-threatening consequences of injuries—mainly massive blood loss due to external and internal bleeding and acute respiratory failure (34.8%), as well as the late septic complications (45.5%). Terms of death depended on the cause of DOW. So for nonsurvivable traumatic brain injuries, they amounted to 0.5 ± 0.1 days, for life-threatening consequences of wounds—2.1 ± 0.2 days, and in the development of complications—15.7 ± 0.3 days.
Conclusions: There is a high mortality rate among the combat casualties delivered to MTF in modern asymmetric warfare (8.1%). Moreover, half of these patients (50.3%) die at Role II field medical units mostly from nonsurvivable injuries and from acute irreversible blood loss that occurred at the prehospital stage. The main cause of hospital combat mortality is severe septic complications of combat trauma.
Reference: Eastridge BJ, Mabry RL, Seguin P, et al. Death on the battlefield (2001–2011): implications for the future of combat casualty care. J Trauma Acute Care Surg. 2012;73(6 Suppl):S431–7.

PR 54

Introduction of a blast tube established at the National Defense Medical College in Japan

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In consideration of the present counterterrorism practices, prevention and initial treatment for primary blast injury by shock waves constitute a particularly urgent subject because blast injuries and gunshot wounds account for the majority of terrorism deaths. In Japan, due to strict ethical standards in animal experiments, there is no appropriate animal model of blast injury. We established an original small animal model of blast injury using a laser-induced shock wave at the National Defense Medical College (NDMC). However, since the experiments were conducted using only small animals, such as mice and rats, it was necessary to establish a medium-sized animal model aimed to test the applicability in human patients in the long term. Correspondingly, we established a blast tube, which was authorized globally as a shock wave-generating device that causes blast injury based on air pressure differences, in the NDMC Research Institute using the budget of Advanced Research on Military Medicine of Japan in 2017. This allowed us to conduct scientific studies on blast injury using medium-sized animals. In this presentation, we will introduce the structure and function of the blast tube installed in the NDMC and present some of the results of our research thus far. This research is financially supported by the budget of Advanced Research on Military Medicine of Japan in 2017.

PR 55

Mass Casualty Incident (MCI) training in a metropolitan hospital with MACSIM® (Mass Casualty SIMulation System)

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Introduction: Mass Casualty Incident Plans, called in Italy with the acronymous PEMAF, are mandatory in all hospitals since the '90. Unfortunately, even if hospital and their staff are an essential key for successful response to MCIs, the plan are seldom well-known and, above all, exercises are quite neglected at local and national levels. Due to MCI rarity, simulation exercises are the only way to achieve proficiency in MCI response. Therefore, we tested an original MCI training system (MACSIM®) adapted to the PEMAF of a large University Hospital in Milan (Italy).
Material and methods: The original MCI training format called MACSIM-PEMAF (Emergency Plan for Massive Influx of Casualties)was developed for the Italian Society for Trauma and Emergency Surgery (SICUT) in 2016. It uses MACSIM®, a simulation tool scientifically validated for training and assessment of healthcare professionals in MCI management. Between 2016 and 2018 the course was held for the Emergency Department staff of a single University Hospital of Milan (Italy) (Foundation Cà Granda-Ospedale Maggiore Policlinico). MACSIM® was used to reproduce the hospital resources, with different MCI scenarios. During the simulation the participants had the opportunity to test the local PEMAF, in adjunct to their knowledge and skills. Course effectiveness was evaluated by a pre- and post-course self-assessment questionnaire.
Results: MACSIM-PEMAF was tested in seven courses, for a total of 258 participants. Pre- and post-test questionnaires showed a significant improvement in hospital staff self-perception of knowledge and skills in MCI management. On a 1–10 scale, the improvement value was from 4.4 ± 2.5 to 7.5 ± 1.9 ($p < 0.001$).
Conclusions: MACSIM-PEMAF is a useful tool to test single hospital PEMAF. It is versatile enough to adapt to specific realties, mimicking different traumatic scenarios. Participants, acting in their usual professional roles, can increase their self-perception to be able to respond to a MCI with in-hospital resources.

PR 56

EMT2 Regione Piemonte, the Mozambique maxi-emergency experience after cyclone Idai

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Introduction: EMT are field health facilities, specifically structured to operate in case of disaster, where local healthcare resources are insufficient. There are 3 types of EMT. "EMT2 Regione Piemonte" is the first Italian EMT to be certificated by WHO. It's a Type 2, meaning that more than triage and stabilization of emergency cases it's provided with an ICU, a 24/7 working operation room, a test lab, radiological and ultrasound devices. It can admit up to 20 inpatients. Cyclone Idai made landfall on 3/15/19 in the district of Dondo in Mozambique. It brought torrential rains and strong winds and had heavy impacts on the city of Beira and surrounding areas resulting in loss of communication and access. In addition important damage and destruction to shelter, settlements, health and WASH facilities occurred. On 3/20 Italian government approved the aid mission, from march 21st to 26th three Italian military aircraft transported the medical staff and the boxes containing the hospital to Maputo and then in Beira. On 3/30, the hospital began working, treating an average of 80 patients and performing 4–5 surgeries per day, involving Mozambican staff who immediately well integrated with the Italian colleagues.
Results: 25 days of activities. 62 surgeries (28 Orthopaedic, 10 General Surgery, 18 Gynaecology, 6 Plastic Surgery). 35.4% of the cases related to cyclone. Mean TISS: 10 (8–13). Mean age 33 (1–73) 34 females, 28 males. Types of anaesthesia: 73% locoregional, 10% general, 17% analgosedation.
Conclusions: Our first experience in a mass casualties' scenario showed how important is to refresh team skills through periodic drills. The leadership is of paramount importance to keep the team united and to support collaboration with other Nations' teams and with the local population. Adaptability and open-mindedness are fundamental. EMTs do not arrive in loco immediately so that longer periods of mission and integration with local medical staffs should be programmed.

PR 57

A terror attack in the Netherlands: simulation vs reality

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Introduction: In Utrecht, the Netherlands, a worldwide unique major incident hospital is continuously standby to receive multiple victims during mass casualty events. Each year, different types of mass casualty events are simulated with a varying number of victims, to train command and control under extreme circumstances. In Utrecht, on March 18th 2019, a terrorist opened gunshot fire in crowded public transport. The aim of the study is to compare our experiences in simulation versus reality.
Material and methods: An internal evaluation was performed by questionnaires completed by participants and an external evaluation was performed by interviews.
Results: All five victims were brought to the major incident hospital, of whom two were dead on arrival, one died seven days after due to multiple organ failure and two survived after multiple surgical procedures. All victims arrived within 36 min after the major incident hospital was activated. A sufficient number of medical staff was alarmed for these five victims, however, since the event occurred during office hours, at least a double amount of staff showed up. Among some medical staff on commanding key positions fear arose about their own safety and of relatives outside the hospital. This was exaggerated by incomplete and incorrect provided information from the scene. Although medical care of the victims was not affected at all, occasionally the anxiety negatively influenced the command and control structure.
Conclusions: The combination of anxiety and a surplus of awaiting and benevolent curious medical staff resulted in occasional insufficient performance of the existing command and control structure, despite proper training. However, simulation of fear in a training is very difficult. Nowadays, with the increasing threat of terror attacks, one should be aware of the influence of fear and anxiety on personnel, even with low numbers of victims.

PR 58

Ethic and law issues during mass casualties management operations in foreign countries

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Introduction: Mass casualties incidents occur even more frequently during the last years globally. International help in order to manage them, when needed and asked, has to take into consideration special aspects of ethics and local law status in order to successfully fulfill its expectation.
Purpose: To demonstrate the ethic and law issues that arise during mass casualties management operations in foreign countries.
Material and method: Literature review from recent management operations in Syria, Iran and sub Saharan Africa.
Results: During such operations a lot of ethical and law issues arise. The knowledge of ethics and laws in the country that these take place is essential and critical for the successful result of them. Special care must be taken for the management of women, children and dead people. Traditions and religion status of the local populations also must be taken into consideration and actions must take place in accordance to respect of the local authorities and social conditions.
Conclusions: Mass casualties management operations in foreign countries is a challenging mission. Ethic and law issues arise and must be taken into consideration for the success of the mission.
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PR 59

Onboarding-surgeon experience: learn a new type of surgery… and learn about yourself

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Western surgical experience is one thing, but surgical practice in countries in conflict zones is another. The pathologies are different, the thermal conditions are often difficult and the follow-up of the patients is fundamentally modified. Humanitarian surgery is becoming more professional and most organizations are setting up a training

program for new surgeons embarking on the humanitarian adventure. International Committee of the Red Cross (ICRC) has implemented an onboarding-surgeon experience, before to become a fully ICRC surgeon. I hereby present my personal onboarding experience in South Sudan: how to learn a new type of surgery, how to come with an helicopter to collect patients in the bush and then, how much you learn about yourself.

Conflict of interest: I only represent my own experience and I do not represent ICRC.

Fig. 1

PR 60

Surgical clinical reasoning during the war

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In the period between 1992 and 1996, I was the Head of operating rooms and ICU at the Clinic for orthopedic surgery and traumatology, in Sarajevo. Working in the operating room whose walls are shaking because of the sniping and shelling was not remembered by any other generation of surgeons. There were around 55000 traumatized citizens of Sarajevo. Thousands of injured, dying patients were seeking for help from a small number of surgeons. The duty of a surgeon working in the war conditions, without water, electricity, medicines, or heat, is not easy at all, and there were a lot of difficult situations. For example, one day, operated children were again wounded by direct shelling on the walls of Pediatric department of our Clinic. After we re-operated the children, we also operated the injured nurses. 27th May, 1992, 5th February, 1994, and 28th August, 1995 were the most painful experiences in the surgical treatment of disaster in the center of Sarajevo, with a large number of massively traumatized patients. While you were helping one casualty, others were pulling our arms or legs. While you were helping one patient, others were dying in the cramp of pain. During the war, a series of traumatic events happened. Above many thousands of them, I admitted a 13-year-old girl, severely injured, with traumatic lower leg amputation of the leg, and severe injuries of the thigh, pelvis, and neck. We operated on her through the night. During the surgery, she received 51 whole blood transfusions. Following the surgery, she was stabilized on Pediatric department of our Clinic. One day, I saw her mother brought her a gift, immensely valuable in those days, a small canister of pure water. In the 2008, one girl approached me, and asked me if I remembered her. I remembered the canister of pure water. She was happy to show me how she can walk now, and told me she lives in Canada and works as a university assistant. I was more than happy to see her walk proudly, as she was leaving.

Fig. 1

Fig. 2

Fig. 3

PR 358

The injury pattern of 2019 earthquake in Athens, Greece: the Panic-effect

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Introduction: Earthquakes are devastating events. Greece is known to be in the first place of seismicity in Europe and sixth worldwide. Lately, a 5.1 Richter earthquake shook the Greek capital, and fortunately no substantial construction damage was sustained. The aim of the study is to evaluate the classification and severity of all injuries, as well as the type of orthopedic surgical procedures performed, in addition to the role that panic plays on the occurrence of these kind of trauma

Material and methods: Prospective case-series study, conducted in the emergency department of our hospital after the July 19th, 2019 earthquake. The study included 18 patients treated by our department, who sustained injuries in their attempt to run away from the scene. Age range was from 20 to 84 years old (mean 54.9 y.o), 11 were female and 7 were male.

Results: A total of 23 injuries reviewed. Upper extremities were involved in 9 of all cases, lower extremities in 13 and one patient suffered minor head trauma. Four patients required hospitalization and all of them underwent surgical treatment. Open reduction and internal fixation performed in 2 patients (1 calcaneus fracture and 1 olecranon fracture), 1 patient underwent Intramedullary nail fixation (tibial shaft fracture) and external fixation was applied to another (distal tibia fracture). Six patients were

Conclusions: Panic is an independent contributing factor in natural disaster associated trauma. Prior education, preparedness and combined team effort are clearly needed, in order to reduce the incidence of these injuries. Regardless of age, panic may result in various types of fractures, even in cases there are no substantial construction damages after an earthquake.

PR 359

Digital and analogue record system for mass casualty incidences at sea: results, reliability and validity

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Introduction: Mistriage may have serious consequences for patients in mass causality incidences (MCI) at sea. Therefore, an exercise was conducted to compare the reliability and validity of an analogue and tablet based recording system for triage of sample patients.

Material and methods: 50 Volunteers were asked to triage with the STaRT-Algorithm (black, red, yellow and green) 50 patients in a given time using an analogue and tablet based system. Triage score distribution and agreement between the two triage methods and a predefined standard were reported. The present study assessed the triage results as well as the reliability through Cronbachs alpha and Kappa. For testing of validity and internal consistency, the sensitivity, specificity and predictive value was measured.

Results: Forty-eight participants completed a total of 3545 triages. While the number of triaged patients in the given time was significantly higher with the analogue system compared to the digital system (p-value 0.001, t-test), the validity measured with the Cronbachs alpha and unweighted Cohens Kappa was higher with the digital system. For each triage category, higher values were gained with the digital system. The sensitivity, specificity and predictive value for the digital system was higher than for the analogue system.

Conclusions: This study gives reliable and valid results comparing a digital versus an analogue triage system for a MCI at sea. Significant differences could be found for the number of triages and the number of under triage. The results of the study show that the used digital system has a slightly higher reliability and validity than the analogue triage system.

References: The present work is part of the project Improved Emergency Treatment and Organization in the event of a mass casualty of casualties at sea (VeNOMAS), planned within the framework of the research network "Kompetenz und Organisation für den Massenanfall von Patienten in der Seeschifffahrt" (KOMPASS) and funded by the Federal Ministry of Education and Research (grant number: 13N13256).

PR 360

Predicting outcome for extremity wounds in pediatric casualties of war

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Introduction: During the early 90s, the International Committee of the Red Cross (ICRC) implemented the Red Cross Wound Classification (RCWC) for penetrating wounds. Wound grades of 1, 2 and 3 describe the amount of kinetic energy transferred to the tissue (low, high and massive, respectively). Currently, this classification system mostly serves as a descriptive tool, but it is hypothesized it could also support clinical decision making. The aim of this study is to assess whether the wound grade of a pediatric patient's extremity wound correlates with patient outcomes.

Material and methods: This study included pediatric patients (age < 15 years), who have been treated by the ICRC for conflict-related extremity injuries between 1988 and 2012. The correlation of the following variables with the wound grade were analyzed: number of surgeries required, length of stay, and in-hospital mortality.

Results: The study cohort consisted of 2459 pediatric patients. The higher the wound grade, the more surgeries were performed per patient ($p < 0.05$), with a mean of 4 surgeries per patient if they had a wound grading of 3. There were no significant differences in mortality rates between any of the wound grades, which were 1.0% (20/1953), 0.0% (0/342) and 1.9% (3/161) for wound grade 1, 2 and 3 respectively. Pediatric patients with wound grade 3 were hospitalized for the longest period (mean 49.6 days), followed by wound grade 2 (mean 40.0 days) and wound grade 1 (mean 25.9 days; all with $p < 0.05$).

Conclusions: The wound grade of pediatric patients' extremity wounds appears to correlate with some patient outcomes, but not with

mortality. Grading of extremity wounds according to the RCWS could support clinical decision making in pediatric patients.

PR 361

A decade in the battlefield (2004–2014): a French military perspective on the high mortality associated with non-exclusively orthopedic or brain combat injuries

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Introduction: During the last few decades, French armed forces have regularly deployed in asymmetric conflicts. Surgical support for casualties of these conflicts occurs in NATO role 2 and 3 medical treatment facilities (MTF); definitive surgical care occurs in France following a strategic medical evacuation. The aim of this study was to describe the combat injury profile of these soldiers who presented with either non-exclusively orthopedic and/or non-exclusively brain injuries.
Material and methods: This descriptive study is a retrospective analysis of the surgical management of French casualties performed in role 2 or 3 MTF in Afghanistan, Mali, Niger, Djibouti and the Central African Republic between January 2004 and December 2014.
Results: One hundred patients were included. Forty had fragment wounds. The most severe lesions were of the head, neck or thorax. The average injury severity score (ISS) was 34.9 (IC 95% 29.8–40). 17 damage control procedures were performed. Thirty patients died with a mean ISS of 61 (IC 95% 56–67); 5 deaths were considered as preventable deaths. The most frequent surgical procedures in the MTF were digestive (n = 31) and thoracic surgery (N = 19). Thirty patients needed second-look surgery in France; eleven had severe complications. No patient died following medical evacuation to France.
Conclusions: Results from this study indicate that the mortality following non-exclusively brain or orthopedic injuries remains high in modern asymmetric conflicts.

PR 362

Telemedical applications in extreme environments and emergency response

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Introduction: Telemedicine has been applied to disasters and extreme environments for more than 20 years, however, despite the many lessons learned so far, telemedicine is still not a common part of the immediate disaster response. For this reason, a review of the literature was conducted to investigate whether telemedicine technology can be used to address medical and non-medical needs in extreme environments.
Material and methods: This systematic review included 9 studies published in the period 2000–2019, originating from literature search bases Medline, Scopus, Cinahl and PubMed. The case of NEEMO project were studied so to evaluate the diagnostical and surgical care of the patients regarding the emergency response in a remote and constricted area, with limited human medical resources and using the telecommunications and telerobotic technologies.
Results: The majority of the included studies have highlighted the importance of telemedicine interventions in extreme environments, stressing that it is a viable solution to health care provision. In addition, it has been found that telemedicinal technology provides the possibility of virtual collaboration between healthcare professionals with various specializations. Projects NEEMO 7,9,12 engaged to eliminate the challenges of telesurgery.
Conclusions: Future studies such as large multicentre randomized trials will have to be conducted that will lead to safe conclusions on the usefulness and efficiency of telemedicine applications in extreme environments.
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PR 364

Evaluation of the efficacy of commercial and non-commercial tourniquets for extremity hemorrhage control in a perfused cadaver model

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Introduction: Tourniquets are a critical tool in the immediate response to life-threatening extremity hemorrhage. The optimal tourniquet type and effectiveness of non-commercial devices is unclear, and the aim of this study.
Material and methods: This prospective observational cadaver-based study was performed using a perfused cadaver model with a standardized Superficial Femoral Artery injury bleeding at 700 ml/min. Five devices were tested: CAT (combat application tourniquet), RATS (rapid application tourniquet system), SWAT-T (Stretch, Wrap, And Tuck Tourniquet), a triangle bandage and a stick and a leather belt. 48 volunteer Medical Students with no prior clinical tourniquet experience participated. Each student underwent a practical hands-on demonstration of each of the 5 tourniquets, prior to the test. Using a random number generator, they then placed all 5 tourniquets in random order. Outcomes measures included time to hemostasis, total time to secure devices, estimated blood loss (EBL) and difficulty rating. A One-Way ANOVA repeated measures was used to compare efficacy between the tourniquets in achieving the outcomes.
Results: Participants' mean age was 25 ± 2.6 years and 29 (60%) were male. All participants were able to stop the bleeding with 4 of the 5 tourniquets. With the RATS there was a 4% failure rate. Among the five types of tourniquets, time to hemostasis and EBL were not statistically significantly different ($p > 0.05$). The SWAT-T required the longest time to be secured (47.8 ± 17.0), while the belt was the fastest (15.2 ± 6.5; $p < 0.001$).

Conclusions: All five tourniquets, including the non-commercial devices, were effective in achieving hemostasis. A standard leather belt was the fastest to place and able to stop the bleeding. However, it required continuous pressure to maintain hemostasis. Nevertheless, in an emergency setting where commercial devices are not available, improvised tourniquets may be an affective lifesaving bridge to definitive care.

Fig. 1

Tourniquet effectiveness and applicability						
	CAT	RATS	SWAT	TRIANGLE BND	BELT	*p* value
Time to hemostasis (s, mean ± SD)	37.7 ± 16.2	33.0 ± 10.3	39.0 ± 17.0	34.0 ± 12.7	38.6 ± 28.8	0.24
Time to secure (s, mean ± SD)	37.0 ± 16.5	34.0 ± 11.0	47.8 ± 17.0	32.0 ± 12.8	15.2 ± 6.5	< 0.05
Blood loss (cc, mean ± SD)	240.7 ± 125.7	236.7 ± 195.6	214.0 ± 138.3	205.7 ± 97.0	190.3 ± 119.8	0.07

PR 365

Hospital preparedness for mass gathering events and mass casualty incidents in Matera, european capital of culture for 2019

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Introduction: Mass Casualty Incidents (MCI) may occur during Mass Gathering Events (MGE). Lack of preparedness of health system increases mortality. Education and training are crucial. Hospital MCI plans are mandatory in Italy, but they are poorly known. On 2014, Matera was declared italian host of european capital of culture for 2019: the local hospital decided to revise the hospital plan for massive influx of injured (PEMAF) and to start a program to train the staff.
Material and methods: The PEMAF was reviewed through simulations that involved all the staff. A partnership with MRMI-Italia (Italian chapter of the International Association Medical Response to Major Incident and Disaster-MRMI&D) leaded to the support of experts and to the organization of residential courses based on the MACSIM® (MAss Casualty SIMulation) simulation tool. Educational capacity of the residential events was tested through a self-assessment tool.
Results: Alert, coordination and command sequences were defined. All the available resources were recorded and the functional areas identified. The communication network was improved. Documentation and registration system was prepared. Standard operational procedures (action cards) were created for the key positions. 7 residential educational events of MACSIM-PEMAF were organized. The educational capacity was tested through self-evaluation: knowledge of participants resulted improved.
Conclusions: MGE are a great opportunity for the hosting community but they also represent an increased risk of MCI. Preparedness is mandatory for Health System. The format MACSIM-PEMAF seems to be adequate to review the existing plans and transfer skills to attendants.
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PR 366

Mass casualty incidents of infectious patients in the maritime setting: what to learn from emergency surgeons?

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Introduction: The cruise industry is facing a constantly growth of infectious diseases. Some of them are reaching the extent of mass casualty incidences (MCI), which are overwhelming the capacity of the local rescue system. Our aim was to improve the ability to act in a MCI due to an infectious emergency regarding the situation at sea/in the port. Hamburg, as one of the largest ports in Europe, was chosen for analysis.
Material and methods: The collaborative project "Adaptive Resilience Management in the Port" (ARMIHN) is funded by the German Federal Ministry of Education and Research. Scenarios due to an infectiological emergency were developed together with the University Central Department of Occupational Medicine and Maritime Medicine and the Hamburg Port Health Center in Hamburg, Germany. These scenarios were specified with all key stakeholders in the port. The organizational structure of the current emergency management was analyzed and a new concept was developed.
Results: For the ship and the port, emergency strategies dealing with mass casualties of injured persons are available. Nevertheless, current concepts regarding this special situation of an infectiological MCI were missing. We developed a new concept, which based on the models concerning mass casualties of injured persons. For this purpose, emergency surgeons can be recommended as experts regarding coping with a major emergency and for developing adaptive training concepts.
Conclusions: New operational concepts coping with MCI of infectious patients were developed. In a second step, an emergency plan and a training concept for relevant stakeholders in the port will be developed. These will be evaluated in a full exercise in the Port of Hamburg and tested for their suitability. The results will be transferred to comparable infrastructures to cope with a major case incident with infected people in the port area. Emergency surgeons should be involved in these steps due to their expertise.
The work was funded by the German Federal Ministry of Education and Research (13N14925). No further significant relationships.

PR 367

War surgery training, the use of swine model in military simulation center

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Introduction: Due to the international instability, our Forces are deployed in many place and our military surgeons have to deal with ballistics trauma and improvised explosive devices related trauma. In order to be well prepared and effective in these isolated situation, The Val de Grace School (Our military Health Service Academy) provide

a 2 years course to train the young surgeon. This 2 year Surgical Courses ended with war trauma surgery simulation on a swine model.
Material and methods: This use of the swine alive model is incorporated in the Cesimco (military surgical simulation center) and also use for the training of our fully registered surgical team. This laboratory responds to all civilian authorizations and ethical considerations as enacted by European rules (FELASA).
Results: The aim of this presentation is to show the different procedures and the teaching provided in this structure to improve surgical skills in war condition. All procedures are approved by the ministry in charge of the animal experimentation and respond to the animal welfare regulation. The number of swine used in these teaching is reduced to the minimum. We think that this animal model and its use in military forward surgical facilities, is the end point of the 2 years military surgical course provided by the Val de Grace School.
Conclusions: This model is actually the most reliable and ethically acceptable teaching procedure we've found. During these teaching the students have to deal with open trauma and hemorrhagic lesions in damage control situation. We try to follow the different type of war related lesions observed in French military in order to stick to the reality of the field. This teaching is now mandatory before being deployed as a military surgeon on field.

Fig. 1

PC 368

Shotgun hip injury with femoral neck fracture and sciatic nerve injury: a clinical case

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Case history: 29-year-old male, previously healthy, admitted to the ER due to shotgun injury to the right hip. During transport, the bleeding open wound was covered, two IV catheters were introduced, and saline and painkillers were administered. On admission, the patient was conscious, eupneic and normotensive, with a GCS score of 15.
Clinical findings: After the primary survey and exclusion of cranial, thoracic and abdominal lesions, the limb injury was addressed, showing a 3 × 4 cm oval-shaped wound. The right leg was shortened and externally rotated. Pulses were present but the patient referred calf and foot hypoesthesia.
Investigation/results: X-rays showed a comminuted pertrochanteric fracture and the presence of metallic foreign bodies.
Diagnosis: Open right pertrochanteric fracture.
Therapy and progressions: Initially, the wound was covered, and IV antibiotics and supportive therapy were given. In the OR, irrigation, surgical debridement, and foreign body removal were performed, followed by ORIF with one Dall-Miles cable and a cephalomedullary femoral long nail. After surgery, the patient maintained lower limb hypoesthesia and had plantar flexion and foot dorsiflexion grade 0 motor deficit. During follow-up, soft tissues recovered uneventfully and bone healing successfully occurred. Full weight-bearing was tolerated at 6 weeks post-op but the neurological deficits persisted despite physiatric treatment. Electromyography confirmed severe partial lesion of the sciatic nerve.
Comments: Generally, clean wound, fracture stability, restoration of circulation and skin closure of neurovascular structures are a priority and should be a reason for delayed nerve repair.
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Fig. 1

Fig. 2

PR 369

Mass casualty incidents involving the paediatric population: hospital preparedness in Milan, Italy

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Introduction: Despite Mass Casualty Incidents (MCI) are becoming a common concern, particularly regarding the care of paediatric victims, pure Paediatric Trauma Centres (PTC) are still rare in Europe. The purpose of this study is to assess the capacity of the hospitals in the metropolitan area of Milan in case of MCI involving the paediatric population, with focus on the pre-impact planning phase.
Material and methods: Relevant literature and existing guidelines were reviewed by the representatives of four referral centres for the management of either trauma or paediatric patients. Minimum standard requirements of care of paediatric trauma and consequently the maximal surge capacities for each hospital were defined based on the severity of injuries and personnel/equipment availability.
Results: Overall, the four hospitals are able to treat 8 patients with the highest priority (T1), 8 to 12 patients with intermediate priority (T2), and 24 patients with deferrable priority (T3). Severely injured patients < 3 years old should be preferentially transported to the hospitals with paediatric expertise, whereas patients between 3 to 12 years of age can be managed in multi-speciality structures.
Conclusions: In case of MCI it is not always possible to rely on the availability of a PTC. Hospitals with paediatric trauma care expertise can work in synergy with PTCs, or offer an alternative if there is no PTC, and should therefore be included in disaster plans for MCI involving paediatric victims.
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PC 370

Proximal ulna infected pseudoarthrosis secondary to a gunshot fracture: a case report

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Case history: We present a case of a 46-year-old male with a proximal radius and ulna gunshot fracture associated with a complete lesion of the brachial artery, which was urgently repaired by grafting in his native country. A partial proximal radius excision was also performed. Three months later, after soft tissue recovery, the ulna fracture was fixed with a DCP plate plus iliac crest bone graft. At 2 months follow up X-rays showed hardware loosening, so the plate was removed and an external fixator was implanted. In this situation the patient attended to our clinic 18 months after the initial injury.
Clinical findings: Findings included proximal pin purulence, an elbow varus deformity and a limited joint motion: flexion 45°, extension 40°, supination/pronation 20°.
Investigation/results: X-rays and CT scan showed proximal ulna pseudoarthrosis.
Diagnosis: Proximal ulna pseudoarthrosis after a gunshot fracture.
Therapy and progressions: A two-stage procedure was performed. Initially we performed a wide debridement and external fixator removal. An ulna nail combined with gentamicin and vancomycin PMMA spacer was implanted. *S. aureus* was identified in intraoperative cultures. In a second stage, 1 year after, the nail and spacer were removed and a vascularized fibula graft with saphenous loop was implanted and fixed with a VA-LCP plate. The central band of the interosseous membrane was repaired with a prosthetic device. Currently, the patient presents full flexion range, hyperextension of 20°, active pronation of 50° and supination of 20°. X-rays show graft consolidation.
Comments: Gunshot fractures are complicated lesions with significant soft tissue damage and high risk of vascular and nervous injury. A thorough study and initial systematic approach is mandatory in order to avoid later complications.
References: Dell PC, Sheppard JE. Vascularized bone grafts in the treatment of infected forearm nonunions. J Hand Surg Am. 1984;9:653–8.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 371

Clinical analysis of features in pediatric trauma among preschool-aged children at a single institution

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Introduction: The purpose of our study was to independently analyze pediatric trauma data, especially that of preschool-aged children, including demographics, injury patterns, the associated mechanism of injury, and outcomes, at a single institution in Korea to gain a better understanding of current trends in non-regional trauma centers.

Material and methods: We conducted a retrospective review of preschool-aged children with trauma, who presented to the emergency department a single center between March 2010 and December 2018.

Results: Overall, there were 303 pediatric patients who experienced trauma admitted during this study period. The frequency of admissions was similarly high in all seasons except winter. Falls were the most common mechanism of injury at all ages, except 1, 2, and 4 years of age, according to comparative analysis by age and mechanism. The most common place of trauma at 1–3 years of age was at home, and outside the home at the age of 4 years or older. The most common injury region was to an extremity (65.7%). Mean injury severity score was 5 ± 4.3, and the mean hospital stay was 5.9 ± 10.4 days.

Conclusions: Although mortality from trauma is low in pediatric patients, we must continue to improve treatment outcomes for children. It is unlikely for a hospital to have a pediatric trauma specialist, such as a pediatric orthopedic surgeon or plastic surgeon, due to manpower constraints. In order to further improve the outcome of treatment with insufficient resources, it is necessary to recognize age-specific characteristics.

References: 1. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AA, Branche C, Rahman Af, et al. World Health Organization. World report on childhood injury prevention. WHO;2008.

2. Upperman JS, Burd R, Cox C, Ehrlich P, Mooney D, Groner JI. Pediatric applied trauma research network: a call to action. J Trauma. 2010;69(5):1304–7.

3. Frieda H. Pediatric trauma systems: critical distinctions. J Trauma. 1999;47:S85–9.

Fig. 1

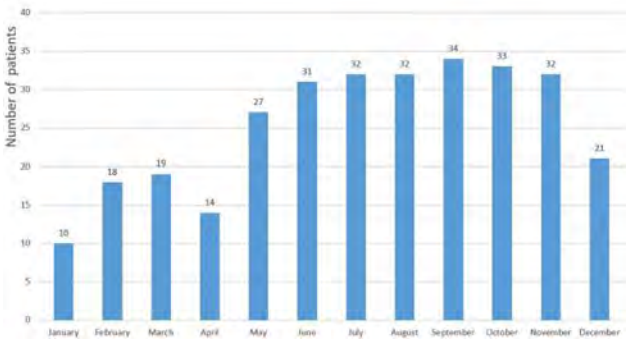

Fig. 2

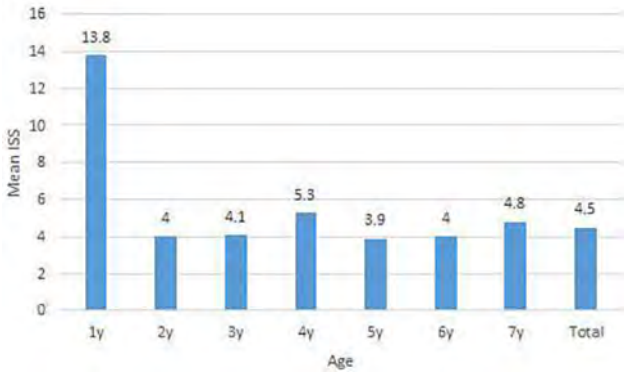

Fig. 3

Table 1. Demographics of 303 pediatric trauma patients

	All patients, n (%) (n=303)
Male	188 (62)
Age(y), mean±SD	4±1.7
Mechanism of injury	
Falls	113 (37.3)
Slip down	65 (21.5)
Other blunt trauma	42 (13.9)
Vehicle related incident	28 (9.2)
Crush	19 (6.3)
Stab	13 (4.3)
Bicycle	12 (4.0)
Unknown and not specified	9 (3.0)
Violence	2 (0.7)
AIS body region of primary diagnosis	
Head or neck	21 (6.9)
Face	94 (31.0)
Chest	5 (1.7)
Abdomen	9 (3.0)
Extremities	199 (65.7)
Combined injuries	18 (5.9)
Location of incident	
Home	85 (28)
Not at home	165 (54.5)
Traffic	41 (13.5)
Unknown	12 (4)
ISS, mean±SD	5±4.3
ISS>15	11 (3.6)
Operation	243 (80.2)
Length of hospital stay	5.9±10.4

SD, standard deviation; AIS, abbreviated injury scale; ISS, injury severity score.

Fig. 4

Table 2. Comparison of place of trauma by age

Place/ Age, n (%)	1 y	2 y	3 y	4 y	5 y	6 y	7 y	*p*-value
Home	2 (50)	13 (52)	20 (49)	14 (33)	16 (31)	11 (15)	9 (14)	.001
Not at Home	2 (50)	8 (32)	18 (44)	22 (51)	30 (59)	43 (57)	42 (66)	
Traffic	0 (0)	2 (8)	1 (2)	7 (16)	4 (8)	17 (23)	10 (15)	
Unknown	0 (0)	2 (8)	2 (5)	0 (0)	1 (2)	4 (5)	3 (5)	

PR 372

Establishing a new modular concept for mass casualty training in a level one trauma center

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Question: The new safety situation in Europe and the lessons learnt civilian events of damage show that hospitals have to be prepared for mass casualties. The shift of the operational mode to "emergency medicine" have to be planed and practiced. The reporting tool for this is the hospital action plan (HAP) that every hospital should have. The efficiency of the existing plan is already proven in different large-scale exercises. In Germany the legislator obligates the hospitals to enable there staff to properly perform the different tasks of the HAP. In addition, the have to develop and evaluate proper training and exercises. Goal of this study was to establish along the HAP of a level one trauma center an modular mass casualty training (MANV 100) that would help to analyze the tasks to face and to deepen the existing structures of communication.

Method: We set a scenario with 100 casualties and evolved the different shifting phases of the trauma center (alarming-, mobilization-, constitution phase). Setting the concept of training outside the regular service period we took in account that there will be a lack of resources and material. We did not exercise in a large-scale but trained in small groups modular. We also did a screen adaption of the HAP of the trauma center to have a mind set for the staff and a starting point to the scenario. To teach our operative procedure we simulated our "3 columns concept" (medical, personal and infrastructure) to the staff. Specific to the different task groups (medical doctors, technicians, nurses) we exercised and the different sectors (ER, TRIAGE, OR, Command etc.) and the necessary shifts of the different hospital sectors when a mass casualty occurs. Before and after we did a query of the staff to see how much impact the modular exercise would have on the HAP-knowledge of our staff.

Results: We were able to simulate realistically an identical mass casualty scenario to different staff groups of our hospital. Knowledge about the HAP increased significant from 76 to 92% after the trainings. 97% of the staff see a clear improvement of information about the HAP. Also, the specific shifting-phases and the enrolment of the plan to move in an "emergency medicine mode" understand 85% better. 95% of the staff fell now a much better preparedness than before. 89% think that through modular exercises and small group training the communication in between working groups improved.

Conclusion: We could manage to improve a significant increase of knowledge about the HAP in our staff. All the small group modular training in the different sector can be easily but together in large-scale exercise and other teams like police, military or fire-department can easily be added.

EDUCATION

PR 61

Definitive surgical trauma care course (dstc): an updated international faculty assessment study

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Introduction: DSTC course focusses on surgical skills for trauma care. It is designed to teach surgical techniques for the definitive treatment of severe trauma. Currently, it has evolved into an international trauma team course. Our objective was to assess faculty members' opinion regarding course content, educational methods, and incorporation of non-technical skills.
Material and methods: A descriptive study was designed using an anonymous online survey issued from May 1 to August 31, 2019. Senior International faculties' opinion from 19 countries assessed. The survey inquired views of courses content, duration, adequacy of hands-on practice, need for updates, and usefulness of incorporating non-technical skills to the course.
Results: From the 102 surveys issued, 36 were (35%) answered. The course content was valued as very satisfactory by 58%; 97% were very satisfied or satisfied with courses educational method. 80% considered the time devoted to lectures, case discussions, and skills lab very adequate or adequate. Course duration (2½ days) was valued suitably by 80% of responders. The inclusion of non-technical skills was considered as very important by 19%, important 31%, of some importance 11%, of little importance by 31%, and unimportant by 8%. This result reflects the insufficient sense of significance, among some, of the importance of trauma team dynamics. Course content updates were seen as convenient by 97% of the surveyed population, suggesting them at least every 2–4 years.
Conclusions: DSTC international faculty response to the online survey tool was inadequate, receiving 35% of the targeted study population. Of the assessed faculty, most were satisfied with course content, duration, and educational methods. The surveyed population lacked a uniform perception of the importance of incorporating non-technical skills.
References: Mackenzie CF, et al. Efficacy of trauma surgery technical skills training courses. J Surg Educ. 2019;76(3):832–4.
No significant relationships to declare.

PR 62

Is DSTC evolving towards a trauma team training course? A three-country 5-year trend analysis

C. J. Yánez Benítez[1], J. L. Blas Laína[1], F. J. Turégano Fuentes[2], A. Güemes[3], G. P. Fraga[4], C. Mesquita[5], T. Lorente[6]

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Introduction: DSTC is an IATSIC course emphasizing on teaching surgical skills for trauma care. In many countries, it is an essential course focused on the "second hour" beyond ATLS and teamwork. Initially centered on the surgeon, it currently seems to be adopting a trauma team training (TTT) model, incorporating the anesthetist to the program (DS-DATC). Our objective was to review this changing trend in three countries: Spain, Portugal, and Brazil.
Material and methods: A descriptive study was designed by faculty from the three countries examining course records and analyzing its evolution during the last five years. Number and types of courses delivered in each country from 2015 to 2019 reported, and the proportion of DSTC to DS-DATC scrutinized. Frequencies and percentages calculated for categorical variables and the proportion of course types also determined.
Results: During the 5-year studied period, 70 DSTC courses were issued: 34 (48%) in Spain, 30 (43%) in Brazil, and 6 (9%) in Portugal. A total of 15 (21%) DS-DATC courses in the three countries, and the percentage of total delivered in each country was as follows; Spain 7 (21%), Portugal 5 (83%) and Brazil 3 (10%). Overall DS-DATC to DSTC ratio was 1:5, detailed as follows: Portugal 5:6, Spain 7:34, and Brazil 3:30. Of the three countries, Spain delivered the most courses and Portugal the highest DS-DATC proportion. The overall number of combined courses (1 in 2014 and 2015, 4 in 2018 and 6 up to August 2019) suggest a growing trend towards a trauma team training model.
Conclusions: DSTC course is evolving from an individual based trauma course to DS-DATC, a trauma team training approach. Of the studied countries, Spain delivered the most courses in both formats, and Portugal the highest DSTC to DS-DATC ratio. The current course format in these countries appears to be shifting from DSTC to DS-DATC.
References: Turégano et al. Teaching courses in the management of visceral trauma. Cir Esp. 2018;96(10):606–11.

PR 63

Personal data management: a review of current European legislation

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Introduction: The aim of this presentation is to raise some questions and doubts that medical professionals may have as they try to comply with the legislation on personal data management.
Material and methods: ESTES Educational Committee established a Study Group to review how current EU legislation should be implemented in medical practice, focusing mostly on the management of visual media data.
Results: Current EU regulations are very strict regarding the management of personal data, and mostly health care personnel are not complying with it.
Conclusions: We present a simplified approach to guide professionals in order to minimise legal problems.

PR 64

The impact of tabletop simulation exercises on Thai Emergency Physicians' preparedness level before a major incident

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Introduction: Thailand is a disaster-prone country with a high dependency on tourism. It has been affected by both natural and man-made emergencies. The Thai emergency healthcare system consists of emergency physicians working at hospitals and prehospital levels, emphasizing their essential role in emergency management of any incident. We aimed to investigate the Thai Emergency Physicians' level of preparedness by using tabletop simulation exercises and three different scenarios.
Material and methods: Using the 3LC (Three Level Collaboration) method, two training sessions were arranged for over 50 Thai emergency physicians, who were divided into three groups of prehospital, hospital, and incident command staff. Three scenarios of a terror attack and explosion, riot and shooting, and high building fire were discussed in the groups.
Results: Our findings indicate that the initial shortcomings in command and control, communication, coordination, and the ability of situation assessment increased in all groups step by step and after each scenario. New perspectives and innovative measures were presented by participants, which improved the whole management on the final day.
Conclusions: Tabletop simulation exercises increase the ability, knowledge, and attitude of Thai Emergency Physicians in managing major incidents in strategic, tactical, and operative managerial levels, and should be included in their professional curriculum.
References: Khorram-Manesh A, Berlin J, Carlström E. Two validated ways of improving the ability of decision-making in emergencies; results from a literature review. Bull Emerg Trauma. 2016;4(4):186–96.
Berlin JM, Carlström ED. Collaboration exercises—the lack of collaborative benefits. Int J Disaster Risk Sci. 2014;5(3):192–205.

PR 65

Use of pulsatile perfusion in a human cadaveric model: a realistic way to improve trauma surgery exposure for surgical trainees

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Introduction: Non-operative management of traumatic injuries has led to decreased surgical exposure for trauma trainees [1]. While simulation using cadavers may improve exposure to damage control techniques, tissue handling realism is variable depending on embalmment and perfusion techniques [2].
Objective: To evaluate the feasibility of perfused thiel cadaver use for trauma surgery simulation.
Material and methods: Thiel cadavers were cannulated in the ascending aorta and right atrium to create a left-to-right perfusion system. A magnetic pump was used to achieve a pulsatile flow with a gelatin-based solution, aiming for a flow of 4 L/min. Peripheral circulation was improved with arteriovenous fistulas (carotid-jugular, femoro-femoral and brachio-brachial). A left common iliac vein injury was performed laparoscopically through the sigmoid mesentery. The surgical trainee was blinded to the initial injury and assisted by a staff surgeon.
Results: A trauma laparotomy was performed. The small bowel was eviscerated and all four quadrants were packed with gauze. A left, expanding zone III hematoma was detected. The left sigmoid colon was mobilized to achieve proximal control of the left iliac vessels. The left common iliac vein was actively bleeding and ligated according to damage control principles. The left ureter was uninjured. The sigmoid mesentery was closed, without active bleeding. The remaining of the abdominal cavity was explored without other injuries. Time from laparotomy to closure was 43 min. Tissue handling and circulation dynamics were highly realistic due to thiel embalmment and pulsatile perfusion.
Conclusions: Pulse-perfused thiel cadavers represent a realistic simulation option for surgical trainees. Widespread implementation may provide accurate simulation for lifesaving procedures rarely performed in an era of non-operative management of traumatic injury.
References: 1. Engelhardt et al. J Trauma. 2001.
2. Kovacs et al. AEM Education and Training, 2018.

Fig. 1

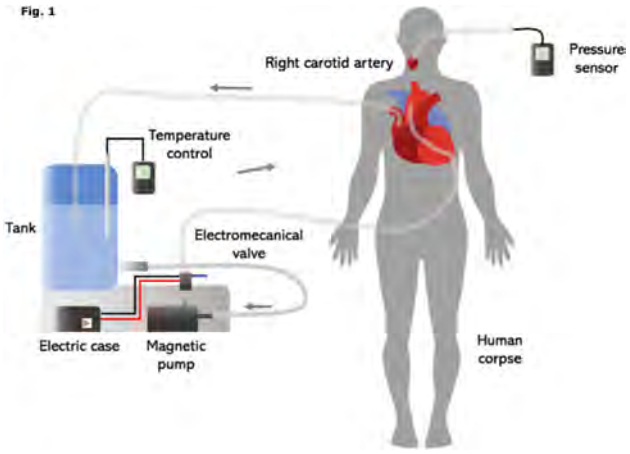

Fig. 2

Fig. 3

PR 66

A new concept of intra-operative performance monitoring and self-assessment in hepato-pancreato-biliary surgery and other surgical specialties

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Introduction: Currently, the majority of learning curve studies for surgical interventions associated with simple chronometric estimation in a whole: from incision to closure. A selective approach for step-by-step time fixation of all HPB interventions (hepatectomy, others) or other surgical specialties can bring a new vision of correlation between intra-operative timing and the clinical outcome.
Material and methods: Every operation can be divided into step items so standardized worldwide, for example, planned or urgent laparoscopic cholecystectomy e.g. incision to port placement, exposure, dissection to cholangiography, cholangiography, extraction, closure.
Results: The prototype named *CHRONOi* of infrastructure for automated monitoring (simulator of time tracking activities, web-service for request processing, database and knowledge base collection subsystems, learning curve representative and analytics software) is designed and to be implemented. Individual self-assessment is available in a real-time fashion. The learning curve changes are shown per procedure. Up to our knowledge, we can firstly in the world describe the surgeons, incl. in HPB, as speedy, standard or non-standard depending on the surgeon's "individual speed" in operative performance. It's to be documented in their e-logbooks according to the current Fellowship standards or practice re-certification.
Conclusion: The intra-operative monitoring and worldwide standardization give a new vision of the surgical practice in HPB surgery meaning an introduction of monitoring-based clinical outcomes (timing with morbi-mortality or other). Only new trials will approve the role of the presented concept in HPB surgery as well as in general, emergency and trauma.
References: Hepatobiliary Surg Nutr. 2017;6(4):239–45.
Surg Today. 2013;43(3):271–5.
Br J Surg. 2010;97(7):972–87.
HPB (Oxford). 2017;19(3):234–45.

The study was partially presented to DigH@cktion, Paris, and to the ECTES Congress Grant support in 2020.

PR 67

Traum'cast: innovating in teaching for trauma care

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Introduction: The management of patients victims of war weapons and collective emergencies represents a major public health issue in France, but also abroad. Terrorist events in recent years on the national territory have highlighted the need for training the population and caregivers in the management of these injuries. Because of his experiment in the domain, the French Military Medical Service (FMMS) was requested to cooperate with the French prehospital teams in order to improve knowledge and teaching in this area. Today, a continuing medical education, easily available and free access is needed in this area.
Material and methods: Development of video podcasts (infographics) of a few minutes on the theme of management of patients victims of war weapons and collective emergencies. The working group ensures the production and quality of educational messages. Production is provided by the Communication Establishment of Defense. The broadcast is displayed on the channel You Tube of the FMMS.
Results: The title of the Traum'cast podcast is the contraction of trauma and podcast. Twelve episodes are scheduled on a 2-weeks rhythm.
The podcast program is as follows:

1. Project presentation
2. War injuries
3. Combat casualty care
4. Triage
5. Damage control surgery
6. Damage control resuscitation
7. Transfusion strategies
8. Explosion
9. Severe burn injury
10. Injuries to the head and neck
11. Reconstructive surgery
12. Rehabilitation
13. Psychiatric injury
14. Interview: combat casualty

Conclusion: FMMS knowledge and experiment in managing patients victims of war weapons is unique. Teaching can take various forms, theoretical, practical, academic, or through publications. Traum'cast is a major innovation in the dissemination of this knowledge and each episode focuses on a specific skill. Traum'cast will highlight the applicability of military medicine concepts in a civilian environment. Traum'cast will be translated in an English version.
Project was supported by grants of French Ministry of Defense (Innovation Department).

PR 68

Splenectomy in current surgical practice: a tricky and elusive procedure for the surgical resident?

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Introduction: Splenic rupture and oncologic resections are the most common indications for splenectomy, but technical expertise is progressively being taken over by non-operative and more conservative approaches.
Material and methods: Retrospective review of all total splenectomies performed between February 2012 and January 2019 at an Italian academic hospital, assessing demographics, diagnosis, operating surgeon, surgical approach, complication rate, postoperative critical care admission, and 30-day mortality.
Results: Over 7 years, 163 consecutive splenectomies were performed by 25 different surgeons, 4 of whom surgical trainees, with 83 unplanned (i.e. emergency/iatrogenic injury) and 80 planned (i.e. benign/malignant disorders) procedures and an average of 11.9 and 11.4 procedures per year respectively. Over the study period, only 9 surgeons performed at least 6 procedures and only 5 performed at least 12 procedures. Laparoscopy was performed in 9.8% of cases, predominantly during planned procedures, with an overall 37.5% conversion rate mostly related to technical difficulties (i.e. spleen dimension, difficult vascular visualization). Overall major postoperative complication rate (Clavien-Dindo ≥ 3) was 19.6%, slightly higher in emergency procedures although not significantly different (13.7% vs. 25.3%, $p = 0.08$). Reintervention rate was 12.3%, due to hemorrhage in more than half of cases. Overall 30-day mortality rate was 5.5%, with elective 30-day mortality rate of 3.7% ($p = 0.49$).
Conclusions: Splenectomy may be required ever more rarely but potential risks are not irrelevant. Competence for surgical trainees should be achieved elsewhere (e.g. simulated/cadaveric training).
References: Kosola et al. Scand J Surg. 2019;1–7.
Dixon H. Ann R Coll Surg Engl. 2018;00:1–4.
Weledji. Int J Surg. 2014;12:113–9.

Fig. 1

Table 1. Planned splenectomies vs. unplanned splenectomies (February 2012 – January 2019)

	Planned (n=80)	Unplanned (n=83)	p
Gender **M**, *n* (%) **F**, *n* (%)	43 (53.7%) 37 (46.3%)	57 (68.7%) 26 (31.2%)	0.05
Age, years *mean ± SD* *(range)*	64.6 ± 15.3 (24 ÷ 87)	59.6 ± 22.2 (17 ÷ 92)	0.09
Duration of intervention, min *mean ± SD* *(range)*	181.3 ± 90.1 (45 ÷ 444)	127.2 ± 75.8 (20 ÷ 448)	0.0001
Surgical approach **Open**, *n* (%) **Laparoscopy**, *n* (%)	65 (81.2%) 15 (18.8%)	82 (98.8%) 1 (1.2%)	0.0001
Conversion rate *n*, %	6 (7.5%)	0 (0.0%)	1.00
Intraoperative complications *n* (%)	6 (7.5%)	4 (4.8%)	0.53
Postoperative ICU admission *n* (%) **Planned**, *n* (%) **Unplanned**, *n* (%)	46 (57.5%) 27 (33.7%) 19 (23.7%)	73 (87.9%) 16 (19.3%) 57 (68.7%)	0.0001
Overall postoperative complications *n* (%)	42 (52.5%)	47 (56.6%)	0.64
Major postoperative complications (Clavien-Dindo ≥ 3), *n* (%)	11 (13.7%)	21 (25.3%)	0.08
Reintervention *n* (%)	7 (8.7%)	13 (15.7%)	0.23
30-day mortality *n* (%)	3 (3.7%)	6 (7.2%)	0.49

Fig. 2

Table 2. Indications for splenectomy

Planned procedure, *n* = 80		Unplanned procedure, *n* = 83	
Malignant disease, *n* (%)	49 (61.2%)	**Emergency**, *n* (%)	64 (77.1%)
Lymphoma	12	*Trauma*	54
Metastatic disease	3	*Spontaneous rupture*	10
Oncologic resection	34	Pathologic spleen	9
Pancreas	16	Oral Anticoagulant therapy	1
Stomach	10		
Colon	5		
Adrenal gland	1		
Retroperitoneal sarcoma	2		
Benign disease, *n* (%)	31 (38.8%)	**Iatrogenic injury**, *n* (%)	19 (22.9%)
Splenic abscess	11	*Total/partial gastrectomy*	8
Splenic infarction	12	*Colonic resection*	9
Hematologic disease	4	*Nissen fundoplication*	1
Immune thrombocytopenic purpura (ITP)	3	*Pancreatic necrosectomy*	1
Spherocytosis	1		
Others	4		
Hemangioma	1		
Splenic artery aneurysm	1		
Splenomegaly	1		
Penetrating peptic ulcer disease	1		

Fig. 3

Table 3. Postoperative complication details

	Planned splenectomy (n=80)	Unplanned Splenectomy (n=83)
Overall postoperative complication rate, %	52.5%	56.6%
Pulmonary complications, *n* (%)	13 (16.2%)	30 (36.1%)
Abdominal collections, *n* (%)	21 (26.2%)	10 (12.0%)
Bleeding, *n* (%)	13 (16.2%)	15 (18.1%)
Others, *n* (%)	24 (30.0%)	22 (26.5%)
Clavien – Dindo classification grade, *n* (%)		
I	6 (7.5%)	11 (13.2%)
II	24 (30.0%)	15 (18.1%)
III A	2 (2.5%)	0 (0.0%)
III B	5 (6.2%)	10 (12.0%)
IV A	0 (0.0%)	3 (3.6%)
IV B	2 (2.5%)	2 (2.4%)
V	3 (3.7%)	6 (7.2%)

PC 69

Malposition of femoral component in hip arthroplasty

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Case history: An 84 year old femal patient underwent changing of the components of the THA because of aseptic loosening. Due to circumstances the surgeon decided to implant a cemented femoral component. The procedure was without any significant abnormalities. The first postoperative radiograph was planned after recovery—as usual. The X-ray imaging showed a misplaced femoral component. Therefore a CT-scan was performed additionally and the malposition of the cemented femoral component was confirmed. The patient had to undergo another surgery—removing of the cemented femoral component and implantation of a new well placed one.

Clinical findings: Malposition of the femoral component.
Investigation/results: There is no international standard in intraoperative imaging.
Diagnosis: Aseptic loosening of THA components.
Therapy and progressions: Changing of the component.

PR 70

Learning and training together:DATC/DSTC course in Spain, surgeon's point of view

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Introduction: DATC (Definitive Anesthetic Trauma Care) course is already established in some European countries like Denmark, Holland, Norway, France and Portugal. The first three editions (2014–2016) were offered along with the surgical version, the Definitive Surgical Trauma Care (DSTC) course, in a combined program on trauma care for surgeons and anaesthesiologists. Master classes are based on well-established principles of trauma care of critical injured trauma patients in the ED, OR and the ICU. The aim of the study was to assess the opinion among spanish surgeons after attending this combined two and a half day course with anesthesiologists.
Material and methods: A follow-up questionnaire was sent by email. 15 questions of 3 groups of issues: (1) self-efficacy in trauma care after attending the course, (2) contents of the DATC course, (3) role of the anesthesiologists in trauma care and relationship with the Anesthesiology. We obtain 18 responders from the last three years.
Results: (1) Self efficacy in trauma care: 90% of them still considered the course quite or very beneficial for their clinical practice. Average confidence rating in managing trauma patients improved from 6 out of 10 pre-course to 8 out of 10 post-course. (2) Contents of the DATC course: 90% considered technical contents of the DATC course as the best part of it 100% of the responders would recommend the course to another surgeon (50% the combined version and 50% the surgical version alone. (3) Role of Anesthesiologists in trauma care/relationship with Anesthesiology: 100% of the responder consider team working the best approach in trauma care. 70% of the surgeons think DATC/DSTC course could very benefitial for improving relationships with the anesthesiologist in daily clinical practice.
Conclusions: The DATC course has been well received in its first editions in Spain among surgeons involved in traumatic patients, with subjective evidence of empowerment and improved ways of judgment.

PC 71

Segmental absence of intestinal musculature: an uncommon cause of intestinal perforation

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Case history: A 55-year-old woman with a previous intestinal resection for spontaneous small bowel perforation returned to attention for an anastomotic leakage requiring rescue laparotomy and re-do anastomosis.
Clinical findings: Admitted to the Emergency Department complaining abdominal pain and fever, the patient quickly developed septic shock.
Investigation/results: Blood tests showed leukocytosis, high CRP level and anemia. CT scan revealed free fluid and air.
Diagnosis: Unknown peritonitis.
Therapy and progressions: After prompt resuscitation, an emergency laparotomy was performed and an anastomotic leak was found, requiring re-do ileo-ileal anastomosis. Postoperative course was complicated by intra-abdominal collection treated by antibiotics alone (Clavien-Dindo grade 2). The patient was discharged on 20th POD. At pathological report, segmental absence of intestinal musculature (SAIM) was diagnosed. The revision of past specimens confirmed the same finding.
Comments: Usually recognized in neonates/premature infants, SAIM is generally an incidental finding in adults [1], often undiagnosed and more frequently described in the colon [2]. In such scenario, main differential diagnosis is ischemia. Etiology is unclear and can be classified as either primary/congenital or secondary. The former is characterized by acute onset of symptoms, whereas in the latter a longer history of intestinal symptoms is usually present [1, 3]. Most authors agree upon a congenital pathogenesis. Generally, SAIM is associated with hollow viscus perforation and treated with surgical resection. Contrary to our experience, no recurrence of intestinal perforation has been reported [2].
References: 1. Segmental absence of intestinal musculature: a case report in an adult. BMJ Case Rep. 2009.
2. Segmental Absence of intestinal musculature: a 64-year-old female-case report and literature review. Am J Case Rep. 2006.
3. Segmental absence of intestinal musculature in an adult. Dig Dis Sci. 1998.

PR 72

How is the specific training in trauma of Spanish surgeons?

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Introduction: Specific training in the management of trauma patients is essential for surgeons. Training through courses in this area (ATLS, DSTC, MUSEC) directly impacts the care of these patients. The aim of this study is to know the specific training in trauma care of Spanish surgeons.
Materials and methods: A national survey has been sent to all member surgeons of the Spanish Surgeons Association. It has evaluated their degree of participation in Emergency Surgery Acute Care, and therefore the possibility of attending trauma patients, their participation in the initial care at their hospital, as well as their specific training in this area.
Results: The survey has been completed by 510 surgeons from 47 Spanish regions, and most surgeons who responded were from Catalonia and Andalusia. 456 (89.41%) of those surveyed take calls for

the ED. Only 171 (33.53%) report having a hospital registry of trauma patients. 72.15% of surgeons answer that in their hospital the general surgeon is not involved in the initial care of trauma patients. 66.47% have taken the ATLS course, 40.78% the DSTC course, and 11.57% the MUSEC course (or another course on E-FAST). Despite this, 85.69% consider the ATLS course should be mandatory during residency, and 43.33% of those surveyed consider trauma care in their hospital as very bad or deficient.

Conclusions: According to this survey, specific training in trauma care is still deficient in Spain and with many aspects that can be improved. Only 40% of those surveyed have received specific training in definitive surgical management of severe trauma. Despite this, a large percentage of surgeons take calls for the ED routinely, and face the challenge of managing these patients.

References: 1. Hogan MP, Boone DC. Trauma education and assessment. Injury. 2008;39(6):681–5.
2. Turegano Fuentes F, Pérez Díaz D. Teaching courses in the management of visceral trauma. Cir Esp. 2018;96(10):606–11.

PR 73

Exploring team leaders' decision-making challenges in civilian and military complex trauma

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Introduction: In the Nordic countries professionals may work in both civilian and military trauma care. Timely and effective decision-making in complex trauma is essential in improving survival benefits. The mindset and management priorities differ among medical professionals, and correlate with different experience levels. Trauma leaders are usually senior surgeons with extensive experience and well-developed decision-making skills. Simulation training has been shown to be effective in practicing decision-making. The aim of this study is to explore the team leaders' decision-making challenges in complex trauma care and structure them with the Activity Theory framework (AT).

Material and methods: Video recordings at a trauma center in Johannesburg and live observations of complex trauma training in Gothenburg focusing on team leaders' decision-making challenges were analyzed and systemized using the AT.

Results: The team leaders' activities were mapped onto the main elements of AT (Fig. 1) whereby the decision making challenges were classified into six categories (Table 1).

Conclusions: The AT framework may benefit and inform the design of educational interventions by structuring key issues of complex activities.

References: 1. Sonesson L, Boffard K, Lundberg L, Rydmark M, Karlgren K. Decision-making in management of the complex trauma patient: changing the mindset of the non-trauma surgeon. World J Surg. 2018;42(8):2392–7. https://doi.org/10.1007/s00268-018-4460-x.
2. Madani A, Gips A, Razek T, Deckelbaum DL, Mulder DS, Grushka JR. Defining and measuring decision-making for the management of trauma patients. J Surg Educ. 2018;75(2):358–69. https://doi.org/10.1016/j.jsurg.2017.07.012.
3. Wilson TD. A re-examination of information-seeking behaviour in the context of activity theory. Inf Res. 2006;11(4):paper 260.

Fig. 1

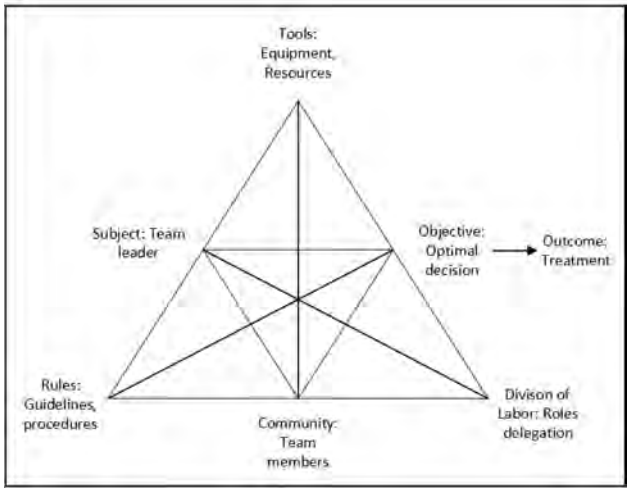

Fig. 2

Team leaders' activity	Complex trauma team leader's decision making challenges
Subject – Objective	• Obtaining patient history • Developing an action plan • Treatment prioritizing
Subject – Tools	• Access to equipment • Building a complete team
Subject – Rules	• Following crew resource management principles • Surgical complexity • Not standardized guidelines
Subject – Community	• Communicational/behavioral problems • Ethical conflicts • Conflicting information
Subject – Division of Labor	• Creating awareness of the team's predefined roles • Delegating roles • Avoiding micromanagement • Debriefing the team
Subject – Subject	• Collaborating with external teams • Different perspectives of team leaders

PR 74

Trauma prevention projects and sustained behavioral changes: P.A.R.T.Y. Program

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Introduction: Trauma is one of the main causes of mortality worldwide and prevention stands out as one of the main ways to modify its incidence. A prime example of such initiatives is the Prevent Alcohol and Risk-Related Trauma in Youth Program (P.A.R.T.Y.). It aims to raise awareness of the population most at risk for trauma, young people from 14 to 18 years. The study objective was to evaluate the program impact on students' knowledge and behavior.

Material and methods: A quantitative, uncontrolled intervention cohort study was conducted through the responses of the P.A.R.T.Y. in 2017 and 2018. Data collection occurred through the application of a questionnaire to participating and non-participating students of public schools in the city of Campinas, after a few months of participation in the Program.

Results: Among 697 answers, 53.9% were male, 87.2% between 15 and 17 years, and 22.7% program participants. Time between participation and answers was 10.4 (± 3.7) months. Regarding the first conducts when facing traffic trauma, 48.7% of those who participated chose the correct answer, against 14.8% of those who did not. About the first care while the service does not arrive, 85.5% of the first group answered correctly, compared to 35.1% of the second. Concerning about the service that should be called in the event of a trauma, 66.4% of participants would call correctly against 28.0% of non-participants. In questions related to traffic laws, 74.3% of participants opted for the correct answer as to what should be done in the face of a running over, against 23.20% of non-participants.

Conclusions: Students who had participated in the program had a higher rate of correct answers, a few months after the event, compared with students who did not attend. Thus, it is concluded that there is a impact over the time caused by it.

References: Dorigatti et al. Importance of multidisciplinary trauma prevention program for youth. Rev Col Bras Cir. 2014;41(4):245–50.

PR 75

Simulation training for intraosseous access is effective for residents: evaluation by successful insertion, comprehension tests, and questionnaires

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Introduction: Currently, intraosseous (IO) devices are necessary for the resuscitation of severe trauma patients. However, opportunities to learn IO device insertion are limited for residents. The aim of this study was to conduct a simulation of IO device insertion for residents and to evaluate its effectiveness.

Material and methods: In this simulation, residents inserted IO needles into the sternum of pigs under general anesthesia with the instructor's guidance. Comprehension tests and questionnaires about satisfaction level and self-efficacy were conducted before and after the simulation. The objective evaluation was the IO access success rate, and the subjective evaluation was obtained from points on comprehension tests and questionnaires.

Results: Thirty-six residents participated in this study. Just one resident had successfully obtained IO access clinically. Success rate of establishing IO access in the simulation was 100%. The rate of test completion was 100% and that of questionnaire with survey response was 61%. The comprehension test results improved from 9.2 ± 0.94 to 9.6 ± 0.79 (mean ± standard deviation, P = 0.01739) out of 10 points. The questionnaires concerning satisfaction level changed from 7.4 ± 2.9 to 14 ± 1.3 ($P < 0.0001$) out of 15 points. The questions specifically concerning self-efficacy dramatically increased from 1.8 ± 0.91 to 4.1 ± 0.64 ($P < 0.0001$) out of 5 points after the simulation.

Conclusions: The simulation in this study improved the knowledge, satisfaction level, and self-efficacy of the residents for IO access. The success rate of confirmation of IO access in this study was 100%. This experience may positively affect their clinical performance in trauma care.

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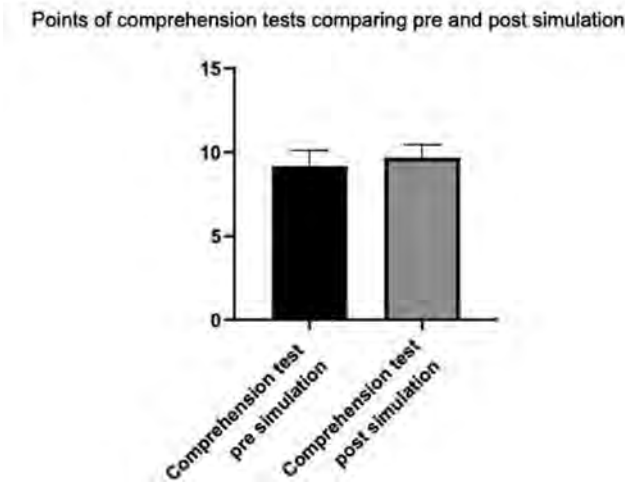
Fig. 1



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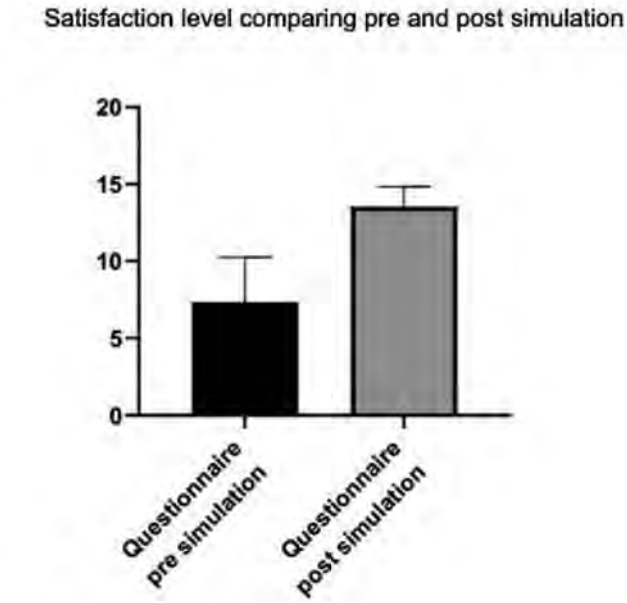
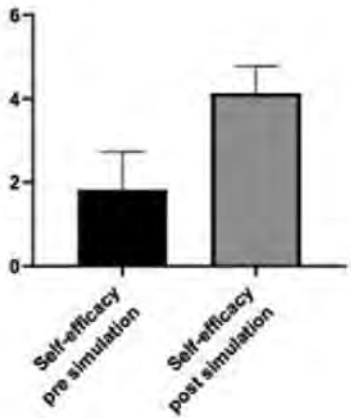


Fig. 3

Self-efficacy level comparing pre and post simulation



EMERGENCY SURGERY

PC 76

Right paraduodenal hernia, a forgotten cause of acute abdomen: report of two cases

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Case history: Case 1. A 37-year-old white man presented to the ED complaining of intense abdominal pain and vomiting. He referred at least two previous episodes with associated fever which resolved spontaneously. Case 2. A 35 years old white man consulted at the ED for intense abdominal pain, nausea, anorexia and constipation for the last 48 h. None history of abdominal surgery were registered.
Clinical findings: In both cases, the abdomen was distended without bowel sounds.
Investigation/results: Case 1. Abdomen xr: distended small bowel loops localized at the right side. CT scan: an encapsulated cluster of dilated small bowel loops into the ascending mesocolon. Case 2. CT scan: an encapsulated nonrotated small bowel in the right side of transverse mesocolon and mesenteric vascular pedicle displaced.
Diagnosis: Intestinal obstruction secondary right paraduodenal hernia
Therapy and progressions: Emergency midline laparotomy that evidenced a RPDH which was reduced before closing the mesentery defect. The postoperative was uneventful.
Comments: Paraduodenal hernias are a type of internal hernia and a rare cause of intestinal obstruction accounting for about 0.5% of all hernias. Right paraduodenal hernias are far less common than left ones. Symptoms of paraduodenal hernias are nonspecific. Preoperative diagnosis of PDH by imaging techniques is difficult. Contrast-enhanced CT scan is highly recommended as the most specific method of diagnosis for PDH. With the increased use and improved enhancement of CT scans, paraduodenal hernias currently can be diagnosed preoperatively. This advancement in diagnostics coupled with increasing experience and facility of general surgeons in using laparoscopic techniques has led to the initiation of laparoscopic repair of internal hernias.
References: Morales Joseph A. Right paraduodenal hernia. Fed Pract. 2017.
Khalaileh A. Left laparoscopic paraduodenal hernia repair. Surg Endosc. 2010.

Fig. 1

PC 77

Diaphragmatic hernia after trauma as cause of intestinal obstruction: a case report

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Case history: A 52-year-old female patient who goes to the emergency department due to vomiting and abdominal pain. Since the accident, the patient reported post-prandial discomfort and gastroesophageal reflux, as well as self-limited abdominal cramps.
Clinical findings: Soft, depressible abdomen. Bowel sounds on left hemithorax.
Investigation/results: CXR: right hemidiaphragm elevation. Lab test: leukocytosis. Thorax and abdomen CT: right anterior diaphragmatic hernia and passive atelectasis secondary to ascent of dilated small intestine and colon.
Diagnosis: Intestinal obstruction secondary post trauma diaphragmatic hernia.
Therapy and progressions: Emergency laparotomy due to symptoms compatible with intestinal obstruction secondary to incarcerated diaphragmatic hernia. It is right diaphragmatic chronic rupture chronic with omental incarceration, antrum, small bowel and ascending colon with reversible signs of suffering. Chelotomy and content reduction, herniorrhaphy with loose spots with non-absorbable material are performed. Endothoracic drainage is left removed at 48 h. The postoperative course is uncomplicated.
Comments: Trauma events should be considered in the diagnostic process to avoid delayed treatment.
References: Pakula A, Jones A, Syed J, Skinner R. A rare case of chronic traumatic diaphragmatic hernia requiring complex abdominal wall reconstruction. Int J Surg Case Rep. 2015;7:157–60.

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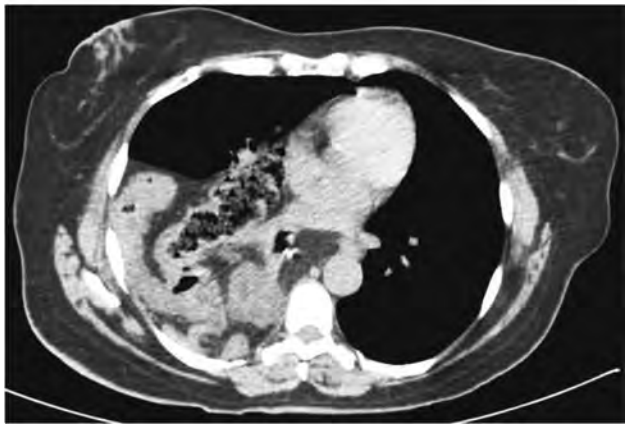
Wakai S, Otsuka H, Aoki H, Yamagiwa T. A case of incarcerated and perforated stomach in delayed traumatic diaphragmatic hernia. Tokai J Exp Clin Med. 2017;42(2):85–8.

Fig. 1



PC 78

Acute complication in a rectal gastrointestinal stromal tumor (GIST)

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Case history/clinical findings: We present a 61-year-old male patient with a history of large pelvic mass in the rectum-prostate space under study, since 4 months. He were admitted into the emergency unit, 3 days after the mass biopsy, with fever up to 40° C and rectorrhagia. The patient rapidly developed septic shock with hemodynamic instability and elevation of acute phase reactants. Abdominal CT was performed: pelvic mass of 11 × 9.3 × 12.5 cm, of heterogeneous content, with areas of blood density. We decided doing an emergency surgical exploration of this mass as the only suspected origin of infection.

Investigation/results: In the surgical exploration the mass was protruding on the anterior rectum wall. The mass was drainaged with an output of 400 ml of purulent material mixed with clots and necrotic tissue. Foley No. 22 probe was placed inside the cavity. In the postoperative period, the patient showed significant hematochezia, so he was reoperated performing hemostasis and rectal tamponade. It was effective and a new Foley catheter was replaced at 24 h. When the purulent drain gave way, the catheter was removed and the patient evolved favorably.

Diagnosis: Cytology analysis: mesenchymal type lesion, morphologically and immunophenotypically compatible with GIST (Gastrointestinal Stromal Tumor). IHQ Profile: CD34, DOG1, C-KIT positive.

Therapy and progressions/comments: The complications of GIST are usually acute abdomen due to peritonitis secondary to perforation or hemorrhage. However, the formation of intratumoral abscesses is very inusual, although is described in the literature. Emergency surgery is often necessary due to the significant affectation of the general condition of the patient and the difficulty of the diagnosis.

Fig. 1

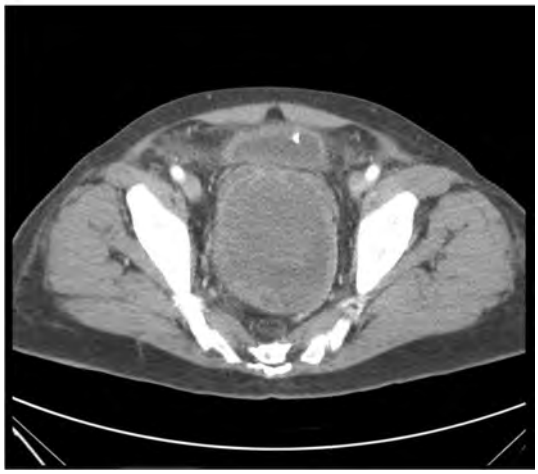
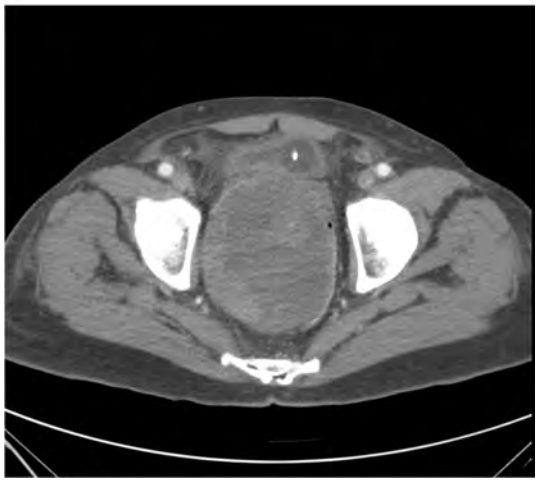


Fig. 2



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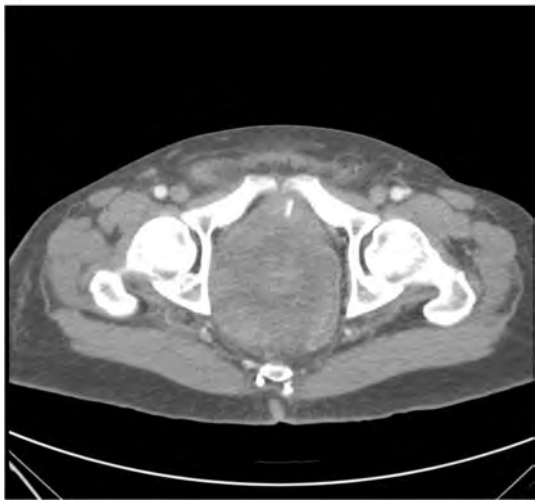

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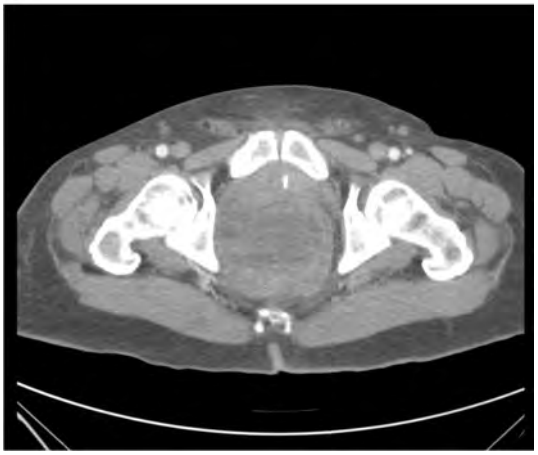

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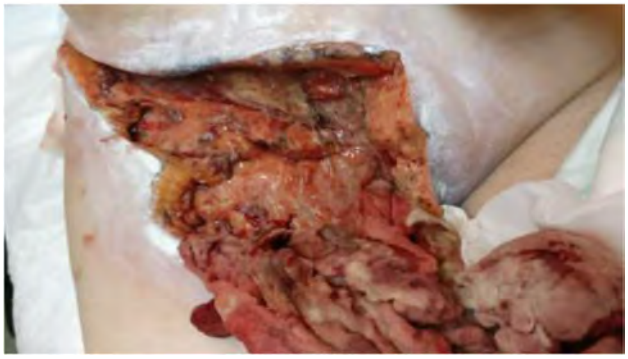

Fig. 2

Fig. 3

PC 79

Fourniers gangrene: an emergent surgical pathology

J. Gomes[1], L. Germanova[2], M. Mega[1], S. Usurelu[1], R. Monteiro[1], J. Peliteiro[1], M. Romano[1], A. Gouveia[1]

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Fournier's gangrene (FG) is a surgical emergency defined by an obliterating endarteritis of the subcutaneous tissue arteries of infectious etiology, with progressive necrotizing fasciitis of the perineal, abdominal, thoracic or lower limbs, which can lead to multiorgan failure. A 75 years old woman was admitted in our ER presenting with a 1 week worsening vulvar pain. Clinical exam showed vulvar and mons Venus erythema, without lesions, BP was 111/47 mmHg and she had a fever of 38.2 °C. Blood work showed leukocytosis ($27.68 \times 10^3/\mu L$), neutrophilia ($25.8 \times 10^3/\mu L$) and CRP of 387 mg/L. Past medical history of obesity, right THP and total thyroidectomy. Vulvar cellulitis was the initial diagnosis and empirical ATB was implemented. On D2, due to an evolution into septic shock and spread of an emphysematous inflammatory process to the right thigh and buttock, the diagnosis of FG was made. During emergent surgery we observed extensive fascial and tissue necrosis from the ASIS and suprapubic region to the proximal third of the right thigh and perineum. Extensive necrosectomy, drainage of purulent exudate and transversostomy were performed. Empirical second-line broad-spectrum ATB was started. She underwent new necrosectomies and surgical debridements on PO days 2 and 4 and needed ICU stay for 5 days. Daily dressing changes were performed with povidone iodine and later with octenidine. Microbiology sample showed polymicrobial infection with Gram positive and negative organisms as well as anaerobes, thus confirming the diagnosis of FG type I of vulvar origin. After surgical and HD stabilization, the patient underwent plastic reconstructive surgery, with local flaps and partial skin graft. The postoperative period was uneventful and the outcome was great.

References: Stevens DL, Bryant AE. Necrotizing soft-tissue infections. N Engl J Med. 2017;377(23):2253–65. https://doi.org/10.1056/nejmra1600673. Review. PubMed PMID: 29211672.
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Fig. 4

PR 80

Appendicitis in the elderly

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Introduction: Appendicitis is not uncommon in the elderly but may often be mis-diagnosed [1]. The aim of this study was to explore the specific traits and treatments of this group in a Swedish context to better understand where to optimize the management.
Material and methods: All acute appendectomies registered in the Southern General Hospital registry between January 2015 and June 2019 constituted the cohort (n = 2687). Patients were stratified into two groups; ≥ 65 and < 65 years of age. Significances were computed with Pearsons Chi2 and ANOVA.
Results: The older group made up 8% of the study population (n = 214). The elderly population was female to a larger extent (OR 1.57, $p < 0.05$), triaged higher in the emergency department ($p < 0.05$) and had higher ASA classifications ($p < 0.05$). The elderly were also perceived as sicker at the time of decision for surgery, expressed as having higher priorities for surgery ($p < 0.05$). No significant difference between the groups in time from arrival to decision for surgery was found, nor for the time from arrival to surgery. There was a higher rate of perforations in the elderly group (53.8% vs 25.0%, $p < 0.05$), twice the length of hospital stay ($p < 0.05$) but no significant differences in complication rates (9.2 vs 5.8%, p = 0.71). Twenty-eight day mortality rate was 0% in the younger group and 1.9% in the older group ($p < 0.05$).
Conclusions: This study shows that an elderly group of appendicitis patients are more frail and more acutely sick when presenting to the hospital. In spite of higher priority for surgery, the elderly experience longer hospitalization and higher mortality rate, but not more complications. The findings are consistent with antecedent research.
References: 1. Spangler et al. Abdominal emergencies in the geriatric patient. Int J Emerg Med. 2014;7:43.

PR 81

Consent quality in patients undergoing emergency versus elective cholecystectomy

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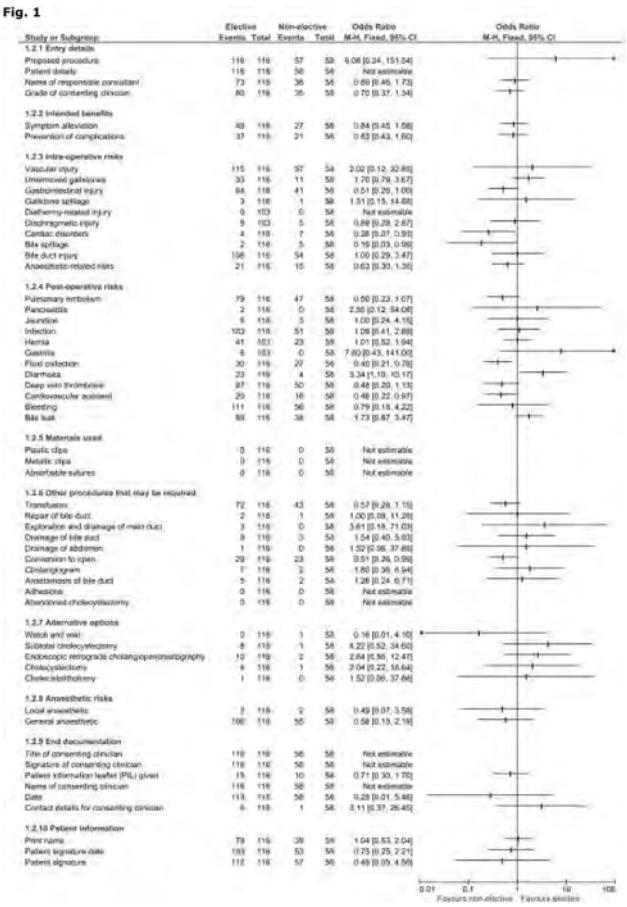
Introduction: Existing evidence points towards the notion that patients undergoing emergency surgery receive a poorer consenting quality when compared to their elective counterparts. With 70,000 cholecystectomies in England a year, cholecystectomy is one of the most frequently performed procedures both in the emergency and elective settings. However, to date, no studies have explored the relationship between consenting quality and the setting of cholecystectomy. We aimed to measure the quality of informed consent (IC) for patients who underwent emergency vs elective cholecystectomy.
Material and methods: The final review included the analysis of 174 IC forms completed between 2011–2017. Percentage proportions were calculated to demonstrate the degree of completeness of consenting against a total of 57 components of information. Binary regression was utilised for subgroup analysis.
Results: Patients undergoing emergency surgery were more likely than elective patients to be warned of severe perioperative complications such as cardiac disorders (46.6% vs 25.9%, p = 0.038), fluid collection (46.6% vs 25.9%, p = 0.010), and infected bile spillage (8.6% vs 1.7%, p = 0.049). Elective patients were more likely to be counselled about the risk of less serious side effects of cholecystectomy such as diarrhoea (19.8% vs 3.4%, p = 0.027). Patients in ASA 2–3 group were more likely to be counselled about the occurrence of pulmonary embolism. Interestingly, patients were more likely to receive a patient information leaflet if they were females and under 60.
Conclusions: The results of this study demonstrate multiple inconsistencies in the level of disclosed information to patients undergoing cholecystectomy. The results suggest that the consenting physicians make assumptions regarding the information that the patient would like to receive based on patient demographics and clinical factors, highlighting the need for more consistent consenting procedures.

Fig. 1



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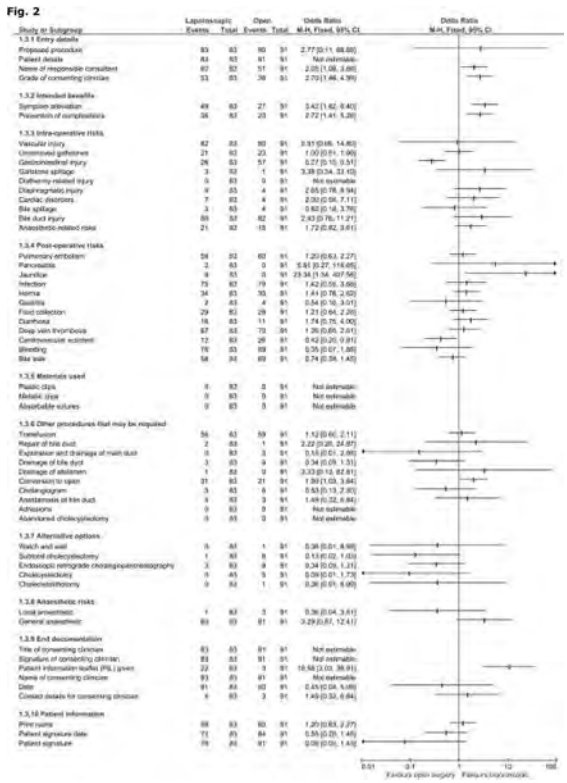

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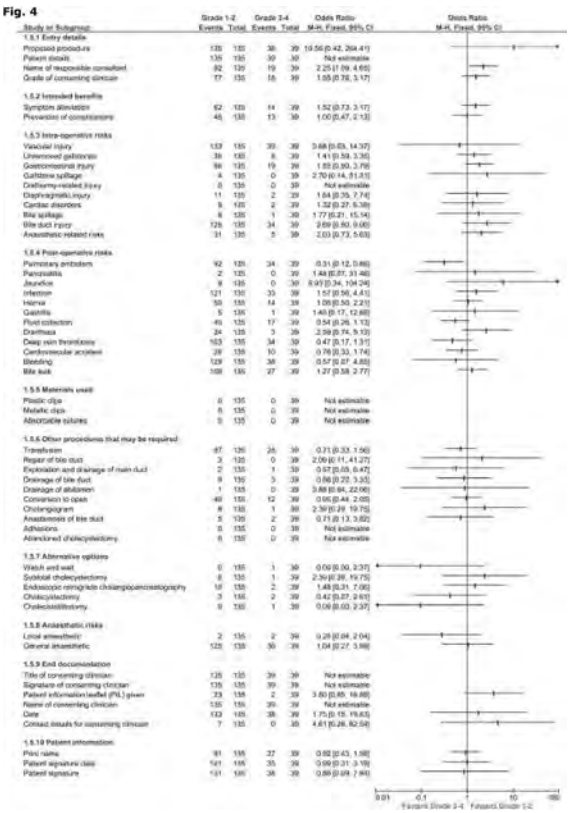

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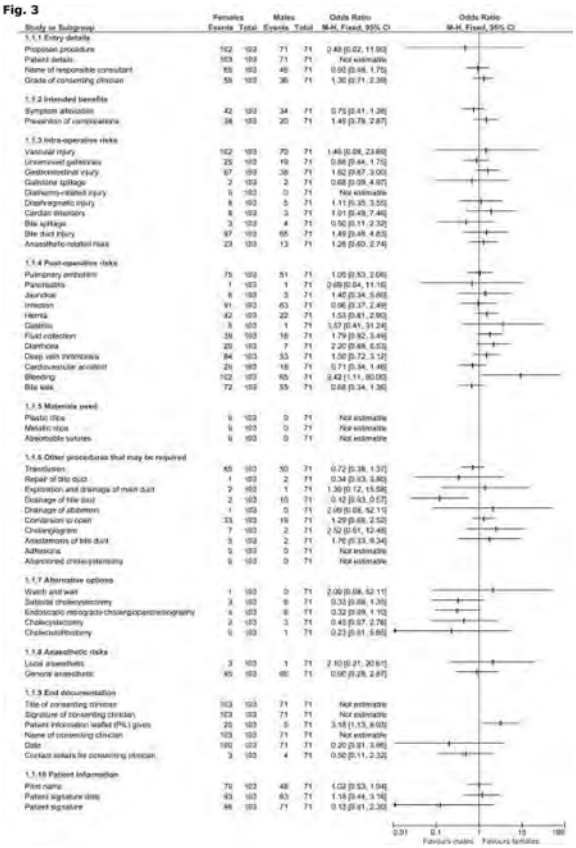

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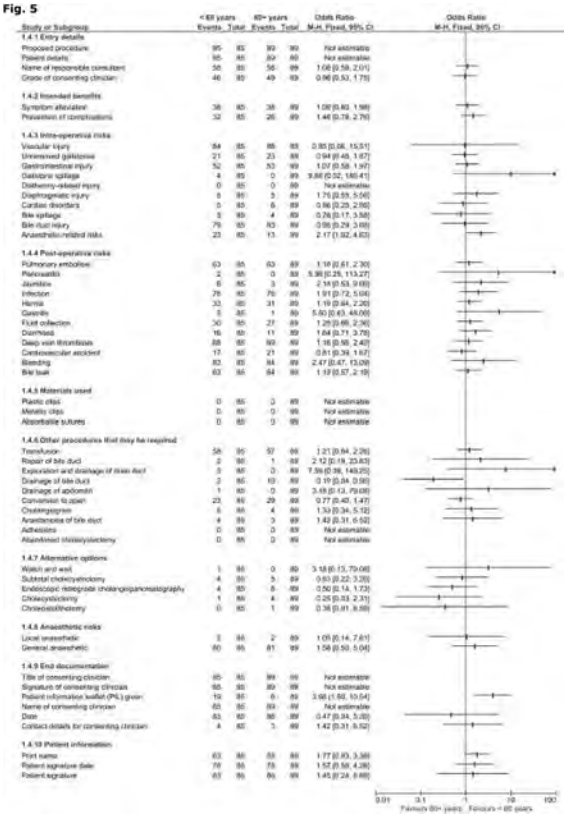

PR 82

Acute calculous cholecystitis and the timing of cholecystectomy: advocating early surgery

I. Moutsos[1], *R. Lunevicius*[1]

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Introduction: Cholecystectomy cures acute calculous cholecystitis (ACC) in nearly all patients and, according to NICE, AUGIS, TOKYO and WSES guidelines, should be conducted at the earliest opportunity, within 7 days of the diagnosis. The present audit aimed to measure whether the care of patients with ACC meets the standards of best practice and to assess whether early cholecystectomy was a more beneficial and safer intervention as compared to delayed cholecystectomy.
Material and methods: A "snapshot" sample of 50 patients operated on between 12/2018 and 06/2019 with an index admission diagnosis of ACC was reviewed. The selected patients were divided into three subgroups according to the timing of their surgery: 1–7 (early), 8–28, and > 28 days. The other measures used in this audit were the rates of conversion to open surgery, subtotal cholecystectomy (STC), peri-operative complication-specific morbidity, secondary interventions, and admission to intensive therapy unit (ITU).
Results: Nine patients (18%) underwent early cholecystectomy—laparoscopic (n = 8) or primary open (n = 1); 40 of the other 41 patients—delayed laparoscopic cholecystectomy. The rates of STC were similar in both subgroups—11.11% (1/9) vs 9.76% (4/41). Delayed cholecystectomy was related to five side effects: higher rates of postoperative collections (three patients, 7.32%), external bile leak (one patient, 2.44%), ERCP (2.44%), emergency re-operations (two patients, 5.56%), and admission to ITU (5.56%). They all occurred in the delayed > 4 weeks surgery subgroup of 36 patients.
Conclusions: Although no significant associations were found when comparing early to delayed cholecystectomy, this analysis shows that postoperative morbidity, the rates of secondary interventions and admissions to ITU were higher when surgery was delayed. This audit advocates that early cholecystectomy should become a standard of practice as per national and international guidelines.

PC 83

Esophagopericardial fistula following primary repair for chronic esophageal ulceration presenting with pericardial tamponade: a case report and outline of management and treatment

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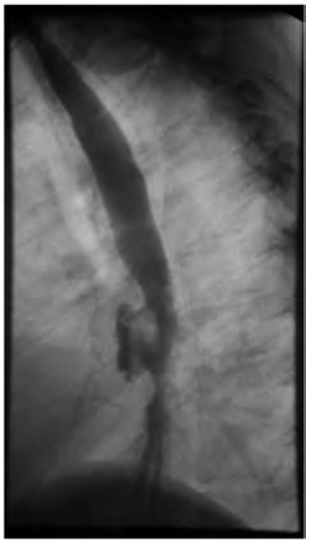
[1]North Estonia Medical Center, Surgery, Tallinn, Estonia, [2]The University of Chicago Medicine, Department of Surgery, Section of Trauma and Acute Care Surgery, Chicago, Illinois, United States

Case history: A 54-year-old man with chronic esophageal ulcerations presented with substernal pain, fever, and shortness of breath. A radiograph revealed a right pleural effusion and pneumomediastinum consistent with an esophageal perforation (Fig. 1). He underwent a right thoracotomy, primary esophageal repair with intercostal muscle flap buttress, and gastrojejunostomy feeding access. A post-procedural gastrograffin study demonstrated an anastomotic leak (Fig. 2). A right thoracostomy drain was placed for diversion. The patient was discharged home and returned 10 days later.
Clinical findings: He presented with substernal pain, hypotension, and fatigue. Thoracic computed-tomography (CT) revealed a pneumopericardium and an esophagopericardial fistula (EPF) manifesting as pericardial tamponade (Fig. 3).
Diagnosis: EPF.
Therapy and progressions: The patient underwent a subxiphoid pericardial window and mediastinal drain placement for decompression. An esophagogastroduodenoscopy revealed an exposed right atrium, thus precluding esophageal stenting. Sepsis and antibiotic-associated Clostridium Difficile colitis complicated his post-operative course. Once resolved, the patient underwent a partial esophageal resection, EPF ligation, and esophagogastrostomy. The postoperative gastrograffin study did not demonstrate an anastomotic stricture or leak. The patient tolerated a regular diet and was discharged home.
Comments: Esophagopericardial fistula is a rare clinical entity most often caused by benign disease. Prompt diagnosis and treatment—pericardial decompression and fistula ligation—is critical. Due to wide use of proton pump inhibitors and development of interventional radiology (IR), causative reasons are changing.

Fig. 1

Fig. 2



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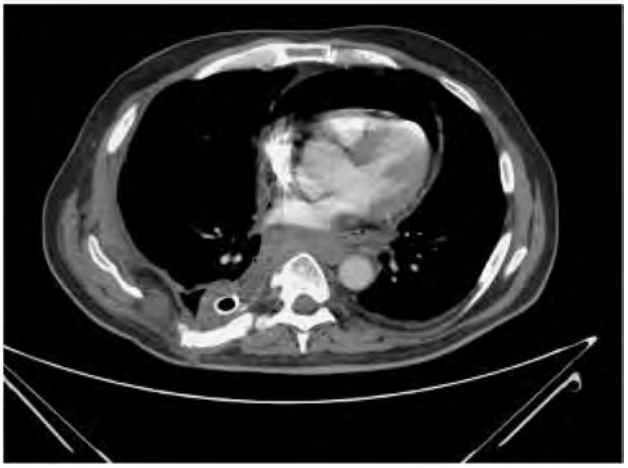

PR 84

Microbiology of community acquired, hospital acquired and postoperative peritonitis

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[1]SMZ Ost-Danube Hospital Vienna, Department of Surgery, Vienna, Austria

Introduction: Secondary peritonitis yields high morbidity and mortality rates. Besides rapid source control, adequate antimicrobial therapy is essential to improve outcomes. Thus initial empiric therapy has to take suspected germ spectrum as well as possible resistance rates into account. Microbial selection and resistances may pose problems during prolonged administration of antibiotics. However, a possible negative effect of multi-resistant germs on mortality has not yet been clarified. The choice of a suitable antibiotic and the relevance of its efficacy on isolated germs as well as the relationship between germ spectrum and clinical condition of the patients need to be clarified.
Material and methods: Intraabdominal swabs from consecutive patients from 2010 to 2018 requiring intensive care due to secondary peritonitis were evaluated retrospectively. Patient characteristics and outcomes, germ spectrum and resistance rates were collected. Changes over the course of therapy and development of resistance as well as influences on the clinical course were analyzed.
Results: Samples from 195 patients (75 community acquired [CAP], 90 postoperative [POP], 28 hospital acquired non-postoperative peritonitis [HAP-non-POP]; 116 with open abdomen) were analyzed. Initially E. coli (26%), Bacteroides spp. (18%) and Enterococcus spp. (15%) were the most common bacteria. 35.4% of tested bacteria were resistant to Ampicillin/Sulbactam (POP 44.2%; CAP 22.3%; HAP-non-POP 39.5%) while 29.0% were resistant to second generation cephalosporins (POP 29.5%; CAP 31.2%; HAP-non-POP 21.4%). Microbial spectrum in open abdomen shifted over time: after 7–30 days of open abdomen Enterococcus spp. (37%) and Candida spp. (33%) were the most common germs.
Conclusions: We described the microbial flora of severe peritonitis at a medium sized acute care hospital. High resistance rates against certain antibiotics should be taken into account for guiding empirical therapy in peritonitis.

PR 85

Community, hospital acquired and postoperative peritonitis: outcome of ICU treated patients

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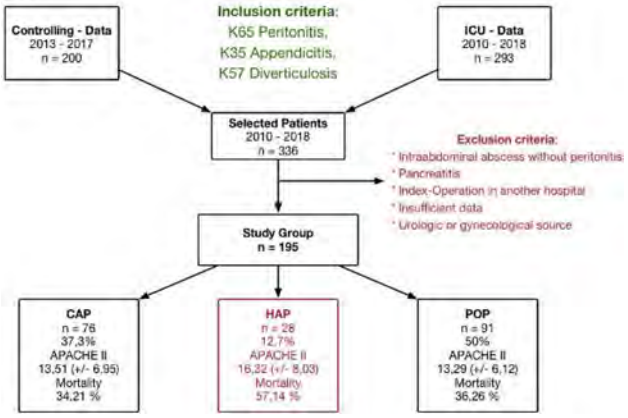
Introduction: Complicated intra-abdominal infections (C-IAI) represent challenging diseases with high mortality rates. Depending on different selection criteria and therapy strategies the reported mortality rates vary between 7.6 and 36%. Usually a distinction between community (CAP) and hospital acquired peritonitis (HAP) is made. HAP can further be classified as postoperative peritonitis (POP) or non-postoperative peritonitis (HAP-non-POP). We conducted a retrospective analysis of patients with C-IAI requiring intensive care therapy.
Material and methods: All patients with C-IAI requiring surgery and intensive care treated at the Danube Hospital in Vienna from 2010 to 2018 were retrospectively analyzed. A total of 195 patients where included into the study and grouped as CAP, HAP-non-POP or POP. For each group comorbidity and patient characteristics, source and cause of infection, hospital and ICU stay, APACHE II, SAPS II and SOFA-Scores, mortality and outcome were calculated and compared to each other, using fisher exact test or Mann–Whitney-U-test.
Results: A total of 195 C-IAI were treated, consisting of 37.3% CAP, 12.7% HAP-non-POP and 50% POP. Concerning the patient characteristics and comorbidities no significant differences were seen between the groups, except for malignant diseases which were significantly higher in POP. The postoperative (Source control) APACHE II and SAPS II values did not differ between CAP and POP (APACHE II mean: CAP 13.5, POP 13.29) whereas both were significantly higher in HAP-non-POP (APACHE II mean: 16.32). Mortality rates were not significantly different in CAP and POP (34.2% vs. 36.26%): however, HAP-non-POP was complicated by a nearly doubled death rate (57.14%).
Conclusions: Although patients with POP are described to have a higher mortality in the literature, this could not be shown in our study. Postoperative survival was comparable between CAP and POP patients. HAP-non-POP demonstrated a significantly higher mortality.

Fig. 1



PC 86

Acute appendicitis and acute diverticulitis presenting concurrently treated surgically and conservatively

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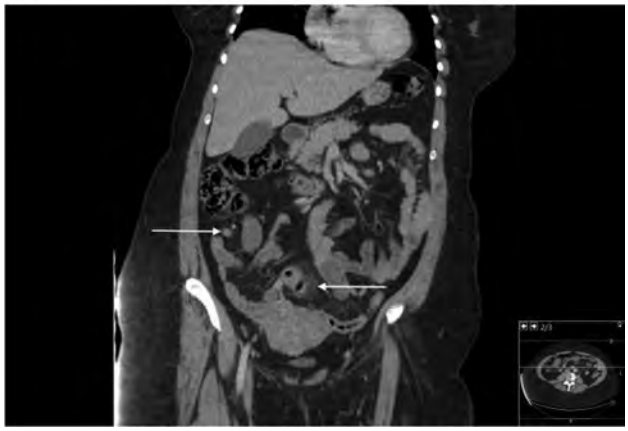
Case history: 46 year old female with one week of worsening lower abdominal pain associated with vomiting and loss of appetite. No relevant past medical history.
Clinical findings: On examination the abdomen was soft but there was tenderness and guarding in the right iliac fossa and suprapubic region. Her observations were stable on admission and she was afebrile.
Investigation/results: Laboratory tests demonstrated a WCC 24.79 ($\times 10^9$/L) and CRP of 57.5 (mg/L). Urinalysis was normal. A CT of the abdomen and pelvis with intravenous contrast demonstrated acute appendicitis with non-perforated sigmoid diverticulitis (Fig. 1, Fig. 2).
Diagnosis: Concurrent acute appendicitis and non-perforated sigmoid diverticulitis.
Therapy and progressions: The patient underwent a laparoscopic appendicectomy. Intraoperative findings included a retrocaecal inflamed appendix and diverticulitis in the pelvis which was not disturbed. There was no pus in the pelvis. She recovered well post-operatively and was discharged home to complete one week of oral antibiotics the following day. The histology demonstrated acute appendicitis.
Comments: There are very few reports in the literature of concurrent appendicitis and sigmoid diverticulitis despite these two pathologies being amongst the most common presentations of abdominal pain. This case demonstrates the value of cross sectional imaging, CT imaging is a helpful diagnostic tool and is highly sensitive and specific for both diverticulitis and appendicitis.The challenge in this case is balancing the two differing managements of these two conditions. Most cases of diverticulitis are managed conservatively with dietary modification and antibiotics. Operative management is only usually considered if there are associated complications such as intra-abdominal perforation. This is in contrast to appendicitis where the standard treatment is to undergo surgery.
References

Fig. 1



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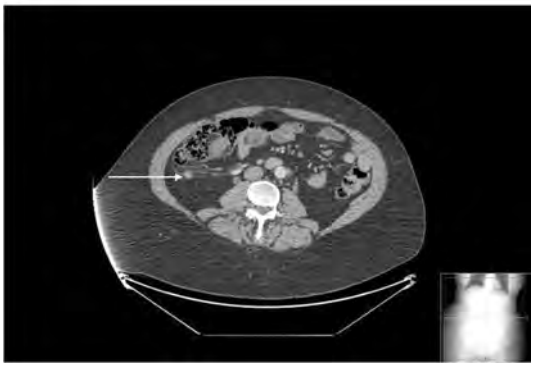

PR 87

Managing life-threatening traumatic hemorrhage: a new solution for a changing world paradigm

M. Deltoff[1]

[1]Core Scientific Creations, Research, Kfar Saba, Israel

Millions of people die from major trauma annually. 30–40% of these deaths are due to exsanguination, with nearly half dying prior to hospital arrival. When properly managed, these deaths are preventable. This paper summarizes data relating to the extent of hemorrhage as a cause of mortality in the traumatic arena. An overview of the pathophysiological steps occurring during massive bleeding and their clinical implication is presented. A variety of treatment options, both historical and current, is then discussed, including vascular occlusion methods and hemostatic dressings, along with their limitations and complications. Finally, WoundClot, a new hemostatic gauze, is introduced, which not only requires no compression when it is applied, but allows the first responder to rapidly and effectively treat more than one casualty within seconds. Additionally, it is adaptable to a wide array of clinical applications, both traumatic and surgical, including situations where vascular occlusion methods are not practical or are contraindicated.

I am the clinical research administrator for Core Scientific Creations

Fig. 1

Fig. 2

PR 88

Treating acute colonic diverticulitis with extraluminal pericolic air; a multi-centre retrospective cohort study

S. Vogels[1], A. N. Morks[2], D. Roos[3], J. Van Den Bremer[1], S. M. P. Koch[1], R. H. M. Smithuis[4], R. Hoencamp[1,5,6,7], G. Van Der Wilden[1]

[1]Alrijne Hospital, Department of Surgery, Leiderdorp, Netherlands, [2]Haga Hospital, Department of Surgery, The Hague, Netherlands, [3]Reinier de Graaf Gasthuis, Department of Surgery, Delft, Netherlands, [4]Alrijne Hospital, Department of Radiology, Leiderdorp, Netherlands, [5]Leiden Univeristy Medical Center, Department of Surgery, Leiden, Netherlands, [6]Erasmus Medical Center, Department of Trauma Surgery, Rotterdam, Netherlands, [7]Ministry of Defense, Defense Healthcare Organization, The Hague, Netherlands

Introduction: To date, the severity of acute diverticulitis (AD) is more accurately estimated due to quality improvement of computed tomography (CT). This resulted in a newly defined category of complicated AD; Hinchey stage 1a, including patients with pericolic air, but without abscess formation. Recent studies question whether this new category of AD might be regarded as uncomplicated, thereby requiring fewer admissions and use of antibiotics. The aim of our study is to report on the clinical course of AD Hinchey 1a, thereby providing evidence for optimal clinical treatment.
Materials and methods: A multicenter retrospective cohort study on patients presenting with AD at the emergency department was performed in three large urban hospitals. Patients with Hinchey 1a diverticulitis, as demonstrated by a CT scan were included, and their files were studied for demographics and clinical workup. Patients with other types of AD were excluded. The primary outcome measure was successful conservative treatment with antibiotics (AB) and/or hospital admission. Readmissions, percutaneous drainage of abscesses and emergency operations were considered as failure. Data sets were analyzed using Pearson Chi square test, a T-test or ANOVA as appropriate. Results were considered statistically significant if $p < 0.05$.
Results: Between October 2016 and October 2018, 959 patients were suspected for AD, of which 87 were diagnosed to have type 1a AD. The average age was 57($\pm$ 26) and the male to female ratio was 11:8. Clinical observation without AB or outpatient use of oral AB was successful in 9 patients, 62 were admitted for intravenous AB, and 16 required intervention. No significant difference between groups was found.
Conclusion: The majority of patients with type 1a AD can be treated conservatively and some even without hospital admission and/or intravenous AB. More research is required to define predictive factors for successful conservative or wait-and-see management.

PR 89

Do acute care surgeons in the trauma center setting offer superior care for emergency general surgery patients?

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[1]Riverside Methodist Hospital, Trauma and General Surgery, Columbus, United States

Background: Since the emergence of acute care surgery as an entity encompassing trauma and emergency general surgery there have been several studies evaluating patient outcomes noting a higher unexpected survivorship and expedited operative times, shorter hospital stays, and fewer complications for patients undergoing procedures such as appendectomy; however, these superior outcomes have not been demonstrated across the array of emergency surgical cases. The aim of this investigation is to determine whether patients operated on by acute care surgeons in a trauma center benefit from the trauma model of in-house availability, earlier availability of surgical care, and care dictated by evidence-based protocol. We examined our health care system's data to determine if trauma centers were to able to provide more timely care with improved outcomes, by focusing on truly emergent general surgery cases. This was examined by identifying and quantitatively comparing time to operative intervention, need for re-operation, hospital length of stay, duration of stay spent in intensive care unit, and patient disposition at time of discharge.
Methods: This is a retrospective cohort study. Patients presenting with emergency general surgery conditions (incarcerated hernia, perforated viscus, SBO, necrotizing soft tissue infection) who underwent surgery within 24 h of presentation were selected. Outcomes were compared between patients presenting to our two trauma centers versus our two non-trauma centers. n = 1600
Results: At this time we are nearing the finalization of our data interpretation. We are examining mean time to operation, LOS, ICU LOS, need for re-operation, and disposition at discharge.
Discussion: Although our data analysis is not complete we feel that the results of our data will shed valuable and needed light onto the care delivered to emergency general surgery patients by surgeons in this increasingly complex population.

PC 90

Use of vacuum system (endosponge) in chronic purulent cavity in rectum stump

A. Landaluce-Olavarria[1], *A. Uriguen*[1], *M. Leon*[1], *J. Gonzalez Taranco*[1], *M. Gonzalez*[1], *J. Barrutia*[1], *L. Fernandez*[1], *B. Estraviz*[1]

[1]Urduliz hospital, general surgery, Urduliz, Spain

Case history: 72 years old male. He suffered from a sigmoidectomy and after that procedure, he developed a lot of complications: anastomosis leakage (Hartmann),pulmonary embolism thrombosis, cerebro-vascular accident with a residual hemiplegia, walking problems and bad general situation.
Clinical findings: He attended to our hospital for the first time with an intrarectal aspirate drainage in the rectum stump and continuous purulent drainage during 6 months.
Investigation/results: A pelvic MR was performed to role out an abscess or a rectal fistulae. MR result was negative.
Diagnosis: Chronic purulent cavity in rectum stump.
Therapy and progressions: A vacuum system (Endosponge) was placed in the cavity guided by rectoscopy and after three changes, all guided by rectoscopy, purulent effluent disappeared and the control rectoscopy was normal.
Comments: Vacuum system (endosponge) has been used in rectal anastomosis leakage with very good results. Its use in rectum stump has not reported. Our case is a patient with a bad status and with a lot of visit, every week during 6 months, to the emergency department due to drainage lost. It is not clear what it is the cause of permanent purulent fluid although it has been role out an absess or fistulae but this system can stop the purulent drainage in a short time period with a great improvement in his life quality. Conclusion: Vacuum system can be a good option in chronic purulent cavity in rectum stump with excellent outcomes.
References: Van Koperen PJ. Surgical treatment of perianaland rectal fistula. S.L.; 2010.
Endo sponge for colorectal anastomosis leakage. August 2019. NICE.

PC 178

Application of botulinum toxin in open abdomen

A. Landaluce-Olavarria[1], *M. Sainz*[1], *A. Sanz*[1], *M. De Francisco*[1], *A. Emaldi*[1], *D. Gomez*[1], *J. Zeballos*[1], *B. Estraviz*[1]

[1]Urduliz hospital, general surgery, Urduliz, Spain

Case history: First patient. male, 58 years. Antecedents of right hemicolectomy and anastomosis leakage due to adherence in distal transverse of colon 3 days after. Second patient. Morbid obese, COPD. Third patient: 80 years old, a lot of comorbidities, liver cirrhosis (B-9). Hartmann due to sigmoidic cancer.
Clinical findings: 1 patient. He attended to the ED, one month later with a mechanical obstruction and diffuse peritonitis. An adhesiolysis + abdominal lavage + VAC was performed. 2 patient. Anastomosis leakage after hartmann removal, with conservative treatment at the beginning but after, bad evolution, a surgery was performed with colostomy and VAC system. 3 patient. After 24 h, he develop a compartmental syndrome and a Vac system was applied.
Investigation/results: 1 patient. After the first change the distance between the two layers was 18 cm and botulinum toxin was applied. 2 pat. The distance between the two layers of abdomen was 20 cm and botulinum toxin was applied. 3 patient. The distance between the two layers was 18 cms and toxin was applied. Unfortunately, he suffered from a hepatorenal syndrome and died.
Diagnosis: Open abdomen with distance between the two layers: 18 cm, 20 and 18 cm.
Therapy and progressions: We have added botulism toxin with doses of 20 units in each side of abdominal wall. 1 patient. Three changes after, the abdomen wall was closed. 11 months later, the abdominal wall is ok. 2 patient. A reduction of 50% was got.
Comments: The use of open abdomen in patients suffer from septic shock or after an abdominal compartment syndrome often poses a challenge in the abdomen closure. We have developed a protocol, dividing our patients according to the distance between the two layers in two group: more than 10 cm or 10 cm or less. In the first group (> 10), We present our first 3 cases in our protocol.
Conclusions: Botulinum toxin can make easier abdomen closure when the distance between the two layers is more than 10 cms

PC 179

Incidentally discovered splenic peliosis in a patient with no comorbidity

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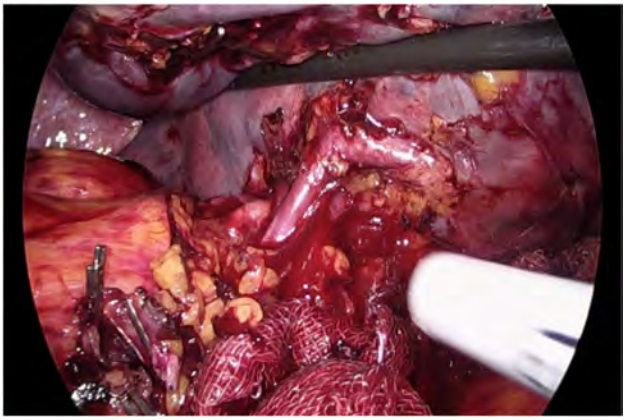
[1]College of Medicine, The Catholic University of Korea, Department of Surgery, Seoul, South Korea

Case history: A 51-year-old man with no comorbidities.
Clinical findings: A 51-year-old man with no comorbidities visited our emergency medical center based on a complaint of chest pain. The chest and abdomen radiographs, electrocardiogram, and cardiac markers showed no abnormalities; therefore, he was discharged from the hospital. Two months later, he returned to our hospital with abdominal pain and distension. He was hemodynamically stable, and there were little tenderness and rebound tenderness on his abdomen, although he complained a slight abdomen discomfort
Investigation/results: No abnormalities were found on the laboratory examinations, including complete blood cell count, cardiac markers, and coagulation profile. An abdomen computed tomography revealed multiple hemorrhagic cysts on spleen with moderate amount of hemoperitoneum.
Diagnosis: Ruptured splenic peliosis with hemoperitoneum.
Therapy and progressions: Laparoscopic splenectomy was done because recurrent rupture of hemorrhagic cysts was strongly anticipated. On histologic examination, the blood-filled cysts were well-demarcated, distributed in red pulp congestion. No vascular-endothelial cells were observed, and normal lining cells were disappeared in the wall.
Comments: A Peliosis is a rare disorder characterized by widespread, blood-filled cystic cavities within the parenchymatous organs. The liver is the most commonly involved organ, and an isolated splenic peliosis is extremely uncommon. Patients are often asymptomatic; therefore, early recognition and withdrawal of offending agents is crucial. In cases with the rupture of surface lesions, which can occur spontaneously or by the minor trauma, prompt surgical management is necessarily required. Splenectomy offers the advantage of a definite histological diagnosis with the complete elimination of the risk of recurrent hemorrhage.
References: Tsokos M, Erbersdobler A. Pathology of peliosis. Forensic Sci Int. 2005;149:25–33.

Fig. 1

Fig. 2



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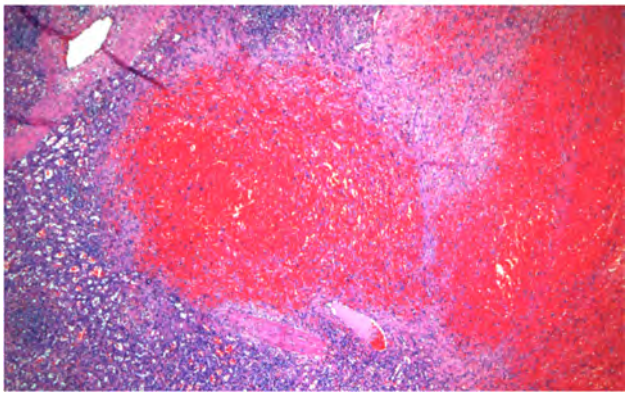

PR 180

Laparoscopic surgery for appendicular peritonitis in children

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Introduction: Despite an evident success and advantages of endoscopic surgery, the discussion on reasonability of endoscopic surgeries in children with acute appendicitis is still going on.
Purpose: To assess the effectiveness of laparoscopic techniques for treating appendicular peritonitis in children.
Material and methods: 149 children with appendicular peritonitis were operated in our hospital (2016–2018). They aged 1–17 years (11 ± 3.5); 65.2% of boys, 34.8% of girls. Appendicular peritonitis was registered in 7.7% cases of acute appendicitis. Three ports were used for the approach: appendectomy was performed by the ligature technique with Roder loop.
Results: Laparoscopic surgery is indicated in all forms of appendicular peritonitis, except appendicular abscess stage 3, and total abscessing peritonitis. In appendicular abscess stage 3, we perform a puncture and drainage under ultrasound control. 3–6 months later appendectomy is made. Total abscessing peritonitis is an indication for laparotomy. Laparoscopic surgery in patients with peritonitis has the following stages: diagnostic laparoscopy; sanation of the abdominal cavity by the aspiration of purulent exudate; ligature appendectomy; in diffuse and combined peritonitis a pelvic aspiration drainage is made. In appendicular abscess stage 2, we additionally put the aspiration drainage in the cavity of destructed abscess.
Conclusions: Laparoscopic technique applied for surgeries in children with acute appendicitis has considerably improved outcomes.
References: 1. Aarabi S, Sidhwa F, Riehle KJ, Chen Q, Mooney DP. Pediatric appendicitis in New England: epidemiology and outcomes. J Pediatr Surg. 2011;46(6):1106–14.
2. Karaseva OV, Roshal' LM, Brjancev AV, Kapustin VA, Chernysheva TA, Ivanova TF. The management of appendicular peritonitis in children. Russ J Pediatr Surg. 2007;3:23–7 **(in Russian)**.

PR 181

Is the conservative approach feasible and safe in patients with an episode of complicated acute diverticulitis modified Hinchey stages 1b to 4? A retrospective study identifying risk factors predicting conservative treatment failure

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Introduction: Aim: to analyze the success of the conservative approach(ConsApp) in complicated acute diverticulitis (AD); modified Hinchey stages 1b-4 on CT-scan, and to identify risk factors of treatment failure.
Material and methods: A retrospective cohort study of patients attended at the emergency department for AD from January 2015–August 2019. Patient demographic, analytical, radiological data and initial treatment strategies were registered. The ConsApp based on intravenous antibiotics (ATB) and bowel rest was deemed unsuccessful when change in ATB, percutaneous drainage (PD) or emergency surgery (ES) were required. Patients treated with ES or PD on arrival were excluded. PD was initially indicated when feasible in cases of abscess > 4–5 cm. Analysis was done with the IBM SPSS statistics 23.0.0.2 software.
Results: 648 AD episodes were registered; 86 were complicated on CT-scan with extraluminal air (88.4%), free liquid (33.7%), or abscess (35%) with 3.6 cm median diameter. ConsApp was used in 76 patients (88.4%) with 84.2% success rate. Second treatment lines included change in ATB in 6.6%, PD in 6.6% and ES in 2.6%. Higher PCR (18.2 vs 9.2, $p = 0.04$) and white blood cell (WBC) count (18400 vs 12700, $p = 0.002$) were associated with ConsApp failure. As were the presence of free liquid (36% vs 7.6%, $p = 0.007$), its location (25% pericolic/Douglas vs 75% fluid in > 2 abdominal quadrants, $p < 0.001$) and distant air (44.4% vs 11.9%, $p = 0.03$). Multivariate analysis identified PCR, WBC count, the presence of free liquid, its location and distant air on CT-scan to be risk factors of ConsApp failure.
Conclusions: ConsApp in AD modified Hinchey stages 1b-4 is feasible with an acceptable success rate. Careful supervision is required if high PCR and WCB values, free liquid in > 2 quadrants and distant air are present.
References: Sartelli M, et al. WSES Guidelines for the management of acute left sided colonic diverticulitis in the emergency setting. World J Emerg Surg. 2016;11:37.

PR 182

Appendectomy on-call and risk of postoperative complications

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Introduction: Nighttime emergency surgery is associated with increased postoperative morbidity and mortality [1], and delayed appendectomy due to acute appendicitis is not linked to a higher rate of postoperative complications (PC) [2]. The aim of this study was to determine whether appendectomy on-call (OC) was associated with higher risk of PC.
Material and methods: Data on all acute appendectomies in patients ≥ 15 years performed at a high-volume Swedish hospital May 2015–June 2019 was analyzed. Time of surgery was defined as either office hours (8 am–4 pm, Monday to Friday) or OC (4 pm–8 am Monday to Friday, and all hours during Saturdays, Sundays and Swedish Holidays). Main outcome was risk of PC registered within 30 days, using multivariable logistic regression.
Results: There were 1880 acute appendectomies and 8.0% PC during the inclusion period. OC surgery was performed in 82.0% and this group of patients did not differ significantly from patients with surgery during office hours, regarding age, sex, or triage level in the emergency department. Patients who underwent appendectomy OC had lower ASA-levels (mean ASA 1.49 vs 1.54, median 1 vs 1, p 0.019). Surgery OC was associated with shorter time from hospital arrival to start of surgery (median 16.0 vs 18.6 h, $p < 0.001$) and shorter hospital stay, (median 37.7 vs 40.7 h, p 0.019). Risk of PC was lower OC (OR 0.40, $p < 0.001$).
Conclusions: Appendectomy OC was associated with lower risk of PC and shorter hospital stay, compared with surgery during office hours. Mechanisms behind these patterns are yet unclear, but the results suggest that patients with acute appendicitis could safely be operated around the clock, regardless of weekday.
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2. van Dijk ST et al. Meta-analysis of in-hospital delay before surgery as a risk factor for complications in patients with acute appendicitis. Br J Surg. 2018.

PR 183

Operation for necrotizing fasciitis: do they need amputations?

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Introduction: Necrotizing fasciitis (NF), a life-threatening soft tissue infection, develops rapid and requires repeated surgery including debridement or amputation. This study aimed to assess the treatment and prognosis of NFs and investigate the need for major amputations.
Material and methods: We included patients with NF treated at the Advanced Critical Care Center, Gifu University Hospital, during a 10-year period (April 2009 to March 2019). Their charts were reviewed and data were analyzed in terms of demographic and microbiological characteristics and therapeutic course including operations and mortality.
Results: This study included 25 patients (men: 21 and women: 4) with an median age of 60 (34–84) years. Eleven patients had diabetes mellitus and 2 had rheumatic arthritis and used steroids. The median laboratory risk indicator necrotizing fasciitis, sequential organ failure assessment scores, and serum Lac were 8 (3–12), 5 (0–15), and 18 (8–68) mg/dL, respectively. *Streptococcus* species were the most detected bacteria, and 22 patients were treated with carbapenem. The median antibiotic duration was 16 (2–64) days. All patients underwent debridement operation on day 1, and the median number of

surgical interventions was 2 (1–8). Two patients underwent major thigh amputation. Negative pressure wound therapy and hyperbaric oxygen therapy were used in 15 and 7 patients, respectively. Three patients died (mortality rate = 12%).
Conclusions: The mortality and major amputation rates (12% and 8%, respectively) were lower than those reported previously. In this study, even when patients had multiple organ failure or septic shock, major amputation was not always needed because of effective communication between the infection control team and intensive care specialists, resulting in radical debridement without amputation.
References: Leiblein M, et al. Necrotizing fasciitis: treatment concepts and clinical results. Eur J Trauma Emerg Surg. 2018;44:279–90.

PR 184

Time is of the essence when treating necrotizing soft tissue infections: a systematic review and meta-analysis

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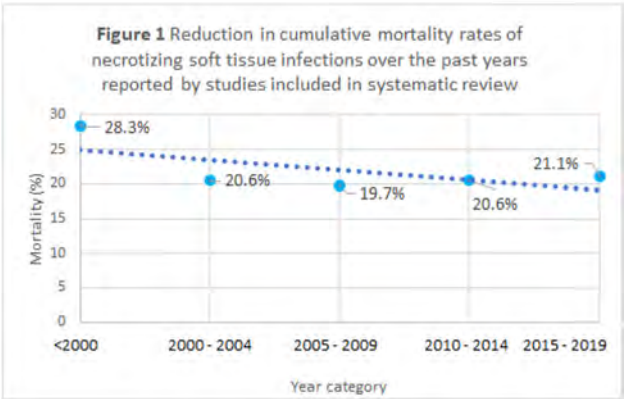
Introduction: Although the phrase "time is fascia" is well acknowledged in case of necrotizing soft tissue infections (NSTI), solid evidence is lacking. The aim of this study is to review the current literature concerning the timing of surgery in relation to mortality and amputation in patients with NSTIs.
Material and methods: A systematic search in PubMed/MEDLINE, Embase, CINAHL and CENTRAL was performed. The primary outcomes were mortality and amputation. These outcomes were related to the following time related variables (1) time from onset symptoms to presentation; (2) time from onset symptoms to surgery; (3) time from presentation to surgery; (4) duration of the initial surgical procedure. For the meta-analysis, effects were estimated using random-effects meta-analysis models.
Results: A total of 109 studies (6051 patients) were included for qualitative analysis, of which 1277 patients died (21.1%). A total of 33 studies (2123 NSTI patients) were included for the different quantitative analyses performed. Mortality was significantly lower for patients with surgery within 6 h after presentation compared to when treatment was delayed more than 6 h (OR 0.43; 95% CI 0.26–0.70). Surgical treatment within 6 h resulted in a 19% mortality rate compared to 32% when surgical treatment was delayed more than 6 h. Also, surgery within 12 h reduced the mortality compared to surgery after 12 h from presentation (OR 0.41; 95% CI 0.27–0.61). Patient delay (time from onset of symptoms to presentation or surgery) did not significantly affect the mortality in this study. None of the time related variables assessed reduced the amputation rate.
Conclusions: Average mortality rates reported remained constant (around 20%) over the past 20 years (Fig. 1). Surgical debridement as soon as possible lowers the mortality rate for NSTI with almost 50%. Thus, a sense of urgency is essential in the treatment of NSTI.

Fig. 1



PC 185

Altemeiers procedure in an emergency setting

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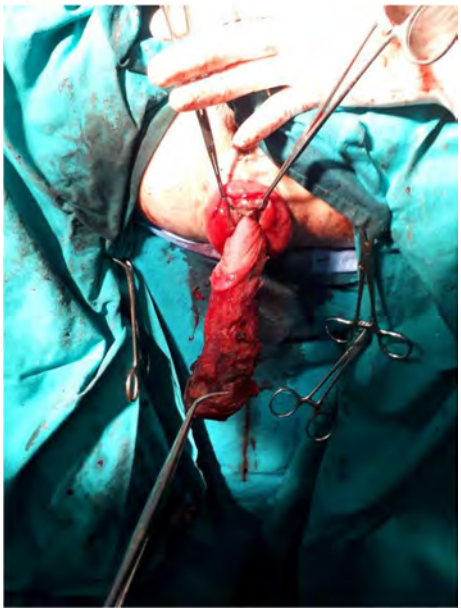
Case history: Three patients with irreducible incarcerated rectal prolapsed were referred to our department for treatment. All patients were female and their age was 57, 82 and 85 years old. All patients suffered from severe co-morbidities.
Clinical findings: All patients presented with incarcerated rectal prolapse. In one patient there was macroscopic evidence of mucosal necrosis, whereas the other two patients had evidence of ischemia. The former patient was febrile whereas the latter did not exhibit signs or symptoms indicative of sepsis.
Investigation/results: Blood panels demonstrated leukocytosis and elevated levels of C-reactive protein (CRP) in all patients. Apart from routine imaging upon admission (e.g. chest radiography), no other imaging modalities were performed.
Diagnosis: Irreducible incarcerated rectal prolapse.
Therapy and progressions: Initially manual reduction of the prolapsed was attempted without success. All patients were evaluated as high risk surgical candidates. Altemeier's procedure was selected as a safer alternative to an abdominal approach. All patients were successfully discharged after resumption of bowel function.
Comments: Incarcerated rectal prolapse is a rare clinical condition. Initial management involves manual reduction of the prolapse. When this is not feasible, urgent surgical management is mandatory. In patients with severe co-morbidities, Altemeir's procedure is a safe and effective treatment when performed by an experienced practitioner.
References: Nguyen XN, Pham PK, Steinhagen RM, Pham GA, Le NH, Nguyen NA. Case series: Incarcerated massive rectal prolapse successfully treated with Altemeier's procedure. Int J Surg Case Rep. 2018;51:309–312.

Fig. 1

Fig. 2



PR 186

A morphologically-normal gall bladder on computed tomography does not always exclude severe gall bladder inflammation

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Introduction: Computed tomography (CT) is generally considered as a sensitive tool for the diagnosis of acute cholecystitis (AC). Difficult laparoscopic cholecystectomy (DLC) can usually be expected if CT revealed a thick-wall, swelling gall bladder with severe adjacent infiltration. However, in occasion a severe acute inflammatory gall bladder with great surgical difficulty can still be noted even though there were no typical CT features of AC. This study aims to look for the factors that can be used to identify these group of patients.

Material and methods: Medical records of all the patients with a diagnosis of AC who had an abdominal CT and underwent laparoscopic cholecystectomy (LC) between Jan 2015 and Dec 2018 were reviewed. Patient demographics, CT and intra-operative findings, operation time, blood loss, length of stay (LOS) and pathology were analyzed. DLC is defined as operative time > 1.5 h, blood loss > 200 ml due to a gangrenous gall bladder.

Results: Of all the 1126 patients, 176 of them were Tokyo Guideline 2018 (TG18) grade I cholecystitis according to the diagnostic criteria. All of these patients received early LC with a conversion rate of 0.5%. Among these patients, 22 of them (12.5%) were identified as DLC cases without typical CT features of AC. The only suspicious CT finding of AC in these 22 patients was that they had a significantly distended gall bladder compared to that of the other patients (mean longitudinal diameter = 10.71 cm vs 8.18 cm, p = 0.032). Due to unexpected surgical difficulty, these 22 patients had a significantly longer OP time, increased blood loss and prolonged LOS.

Conclusions: Our data showed that CT findings of gall bladder were not always compatible with that of intra-operative findings. A gall bladder that expected to be resected with ease might turn into a DLC case. Patients with a distended gall bladder should be prepared for a DLC even though there were no typical features of AC on abdominal CT.

References: J Hepatobiliary Pancreat Sci. 2018;25:41–54.

PR 187

Risk of appendiceal neoplasia after conservative management of appendicular plastron. Is it necessary to perform interval appendectomy systematically?

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Introduction: Indication of an interval appendectomy after conservative management of an appendicular plastron has been discussed after publication of a clinical trial on March 2019 with a high rate of appendicular neoplasia (20%) so it was prematurely interrupted.

Material and methods: Retrospective review of patients with appendicular plastron in our centre from June 2009 to March 2019 was made. Demographic, clinical and analytical data and the presence of appendicular collections or appendicolite were collected. The mean length of hospital stay, the readmission rate, the need for percutaneous drainage, the performance of interval appendectomy and the follow-up were analysed.

Results: A total of 73 patients with appendicular plastron were registered. 54.8% men with a mean age of 53 years (SD 19). 59 patients (80.8%) had intra-abdominal collection and 11 patients (15.1%) had an appendicolite. Initial management was with empirical antibiotic therapy and 21 patients needed percutaneous drainage. 1 patient (1.36%) required urgent surgery. Interval appendectomy was performed in 34 patients (46.5%) and associated a morbidity rate of 5.88% (1 Clavien-Dindo I, 1 IIIa). Appendicular neoplasia was

identified in 2 patients (5.88%) after the interval appendectomy and the recurrence rate was 9.6%. The mean follow-up time of the patients was 16.64 weeks (RIQ 4.3–41.49).
Conclusions: In our hospital, a low incidence of both neoplasia (5.88%) and recurrence (9.6%) was reported. Due to the controversy, we consider it's necessary more prospectives studies to provide quality evidence and assess the indication of interval appendectomy.
References: Mällinen J, Rautio T, Grönroos J, et al. Risk of appendiceal neoplasm in periappendicular abscess in patients treated with interval appendectomy vs follow-up with magnetic resonance imaging: 1-year outcomes of the peri-appendicitis acute randomized clinical trial. JAMA Surg. 2019;154(3):200–7.

PR 188

Intestinal ischemia: a five year experience in an ICU

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Keywords: Intestinal ischemia, Intensive care
Introduction: Intestinal ischemia is caused by a reduction in blood flow due to arterial occlusion, venous occlusion or hypoperfusion. It is an emergency and it accounts for about 1:1000 hospital admissions. Its difficult diagnosis and delayed treatment contribute to a high mortality rate. This study aims to provide recommendations to improve clinical outcome.
Material and methods: Retrospective study of all adult patients with intestinal ischemia diagnosis in an Intensive Care Unit (ICU) from 2013–2017.
Results: Our study included 38 patients: 45% with colonic ischemia, 29% with acute mesenteric ischemia and 26% with both. Around 55% of patients were male with a median age of 75, 66% had high blood pressure, 37% had heart disease, 16% used renal replacement therapy and 42% were taking antiplatelet/anticoagulant medication. At presentation, 95% had abdominal pain, 88% had hyperlactacidemia, 86% had high CRP and 62% had high HDL. Abdominal ultrasound, CT scan, X-ray and endoscopy were used in 74, 63, 40 and 24% of cases, respectively. Of 66% patients admitted from the Emergency Department, 50% had immediate surgery, with a median time of 10 h from admission to surgery. The mortality rate was 58%.
Conclusions: To improve clinical outcome, physicians must consider the patient's clinical presentation as well as avoid time-consuming, inappropriate, diagnostic procedures.
References: Bala M, et al. Acute mesenteric ischemia: guidelines of the World Society of Emergency Surgery, 2017; WJES.
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PR 189

Review of sigmoid volvulus cases: a 10 year single-center retrospective study

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Introduction: Treatment options for sigmoid volvulus are decided by its severity. Uncomplicated cases are usually treated by endoscopic detorsion followed by elective surgery and complicated cases or cases can't be detorsioned are treated with emergency surgery. In this study we aim to review a single center experience in long term management of sigmoid volvulus cases.
Material and methods: Data of the sigmoid volvulus cases between 2009–2018 were collected using hospital database. Files of 57 patients were reviewed for treatment modalities, demographic info and complications. 4 patients were dropped from the study due to inadequate long term follow-up.
Results: 37 were men and 16 were women. Mean age was 54,9. Endoscopic detorsion was attempted in 30 cases. Success rate was 90% (n = 27). 10 of these patients were followed up with elective surgery. 23 patients with complicated cases and 3 unsuccessful detorsion patients were managed by emergency surgery. 16 hartman procedures, 10 anterior resections, 2 left hemicolectomies, 1 subtotal colectomy and 2 transverse loop colostomies were done. A stoma was created in 28 cases. 22 patients had their stoma created in the primary surgery and an additional of 6 stomas were created due to anastomosis leakage. Mortality rate in the first 7 days was 25% (n = 7) in patients with a stoma (n = 28). ASA and Charlson co-morbidity scores were exceptionally high in the mortality group. In the remaining patient group, stoma closure rate was 57.1%.
Conclusions: Endoscopic detorsion is a powerful and highly successful management option in uncomplicated cases when done by an experienced staff. Emergency surgery shouldn't be delayed in complicated cases or after unsuccessful detorsion attempts.
References: 1. Iida T, et al. Clinical outcomes of sigmoid colon volvulus: identification of the factors associated with successful endoscopic detorsion. Intest Res. 2017;15(2):215.

PR 190

Review of esophageal perforation cases: a 10 year single-center retrospective study

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Introduction: Esophageal perforation has high mortality rates when not treated aggressively. Treatment options are conservative approach, endoscopic intervention and surgery. Purpose of this study is to review cases of esophageal perforation in a single center and to evaluate types of diagnosis and treatment options.
Material and methods: Using hospital database we collected data of 26 patients diagnosed with esophageal perforation between 2009–2018. We reviewed treatment modalities, demographic data and complications. 1 patient was removed from the study due to insufficient long term data.
Results: 13 were female and 12 were male. Average age was 59.9. Average time between the onset of symptoms and admission was 2.2 days. The most common etiology was iatrogenic (n = 16) followed by consumption of corrosive substances in 2 patients, spontaneous perforation in 2 patients, esophageal tumour in 3 patients and foreign body ingestion in 2 patients. 11 patients were treated surgically, 8 patients were treated with endoscopic stenting and 1 patient was treated with surgery following stenting. 5 patients were managed conservatively with antibiotherapy. Average time in intensive care was 8.4 days and average hospital stay was 26.6 days. Mortality was seen in 3 patients treated with surgery and 2 patients treated with stents.
Conclusions: Esophageal perforations are mainly iatrogenic but also can be caused by multiple reasons. Especially in cases developed after endoscopy, rapid intervention can be a significant factor that can decrease both mortality and morbidity rates.
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PR 191

Factors associated with mortality in patients with peritonitis undergoing emergency laparotomy

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Introduction: Damage control surgery (DCS) has been emerging as a feasible alternative for the management of patients with abdominal infections and sepsis. However, early identification of patients with higher odds of mortality and potential complications using clinical variables still is challenging. This study aimed to identify factors associated with mortality in patients with peritonitis undergoing emergency laparotomy at a high complexity center.
Methods: Emergency general surgery adult patients undergoing laparotomy from January/2012 to December/2018 were included. Trauma patients, non-traumatic hemorrhagic emergencies and mesenteric ischemia incompatible with survival were excluded. Multivariate logistic regression (MLR) analysis adjusted for age, sex, cancer, systolic blood pressure (SBP), SOFA and perforated hollow viscus was conducted.
Results: 198 patients were included, 100 with medical peritonitis (MP) and 98 with post-operative (PP) peritonitis. 111 (56.3%) were male and median age was 62 years (IQR: 46–73). There were not differences in the hemodynamic status on admission between subgroups; [MP = SBP: 113 mmHg (IQR: 96–133) vs. PP = SBP: 115 mmHg (IQR: 100–130)]. There was a higher proportion of cancer among PP patients [MP: 27 (27%) vs. PP: 41 (42%), p = 0.03]. 50 (25%) patients died, with higher mortality among MP patients (MP: 33% vs. PP: 17%, p = 0.01). MLR stratified for type of peritonitis showed that in MP patients, age and SOFA score on admission were associated to higher odds of mortality; on the other hand, in PP patients SOFA and age had association, however, a greater SBP was protective factor for dead [ROC curve = 0.85, Goodness of fit test, Prob > Chi^2 = 0.1037].
Conclusion: In patients undergoing emergency laparotomy, age, SOFA score and SBP showed a good performance for mortality prediction.
References: Girard E, et al. Damage control surgery for non traumatic abdominal emergencies. World J Surg. 2018;42(4):965–73.

Fig. 1

Multivariate logistic regression, Medical peritonitis

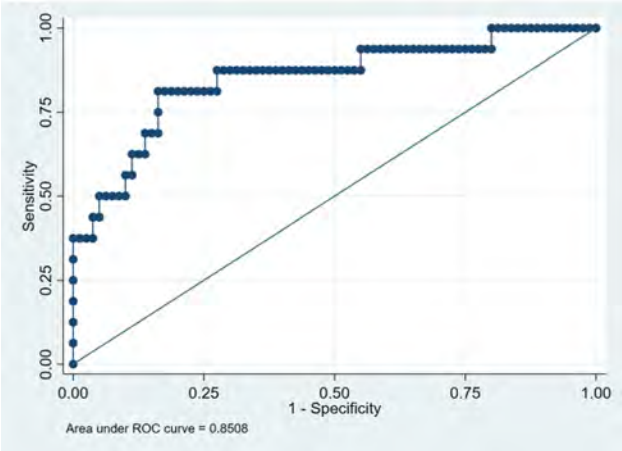
Variables	OR	[95% Conf. Interval]	p value
Age	1.05	1.02-1.09	0.001
Sex	2.43	0.85-6.93	0.09
Systolic Blood Pressure	0.99	0.97-1.01	0.19
SOFA*	1.21	1.05-1.39	0.007
Perforated hollow viscus	2.69	0.99-7.28	0.05

Multivariate logistic regression, Post-operative peritonitis

Variables	OR	[95% Conf. Interval]	p value
Age	1.06	1.02-1.11	0.007
Sex	0.95	0.24-3.66	0.95
Systolic Blood Pressure	0.97	0.94-0.99	0.03
SOFA*	1.42	1.14-1.75	0.001
Perforated hollow viscus	0.41	0.78-2.17	0.29

*SOFA=Sequential Organ Failure Assessment, Dependent variable= mortality, *Goodness of fit test, Prob>chi2= 0.1037*

Fig. 2



PR 192

Single-center experience in the surgical treatment of ruptured liver tumors and proposal of management algorithm

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Introduction: Spontaneous rupture of liver tumors (RLT) is a rare but potentially life-threatening condition. Damage control techniques, namely perihepatic packing (PHP), is a resource for the most physiologically compromised patients, with more stable patients undergoing transarterial embolization (TAE) or immediate resection. Decision algorithm depends on patient status, available resources and liver function. The authors present their center experience in managing RLT and propose a management algorithm.

Material and methods: Eighteen consecutive patients who underwent surgery for RLT in our department (January 1988–October 2019). Inclusion criteria: spontaneous rupture and evidence of intraperitoneal bleeding. Fourteen patients were male. Mean age of 62.6 years (35–86). Thirteen patients (72%) presented in hemorrhagic shock. Mean tumor size was 6.72 cm (3–17). Most frequent pathological diagnosis were: hepatocellular carcinoma in 12 cases (67%); adenoma in three cases (17%); metastases in two cases (11%); liver sarcoma in one case (5.6%). Median of seven units transfused by patient (0–25). Statistical analyses with SPSS^{TM} version 23.0

Results: Six patients (33%) needed immediate surgery (PHP in three and resection in three). Five (28%) underwent urgent (> 2 h and < 24 h) and seven (39%) delayed (> 24 h) resection. Hepatectomy was performed on all (fifteen minor and two major) but one patient PHP only. Eight patients (44%) underwent TAE prior to resection, two of them (11%) between PHP and hepatectomy. Median length of stay 10 days (4–68). Major morbidity in three patients (17%); mortality in three patients (17%). Number of transfused units associated with increased risk of complications (p = 0.009).

Conclusions: Rupture of liver tumors is a severe complication. Although hepatic resection, with or without preoperative TAE, should be considered gold standard, damage control techniques such as PHP are the only option for physiologically compromised patients (Fig. 1).

Fig. 1 Algorithm for Management of Ruptured Liver Tumors

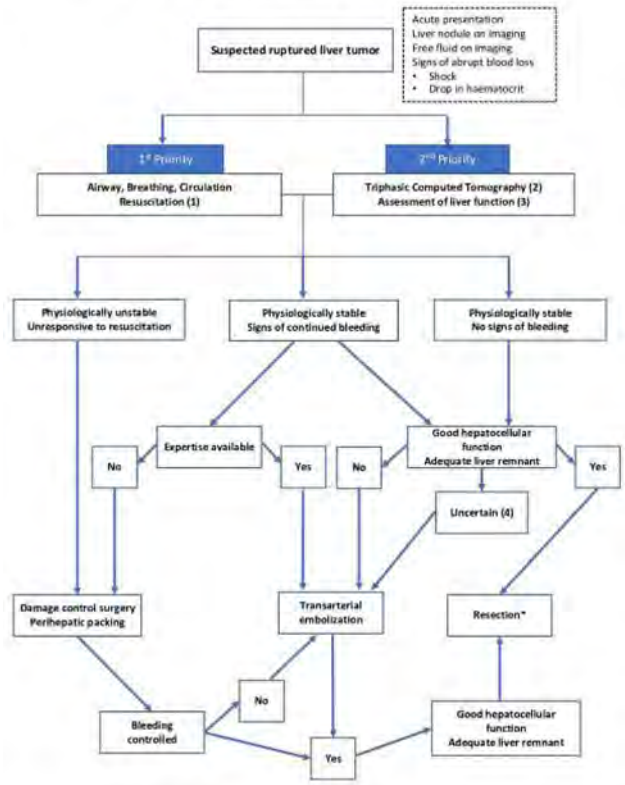

Figure 1: Proposed algorithm for management of Ruptured Liver Tumors based on a single-center experience

(1) – Damage control resuscitation, with mostly blood components and little or no crystalloid

(2) – Triphasic Angio-computed tomography to asses: number and likely diagnosis of nodules, signs of ongoing bleeding (blush on arterial phase), vascular anatomy for planning angioembolization

(3) – In patients with suspected hepatocellular carcinoma (hypervascular nodule on arterial phase, with washout on portal / venous phase) and cirrhosis (radiological signs of cirrhosis); hepatocellular function should consist of determination of Child-Pugh score, MELD score and detection of signs of portal hypertension (low platelet count, varices on imaging, splenomegaly)

(4) – Cirrhotic patients with acute bleeding may have underestimated liver function (free fluid can be either blood or ascites? / higher INR due to depressed liver function or due to bleeding? / low platelet count due to portal hypertension or due to bleeding?); in these cases, embolization may allow for temporary stabilization of patient condition and later assessment of hepatocellular function and reserve

* – Resection reserved for patients without signs of shock, clinically stable and provided expertise in hepatobiliary surgery is available; otherwise transfer for a large-volume center should be arranged

PR 373

Seasonal variability of cellulitis: a five year retrospective cohort study

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Introduction: It is commonly purported that the incidence of cellulitis is highly seasonal but there is little empirical evidence supporting this assertion. This 5 year retrospective cohort study set out to identify whether there is a statistically significant relationship between an increase in temperature and incidences of cellulitis. As a corollary to this proposition, length of hospital stay for cellulitis was examined in relation to the level of inflammatory markers upon admission and micro-organism identified on culture.

Material and methods: This is a 5 year retrospective single centre cohort study of all patients admitted with cellulitis to Tallaght University Hospital from 2014 to 2018 inclusive. The patient cohort was identified via the use of a prospectively managed database of all

surgical admissions and corroborated via examination of clinical chart records. Dates of admission were correlated with the average temperature of Dublin as provided by the meteorological office of Ireland. Site of infection, inflammatory markers and the prevalent micro-organism were also identified whilst the length of admission was extrapolated from HIPE (Hospital Inpatient Enquiry) records.

Results: There were 710 admissions for cellulitis with 3 cases of necrotising fasciitis. There was a statistically significant ($p < 0.05$) relationship between temperature and cellulitis with admission peaking in late Summer/Autumn. Age correlated significantly with readmission. Furthermore, the level of CRP had a statistically significant prognostic value as an independent predictor for the length of hospital stay with a high level resulting in a prolonged admission.

Conclusions: There is a statistically significant relationship between a rise in temperature and the incidence of cellulitis. Furthermore age is an independent risk factor for re-admission with same whilst inflammatory markers at time of admission can be used as a prognostic marker for length of stay.

PC 374

Fish bone perforation of the duodenum: an unusual etiology of hepatic abscess

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Case history | Clinical findings: A 88-year-old female patient, with history of type II diabetes, high blood pressure and major depressive syndrome, was admitted in the emergency room department complaining of abdominal pain. Based on the patient's history and physical examination, a presumptive diagnosis of renal colic was initially made. However, after 2 days, the patient showed signs of fever, aggravated abdominal pain and vomiting.

Investigation/results | Diagnosis | Therapy and progressions: A CT scan showed the presence of a radiopaque foreign body near the duodenum, the presence of air bubbles outside the intestinal lumen and an hepatic abscess. We agreed to perform a laparoscopy, drainage of hepatic abscess and fish bone removal after successfully identification. After 4 days, the laboratory findings showed persistent leukocytosis and raised CPR, which led to a second CT scan with maintenance of the hepatic abscess. The decision was to perform a percutaneous drainage. After the second drainage, the patient had an uneventful recovery.

Comments: Foreign body ingestion into the gastrointestinal (GI) tract is rare and typically accidental in adults. Most ingested foreign bodies pass through the gastrointestinal tract without the need for any intervention. GI perforation is rare and can occur at any site. Surgical intervention is required in less than 1% of the cases. Fish bones are the most commonly ingested objects. Preoperative diagnosis, when possible, is made with CT scan, identifying a linear high-density structure. High level of suspicion is of paramount importance. In cases of delayed diagnosis, perforation may lead to intraperitoneal abscess formation. Reports of hepatic abscess secondary to fish bone perforation has been limited to isolated case reports in the literature.

Fig. 1

PC 375

Goblet cell carcinoid tumor (GCCT) manifestation as an acute appendicitis

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[1]Royo Villanova General Hospital, General Surgery, Zaragoza, Spain, [2]San Jorge University Hospital, General Surgery, Huesca, Spain, [3]Severo Ochoa University Hospital, General Surgery, Madrid, Spain, [4]Royo Villanova General Hospital, Pathology, Zaragoza, Spain

Case history: Description of two cases of appendicular goblet cell carcinoid tumors, which debuted as acute appendicitis. Patient A was a 54-year-old woman with a 24-h evolution of classic symptoms of acute appendicitis. Patient B was a 70-year-old female that consulted for chronic abdominal pain in RLQ that recently increased pain intensity and fever.

Clinical findings: Patient A had pain and defense in RLQ without a fever. Patient B had a chronic painful fluctuating mass in RLQ, with fever over 38 °C.

Investigation/results: Patient's A lab test showed leukocytosis and US findings of acute appendicitis. The patient's B CTscan showed an intra-abdominal abscess fistulized to the abdominal wall, along with formation of a phlegmonous mass related to appendicular plastron.

Diagnosis: The anatomopathological reports for both patients were informed as Appendicular Goblet cell carcinoid tumor.

Therapy and progressions: Both underwent laparoscopic exploration. After appendicectomy in patient A, when the diagnosis of GCCT was made, the case was discussed at our MDT meeting and a right hemicolectomy was indicated and performed shortly after. In the patient B a right hemicolectomy was performed in the initial surgery due to the magnitude of tissue involvement. Currently, both are receiving chemotherapy with Xelox without signs of recurrence or tumor spread on follow up.

Comments: The GCC is a rare entity of appendicular tumors with a less favorable prognosis than the appendicular pure neuroendocrine tumors. It behaves like a low-grade adenocarcinoma and often presents as disseminated disease. Therefore, sometimes surgical treatment with appendicectomy is not enough, needing the right hemicolectomy to avoid recurrence. This is recommended for tumors > 2 cm, pT3 or T4 and higher grade histology.

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Fig. 1

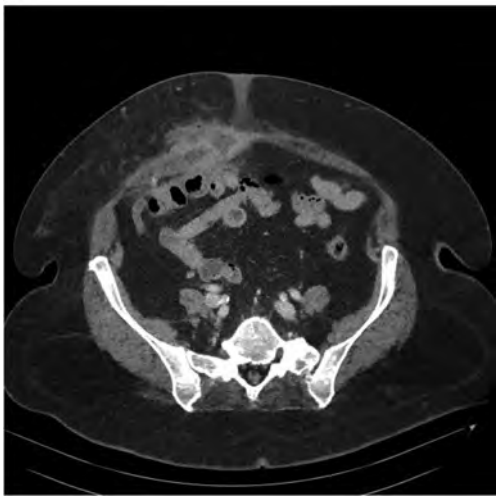


Fig. 2

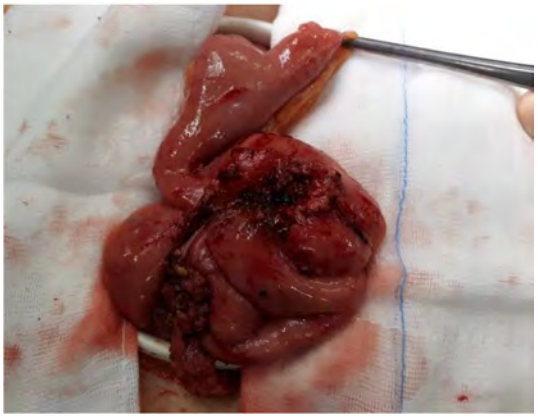
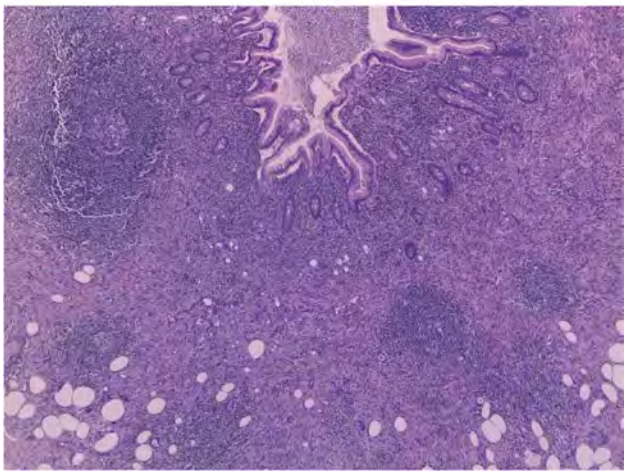


Fig. 3



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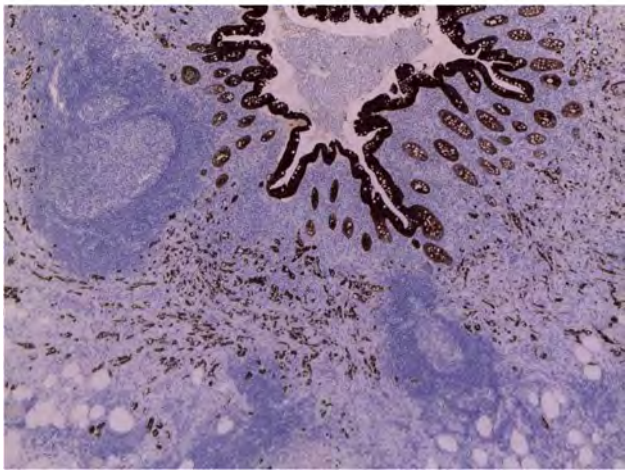
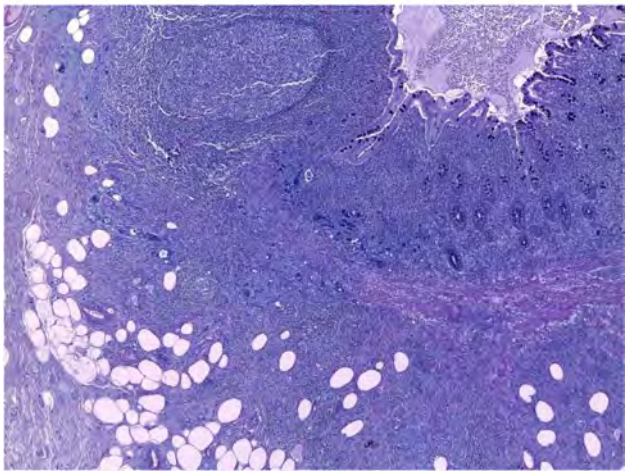


Fig. 5



PR 376

Post pancreatoduodenectomy hemorrhage: association between cause and severity of bleeding

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Introduction: Among the post-pancreatoduodenectomy complications post pancreatoduodenectomy hemorrhage (PPH) is the least common complication, but severe form may be life-threatening without an urgent treatment. Late PPH are more likely due to a complex physio-pathological pathway secondary to different etiologies. The understanding of the etiology and such a pathway could

therefore be of great interest to guide the treatment of potential life-threatening late severe PPH.

Results: During the aforementioned period 347 patients underwent PD, of whom 18 (5.18%) developed PPH. Early PPH was reported in one patient (5.6%) with severe bleeding from the gastric stapler line. Late PPH were reported in 17 of these patients (94.4%). The most common causes were bleeding from a vascular pseudoaneurysm reported in 6 patients of which, one had mild and 5 had severe hemorrhage and bleeding from gastro-enteric anastomosis marginal ulcer in 6 patients, all with mild hemorrhage. No etiology was fond in 5 patients with mild hemorrhage. A significant association was found between the severity of late hemorrhage and the vascular pseudoaneurysm as a cause of bleeding ($p < 0.001$). All pseudoaneurysm bleeding occurred in cases complicated by a post-operative pancreatic fistula (POPF) with a significant statistical association ($p < 0.001$).

Conclusions: The most common cause of PPH was bleeding from a vascular pseudoaneurysm, most of them were severe bleeding with late presentation and all were associated with a POPF. In these cases, early detection by CTA is mandatory, allowing an urgent treatment by angiography of such a bleeding vascular complication following PD.

Fig. 1

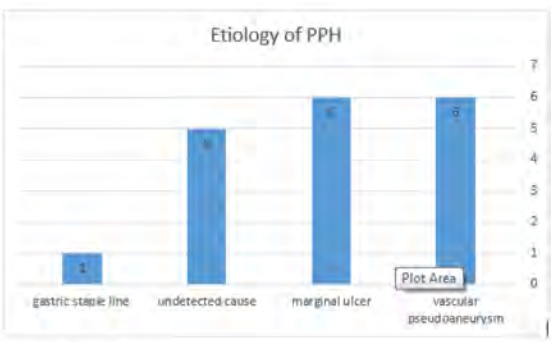

Figure 1: Distribution of causes of PPH

Fig. 2

		Mild	Severe	Total
Timing	**Site of bleeding**			
Early	Gastric stapler line	0	1	1
Late	Pseudoaneurysm	1	5	6
	Marginal ulcer	6	0	6
	Unknown	5	0	5
Total		12	6	18

Table 1: Summarize of timing, site of bleeding and severity of PPH.

Fig. 3

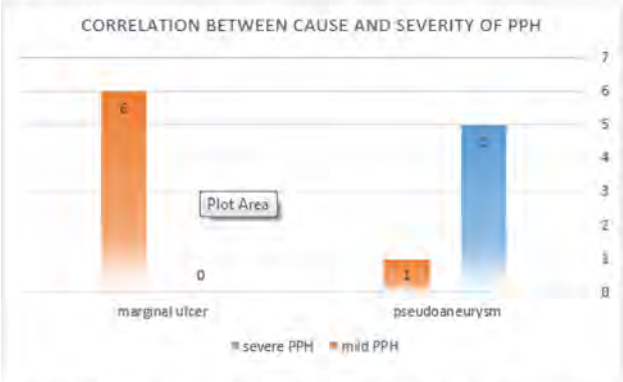

Figure 2: showing the correltaion between the cause of PPH and severity of bleeding.

PR 377

Ventral hernia in hostile situation

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[1]Hospital del Mar, General Surgery, Barcelona, Spain

Introduction: There is no consensus about the benefit or harm derived from adding a mesh hernioplasty at the same time as an urgent intraperitoneal surgery for another cause. The use of a prosthesis in contaminated fields is controversial, but suture repair has a high risk of recurrence. The main objective has been to analyze the impact of the simultaneous repair of uncomplicated midline hernias at the same time as emergency surgery for another cause, in relation to the presentation of complications, the surgical site infection rate (ISQ) and recurrences.

Material and methods: Retrospective, observational study of all urgently operated patients (surgery open and laparoscopic) in the period between 2015–2018 who underwent a simultaneous midline primary ventral hernioplasty. The background, circumstances of the surgery and postoperative complications during the first month and long term through the basis of prospective data of emergency surgery and complications of our surgery department.

Results: A total of 94 patients (50 female) met the inclusion criteria with a mean age of 57.2 years (SD = 17.5), average BMI of 28.7 kg/m^2 (SD = 5.1). The most frequently performed interventions were: appendectomy (38.3%); cholecystectomy (48.9%); and lysis of adhesions (4.3%). The 89.4% of all interventions were performed by laparoscopic approach. They presented associated peritonitis in 12.8% of the cases. The 41.5% of patients presented some complication, in 13.8% surgical site infection (3.2% organ space). During the follow-up three recurrences were detected (3.2%), no patient has presented chronic infection related to the use of prostheses.

Conclusions: In our series the simultaneous performance of hernia repair of the midline in the context of emergency surgery for another cause has been safe and not associated with long-term complications and low recurrence rate.

PR 378

The open abdomen: our experience

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Introduction: "Open abdomen" refers to a solution in which the abdominal content is left deliberately exposed under a temporary cover for a variable amount of time. Since 1970 this method has been used more and more for the treatment of severe intra-abdominal infections. Starting from the 80s the concept has been also applied in trauma surgery.

Material and methods: Between 2002/2019 we have treated 200 patients with this technique. In 45 cases the etiology was traumatic, in the remaining cases the abdominal pathology was inflammatory. In the last years we also started to use it in some cases of treatment of surgical complications. The techniques we used were different and changed during the time. At the beginning of the experience we've completed 4 drainages of the abdominal cavity according to Mickulizt, 5 laparostomies with mesh, 18 Bogota bags. These techniques have been abandoned since the negative pressure therapy came out. We started with the Barker vacuum pack (36 cases), followed by the VAC (Vacuum Assisted Closure) and AB Thera KCI® (33 patients) systems and in the last three years we used the CNP Suprasorb® of Lohmann and Raucher (104 patients).

Results: This therapeutic choice is made in case of massive intestinal edema, risk of or treatment of compartment syndrome, presence of the "lethal triad" (hypothermia, acidosis and coagulopathy) and in presence of massive peritonitis. The need of multiple second looks of the abdominal cavity is another good indication. Negative Pressure guarantees the removal of infected material, reduces intra-abdominal pressure, removes and quantifies the peritoneal fluid, promotes healing and protects the surgical wound.

Conclusions: Negative pressure therapy is an effective tool in the management of the open abdomen. It is a good option either in damage control surgery, where infections and inflammations could be a frequent complication, or in the management of primary infectious and inflammatory diseases.

References:

Fig. 1

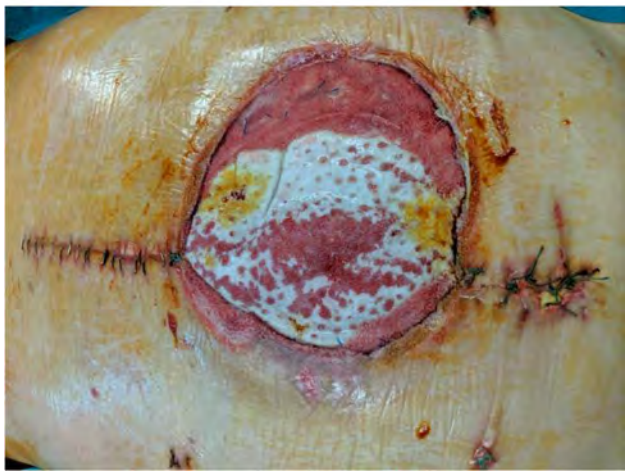

Fig. 2

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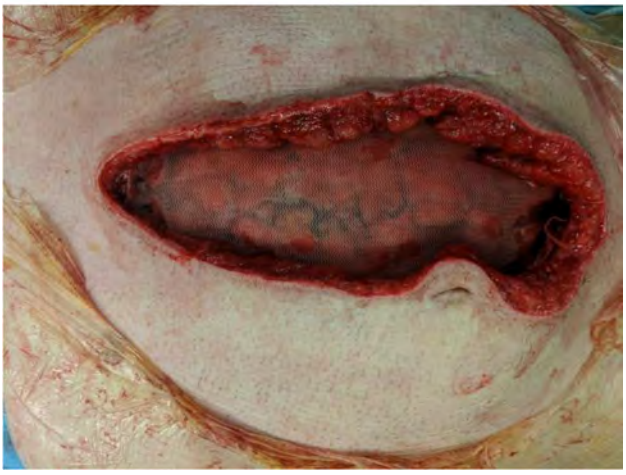

PC 379

A rare finding: small bowel obstruction caused by incarcerated right obturator hernia

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Case history: 79 year old lady presented at the A&E with few days history of constipation, faeculent vomiting, abdominal distension and pain in the lower abdomen. She had Hysterectomy many years ago through a lower midline incision. Her urgent CT scan of the abdomen and pelvis confirmed an incarcerated right obturator hernia containing a small bowel loop causing bowel obstruction.

Clinical findings: Elderly, frail patient with mild tachycardia, distended abdomen and lower abdominal tenderness with guarding in the left iliac fossa. Per rectal examination was unremarkable.

Investigation/results: Inflammatory markers were raised, lactate, liver and kidney function was in normal limits with only mild hypokalaemia and hyponatraemia. CT abdomen and pelvis confirmed small bowel obstruction at the mid ileal level due to right obturator hernia.

Diagnosis: Incarcerated right obturator hernia causing small bowel obstruction.

Therapy and progressions: Patient was taken to the operating theatre for urgent laparotomy. Dilated small bowel loops and incarcerated right obturator hernia was found with proximal ileal loop in it. After blunt stretching and dilatation of the obturator foramen, the involved ileal loop was reduced. It was deemed viable, therefore no bowel resection was required. The defect at the right obturator foramen was closed with suture. Post-operatively the patient was transferred to the Intensive Care Unit for further management.

Comments: Obturator hernias are a rare type of pelvic hernias. Their real incidence is unknown but it is thought to be less than 1% of all hernias worldwide and due to its non-specific symptoms and late diagnosis, they require bowel resectional surgery in nearly 50% of the cases. Howship-Romberg sign is helpful in diagnosing such a hernia, but the ultimate diagnostic choice is CT scanning which is the only way to find this condition early and avoid bowel ischaemia.

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PC 382

Trichobezoar: an unusual gastric mass

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[1]University of Trieste, General Surgery, Trieste, Italy

Case history: A 21-year-old woman without previous medical history presented to the emergency department with abdominal pain and dysphagia associated with nausea, vomiting and absolute constipation. During previous months, she reported having ingested hair.

Clinical findings: Abdominal examination revealed a distended abdomen with rebound tenderness and tinkly bowel sounds.

Investigation/results: CT-scan showed a distended stomach with a mussel-shaped, heterogeneous and non-enhancing mass. An esophagogastroduodenoscopy revealed hair inside the lower esophagus and the stomach.

Diagnosis: High intestinal obstruction due to a gastric trichobezoar.

Therapy and progressions: The patient underwent laparotomy, gastrotomy and trichobezoar removal (Fig. 3). The postoperative period was uneventful and she was discharged home on the 8th POD with a psychiatric evaluation scheduled.

Comments: Bezoars are rare conditions consisting of compacted material that is unable to pass through the gastrointestinal tract. 1 This condition usually involves the stomach; rarely, it can extend into the small bowel and even the colon, giving the so-called Rapunzel syndrome. 2 Bezoars could be composed by vegetable material (phytobezoars), hair (trichobezoars), drugs (pharmacobezoars), or other materials. 1, 3 A trichobezoar is the result of trichotillomania, trichophagia or other psychiatric disorders. 3 Always consider Bezoars in differential diagnosis.

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Fig. 1

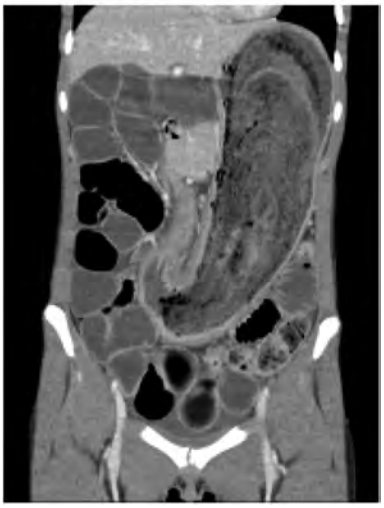

Fig. 2

Fig. 3

PR 383

Critical appraisal of the management of acute severe necrotizing pancreatis according to the step-up approach concept: a single center experience

P. Fransvea[1], M. Di Grezia[1], V. Cozza[1], A. Agnes[1], G. Terzulli[1], S. Magalini[1], D. Gui[1], G. Sganga[1], A. La Greca[1]

[1]Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Catholic University of Rome, Division of Emergency Surgery, Roma, Italy

Introduction: The effectiveness of different step-up approaches is increasingly evaluated but results are controversial. We assessed the results of a standardized step-up approach protocol in the treatment of acute severe necrotizing pancreatitis, with a special focus on patient stratification to obtain an early identification of those deserving a more aggressive strategy.
Matherials and Methods: This is a retrospective analysis of patients with acute severe pancreatitis over a period of 10 years. The variables taken into account were: etiology and severity of the disease, sepsis, organ failure, hemodynamic stability, treatment, LOS, morbidity, mortality. Since 2016, patients with infected necrosis underwent a standardized step-up approach: percutaneous drainage only; percutaneous and endoscopic procedure; surgery. The results were compared with the standard care delivered from 2009 to 2015.
Results: among 142 patients, 51 (35.9%) were identified as affected by severe necrotizing disease. Overall mortality was 29.4%. The initial management was non operativein all patients. Mortality in the step-up group was 20% (3/15) vs 25% (9/36) in the standard care group.
Conclusion: a standardized step-up approach protocol offers better results than standard care in the management of acute severe necrotizing pancreatitis. However, a better stratification of patients.
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rationale of a randomised controlled multicenter trial [ISRCTN09186711]. BMC Gastroenterol. 2013 Nov 25;13:161.

PR 384

A New laparoscopic technique for the treatment of complicated appendicitis which has necrosis and base perforation

T. Donmez[1], *S. Yilmaz*[1], *A. Surek*[1], *M. Karabulut*[1], *E. Gemici*[1]

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Introduction: The appendix stump closure in complicated appendicitis has been widely practiced in different ways such as metal clip, hem-o-lok clip, endoloop and endostapler. The treatment of complicated appendicitis with necrosis and perforation of the appendix base is controversial. We aimed evaluate the efficacy of laparoscopic partial caecum resection with endostapler in complicated appendicitis with necrosis and base perforation.

Material and Methods: From January 2015 to October 2019, we evaluated 28 consecutive patients who underwent a laparoscopic partial caecum resection in complicated appendicitis with necrosis and perforation of the appendix base. Partial caecum resection was performed with the endostapler to close the appendix base at ileo-caecal junction.

Results: The laparoscopic partial caecum resection with endostapler was used in %92.8 of the cases. The mean operative time was 100.07 ± 34.12 min. There were necrosis of appendix base in 12, perforation of appendix base and diffuse peritonitis in 9, perforation of the appendix base and localized peritonitis in 7 of the patients. The wound and intra-abdominal infection rates were 9.8% and 7.2%, respectively. There were no operative complications and the conversion rate was 7.2%. The average length of hospital stay was 4.46 ± 3.10 days. There was no leakage on the stapler line.

Conclusions: The laparoscopic partial caecum resection with endostapler in complicated appendicitis with necrosis and perforation of the appendix base, is a safe and effective technique.

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PR 385

To operate or to not operate, the sigmoid volvulus dilemma in the elderly

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Introduction: the term ""volvulus"" comes from the Latin ""volvere""meaning twist. If left unattended, sigmoid volvulus can compromise the blood supply of the involved segment,leading to ischemia,gangrene,perforation and death. The mainstay of sigmoid volvulus management has been through proctoscopic or colonoscopic decompression when feasible, followed by surgery either during the same admission or electively. The aim of our study is to identify patients which can benefit of immediate surgical approach and prognostic factors associated with failure of conservative/endoscopic treatment.

Materials and Methods: charts of 27 patients admitted for sigmoid volvulus to our institute were retrospectively analysed. We revised CT scan images and laboratory tests of all the patients to identify risk factors for conservative treatment failure.

Results: 18 patients underwent surgical procedures; in 9 cases after a failure of an initial conservative approach; 9 patients were managed with endoscopic approach only. Elective surgery was performed in 2 patients.

Conclusion: elevate lactate levels, sigmoid distension > 11 cm, age > 80 years and a non-immediate complete resolution of the bowel obstruction after the endoscopic procedure are risk factors for conservative treatment failure

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PC 386

Chemical tenosynovitis in middle finger after pressured paint gun shot

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[1]Hospital Infanta Elena, Madrid, Spain

Case history: We report a 32-year-old male case presenting left hand middle finger pain after pressured paint gun shot in volar proximal phalanx

Clinical findings: On physical examination swelling and tenderness on the volar side of the hand was observed (Fig. 1)

Investigation/Results: Pain was remarkably more intense with passive finger extension. Distal nerurovascular status was unscathed. There was no fracture reported on radiography. Leukocytosis and acute phase reactants rise was observed on laboratory examination

Diagnosis: After physical, radiological and laboratory examination the diagnosis of acute flexor tenosynovitis was made.

Therapy and Progressions: Open debridement and irrigation following Bruner incisions on middle finger was undertaken within 4 h of injury. Paint impregned in tissues could be observed in subcutaneous tissue, palmar fascia and flexor tendon sheath. Paint affected tissue´s samples were analysed in microbiology laboratory (Fig 2, 3) After checking nerurovascular indemnity, 14G drainage was left in deep tissues and skin suture was performed with 4-0 monofilament non absorbable suture.

The patient followed 3 days intravenous antibiotical therapy followed by 4 weeks oral treatment. He attended Physiotherapy program postoperatively, reporting no functional disability or wound complications after 3 weeks.

Comments: Chemical flexor tenosynovitis is an important emergency which must be correctly diagnosed and treated due to quick progression and potential morbidity if not treated effectively (1)

In our experience, case was managed by open debridement and irrigation but different treatments can be followed depending of

patients´clinical situation, such as IV antibiotics with serial examinations or percutaneous drainage.

References:

1. Bolton, L. E., & Bainbridge, C. (2018). Current opinions regarding the management of pyogenic flexor tenosynovitis: a survey of Pulvertaft Hand Trauma Symposium attendees. Infection.

Fig. 1

Fig. 2

Fig. 3

PR 387

Emergency secondary Laparoscopical treatment of Complications after primary interventions

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Introduction: The evolution of laparoscopic surgery led to the increased growth of the minimally invasive surgical procedures and techniques. Major abdominal surgery can be conducted through a laparoscopical approach. The main advantages of laparoscopy are shorter and smooth initial operative course, minimal pain and early mobilization. In case of unsual pattern in the postoperative course then a possible complication should be suspected.

Material & Methods: For the years 2009 to 2018 selective operations were performed at specific surgical departments of NHS General hospitals and private sector hospitals, using the laparoscopical techniques, the three arm Da Vinci Robotic technology, SILS and NOTES technique. The psecondary procedures followed endoscopic and surgical complications and included bleeding, peritonitis, bowel obstruction and concerned a wide range of reoperations.

Results: The indexes measured in the outcome involved the timing of relaparoscopy, the mean operative time and range, the conversation rate, the postoperative stay, the postoperative complications and mortality. Depending the procedures, the incidence of reported complications ranges between 0.05 and 1.8%. The growing experience of doctors and the diffusion of specialized centers flagged the importance of laparoscopic approach, that had been engaged in the diagnosis and treatment of emergencies. The efficacy and safety of

laparoscopy contributed to the management of the 80% of the cases of acute abdomen.

Conclusions: Laparoscopy provided abdominal wall intergrity,complete visualization of the abdominal cavity, quick identification of the complications, reduces mortality, morbidity and hospitalization.

References: Kirshtein B et al., Early laparoscopic for management of suspected postoperative complications. J Gastrointestinal Surg/Laparoscopic diagnosis and treatment of postoperative complications Am J Surg

Rosin D et al., Laparoscopic management of surgical complications Am J Surg

PR 388

The Acute Surgical Unit at The Canberra Hospital, 10 years down the track, lessons learnt

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Introduction: The Canberra Hospital (TCH) is a tertiary hospital and is a level I trauma centre. It services both an urban and rural population base.

In 2008, a government inquiry into acute hospital services following a series of high profile medical mishaps recommended the setting of a dedicated acute surgical units in the major hospitals.

It should also be noted that Australia does not have a specific subspecialty in Emergency Surgery.

The acute surgical unit at the TCH was set up in 2010 in order to provide a dedicated acute unit to service the ever increasing demand acute surgery. Previous model was that the acute surgical service was integrated into the elective work.

16 additional beds were provided to the unit including the positions of a dedicated director and chief nurse.

The achievement of the unit has been the decreased time to theatre, less after-hours operating, standardised treatment approaches, and dedicated emergency surgery medical staff.

The difficulties have included clinician engagement, competing resources with elective surgery, emergency surgical presentations increasing by 3–6% each year, and the unit"s beds being used for non-acute patients as the hospital approaches regular 100%.

The acute surgical unit has evolved into a specialised acute care that enables rapid assessment and treatment of patients with staff dedicated with skills in this area.

PC 389

Treating pyogenic liver abscesses secondary to diverticulitis in a patient using immunosuppressants for Crohns disease by performing a sigmoid colectomy

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[1]Alrijne Hospital, Department of Surgery, Leiderdorp, Netherlands, [2]Leiden Univeristy Medical Center, Department of Surgery, Leiden, Netherlands, [3]Erasmus Medical Center, Department of Trauma Surgery, Rotterdam, Netherlands, [4]Ministry of Defense, Defense Healthcare Organization, The Hague, Netherlands

Introduction: Pyogenic liver abscess (PLA) formation due to microbial contamination of the liver parenchyma is often seen secondary to intra-abdominal infections. PLA formation due to Crohn"s disease (CD) is a rare complication and not well-documented in current literature. As symptoms often mimic a CD exacerbation, diagnosis is often delayed and severe disease may develop. Optimal treatment for this group of patients remains debatable.

Case Presentation: A 54-year-old man was admitted to the hospital with a 2-week history of overall malaise, fever and night sweats. Patient"s history solely stated a 6-year treatment of CD that was stable over the past period with infliximab and azathioprine.

Investigations and Treatment: Biochemical analysis revealed a C-reactive protein of 314 mg/L and a white blood cell count of 15.3 × 109/L. An abdominal CT scan showed multiple abscesses in the right lobe of the liver and a thickening of the wall in the transition of the descendent colon to sigmoid. The patient"s immunosuppressants were paused, intravenous antibiotics were administered and a percutaneous drainage of the biggest PLA was performed. However, the clinical condition of the patient did not improve. Colonoscopy and PET-CT scan did not reveal any other sites of infections. As patient remained septic and previous imaging revealed mild diverticulitis rather than active CD, an emergency Hartmann"s procedure was performed. Hereafter, the patient recovered rapidly and the PLAs resolved completely.

Conclusion: Diverticulitis of the sigmoid colon should be considered as causative pathology in patients presenting with multiple pyogenic liver abscesses and a history of Crohn"s disease that is in full remission with immunosuppression. When the abscesses exceed 3 cm in size and are multilocular, resection of the inflamed colon can be a treatment option of value.

Content adapted from: Pielage M, Vogels S, Hoencamp R, et al. BMJ Case Rep 2019; accepted Oct 15. https://doi.org/10.1136/bcr-2019-231031.

Fig. 1

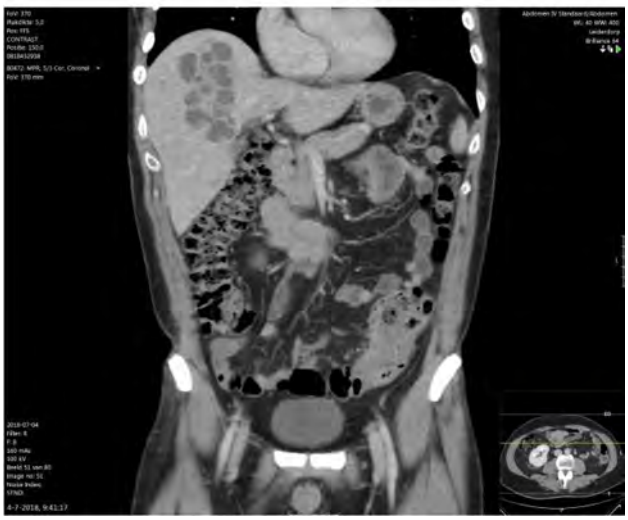

Fig. 2

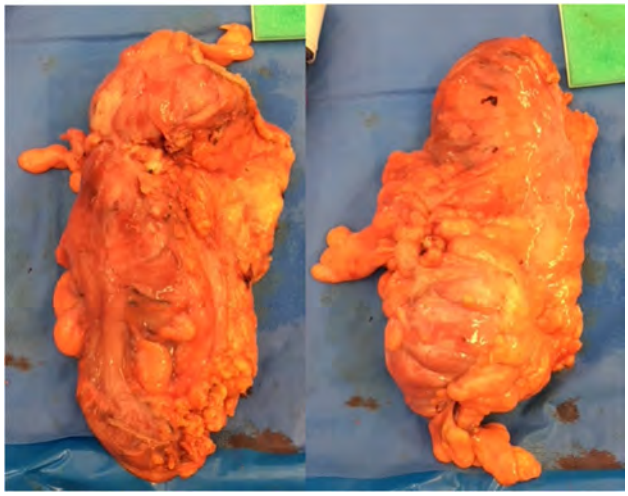

Fig. 3

PC 390

Reinforcement of lower esophageal sphincter with round ligament (*ligamentum teres hepatis*) and anterior partial fundoplication (Dor) in the treatment of right sided strangulated paraesophageal hiatal hernia (PEH)

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Case history: 84-year-old male patient, admitted in the emergency room

Clinical findings: Epigastric pain and recent episode of hematemesis. Pain at deep palpation of the epigastrium, no signs of peritoneal irritation

Investigation/Results: Abdominal x-ray and CT showing a large right sided strangulated paraesophageal PEH, with pneumatosis of the gastric wall

Diagnosis: Right sided strangulated PEH

Therapy and Progressions: Emergent laparotomy. PEH reduced, ischemic portion of the stomach recovering viability. Closure of diaphragmatic defect with non-absorbable suture, reinforcement of lower esophageal sphincter with round ligament (*ligamentum teres hepatis*) and anterior partial fundoplication (Dor). Postoperative course uneventful, patient discharged on 10th pod.

Comments: PEH are mediastinal displacements of abdominal organs, most often the stomach, associated with laxity or a hole in the phrenoesophageal membrane, large enough to allow the gastric fundus to herniate. Because the stomach is attached to the gastroesophageal junction, it tends to rotate around its axis leading to organoaxial volvulus. Occurrence and size increases with age. PEH account for 5–15% of all diaphragmatic hernias. In patients without prohibitive operative risk, they should be surgically corrected, avoiding the risk of acute and potentially life-threatening complications when emergent surgical repair is required. The risk of developing these complications is less than 2%/yr and associated mortality rate is approximately 5%.

References:

Skinner DB. Hernias (hiatal, traumatic, and congenital). *Berk JE, editor. Gastroenterology. Vol. 4. W. B. Saunders; Philadelphia.* 1985 (4): 705–716.

Kahrilas PJ, Kim HC, Pandolfino JE. Approaches to the diagnosis and grading of hiatal hernia. *Best Pract Res Clin Gastroenterol*. 2008;22(4):601–616.

Kohn PG, Price RR, Demeester SR *et al.* Guidelines for the Management of Hiatal Hernia. *SAGES*. 2019.

Fig. 1

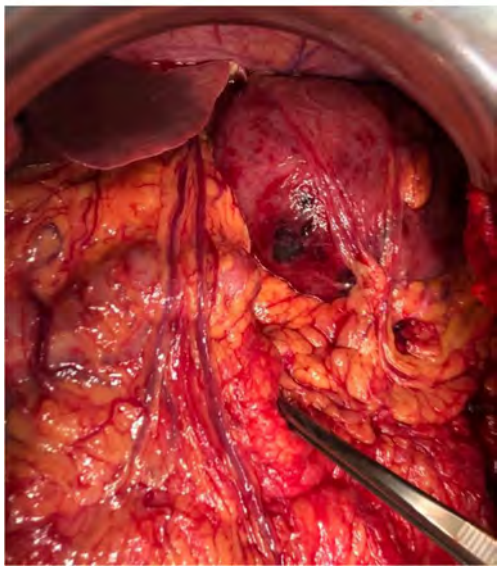


Fig. 2

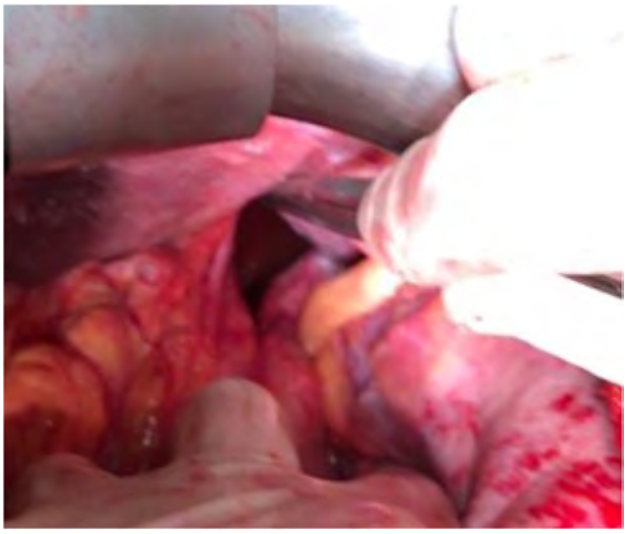
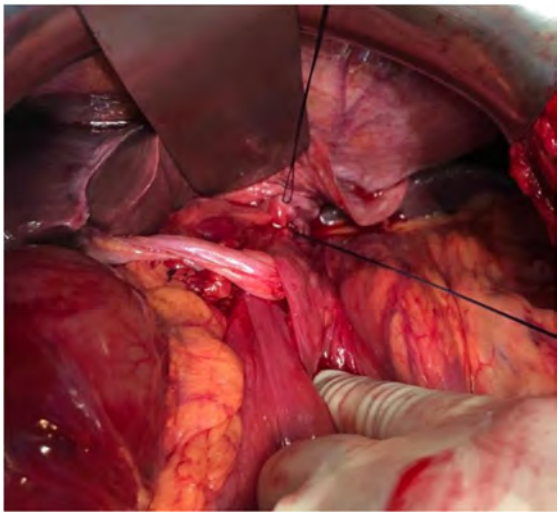


Fig. 3



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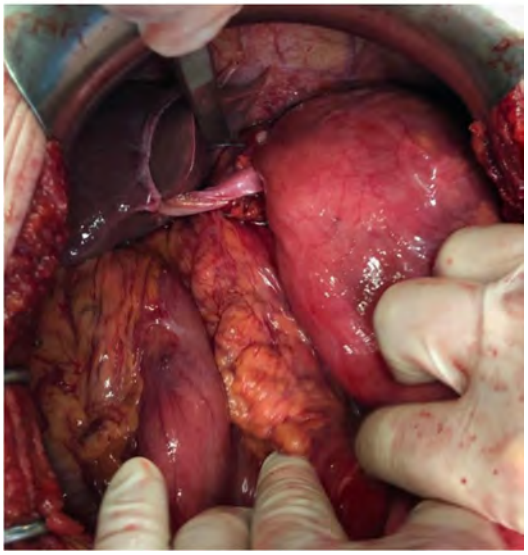

PC 391

Damage Control Surgery in Necrotizing Myositis. A rare and severe cause of Streptococcal Toxic Shock Syndrome

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Case history: Patient was a previously healthy 40-year-old female with an unremarkable past medical history, non-smoker with a high body mass index (BMI > 30). She first presented to a Level 2 medical facility with acute left upper leg pain and swelling. One week prior to this she had a progressive cough, swinging fever, and malaise.
Clinical findings: Patient was transferred to our hospital haemodynamically unstable, acidotic, hypoxemic and delusional. Tachypnea and oliguria were present. She continued to deteriorate clinically with pyrexia (T 39,3 OC), resistant shock, and toxaemia. On examination her left leg was found to be paresthetic below the femoral-inguinal fold.
Investigation/Results: ABg samples showed lactic acidosis with a PH of 7.32 and lactate of 3.2 mmol/L. Hypoxia and hypocapnea were present.Her biochemical profile showed acute kidney injury (AKI) with raised creatinine kinase (CPK) 850 and serum creatinine (CR) 2.08. Chest X-Ray illustrated bilateral lung infiltrations (ARDS image).
Diagnosis: Patient was urgently referred to a CT scan of the left femur with I.V. contrast for suspected necrotising fasciitis. CT findings highlighted a deep muscular femoral abscess with multiple regional fluid collections and necrotizing inflammation from the femur diaphysis to the patella.
Therapy and Progressions: The patient was immediately transferred to OR for emergency surgical exploration and debridement. Almost the entire anterior compartment of the femur was necrotic and hence an extensive excision of the dead tissues and packing with NPWT was performed.
Comments: Severe SNM can cause marked systemic toxic effects, namely, the streptococcal toxic shock syndrome (STSS). STSS secondary to SNM is a life-threatening host response to GAS superantigens with a mortality rate as high as 80%.
References: Hasenboehler E. A., McNair P. J., Rowland E. B., Burch J. M. Necrotizing streptococcal myositis of an extremity: a rare case report. Journal of Orthopaedic Trauma2011.

PC 392

A rare Breed- Small bowel obstruction in an internal hernia due to "V-Lock" peritoneal suture failure after laparoscopic TAPP inguinal hernia repair

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Case history: A 61 year old male who had an elective laparscopic TAPP repair of a right inguinal hernia represented to hospital, 7 days post operatively with features of small bowel obstruction.

Clinical findings: Patient had a diffusedlty tender abdomen and had not passed flatus proceeding his admission to the A + E department and was vomiting.

Investigation/Results: CT abdomen showed small bowel dilatation with abrupt cut-off point proximal to the ICV

Diagnosis: A diagnosis of small bowel obstruction was made based on the clinical and CT findings.

Therapy and Progressions: Patient was taken to theatre for laparoscopy + -proceed and a 'slipped' bowel lopp was noted within the peritoneal flap that had been created a week prior during the original hernia repair. The 'V lock" suture line was found to be loose which is thought to have led to this complication. The bowel loop was reduced, deemed viable and an internal hernia repair was performed. Post-operative period was unremarkable and the patient was discharged day 3 posy-operatively.

Comments: During Lap Tapp hernia repair, there are currently at least 3 options avaiable for peritoneal flap closure; (sutures, tackers and glue.) Suregons prefernce prevails over the chosen approach. When sutures are chosen, most surgeons prefer the self-locking V-lock stitch. By adopting this technique, meticulous periotneal closure is impoartan, as loose suturing of the peritoneum can lead to post operative complications of internal herniation and small bowel obstruction, as described in this case.

A multi-centre prospective study would be welcomed, to compare efficacy and safety of all types of peritoneal closure devices.

PR 393

Assessment of severe complications after gastrointestinal surgery at a major norwegian acute care hospital—2018

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Introduction: Peer review assessment of medical treatment has been shown to be a robust way of improving quality of care in trauma in our institution and globally. In 2016 we introduced regular morbidity and mortality meetings at the department of gastrointestinal surgery. Severe complications (Revised Accordion Classification > 3) after surgery were identified on a weekly basis, evaluated and data included in a local quality registry with the aim of revealing suboptimal surgical quality and continuously improving our results.

Material and Methods: Retrospective analysis of collected data from the described quality registry. All adult patients who had undergone gastrointestinal surgery in 2018 were assessed.

Results: Of 2091 surgical procedures performed, 70% were emergency procedures. A total of 11% (239/2091) experienced a severe complication after surgery and 6% (125/2091) required reoperation. In the group of upper gastrointestinal surgery [n = 570 (27%)] 59% were emergency procedures. Anastomotic leak (AL) was identified in 15% (9/59) undergoing thoraco-laparoscopic esophagectomy and in 8% (3/36 patients) after gastrectomy. Of 190 laparoscopic cholecystectomies, 79% were emergency procedures with 1% (1/151) reoperation. Of 106 hernia repairs, 5% required reoperation.

In the group of lower gastrointestinal surgery [n = 1521 (73%)] 74% were emergency procedures. AL was diagnosed in 5% of 257 colonic resections and 11% of 87 patients after rectal resection. In emergency colorectal resections(n = 30) there were no AL. Of 497 appendectomies, 5 patients (1%) required reoperation. The most frequent cause of reoperation was revision of stoma (26), followed by reoperation for AL (25), abscess (19), and wound dehiscence (13). 17 patients died after surgery of which 15 were emergency surgical patients.

Conclusions: Systematic assessment of all severe complications helps reveal surgical procedures which can be improved but also to identify surgical procedures with low complications rates. Plans are being developed to improve the quality of the identified procedures. All surgical departments should have regular and thorough assessment of their activity.

PR 395

Acute surgical patients operated by emergency surgeons has less risk of post-operative complications and mortality

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Introduction: In England and wales, we perform over 300,000 emergency laparotomy every year. 30 days mortality rate is around 10–11%. In our study we are trying to demonstrate if have dedicated emergency surgery service will make a difference in the outcome of emergency laparotomy.

Material and Methods: Retrospective study on prospectively collected data from NELA database done in a large district general hospital. All patients over 18 years old who underwent emergency laparotomy for acute surgical condition between November 2017 and January 2019 were included in the study. Mortality and post-operative complications were the primary outcomes.

Results: Total of 191 patients were included in the study, 114 operations were performed by Emergency surgeons (ES). 30 days mortality rate was 9%, while it was 12.8% for the none emergency surgeons group (NES) post-operative complications were 13.1% compared to 15% for patients operated by NES. There was shorter ITU stay with average of 2.8 days, while the ITU stay for the other group was 3.3 days, but the ES group had higher chance of unplanned return to theatre. 7.6% of the patients went back to theatre compared to 6% of the other group. Reasons of unplanned return to theatre was mainly post-operative collection or wound dehiscence.

Conclusions: Emergency surgeons has better outcomes when they perform emergency laparotomy, may be because they perform higher number of laparotomy compared to their peers. Emergency surgery has been a growing subspeciality recently, and with no doubts having surgical emergency units has improved the patient's care around UK.

PR 396

The advantage of 2 g over 1 g of prophylactic cefazolin in surgical site infections in trauma surgery below the knee

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Introduction: The rate of surgical site infections(SSI) after foot/ankle surgery remains high, despite the implementation of antibiotic prophylaxis(1). Recently guidelines suggest a single dose of 2 g instead of 1 g of cefazolin for implant surgery, this decision is largely based on pharmacokinetic studies(2). However, the clinical effect of this higher dose has never been investigated in this region. This retrospective cohort study therefore investigated the effect of 2 g compared to 1 g of prophylactic cefazolin on the incidence of SSIs in foot/ankle surgery.

Material and Methods: All patients undergoing trauma-related surgery of the foot, ankle or lower leg between September 2015 and

March 2019 were included. Primary outcome was the incidence of a SSI. SSIs were compared between patients receiving 1 g and 2 g of cefazolin as surgical prophylaxis.

Results: A total of 293 patients received 1 g and 126 patients received 2 g of cefazolin. The groups did not differ in gender, age, weight, co-morbidities or intoxications. The overall number of SSIs was 19 (6.5%) in the 1 g group and 6 (4.8%) in the 2 g group. Corrected for the confounders "age", "smoking" and "blood loss" this was not statistically significant (p = .705).

Conclusions: Even though the decrease in SSI rate from 6.5 to 4.8% was found not to be statistically significant, it might be clinically relevant considering the reduction in morbidity, mortality and healthcare costs. Research linking pharmacokinetic and clinical results of prophylactic cefazolin is needed to establish whether or not the current recommendations and guidelines are sufficient for preventing SSIs in foot/ankle surgery.

References: Modha MRK et al. Antibiotic prophylaxis in foot and ankle surgery: A systematic review of the literature. J Foot Ankle Res. 2018.

Brill MJE et al. Reduced subcutaneous tissue distribution of cefazolin in morbidly obese versus non-obese patients determined using clinical microdialysis. J Antimicrob Chemother. 2014.

PR 397

Differences between Right-sided and Left-sided colonic diverticulitis for the implementation of an outpatient management

M. Savoie Hontoria[1], R. J. Orti Rodríguez[1], M. î García Bello[1], I. Ferrer Vilela[1], N. Díaz Jiménez[1], L. E. Pérez-Sánchez[1], A. D. Pérez Álvarez[1], M. î Barrera Gómez[1]

[1]Hospital Universitario Nuestra Señora de Candelaria, General Surgery, Santa Cruz de Tenerife, Spain

Introduction:Right-sided colonic diverticulitis (RD) is much rarer than Left-sided (LD) and subsequently, controversies concerning the most appropriate treatment remain unsolved. Our experience let us believe that mild RD can benefit from an outpatient management.

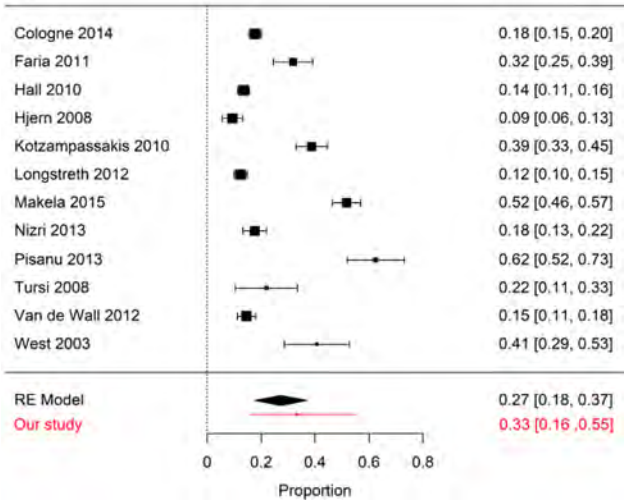
Material and Methods: We performed a single center retrospective comparative study in which we included all our diverticulitis patients that were treated as inpatient in our unit. We divided in two groups:RD and LD group. The LD group was created by randomization from a prospective LD patients database.

Results: We included 24 RD and 94 LD patients treated in our unit from July 2016 to July 2019. Median age was 53.9 in RD and 57.2 in LD, with a 52.2% of females in RD vs 45.2% in LD. ASA classification was significantly lower in RD (ASAI:58.3% vs 33%, ASAII:41.7% vs 46,8, ASAIII:0 vs 18.1%, ASAIV:0 vs 2.1% p = 0.005). The presence of neumoperitoneum in CT scan was significantly higher in LD 16.7% vs 59.6% p = 0.001) Surgery was performed in 26.5% of the left-sided diverticulitis compared to 0 of the RD group (p = 0.0019). Antibiotics of third line (Imipenem and Meropenem) were only required for LD (0 vs 26.1% p = 0.003). Length of hospital stay was significantly shorter (p = 0.001) in RD (3.58 ± 1.35) than in LD group (6.11 ± 3,47)

Conclusions: In our series, patients with right diverticulitis had fewer perforations in the CT scan, they required lower spectrum antibiotics and did not required any surgical treatment with a shorter length of hospital stay. We consider that mild right diverticulitis could benefit from an outpatient treatment with oral antibiotic following similar recommendations to those followed for mild LD patients.

References: Schneider L, Millet I, Boulay-Coletta I, Taourel P, Loriau J, Zins M. Right colonic diverticulitis in Caucasians: presentation and outcomes versus left-sided disease. 2016;42(3):810-817

Fig. 1



PR 398

The PA.R.C.O.UR protocol (PAtient Reconvoqué pour Chirurgie One-day en URgence) in the management of deferred surgical emergencies at the University Hospital of Lille

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Background: Increasing efforts are encouraging the development of outpatient surgery (OS).

The extension of the OS to abdominal and general emergencies becomes a subject of major interest.

When surgery should not be immediate, a night of hospitalization in a specialized environment is performed and surgery deferred overnight.

In some selected patients, a return home is possible with a scheduled emergency surgery the next day.

The PA.R.C.O.UR protocol is set up in the Surgical Emergencies of the University Hospital of Lille after a suitable medical treatment and enlightened information.

This retrospective study assesses whether this deferred surgical management allows a return home on the day of the operation.

Methods: Between 1/01/2015 and 1/09/2018, 3468 records of patients operated for an abscess, appendicitis, cholecystitis or symptomatic inguinal hernia were reviewed. 321 patients who did not have criteria for immediate surgical management (peritonitis, occlusion, sepsis, cellulitis, intravenous treatment need) agreed to return to their home for an OS the next day.

Results: 286/89% interventions were performed in OS and allowed a return home at day 0, within a median time of 7 h [IQR 6–9].

Conclusions: The PA.R.C.O.UR protocol makes it possible to reserve the availability of the entire technical platform (operating rooms and beds) to the most serious pathologies with a failure rate of 11%. The medico-economic benefits, the efficiency in the management of the beds and the satisfaction of the patient and medical staff of this protocol must be evaluated prospectively.

PR 399

Ingested foreign bodies in children

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Introduction: Foreign body (FB) ingestion in childhood is not a rarity in children younger than 5 years, and most FBs pass spontaneously down the gastrointestinal tract. However, in selected cases endoscopic or surgical removal might be needed. The aim of our study was to examine epidemiological factors of children admitted after FB ingestion with special focus on demographics, type of FB swallowed, location/impaction site and type of intervention if any.
Material & Methods: Retrospective review of medical records of children younger than 18 years admitted to Oslo University Hospital with a history of FB ingestion between 2005 and 2018.
Results: A total of 166 patients were included in the study out of which 81 were females (48.8%) and 85 (51.2%) male. Median age was 2.5 years (range 3 months–17 years). Battery was the swallowed FB in 40 patients (24.1%), coin in 39 (23.5%), magnet in 5 (3.0%), and uncategorized FB in 82 (49.4%). The ingested FB passed spontaneously in 52 patients (31.3%). Upper endoscopy was performed in 112 patients (67.5%) with successful removal of FB in 98. Three cases needed surgical intervention (magnets in 2 cases and battery in 1). Of the 48 patients with a FB impacted in the esophagus, 14 were post esophageal atresia repair. Not surprisingly, the FB was food bolus in all except one. Complications were registered in 6 patients (3.6%). A total of 8 patients (4.8%) were readmitted with a new episode of FB ingestion in the study period.
Conclusions: FB ingestion is equally distributed between girls and boys. Two-thirds of admitted patients underwent interventions, with upper endoscopy dominating and with successful removal of the FB in almost 90% of cases. In one-third of patients the FBs passed spontaneously. Children with underlying esophageal pathology are predisposed to FB impaction. Surgical intervention is rarely indicated.

PC 400

Perforation of a Jejunal Diverticulum by a Cod Fishbone

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A 69 years old woman was admitted in our ER presenting with a 12 h sharp epigastric and RUQ pain, fever, nausea and vomiting, HD stable. The patient had a past medical history of tachyarrhythmia, open-angle glaucoma and lower limb venous insufficiency. Her past surgical history included an hysterectomy and bilateral salpingo-oophorectomy, appendectomy and left inguinal hernioplasty. During clinical examination, signs of peritoneal irritation were present. CT scan revealed a small pneumoperitoneum in the LUQ and multiple small and large bowel diverticula, without free peritoneal fluid. Blood work showed mild leukocytosis and neutrophilia.

We performed an urgent exploratory laparoscopy in which dozens of small intestine diverticula were found, increasing proximally in number. One of them, 20 cm distally from the Treitz´s angle, showed signs of perforation, with a small abscess and surrounding fibrin. The affected bowel was externalized through a 4 cm laparotomy for segmental resection and a manual double-layer terminoterminal jejunojejunostomy was performed.

In the perforated jejunal diverticulum, a 25 mm cod fishbone was identified as the cause of the perforation. The histopathological examination of the extracted 6 cm tissue sample, found several diverticular structures of the muscular wall, one of which with a 2 mm perforation and a granulocytic infiltrate with serosa involvement.

Complicated cases of small bowel diverticulosis are best managed by segmental resection surgery. Despite being quite rare, every surgeon should be aware of such acute abdomen presentation. Asymptomatic cases benefit from a watch-and-wait approach.

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Fig. 1

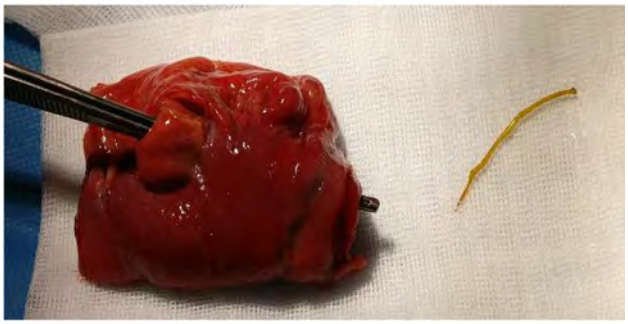


Fig. 2

Fig. 3

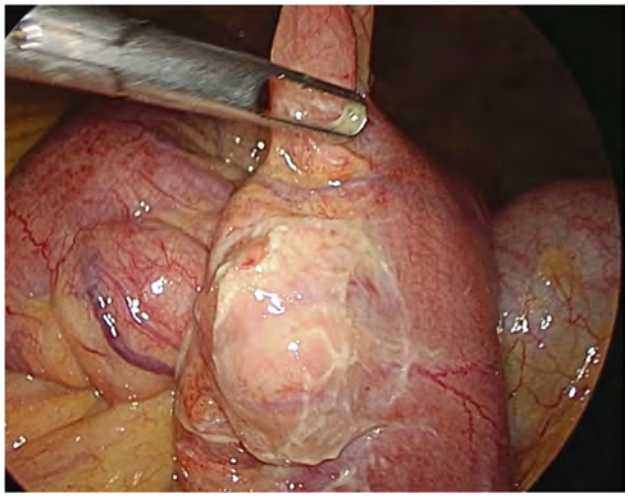
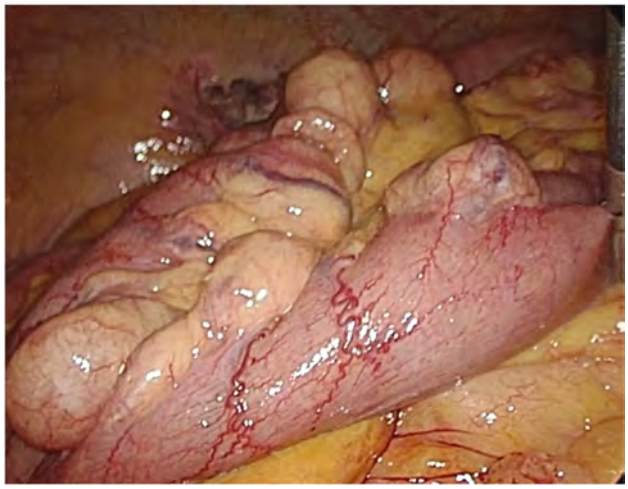


Fig. 4



PC 401

Hemoperitoneum due to gastric volvulus: a very rare clinical manifestation

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Case history: A 47-year-old female consulted to the emergency department for a 24 h epigastric pain. It was accompanied by nausea without vomiting.
Clinical findings: The patient was hemodynamically normal and the abdomen was soft with minimal distention.
Investigation/Results: X-rays showed large gastric dilation. The abdominal CT scan showed mesenteric axial gastric volvulus with minimal free fluid. Suddenly, the patient presented diffuse abdominal pain with diaphoresis, mucocutaneous pallor, hypotension and tachycardia.
Diagnosis: A gastric volvulus with gastric ischemia was suspected. Broad-spectrum antibiotic therapy and resuscitation measures were started. Emergency surgery was indicated.
Therapy and Progressions: A decompressive gastrostomy, gastric reduction and devolvulation, transverse colon resection due to ischemia and splenectomy were performed. After 12 h, she required total gastrectomy and right hemicolectomy due to ischemia secondary to severe septic shock associated with disseminated intravascular coagulation.
Comments: The gastric volvulus is an uncommon entity, being the mesenteric-axial type so rare. There are very few cases described whose manifestation is accompanied by hypovolemic shock secondary to splenic laceration, which occurred due to the great gastric distention. Early diagnosis is the key to start treatment as quickly as possible, due to high mortality The main mechanism of death is usually vascular involvement, perforation and multiorgan failure.
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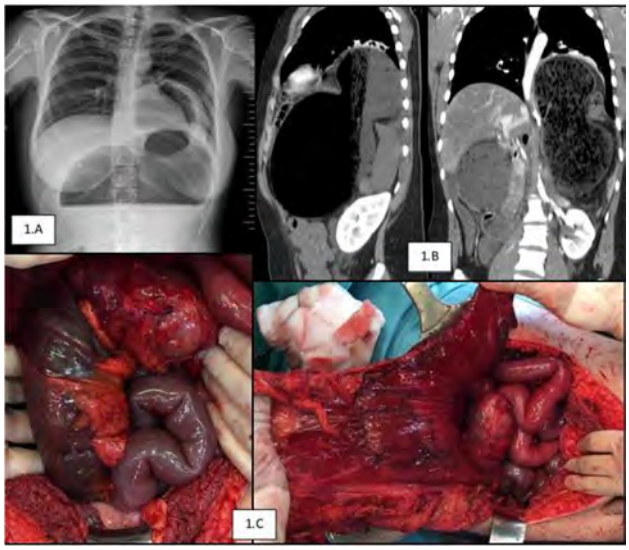
Fig. 1



PR 402

Demographics of Pediatric Open Globe Injury As Seen in a National Database

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Introduction: The objective of our project is to utilize the National Inpatient Sample (NIS) Database to describe the demographics and identify trends in pediatric open globe injuries (OGIs).
Material and Methods: This is a cross-sectional observational study of 13,621 (weighted) cases of pediatric OGI between 2002 and 2013 in the NIS Database, a database of national inpatient stays in the United States. Weighted analysis was performed using IBM SPSS Statistics 25. We used codes from the *International Classification of Disease, Ninth Revision* to identify pediatric OGI cases and procedures. We defined the pediatric population as ages 0–20 years.

Results: We analyzed 13,621 pediatric OGIs, and 23.3% of pediatric cases occurred in the 0–5 age group, 20.1% in 6–10, 19.9% in 11–15, and 36.7% in 16–20. The average age of the cohort was 11.5 years and 76.5% of cases occurred in boys. Racial distribution revealed 35.8% of cases in Caucasians, 17.0% in African Americans, and 17.3% in Hispanics. Most (39.9%) cases were documented in the Southern United States. Of our 13,621 cases, 12.6% underwent vitrectomy, 4.2% underwent enucleation, and 1.8% developed endophthalmitis. The rate of endophthalmitis development after OGI was highest (4.6%) in the Asian/Pacific Islander group. The average length of stay for the entire cohort was 3.51 days, and the average cost per day was $11,724.01. Table 1 contains a breakdown of our statistics.

Conclusions: As documented in the NIS, OGI occurs more commonly in boys than in girls at a ratio of approximately 3:1. The rates of vitrectomy and enucleation are higher in boys. We noted a higher of rate of enucleation in Asian/Pacific Islanders and African Americans. The plurality of OGIs occur in the 16–20 age group; this age group also has the highest relative rate of enucleation. With respect to location, OGIs occurring in the Western United States had the highest average cost per day of inpatient stay.

Fig. 1

Table 1: Descriptive Statistics.

	Number of OGIs	Percent of OGIs undergoing PPV	Percent of Enucleated OGIs	Percent of OGIs Developing PTE	Average Length of Stay (days)	Cost/Day
Overall	13,621	12.6%	4.2%	1.8%	3.51	$11,724.01
Sex						
Boy	10,548	13.6%	4.6%	1.8%	3.43	$11,738.39
Girl	3127	9.7%	3.0%	2.0%	3.83	$11,456.77
Missing (118)						
Race						
White	4940	14.6%	3.1%	1.5%	3.70	$11,607.44
Black	2351	8.1%	6.3%	0.9%	3.47	$11,554.97
Hispanic	2380	12.2%	3.8%	2.3%	3.48	$14,749.80
Asian/Pacific Islander	308	12.8%	11.0%	4.6%	3.30	$13,141.99
Native American	151	6.4%	0.0%	3.0%	4.35	$15,283.51
Other	515	7.5%	2.7%	0.0%	3.33	$8,656.47
Missing (3148)						
Age (years)						
0-5	3221	10.5%	1.2%	1.7%	3.30	$10,649.62
6-10	2771	13.7%	1.4%	2.6%	2.27	$10,230.43
11-15	2746	16.5%	4.8%	2.5%	2.99	$11,009.32
16-20	5056	11.4%	7.4%	1.1%	4.49	$13,622.28
Location						
Northeast	2469	9.8%	3.9%	2.0%	3.22	$10,439.32
Midwest	2796	13.9%	5.5%	2.5%	3.16	$10,016.32
South	5500	12.9%	3.8%	1.5%	3.91	$10,688.36
West	3028	13.4%	4.1%	1.6%	3.34	$16,647.95

SKELETAL AND SPORTS TRAUMA

PR 91

Autologous tissue from intramedullary channel parietes for femur nonunions management

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Introduction: A reamer-irrigator-aspirator (RIA) method is deeply reliable for getting high volumes of bone graft/MSCs. High rates of successful outcomes have been reported after the use of RIA bone fragments to cure non-unions.

Material and Methods: Being supported by histomorphological examination of the material acquired while drilling intramedullary channels of 41 patients with femur nonunions (20—hypertrophic, 21—oligotrophic), we have discovered that nevertheless, expressions of the dystrophy and necrosis in bone tissue and marrow in pseudoarthrosis areas depend on time since fracture occurrence, the microscopic study of the material 5 cm above and below a fracture line has demonstrated ordinary structures of bone tissue and marrow in all cases.

Results: The efficiency of cloned stromal stem cells from femoral bone marrow in hypertrophic pseudoarthrosis was 24.07 ± 1.74 out of 105 nuclear cells, contrasted to 2.03 ± 0.49 out of 105 nuclear cells in cases of oligotrophic nonunions. In the case of hypertrophic nonunions, the number of colonies of bone marrow stromal fibroblasts in the Petri cups 12 times exceeded the same value of the patients with oligotrophic pseudoarthrosis (193 ± 16.20 and 25.4 ± 4.20 respectively).

Conclusions: An Autologous Tissue from Intramedullary Channel Parietes facilitates reparative osteogenesis only for hypertrophic nonunions. To support reparative osteogenesis in oligotrophic nonunions, bone plastic shall be accompanied by other the other autologous materials of the connective tissues (PEFG, PEFC, etc.) shall be added to the bone plastics.

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PR 92

Screw Fixation of the Posterior Malleolus Fragment in Ankle Fracture

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Introduction: This study aimed to evaluate the outcomes of ankle fractures with posterior malleolus fragments (PMFs) involving < 25% of the articular surface treated with or without screw fixation.

Material and Methods: Among patients with ankle fractures and PMFs who underwent surgery between March 2014 and February 2017, 62 with type 1 PMFs involving < 25% of the articular surface were included. Of these 62 patients, 32 underwent screw fixation for PMFs and lateral and/or medial malleolar fracture fixation (group A) and 30 underwent internal fixation for malleolar fractures without screw fixation for PMFs (group B). Ankle joint alignment and fracture healing were measured using plain radiography and computed tomography (CT). Clinical outcomes were determined using the American Academy of Orthopaedic Surgeons Foot and Ankle Questionnaire, Short Form-36, and American Orthopaedic Foot & Ankle Society Scale.

Results: Nonunion was not noted in either group. However, we detected union with a step-off of 2 mm or more in 2 cases from group B. With regard to ankle joint alignment, 1 case in group A and 3 cases in group B showed mild asymmetry of the medial and lateral clear spaces on CT at 12 months. Clinical outcomes at 6 and 12 months after surgery were better in group A than in group B.

Conclusions: Screw fixation of PMFs was effective for fracture healing and maintaining ankle alignment. Additionally, it improved short-term clinical outcomes, which we believe was due to stabilization of ankle fractures with PMFs involving< 25% of the articular surface.
References: Level II, prospective comparative study.

Fig. 1

Fig. 2

PR 93

How accurate can gaps and step-offs be determined in acetabular fracture treatment?

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[1]UMCG, Trauma Surgery, Groningen, Netherlands, [2]UMCG, Oral and Maxillofacial Surgery, Groningen, Netherlands, [3]UMCG, Groningen, Netherlands

Introduction: The assessment of gaps and steps in acetabular fractures is challenging. Studies evaluating the value of various imaging techniques to enable accurate quantification of acetabular fracture displacement are limited. This study aimed to assess the inter- and intra-observer variability of gap and step-off measurements using pelvic radiographs, intraoperative fluoroscopy and computed tomography (CT).
Material and Methods: Sixty patients, surgically treated for acetabular fractures, were included. Five observers measured the gap and step-off on all the pre- and postoperative pelvic radiographs and CT scans. Intraoperative fluoroscopy images were reassessed to determine the presence of gaps and/or step-offs. The inter- and intra-observer variability were calculated for the measurements using pelvic radiographs or CT scans. Kappa was calculated for the intra-operative fluoroscopy assessment.
Results: For the preoperative displacement, the Intraclass Correlation Coefficient (ICC) was 0.4 (gap and step-off) using pelvic radiographs, and 0.4 (gap) and 0.0 (step-off) using CT scans. For the postoperative displacement the ICC was 0.4 (gap) and 0.2 (step-off) using pelvic radiographs and 0.3 (gap) and 0.4 (step-off) using CT scans. The average Kappa for the intraoperative gap and/or step-off assessment using fluoroscopy was 0.2 (− 0.36 to 1) both for the inter- and intra-observer assessment.
Conclusions: There is little agreement between the observers regarding the measurements of the preoperative displacement, the presence of gaps and step-offs intraoperatively and the measurements of the postoperative displacement.
A possible explanation for this is that the acetabulum has a three-dimensional spherical shape with multiple fracture lines and fragments going in different directions. Single radiographic or CT-based gap or step-off measurements do not seem to be representative for the fracture characteristics, therefore the use of 3D measurements should be considered.

PR 94

Combined administration of vitamins *d* and *e* prevents the occurrence of glucocorticoid-induced osteochondropathy (Experimental study)

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Introduction: Long-Term intake of glucocorticoids leads to pathologic changes in bone and cartilage tissues.
Material and Methods: To understand how to prevent the occurrence of the pathology, we studied the use of vitamin D, vitamin E and a combination thereof on the background of the intake of prednisolone, 0.5 mg/100 g of body weight. The experiment involved 68 male rats of Wistar linear breed. The animals were 2 months old and weighted 100.0 ± 5.0 g. The experiment included 4 series of animals, 17 rats in each, namely: the first group–intact animals; the rest of the animals received prednisolone, 0.5 mg/100 g of body weight. The rats of the third series received additionally 100 IU of vitamin D3. The animals from the fourth group also received 0.726 IU (0.6 mg) of vitamin E.
Results: Long-term administration of prednisolone to the experimental animals has caused significant structural and functional disorders in their bone and cartilage tissues. They can be construed as simulated glucocorticoid-induced osteochondropathy.

The combination of the vitamins D3 and E has demonstrated its ability to promote restoration of histomorphologic features of bone and articular cartilage in proximal femur epiphysis and epiphyseal cartilage of proximal femur epimetaphysis in animals with simulated glucocorticoid-induced osteochondropathy.

The combination of the vitamins D3 and E has demonstrated a better effect on the background of the glucocorticoid-induced osteochondropathy, compared to the vitamin D3 alone.

Conclusions: Preventive administration of the vitamins D3 and E while treatment with prednisolone leads to avoidance of the majority of pathologic changes, resulting otherwise from glucocorticoid-induced osteochondropathy.

PR 96

Clinical Results of Osteochondral Autograft from Ipsilateral Femoral Head for Femoral Head Defect after Posterior Hip Fracture Dislocation—Short Term Preliminary Study

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[1]chung-nam national university hospital, orthopaedic, daejeon, South Korea

[2]Konyang university hospital, orthopaedic, deajeon, South Korea

Introduction: The purpose of this study was to evaluate clinical, radiological and functional outcomes of patients had osteochondral autograft harvested from the ipsilateral femoral head for a femoral head defect after posterior hip fracture dislocation

Material and Methods: This study was approved by IRB at our institution. A retrospective chart review of a prospectively performed operation was performed at two university hospital between March 1, 2014, and June 30, 2018. All fracture was classified by the AO/OTA classification. We included the patients had minimum 6 months of follow up periods. Ten displaced head fractures were addressed through posterior surgical dislocation and two patients had no posterior dislocation was operated using Smith-Peterson approach. An osteochondral graft was harvested from inferior non-weight bearing articular surface and grafted to osteochondral defect. All patients were full weight bearing by 3 months

Results: We had 86 femoral head fracture dislocation. 5 patients were excluded due to lost to follow up. Twelve of 81 with type I/II Pipkin fracture dislocation with the articular defect and reduced within 12 h of injury was identified for review. The patients were followed up for a mean of 13.2 months. There was no osteonecrosis. Decreased joint space was identified in two patients. All fractures achieved union. The mean Harris Hip Score of last follow up was 89.1 (56–98) One patient who operated using the Smith-Peterson approach had femoral nerve palsy.

Conclusions: The clinical and radiological results after treatment of femoral head fracture dislocation with articular defect by Osteochondral autograft harvested from its own non-weight bearing articular surface show good outcomes.

PR 97

Posterior malleolus in ankle fractures. A prospective series

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Introduction: Preoperative computerized tomography scan provides important information about ankle fractures associating posterior malleolus, helping us distinguishing fractures affecting distal tibiofibular joint. The aim of our paper is to describe our series of patients suffering an ankle fracture with posterior malleolus involvement.

Methods: Fifty-two consecutive patients, with ankle fracture involving posterior malleolus were evaluated prospectively. All of them were assed with a preoperative CT scan, Demographic data, fracture mechanism, surgical approaches, posterior malleolus size measured classification and treatments were analyzed.

Results: Most frequent posterior malleolus pattern according to Bartonicek classification was type II, twenty-two patients (42.3%). An alternative surgical approach was performed in thirty-three patients (63%) as a consequence of information provided by CT scan. No statistical differences were observed when measuring posterior malleolus in conventional x-rays or CT scan. Analysis of variance showed a p value less than 0.05 when comparing PM size and Haraguchi and Bartonicek classifications.

Discussion and Conclusion: CT scan is required to perform an adequate preoperative study of ankle fractures involving posterior malleolus, using this information to provide a better outcome to our patients.

PR 98

Effect of atorvastatin and losartan on gene expression and cell count in a rat model of posttraumatic joint contracture of the knee—a blinded and randomized animal study

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Introduction: Myofibroblasts have been associated with increased posttraumatic joint contracture, which has a massive impact on articular function. Atorvastatin and losartan have shown to reduce the proliferation of cardiac, hepatic and pulmonary myofibroblasts. The aim of this study was to evaluate the effect of atorvastatin and losartan on gene expression, cell count and collagen deposition in the posterior joint capsule 2, 4 and 8 weeks after trauma in a rat model of posttraumatic joint contracture of the knee.

Material and Methods: Posterior capsular injury and Kirschner-wire immobilization of the knee were performed in 72 Sprague–Dawley rats. Atorvastatin, losartan, or placebo was administered daily orally. The rats were sacrificed at either 2 (n = 24), 4 (n = 24) or 8 (n = 24) weeks after initial surgery. Rats euthanized at week 8 had their K-wire removed at week 4, followed by a remobilization period of another 4 weeks. The results were evaluated via qPCR and immunohistochemistry.

Results: Losartan reduced the number of myofibroblasts in comparison to the control at week 2 and 4, whereas atorvastatin lowered myofibroblasts only at week 2 ($p < 0.05$). Atorvastatin reduced the collagen deposition at week 2, whereas losartan had no effect on collagen deposition. Losartan decreased gene expression of connective tissue growth factor (CTGF) at week 4 and of TGF-β at week 8. Conclusions: While atorvastatin had little effect on cell count and gene expression, losartan reduced the number of myofibroblasts during contracture development as well as the expression of proinflammatory TGF-β and profibrotic CTGF

References:

Baranowski, Andreas, et al. "A novel rat model of stable posttraumatic joint stiffness of the knee." Journal of orthopaedic surgery and research 1(2018): 185.

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Fig. 1

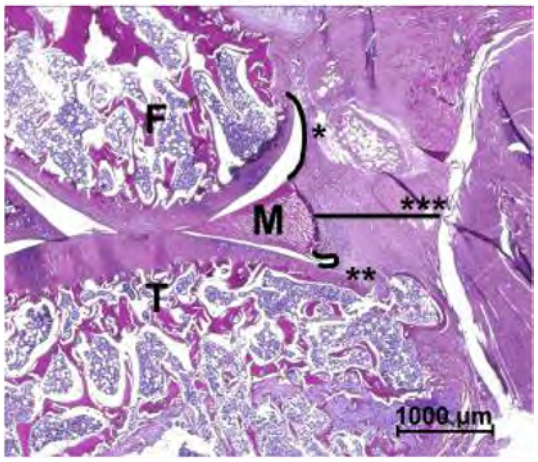
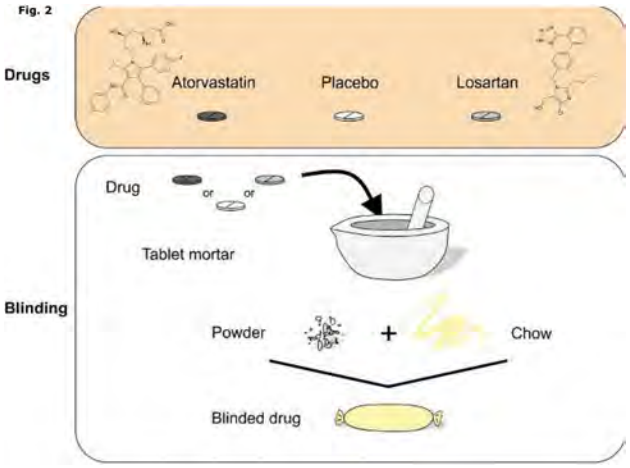


Fig. 2



PC 99

Low Energy Closed Knee Dislocation With Patellar Tendon Rupture: A Case Report

J. D. Serrano Alonso[1], *D. Bustamante Recuenco*[1], *L. M. Ramos Ramos*[1], *C. Navas García*[1], *E. García Jarabo*[1], *J. Sevilla Fernández*[1], *C. Vidal Bujanda*[1]

[1]Hospital Universitario 12 de Octubre, Cirugía Ortopédica y Traumatología, Madrid, Spain

Case history: A 33 year-old male suffered a direct trauma on his right knee while playing football.

Clinical findings: Positive anterior drawer test, grade III valgus instability, and a palpable gap below the patella were assessed. No neurovascular alterations were found and ankle-brachial index scored > 0.9.

Investigation/Results: Initial immobilization with a splint was performed. Radiographs showed a high patella with no other lesions. MRI revealed a complete rupture of the patellar tendon and a complex multiligamentous injury with complete anterior cruciate ligament (ACL) tear, avulsion of distal medial colateral ligament (MCL), and a complex rupture of both meniscus.

Diagnosis: Knee dislocation with patellar tendon rupture.

Therapy and Progressions: Definitive treatment was performed 7 days after the initial lesion, with arthroscopic resection of the posterior horn of the external meniscus and reconstruction of the ACL with posterior tibial tendon allograft, as well as open repair of the patellar tendon and the internal meniscus, with subsequent MCL distal reinsertion. Immediate partial weight-bearing with an extension orthosis was allowed. The patient is currently progressing with rehabilitation.

Comments:

Knee dislocation is a rare injury, and most cases are due to high-energy trauma. Concomitant rupture of the patellar tendon is very unusual, and most cases are described in the context of open injuries.

Surgery is mandatory in order to restore full stability of the knee, with either one intervention or a staged surgery, including repair of the collateral ligaments and the patellar tendon followed by arthroscopic reconstruction of the cruciate ligaments. Postoperative management consists on early ROM restoration and weight-bearing as tolerated.

References:

Takahashi T, Matsumara T, Ishihara K, Hiyama S, Takeshita K. Open knee dislocation with a patellar tendon rupture: Result of staged surgical repair. *SAGE open medical case reports* 2019; 7: 1–7.

Fig. 1

Fig. 2

Fig. 3

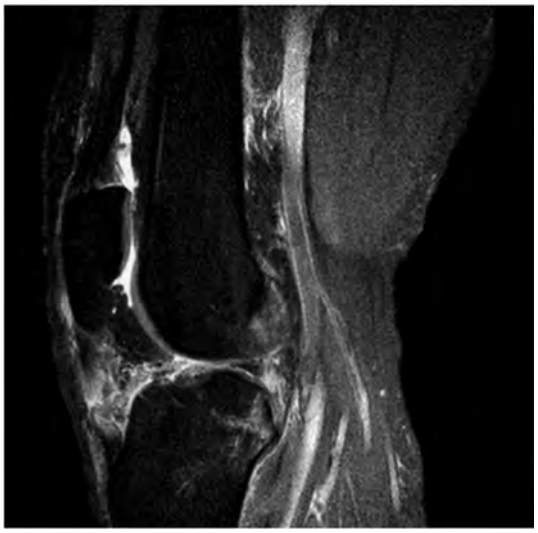
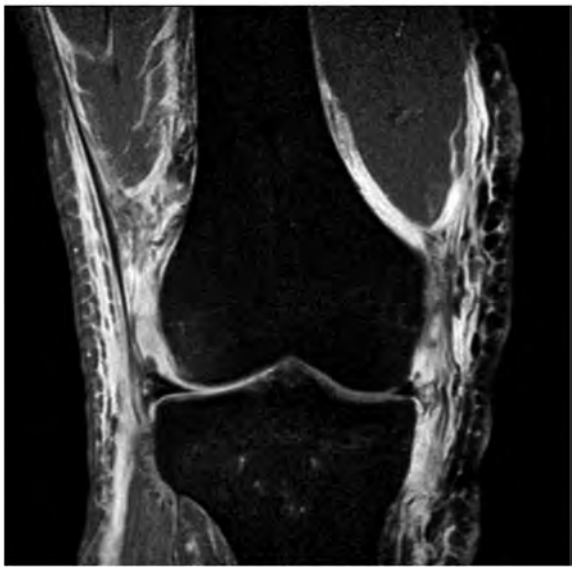


Fig. 4



PR 100

Anterior Inferior Iliac Spine Avulsion Fracture In A Young Athlete, How To Manage?

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Introduction: Apophyseal Anterior Inferior Iliac Spine (AIIS) fractures are rare injuries. They most commonly occur in athletes in adolescence period. Because the ossification of pelvis is not completed, apophyses are the weakest part of musculo-tendinous unit during this period, thus avulsion fractures are more frequent than muscle ruptures. AIIS avulsions are the result of sudden and forceful contraction of rectus femoris muscle concentrically or eccentrically.
Material and Methods: We report a clinical case of a AIIS avulsion fracture in a young male football player, after being misdiagnosed as muscle strain.
Results: Our patient was treated with conservative treatment including bed rest, analgesia, using crutches and toe-touch weight bearing, progressing to full weight bearing as tolerated and nonsteroidal anti-inflammatory drugs. At follow-up, he showed relief from his pain and mechanical symptoms and regained full range of motion and returned to his previous levels of activity.
Conclusions: Diagnosis requires careful attention to the physical examination and imaging. In this case, the fracture was managed successfully with a conservative approach. Good results and return to previous levels of activity can be achieved with conservative treatment. When misdiagnosed as a simple strain, the late diagnosis may cause chronic pain with decreased sportive performance in the future. Therefore, a carefully taken anamnesis and physical examination with comparative anterior–posterior pelvic x-rays are needed not to miss avulsions in adolescents; also in some instances, more advanced scanning methods must be considered.
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I have no actual or potential conflict of interest in relation to this program/presentation.

PR 101

Surgical treatment of the meniscal tears in children

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Introduction: The problem of meniscus damage in children is due to unsatisfactory treatment results, which is associated with the frequent execution of meniscectomies. Amount of unjustified meniscectomies and the incidence of osteoarthritis can be reduced if menisci are repaired.
Material and Methods: During the period January 2018–August 2019 66 children with injuries of the meniscus were treated in Morozov Children's Clinical Hospital. 59 children underwent meniscus repair by suturing using three techniques: "all inside", "inside out" and "outside to inside". Meniscus suture decision was

made taking into account the assessment of the severity of the damage. The period from the moment of injury wasn't taken into account. The technique of meniscus suture was determined depending on the location and type of damage. We met 4 children with damage to the discoid meniscus who underwent partial resection and meniscus suture. 7 children underwent a meniscectomy due to severe traumatic and degenerative changes. Children had MRI of the knee after 6 months and X-ray after 12 months.

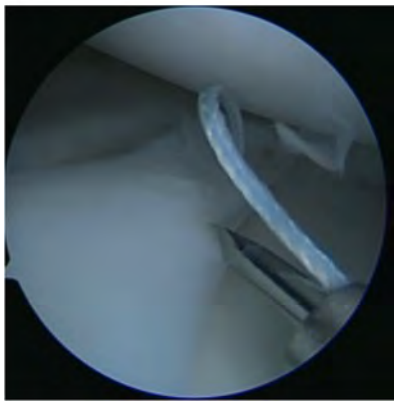
Results: 30 children achieved a satisfactory functional result; 28 operated children are at the rehabilitation stage. We faced a complication—limitation of flexion in the knee joint in 1 child. In all children on the control MRI, the absence of synovitis, the safety of the reconstructed meniscus contour and the decrease in the intensity of the hyperechoic signal in the gap zone in dynamics are determined.

Conclusions: The introduction of a technique for repair meniscus integrity in the daily practice of an arthroscopist makes it possible to reduce the number of meniscectomies, which will reduce the number of unsatisfactory treatment results for this pathology and prevent the development of early osteoarthritis

References: Patil A.S., Chandorkar A.H. Imaging of Meniscus Repair and Healing: A Review of Current Trends/Literature//Asian Journal of Arthroscopy. Aug–Nov 2016. 1(2). 23–27p

Fig. 1

Fig. 2



PR 102

Plastic surgery of the medial patellofemoral ligament with a tendon of the quadriceps femoris in children with a dislocation of the patella

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Introduction: Dislocation of the patella is one of the most common knee injuries in children. The presence of a large number of treatment methods and frequent relapses indicates the absence of a unified approach to the treatment of this pathology

Material and Methods: From 2015 to August 2019 189 children with dislocation of the patella addressed to the Morozov Children's Hospital. Of these, 97 children revealed a fracture-dislocation of the patella. In 64 children, a tangential fracture of the lateral condyle of the femur was noted. In 110 children, the dislocation was repeated. We met 89 children with bilateral damage. All children with complete damage to the medial patellofemoral ligament, fracture-dislocation of the patella and dysplastic dislocation were performed tendon plastic using the quadriceps femoris tendon. The technique includes: transplanting a graft quadriceps tendon graft without cutting off the patella. Next, the transplant is subfascial carried out in the medial direction and is fixed with a bio-integrated screw in the femur.

Results: The rehabilitation period was 4 months. 10% of children have a satisfactory result (there is a limitation of flexion in the knee joint to 90°). 90% have an excellent clinical result: the full range of motion in the knee joint, the absence of pain and a return to sports. None of the operated children had relapses of dislocation.

Conclusions: It is recommended to consider the technique of tendon plasty of the medial patellofemoral ligament using the quadriceps femoris tendon as a method of choosing the treatment for patellar dislocation in children.

References:

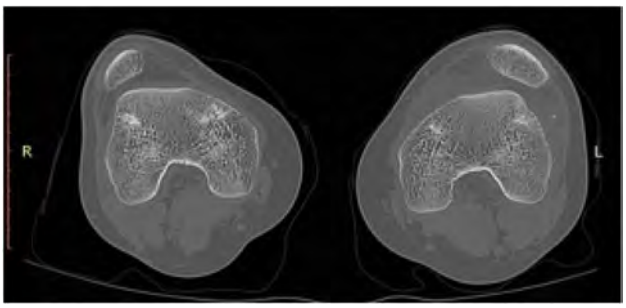

Fig. 2

Fig. 3

PC 103

Bosworth like fracture: Rotational displacement of the distal epiphysis of the tibia -A case report

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[1]SHOWA UNIVERSITY YOKOHAMA NORTHERN HOSPITAL, orthopedic surgery, Yokohama City, Japan

Case History: A 13-year-old boy who was injured while playing baseball. He was playing as a catcher and was bumped into the runner, therefore his ankle got twisted. He was immediately taken to the hospital.

Clinical Findings: X-ray the distal tibial epiphyseal growth plate was irregular. Although the ankle joint was not dislocated. In the CT, the proximal fibular fragment was caught behind the posterior edge of epiphysis of the distal tibia and was trapped there.

Investigation/Results: The patient must be operated in order to repair the ankle. But the reduction of the entrapped distal tibia epiphysis was not easy without open.

Diagnosis: We diagnosed with Bosworth like fracture.

Therapy and Progressions: Reduction was not easy, however we performed it by the pulling the fibula towards to outside, pulling out the curled anterior tibiofibular ligament, and then pushing into the tibia. We performed screw fixation after reduction of distal tibial epiphysis. Furthermore, we fixed the fibula with plate. We made him to do range of motion exercise and toe touch gait from next day, and full weight bearing from 6 weeks. We removed the implant 5 months after the surgery. He did well subsequently, and at 3 years after injury, he had normal function of the ankle, and normal X-ray. And he has returned to sports without pain.

Comments: The Bosworth fracture was originally defined as a bimalleolar fracture-dislocation of the ankle, with the proximal fibular fragment entrapped behind the posterior tubercle of the distal tibia. Bartonicek et al. Reviewed 108 cases of Bosworth Fracture and reported Anatomy and classification of the Bosworth lesion. He reported 8 such cases, This case is dislocation of the distal fibula was associated with epiphyseolysis of the distal tibia in children and adolescents. Now we will report including CT.

References: Jan B. Stefan R Karel K. Bosworth fracture: A report of two atypical cases and literature review of 108 cases. FussSprungg 2017; 15: 126–37.

Fig. 1

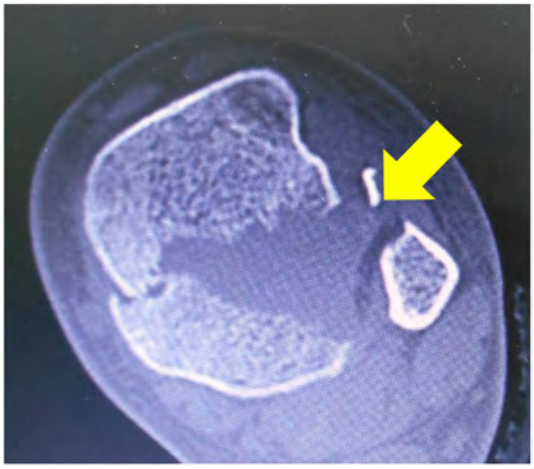

Fig. 2

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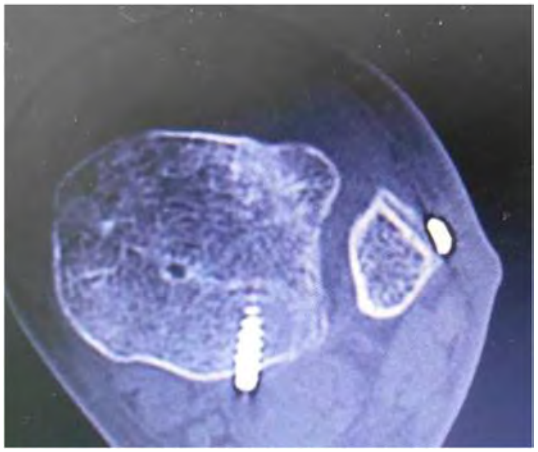

Fig. 5

PR 104

Judo Competition Injuries in International Junior Athletes

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Introduction: Judo is the most popular martial art in the world and the first martial art recognized since 1964 as an Olympic sport. Worldwide, the International Judo Federation has registered 200 countries with about 40 million Judo practitioners. Like martial arts, judo mainly involves grip and throwing techniques. The competition rules in judo have been subject to constant adjustment and optimization in recent years. Injuries prevalence is an important factor in the contact martial arts.
Material and Methods: A prospective cohort study of all registered international athletes (1023) at three different European Judo contests in Germany were accomplished with the aim to investigate the injury rate as well as the pattern of injury. The age of the athletes ranged between 15 and 20 years. Injury incidence rates were calculated per 1000 athlete-exposures (IIRAE) and per 1000 min of exposure (IIRME). Independent variables were sex and weight division. Subgroups were compared by calculating the injury incidence rate ratio.
Results: Severe injuries by judo tournaments are rare. The most frequently injured regions were the hand and head. The fights of the main block are riskier than the finals. The incidence of injury in heavyweight division differed with lightweight competitors. The risk of injury for female and male competitors differed slightly.
Conclusions: Further studies are needed to determine a judo specific injury patterns and factors especially in the pre-competitional phase. Investigation of prevention-strategies like the adaptation of competition rules etc. makes sense.

PR 105

Does Garden"s classification of femoral neck fracture match between orthopedic specialist and clinical resident?

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Introduction: Garden"s classification is the most popular classification of femoral neck fractures. Femoral neck fracture should be operated ≦24 h; however Poor agreement make waiting time longer because it takes more time to prepare implants and biological clean room. We investigate the agreement of the Garden"s classification (non-displacement type or displacement type) between clinical resident and orthopedic specialist.

Material and Methods: The examiner are a clinical resident (2nd year) and an orthopedic specialist (19th year). The subjects were 55 cases of femoral neck fractures treated at our hospital between January and December 2018. First, the examiners classified them into a non- displacement type and a displacement type (test 1). Second, the examiners studied the literature about unclassifiable type. Third, the examiners classified 55 cases 1 month later once more (test 2). Finally, we compared the first test with the second test using the agreement (the number of matched patients/total) and Kappa coefficient.

Results: The test 1 showed that the agreement and Kappa coefficient were 81.8% and 0.337. The test 2 showed agreement was 90.9%, 0.614. The intra-observer agreement of clinical resident was 90.90% and Kappa coefficient was 0.6520. The orthopedic specialist was 98.18%, and Kappa coefficient was 0.930. At test 1, 10 cases did not match. 4 cases of those were unclassifiable type, which were valgus type with medial fracture line. With slight displacement, agreement will get lower; some doctors consider it displacement type.

Conclusions: Unclassifiable type makes us confused. It makes agreement better to discuss about unclassifiable type.

References: Garden, R. S. Low-angle fixation in fractures of the femoral neck. J Bone Joint Surg :1961;43-B: 647–663, Seiko Takai et al. Inter-observer Variation in Garden"s classification (dislocation group/non-dislocation group) for Femoral Neck fracture.Orthopedics& Traumatology; 2011:60(3):522–526, Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics. 1977; Mar; 33(1):159–74

SKELETAL TRAUMA & BONE INFECTIONS

PR 106

MISSED SKELETAL INJURIES IN POLYTRAUMA PATIENTS. A RETROSPECTIVE STUDY

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Introduction: The aim of this retrospective study was to describe the profile of missed hand and foot fractures in multitrauma patients and to elucidate risk factors for the delayed diagnosis.

Material and Methods: From 2005 to 2017, there were included 279 patients. Missed fractures were defined as fractures, which were not diagnosed during primary and secondary survey. Patients were assessed for age, sex, Glasgow Coma Scale, Injury Severity Score, and length of stay in hospital (LOS). Timing of hand or foot diagnosis related to admission date (measured in days) was noted.

Results: Overall, 5.9% of patients had a delayed diagnosis of hand fracture, 7.3% ha a delayed diagnosis of foot fracture. The mean GCS for patients with delayed diagnosis was 11, whereas patients with diagnosis the day of admission had and mean GCS of 14 ($p < 0.001$). Patients with delayed diagnosis had a mean ISS of 13.4 versus 9.1 for those diagnosed the day of admission ($p < 0.001$). Furthermore, patients with delayed diagnosis had a mean LOS of 9.8 days, whereas those diagnosed at the time of admission had a mean LOS of 5 days ($p < 0.001$). Concerning delayed diagnosis hand fractures, metacarpal and phalangeal fractures were the most common injuries overall (46.9% and 25.8%, respectively). Concerning delayed diagnosis foot fractures, metatarsal fractures (52 cases) and calcaneus fractures were the most common injuries overall, followed by talus fractures and toe fractures.

Conclusions: This study revealed that with a decreased GCS and increase in ISS, polytrauma patients are increasingly at risk for delayed diagnosis of hand and foot fractures with a concomitantly increased LOS. As a delayed diagnosis has significant impact on the final functional outcome, correct and careful primary, secondary and tertiary survey is essential.

References:

Chang JH, Shieh SJ, Kuo LC, et al. The initial anatomical severity in patients with hand injuries predicts future health-related quality of life. J Trauma. 2011;71:1352Y1358.

Ahrberg AB, Leimcke B, Tiemann AH, Josten C, Fakler JK. Missed foot fractures in polytrauma patients: a retrospective cohort study. Patient Saf Surg. 2014;8(1):10.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

PR 107

Methods of hemorrhage control and mortality rates in patients with severe pelvic fractures

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Introduction: The aim of this study was a) to determine the methods of hemorrhage control currently being used in clinical practice and b) to analyze pelvic fracture mortality rates before and after initiation of a multidisciplinary pelvic fracture protocol.

Material and Method: Between 2005 and 2017, we included 98 trauma patients with pelvic fractures (group 1). A similar retrospective examination was performed on a number of 85 trauma patients without pelvic fractures (control group). There were collected Injury Severity Score (ISS), the highest Abbreviated Injury Scale (AIS) score in each anatomic region and methods of pelvic hemorrhage control. There were also recorded hospital lengths of stay (LOS) and in-hospital mortality.

Results: The average follow-up was 24-months. The average ISS in group 1 and group 2 was respectively 13.8 and 9.7. In both groups the commonest mechanism of injury was motor vehicle crash (40.5%). In group 1, angioembolization and external fixator placement were the commonest used method of hemorrhage control. 8 patients underwent diagnostic angiography with contrast extravasation noted in 4 patients. Patients with pelvic fracture had a mean hospital LOS of 17.3 days. The overall in-hospital mortality rate of patients with pelvic fractures was 11.7%, while in group 2 the overall in-hospital mortality was 6.5%. Age, shock, severe head injury and increasing ISS, are all significantly associated with mortality in the pelvic fracture group.

Conclusions: The findings from this study demonstrate no clear relationship between the choice of hemorrhage control intervention used and the patient's clinical status. In healthier patients with unstable pelvic fractures, the mortality rate was similar to that of patients with stable fracture patterns.

References:

Toth L, King KL, McGrath B, et al. Factors associated with pelvic fracture-related arterial bleeding during trauma resuscitation. J Orthop Trauma. 2014;28:489–495.

Yoshihara H, Yoneoka D. Demographic epidemiology of unstable pelvic fracture in the United States: trends and in-hospital mortality. J Trauma Acute Care Surg. 2014;76(2):380–385.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

PR 108

Accuracy of Screw Placement for Pelvic and Acetabular Fractures Using with 3D-CT Navigation

T. Noda[1], Y. Mochizuki[2], Y. Shimamura[3], T. Uehara[4], T. Saito[2], M. Matsuhashi[2], H. Kondo[2], K. Sato[2], T. Ozaki[2]

[1]Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Department of musculoskeletal traumatology, Okayama city, Japan, [2]Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Department of Orthopaedic Surgery, Okayama, Japan, [3]Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Department of Musculoskeletal Sports Medicine, Okayama, Japan, [4]Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Department of Emergency Healthcare and Disaster Medicine, Okayama, Japan

Introduction: Various percutaneous screw placement for pelvic and acetabulum fractures is often difficult because of complex anatomical morphology, however, it becomes very beneficial to set enough fixation stability if we can insert the long screws. 3D-CT navigation system for the screw placement is beneficial for precise screw insertion. We investigated the accuracy of screws with 3D-CT navigation.
Material and Methods: Our retrospective case series were assessed by the accuracy of screws with 3D-CT navigation for pelvic and acetabulum fractures. Twenty-six patients who sustained pelvic fractures and thirteen patients who sustained acetabular fractures were included in this study and 3.5 mm cortical screws or 6.5 mm cannulated screws were inserted with 3D-CT navigation. We investigated the number of screws and screw positions which is measured by postoperative CT scan and classified by Smith criteria.
Results: We inserted 13 TITS (transiliac-transsacral) screws and 31 IS (iliosacral) screws for pelvic fractures. 43 of 44 screws (97.7%) were placed in correct position (grade0 or 1). 1 screw for S1 lesion was placed in incorrect position. Meanwhile we inserted 1 antegrade pubic screw, 5 anterior column screws, 27 posterior column screws and 6 infra-acetabular screws. 35 of 39 screws (89.7%) were placed in correct position (grade0 or 1). 4 screws were in incorrect position and they were all cortical screws. And there was no complication related to screw insertion.
Conclusions: Our study highlights that 3D-CT navigation system reduced the malposition rate of screw insertion for pelvic and acetabular fractures. However, we sometimes had difficulty in inserting TITS screw for S1 lesion and cortical screw for acetabular fractures. We assumed that this was caused by narrowness of S1 corridor and flexibility of drill or inserting cortical screws in wrong position manually. We should pay much more attention even using 3D-CT navigation.

PR 109

Is operative therapy still warranted for dislocated acetabular fractures in elderly patients?

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[1]Radboudumc, Trauma surgery, Nijmegen, Netherlands

Introduction: The incidence of acetabular fractures in elderly patients is increasing. There is no consensus about the right treatment for the impaired elderly patient with an acetabular fracture. The aim of study was to investigate acetabular fractures in the elderly patient and the risk of a secondary THA.

Material and Methods: A retrospective study was performed from 2004 till 2014 in the Radboudumc Nijmegen. All patients with an acetabular fracture were reviewed. They were divided into two groups, younger than 65 and 65 or older. CT scans were used for classification according to Letournel and for the quality of the reduction according to Matta. There was a follow-up of minimal 2 years.

Results: In total, 267 patients attended at the Radboudumc with an acetabular fracture, of which 68 were 65 years or older. In the younger group, 156 patients received surgery and 40 elderly patients. According to Matta, an anatomical reduction was achieved in 15% of the young patients and 8% of the elderly patients. Imperfect reduction was achieved in 46% of the younger patients and 49% of the elderly patients. Thirteen percent of younger group and 30% of the older group needed a THA based due to the posttraumatic arthritis, the younger group after 32 months and the older group after 22 months on average. One younger patient with anatomical reduction needed a THA, none of the elderly patients. Twenty-three percent of the younger patients and 50% of the elderly patients, all with a poor reduction, needed a THA. Age, the complexity of the fracture and the quality of the reduction were important factors leading to a secondary total hip arthroplasty.

Conclusions: Elderly patients are two times more likely to need a secondary total hip arthroplasty. After an anatomical reduction, the risk is very low, even in the elderly. Surgery for dislocated acetabular fractures is a good option when there is a possibility for a good reduction.

References:

Letournel E. Matta JM.

PR 110

New classification and clinical results for basicervical fractures of the proximal femur

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Introduction: In Japan, as a definition of basicervical fractures of the proximal femur, a fracture line is placed into and out of the joint capsule of the hip joint. However, in fact there are various fracture types.We classified these fracture types based on treatment methods and reported on these results.

Material and Methods: 958 cases of proximal femoral fractures treated in our hospital from January 2011 to December 2017. Basicervical fractures occurred in 25 cases (2.61%). All cases diagnosed with X-ray and 3D-CT, and observed for 3 months or more after surgery.

Results: There are two types of basicervical fractures: the fracture line exists around the just inside of the intertrochanteric part: Normal type(N type); 5 cases (0.52%), and fracture line exists subcapital at ventral side, the coronal plane in the center of the neck and the trochanteric fossa at the dorsal part: Coronal shear type(C type); 20 cases (2.09%).C type was further classified by treatment method depending on existence of posterolateral fragment and anterior wall fracture. C type without comminution (2 part:C-2 type) was 12 cases (1.25%). With posterolateral fragment (3 part:C-3 type) was 5 cases (0.52%), with posterolateral fragment and anterior wall fragment (4 part:C-4 type) was 3 cases (0.31%).N type and C-2 type were treated by Sliding hip screw (SHS) with anti-rotation screw. C-3 type: SHS with trochanteric stabilizing plate, C-4 type because of the bony contact area is very small: hemi-arthroplasty with calcar replacement was performed. Cut out occurred in 3 cases of C-2 type and 1 case of C-3 type, but others obtained union.. One case of C-4 type occurred peri-prosthetic fracture intraoperatively.

Conclusions: We classified 25 cases of basicervical fractures, and according to its classification, treatment method was decided and good clinical results were obtained.

Fig. 1

Fig. 2

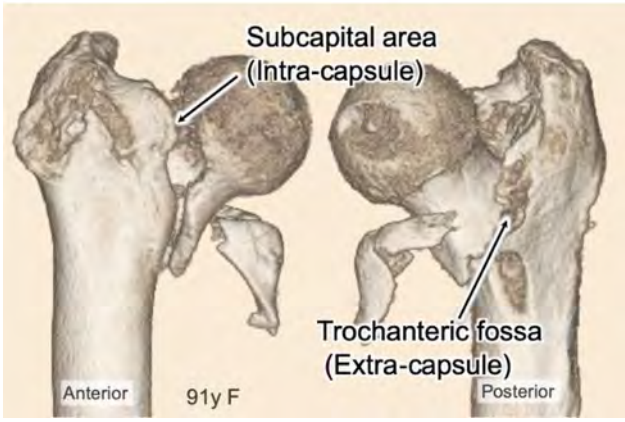
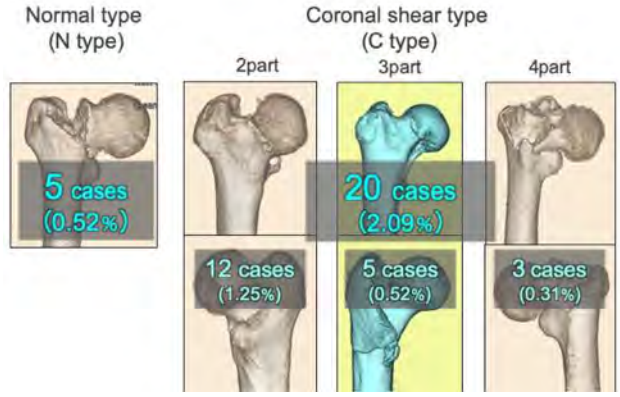
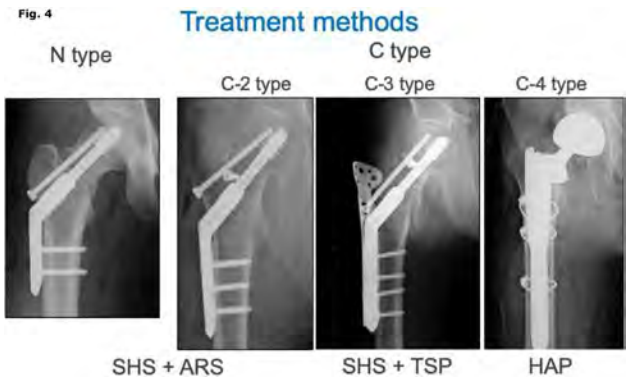


Fig. 3





PR 111

Strategies aimed at preventing chronic opioid use after trauma: a scoping review

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[1]Université Laval, Faculty of Nursing, Québec City, Canada, [2]CHU de Quebec Research Center, Université Laval, Trauma, Emergency, Critical Care Medicine, Québec City, Canada

Introduction: A high incidence of chronic opioid use (up to 58%) has been documented after trauma.[1] Solutions are urgently needed considering the importance of this public health issue. We aim to identify strategies to prevent chronic opioid use in the trauma population and to assess their level of evidence.
Material and Methods: We initiated a scoping review of literature to identify research articles and guidelines on preventive strategies. Several databases and websites of trauma were searched. Strategies were classified according to their types and targeted trauma populations. The level of evidence was summarized according to an adaptation of Oxford Center for Evidence-based Medicine classifications and strategies effectiveness.
Results: Close to 10 000 items have been screened until now from which 3 studies[2–4] and one guideline were found eligible.[5] Two studies[2–3] combined education with mandatory limit of opioid prescriptions (level III) in the orthopaedic trauma population and the other study used tailored physical training after whiplash injury[4] (level I). Findings showed reduction of opioid use or complete weaning at 6 and 12 weeks after trauma, however the effect was not maintained beyond 12 weeks. Guidelines on orthopaedic trauma[5] made the following recommendations: Prescribe the lowest effective dose for the shortest period (strong, high-quality evidence), avoid long-acting opioids in the acute setting (strong, moderate-quality evidence), and prescribe precisely (avoiding ranges of dose and duration) (strong, low-quality evidence).
Conclusions: Chronic opioid use is an important issue in trauma patients. Findings highlighted the need for more research to reduce the burden associated with chronic opioid use in this population.
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5-Hsu (2019). J Orthop Trauma, 33; e158.

PR 112

Complications of surgical approaches for osteosynthetic treatment of acetabular fractures: analysis of pitfalls and how to avoid them

M. A. Küper[1], *C. Konrads*[1], *A. Trulson*[2], *C. Minarski*[1], *U. Stöckle*[3], *F. M. Stuby*[2]

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Introduction: Fractures of the acetabulum are rare injuries. The indication for surgical stabilization depends on the grade of instability and dislocation. Exact knowledge of the different possible surgical approaches is essential for the planning of the surgical treatment. Both, knowledge of anatomical structures and possible risks of the different approaches, are important.
Material and Methods: Over a course of 15 years, we analyzed our complications stemming from the standard surgical approaches to the acetabulum in a single center study. Besides our complication rates, we describe the reachable anatomical structures, and we focus on strategies to reduce the risk of approach-related complications in acetabular surgery.
Results: Out of 523 patients with an acetabular fracture who have been treated in our tertiary trauma center between January 2003 and December 2017, 101 patients had a complication, resulting in an overall complication rate of 19.3%. Surgically treated patients had a higher complication rate of 21.2% (63/296) compared to conservatively treated patients with a complication rate of 16.7% (38/227).
Conclusions: Patients with acetabular fractures are at risk for complications. The most common risks are neuro-vascular incidents. For surgical treatment, indication and approach should be carried out carefully, including individual patient parameters and fracture types.
References:

PR 113

Surgical management of tibial plateau fractures in adult patient

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Introduction: The aim of study was to analyze the methods of surgical management of patients with tibial plateau fractures treated in Orthopedics and Traumatology Clinic "V. Betisor" durind 2014-2016 years.
Material and Methods: We analyzed 85 clinical cases: men—32 and women—53, mean age 53 years. Trauma circumstances: habitual trauma—60 cases, traffic accident—15, precipitation—6, sport—3, aggression—1. For cohort analize Schatzker classification was used: especially type I was meet in 9 cases, II—22, III—11, IV—3, V—26, VI—14; 81 close, 4 open. For paraclinic examination were used X-ray and CT. Surgical management consisted of: close reduction, internal fixation—10 cases (8- percutaneus canulated screws arthroscopic assisted, 2-external fixator), open reduction, internal fixation—75 cases. Bone graft was done in 15 cases.
Results: Postoperative follow up was performed at 6, 12, 18, 24 weeks. Patients were evaluated according to the Lysholm Knee Scoring Scale, obtaining an average score of 88 points. Bone healing was achieved in a period of between 12 to 18 weeks. Postoperative

complication developed in 11 cases. Results were depending on the stability of osteosynthesis, precocity, rightness of functional reeducation and patient compliance.
Conclusions: Favorable functional results and less complication were met in cases of individual approach of surgical management, a good choice of implants and minimally invasive surgical techniques.

PC 114

Fractures of the Shoulder Processes—A Case Report

R. Sousa[1], *A. S. Costa*[1], *G. Pina*[1], *M. R. Vaz*[1], *T. Rebelo*[1], *A. Carvalho*[1], *M. Sousa*[1]

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Case history, Clinical findings and Diagnosis: 17-year-old male, low-speed motorcycle crash with subsequent polytrauma. He presented with right shoulder pain, swelling and pain to the touch. Articular CT revealed a type I fracture of the coracoid base, type III acromion fracture and scapular body fracture without displacement.
Results, Therapy and Progressions: He was submitted to surgical treatment 7 days later. A superior "sabercut" approach with open reduction and osteosynthesis of the coracoid process was performed with a cancellous screw and washer and fixation of the acromion with 2 K-wires and tension band wire. Fracture of the scapular body followed a conservative treatment. Immediate postoperative period was uneventful and he presented with favourable evolution in the subsequent 6-week, 12-week and 6-month follow-up. At present time, at 14-month follow-up, maintained anatomical reduction in radiological control, complete arm abduction and no limitation with efforts.
Comments: Conservative treatment is generally indicated for all shoulder body fractures without displacement. Fractures of the coracoid or acromion with > 1 cm displacement are described as an indication for surgical treatment. Fractures of the acromium without displacement may follow conservative treatment with sling immobilization. Surgical fixation can be achieved with screws, plate and screws or tension band wire. Although controversial, surgical treatment for coracoid fractures is preferred, especially in active young patients with open reduction and fixation with screws or, if necessary, with plate and screws. The treatment applied in the present case, all approaches described in the literature as being effective and with good results, is in agreement with the options described in the literature and constitutes a corroborative example of its efficient results.
References: Court-Brown,Charles M.et al.(2014)."Rockwood and Green's Fractures in Adults",8th edition,Wolters Kluwer Health

Fig. 1

Fig. 2

Fig. 3

Fig. 4

PC 115

Missed dorsal dislocation of the lunate—a case report

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Case history: A 49-year-old male, hand worker, attended to our emergency department after a traffic accident complaining about pain and swelling in his left wrist. Initial radiographs revealed an isolated dorsal dislocation of the lunate that went unnoticed. Two and a half months later he was referred to our clinic.
Clinical findings: Findings included dorsal wrist deformity and pain. He presented a decreased passive wrist flexion and extension range of motion, with normal finger tendinous function.
Investigation/Results: Plain X-rays showed persistence of the lunate dorsal dislocation without any associated injuries.
Diagnosis: Chronic isolated dorsal dislocation of the lunate
Therapy and Progressions: Open reduction was performed using a dorsal approach. The scapholunate, lunotriquetal and scaphocapitate spaces were stabilized with a compression screw and Kirschner wires respectively. The patient persisted with pain and functional limitation after the surgery, showing an insufficient reduction of the scapholunate space on the X-ray. Nine months after the initial surgery, he developed a purulent fistula on the ulnar edge of the carpus. After it was resolved, a total wrist arthrodesis was performed using the Mannerfelt technique. At the 3 months follow up, he was clinically stable, consolidation of the arthrodesis was documented and he had returned to his previous normal activities.
Comments: Isolated dorsal dislocation of the lunate is a rare lesion. The delay in the diagnosis of carpal dislocations is frequent. This compromises the final outcome of reconstructive techniques and the risk of residual instability, hence increasing the risk of chronic pain associated with posttraumatic osteoarthritis. In the case of chronic lesions, treatment with palliative techniques such as proximal carpectomy or joint arthrodesis should be taken into consideration.
References: Siddiqui N., Sarkar S. Isolated dorsal dislocation of the lunate. Open Orthop J. 2012;6:531–4

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 116

Is ultrasound-guided regional anesthesia safer than landmark technique? One-hospital experience

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Introduction: According to the literature the application of ultrasound (US) in performing regional anesthesia had a significant impact on patient safety by increasing the success rate [1]. In 2006 a donated ultrasound device became available in the Institute of Emergency Medicine, Chisinau, Republic of Moldova. Due to lack of equipment both US guided and landmark techniques have been performed. The aim of this study was to analyze the two methods of performing regional anesthesia, in order to estimate the potentials benefits of of US guided techniques (succes rate and doses).
Material and Methods: A retrospective research enroled 200 pacients, divided in US guided group (USG) and landmark group (LMG).
Results: The bivariate analysis showed that, out of 100 anesthetics in LMG, a number of 13 were reported as unsuccessful, compared with a number of 20 in USG. The χ^2 test with corrections for continuity did not determine significance (test value 1.306, df = 1, p = .253, effect size = .007), RR being 1.67 (95% CI 0.78–3.58). Linear regression for dose (lidocaine) modeling, in patients included in the research, showed a decrease of the dose by 57 mg in LMG, the confidence interval being quite wide (95% CI − .938, − .192). That is, the actual decrease is within the limits of 19 and 94 mg.
Conclusions: The tendency towards higher failure rate in successfully performing an US guided regional anesthesia and relative "uncertain" decreasing of dosage are in contradiction with the international statistical data. This in turn evidenced probable deficiencies in the training of the practitioners in field of ultrasound guided techniques in our country. The prospective research to confirme/infirme these results and estimate the complication rate follows.
References:
1. Barrington MJ, Uda Y. Did ultrasound fulfill the promise of safety in regional anesthesia? *Current Opinion in Anaesthesiology* 2018; 31 (5): 649–655.

PR 117

Malunion of the distal radius: a rare and severe complication

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Introduction: Malunion of the distal radius (MDR) is a rare and uncommon complication. Our objective is to analyze the functional and radiological results after surgical treatment.
Material and Methods: Between 2010 and 2016, 6 cases of MDR were diagnosed and reviewed in February 2019. Loss of one of the cases due to death of the patient.
Results: Average age 41 years old (34–62).All were active labour patient. The most frequent mechanism was high energy trauma (traffic accident), 2 of who presented Gustilo grade IIIB open fractures operated in the country of origin. Most frequent pattern of fracture was 23-C.2 (2 cases) and 23-C.3 (2 cases). Initial conservative treatment was performed in 2 of the cases. One persistent pseudoartrhosis with osteosynthesis material failure. In every case, preoperative CT and early surgical intervention were carried. In 3 cases, an additional procedure was associated at the radioulnar distal joint. In all cases consolidation occurred. One patient required reintervention for persistent pseudoarthrosis. Average consolidation time 6 months (3–9).Average follow-up of 61 months (22–116). Average active joint balance: flexion 49° (15°–70°), extension 38° (10°–65°), pronation 68° (40°–70°), supination 82° (70°–85°). Average DASH 21.56 (0–50.8).Force reduction greater than 50% compared to contralateral in 2 of the cases. Radiological parameters:radial height 8.7 mm (7–12),radial inclination 15°(9–19°),volar angulation 11.8° (0.2°–21°), ulnar variance 2.85 mm (1–5).
Conclusions: Malunion of the distal radius is an uncommon and severe complication with increasing incidence that requires early and personalized surgical treatment to achieve the correction of the deformity, preserving mobility acquiring consolidation with acceptable functional results
References:
Fernandez DL, Ring D, Jupiter JB. Surgical management of delayed union and nonunion of distal radius fractures. J Hand Surg Am 2001;26:201–9.

Fig. 1

Fig. 2

Fig. 3

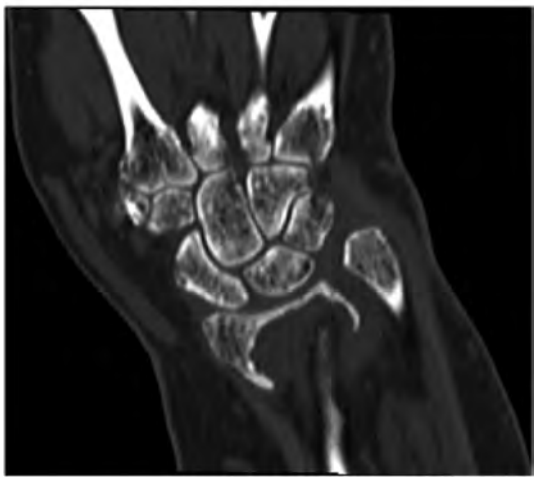

Fig. 4

Fig. 5

PC 118

Isolated open ulnar translocation of the radiocarpal joint

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Case history: Isolated ulnar translocation of the carpus is unusual. When the translation occurs without injury of the radius, ulna or carpal bones are often misdiagnosed. Early diagnosis is key, to avoid further complications such as redislocation of the carpus (1).
Clinical findings: In our case a young male patient suffered a high energy motorcycle accident. He had no A B C D problem
Investigation/Results: The ulnar translation of the left carpus was evident but comparison x-rays were taken on both wrist for further evaluation. The distance between the line, drawn through the axis of

the radius and the center of the capitate bone was measured bilaterally. The results were 14.3 mm vs 4.7 mm.

Diagnosis: Isolated, open ulnar translocation of the radiocarpal joint, Dumontier type I, was diagnosed.

Treatment: The primary treatment was debridement, reposition and fixation with ex fix. After the wound healing on 18th days we made reconstruction. Volar approach was used, we re-reponate the carpus and fixated the position with two 2 mm smooth Kirschner wires. The radioscaphocapitate and long radiolunate and radioscaphoid ligaments were reattached to the volar margins of radius using Mitek mini anchors. We put the ex fix and left the bended wires percutaneously. After 10 weeks the ex fix and the K wires were remove. Wrist motion exercises were initiated under supervision of physiotherapist.

Comments: After 16 weeks the wrist was in good alignment, the flexion–extension were 20–20, the deviations were 15–20°. The radiographic signs of this injury are unusual and often misdiagnosed. It can be useful to compare with contralateral x-rays. The radiolunate and radioscaphocapitate ligaments is considered crucial in prevention of ulnar translation. In our opinion the radiolunate arthrodesis can be reserved for failed ligament repairs.

References:

M Rutgers et al.: Isolated posttraumatic ulnar translocation of the radiocarpal joint, J Hand microsurg, 2009 1(2):108–112

Fig. 1

Fig. 2

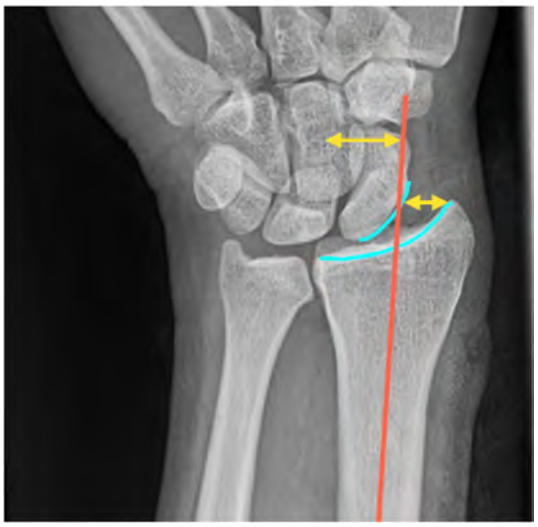

Fig. 3

Fig. 4

Fig. 5

PR 119

Opioid use following closed reduction & percutaneous pinning of supracondylar elbow fractures is not required to achieve adequate pain relief

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Introduction: Within the orthopaedic paediatric population, there is a distinct paucity of literature in regard to post-operative paediatric analgesic regimes. Supracondylar humeral fractures account for 33% of all paediatric limb fractures and there has been a marked divergence in recent literature concerning the most appropriate choice of analgesia for this cohort with recent studies recommending the routine inclusion of an opioid agent post-operatively on prescription. Opioids have deleterious side effects pertinent to paediatrics. In our institution, patients" only receive a prescription for acetaminophen and NSAIDs upon discharge.

Our study assessed postoperative analgesic satisfaction rates in all paediatric patients who underwent CRPP for supracondylar humeral fractures in our institution from January 2018 to December 2018.

Material and Methods: This is a retrospective multi-surgeon case series of all paediatric patients who underwent CRPP from January 2018 to December 2018. Patient data was extrapolated from theatre records and clinical charts. For each patient, all analgesic agents given were identified, the dosage, route and frequency of administration in addition to the length of their hospital stay and time from injury to operation. Following discharge, patients" guardians were contacted retrospectively and a questionnaire was administered which ascertained the efficacy and duration of analgesia used by the patient post-operatively.

Results: Fifty patients were identified for inclusion within the study who met the inclusion and exclusion criteria. There was a 92% satisfaction rating amongst the responders with the analgesic regime recommended-acetaminophen & NSAIDs.

Conclusions: In stark contrast to papers which we discuss throughout our paper, our study conclusively demonstrates that opioid prescriptions are not required upon discharge for supracondylar fractures within a paediatric population

PC 120

Middle phalangectomy of the hand as an alternative to amputation in open fractures with severe comminution and contamination. A case report

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Case history: A 57-year old man suffered an isolated injury of his right hand in a motorcycle accident.

Clinical findings: The patient presented with a swollen hand, a subtotal amputation of the middle finger at the level of the middle phalanx and lacerations to the other fingers (Fig. 1).

Investigation/Results: After excluding injuries to other body regions, radiographs and a CT of the hand were performed (Fig. 2).

Diagnosis: Closed fracture dislocation of CMC joints from II. to V. finger, comminuted fracture of the middle phalanx of the middle finger, closed fracture of the proximal phalanx of the middle finger, other lacerations to the IV. and the V. finger.

Therapy and Progressions: Urgent open reduction and internal fixation (ORIF) with K wires of the CMC joints. Exploration of the middle finger reviled heavy contamination and comminution of the phalanx, with injury to one neurovascular bundle. A phalangectomy with acute finger shortening was performed with creation of a new IP articulation (distal to proximal phalanx) (Fig. 3, 4). Progression after the surgery was uneventful. There was no sign of infection. The shortened finger was sufficiently perfused and the patient reported a sense of touch. K wires were removed after 6 weeks and physical therapy was started. The patient has limited ROM in his neo IP joint with minimal pain (VAS 2–3) (Fig. 5).

Comments: Middle phalangectomy of the hand was described in the literature only in two papers which report treatment of chronical or congenital diseases. The authors propose this method as an alternative to amputation in selected trauma cases.

References:

Raimbeau, G., et al. (2019). Middle phalangectomy with shortening fusion of the fifth finger in Dupuytren"s digital hooks. Hand Surgery and Rehabilitation, 38(2), 108–113.

Tan, O., et al. (2006). Middle phalangectomy: A functional and aesthetic cure for macrodactyly. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery, 40(6), 362–365.

Fig. 1

Fig. 3

Fig. 2

Fig. 4

Fig. 5

PR 121

Does the immunosuppressive therapy influence postoperative fracture healing after organ transplantation?

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Introduction: Within the last years, the number of people with transplanted organs, as well as their lifetime and quality of life after organ transplantation (TPL) increased. They actively participate in everyday life, can suffer fractures. Do patients after organ transplantation and under immunosuppressive therapy have impaired fracture healing and an increased postoperative complication rate?
Material & Methods: A retrospective analysis of the database of a level one trauma center was made. Immunosuppressed patients after TPL treated with an osteosynthesis between 2004 and 2016 were included. They had regular radiological and clinical follow-up. The fracture healing time was assessed and compared.
Results: 29 patients (15 m, 14 f, mean age 43 y) with 40 fractures were included. 13 kidney-TPL, 6 lung-TPL, 5 liver-TPL, 3 heart-TPL, 2 kidney/pancreas-TPL. All patients got treated with at least two immunosuppressive drugs. Cause of accident: 37.5% sports/leisure, 35% work/household, 12.5% traffic accidents, 5% without trauma.
The operation was performed under perioperative long-term antibiosis, often with a combination of two or three drugs. Patients were hospitalized for an average duration of 11.3 days and were also examined by the particular organ specialists.

Osteosynthesis: in 90% primary operative fracture treatment, in 10% two-step procedure. 11 plates distal radius and ulna [healing period (h) 14 weeks (w)], 3 plates tibia [h 20 w], 3 plates fibula [h 11 w], 9 nails femur [h 51 w], 3 plates clavicle [h 51 w], 4 spondylodesis spinal column [h 24 w], 3 plates/screws pelvis/sacrum [h 7 w], 1 tension band wiring patella [h 49 w], 3 plates humerus [h 34 w].
Conclusions: The fracture healing was possible but significantly delayed. The wound healing took longer. The immunosuppressive therapy may be responsible for these problems. The rehabilitation of movement and weight bearing has to be adapted to the slowed fracture healing.

PR 122

Trans-sacral Bar Fixation used to treat Fragility Fractures of the Pelvis—Retrospective Study of 79 Cases

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Introduction: The prevalence of fragility fractures of the pelvis (FFP) increases, including in up to 90% a lesion of the posterior pelvic ring. An operative therapy is indicated in cases of prolonged or immobilizing pain or in a displaced dorsal fracture.
Methods: Patients suffering an FFP treated with a minimal-invasive trans-sacral bar through S1 from 2009 to 2017 were included. The patients or their relatives were contacted to ask about mortality, the present mobility and place of residence. 96% of all patients still alive could be included in follow-up.
Results: 73 females and 6 males with a mean age of 76.7 ± 9.5 years (50–95) were included. Concomitant stabilization of the anterior pelvic ring was performed in 53%. 16.5% underwent an operative revision (5% evacuation of hematoma, 5% peri-implant infection, 10% hardware removal—combinations possible). The trans-sacral bar was removed in one case due to malpositioning. The length of stay was 20 ± 12 days. At discharge, 46% were mobile on the ward, 14% in their room, 35% for transfer to sitting position and 5% were bedridden. 24% were discharged to their home, 49% in geriatric rehabilitation unit, the remaining to other rehabilitation or to a nursing home.
During follow-up, mortality was 27%, one patient died during hospital stay. The patients died in average 158 ± 109 weeks after discharge.

After a follow-up of 206 ± 151 weeks, 52% lived at their home, thereof one-third with assistance. 63% needed a walking aid, 16% were mobile without walking aid, 21% were bedridden or only mobile to sitting position.
Conclusion: The trans-sacral bar in S1 is a valuable minimal-invasive stabilization method to recover mobility in elderly with an FFP. A relatively long in-hospital stay could be explained by the initial trial of conservative treatment and due to intra- and inter-departmental co-geriatric services. The high mortality and need for assistance reflects this geriatric, multi-morbid patient collective.

PR 123

Complex elbow fractures

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[1]State institution Dnipropetrovsk medical academy of the Ministry of Health of Ukraine, Traumatology in the Mechnikova Regional hospital, Dnipro, Ukraine

Introduction: Intraarticular fractures of the distal humerus account for 0.5–5% of all fracturesin adults and approximately 30% of fractures in the elbow joint. Despite of the considerable number of various modern methods of treatment of this pathology, the proportion of unsatisfactory results (15–40%) is still high, and patients are

recognized disabled in 18–20% of cases. Goal. Analysis of treatment results of the patients with elbow joint fractures.

Material and Methods: In the traumatology department of the hospital, from 2013 to 2018, 94 patients with fractures of the elbow joint were treated, including 53 fractures of the distal humerus and 41 fractures of the proximal forearm bone. The age of the patients was from 20 to 75 years, men—39 (41.5%), women—55 (58.5%). According to the AO classification, type A—19 (20.2%), type B—36 (38.3%), type C—39 (41.5%) patients.

Results: The results were evaluated in 80 patients on the Mayo scale. This test allows to evaluate the severity of pain, the amplitude of movements in the elbow joint, the condition of the joint, the strength of the limb and daily life activity. Good and satisfactory results were obtained in 77.5% of patients. 22.5% of the poor results were associated with errors during treatment.

Conclusions: Anatomical reposition, stable fixation of fragments in combination with atraumatic technique and early rehabilitation in the postoperative period supports the successful treatment of the elbow joint fractures.

PC 124

Open Aquilles Tendon Avulsion through Popliteal Fossa

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Case history: A 58-years-old woman was admitted in the emergency room after being run over by a bus.

Clinical findings: At the emergency room, she was conscient and hemodynamic stable. Head, thoracic or abdominal trauma were excluded. The patient presented with an open wound in left popliteal area with massive bleeding with exposure of gastrocnemius and soleus muscles and Achilles tendon

Investigation: Radiologic images didn't show any fracture. A limb angiography showed complete perfusion of the leg, without any lesion on major arteries.

Diagnosis: open aquilles tendon avulsion through the popliteal fossa

Therapy and Progressions: The patient was taken to the operating room. We approach the popliteal area and found a small laceration of popliteal vein, which was sutured with Prolene 6/0.

Then, we reference the Achilles tendon, and tunneled the posterior face of the leg, and passed the tendon through the tunnel. A distal approach, above the insertion of Achilles tendon was done, and two suture anchors preloaded with 2 sutures were inserted in the medial and lateral sides of the calcaneal tuberosity, then we did an Krackow suture. We also did a fasciectomy on the lateral side of the leg, to prevent compartmental syndrome. The patient was put in a posterior cast with 20° of flexion for 4 weeks.

The immediate post-operative time was in an intermedia unit care, to control possible multiorgan failure. In 2 days, she was discharged to orthopedics nursery. Due to the degloving of subcutaneous tissue, she evolved with some blisters which made her stay inpatient about 4 weeks.

After some time, she developed some areas of skin necrosis, which needed some intervention by plastic surgery with skin graft.

Now, she has skin completely healed, some loss of strength in the leg, with loss of plantarflexion, and is under prolonged rehabilitation program.

Comments: No similar case is described in the literature

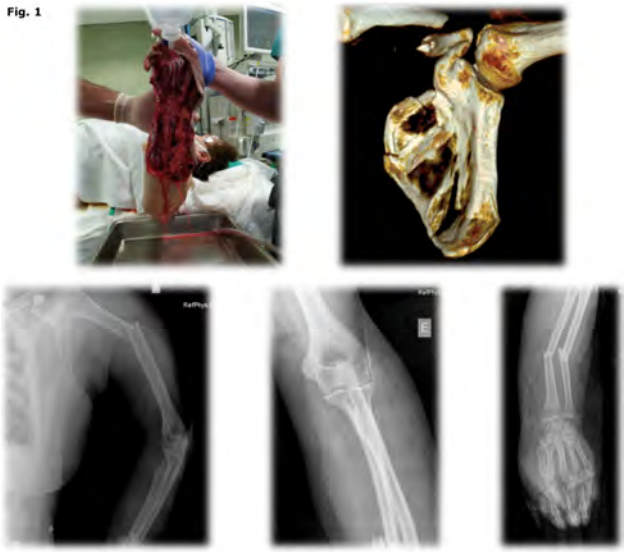
Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 1



Degloving injury of the upper limb. Pre operatory images.

Fig. 2

Post operatory –external fixation of the humerus and bones of the forearm

Fig. 3

A- Nailing of humeral shaft fracture and osteosynthesis of the clavicle fracture with anatomical plate
B - Open reduction and internal fixation of the radius with LCP plate and closed reduction and internal fixation of the ulna with an anterograde TEN nail was performed

PC 125

Management of degloving injury and multiple fractures of the upper limb—a case report

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[1]Centro Hospitalar Tondela Viseu, Department of Orthopaedics and Traumatology, Viseu, Portugal

Case history: A 73-year-old woman, polytraumatized, victim of a bus run-over, who suffered:Head injury, chest trauma, degloving of the left hand and forearm with multiple tendon sections, open fracture (GIIIA) of left forearm bones; fracture of both clavicles, left scapula fracture, left humeral shaft fracture, left epicondyle avulsion fracture, 3rd left metacarpal fracture (floating shoulder and elbow).MESS score of 7.

Therapy and Progressions: She was rushed into the OR and submitted to external fixation of the humerus and bones of the forearm, debridement, and primary closure of the forearm and hand. Successive dressings and debridement was maintained and, at 19th postoperatory day(po) the external fixator of the left humerus was removed and a nailing was performed as well as an osteosynthesis of the clavicle fracture with anatomical plate. At 40thpo the external fixator of the forearm bones was removed and an open reduction and internal fixation of the radius with LCP plate and closed reduction and internal fixation of the ulna with an anterograde TEN nail was performed. At 49thpo, she underwent an autologous skin graft of the forearm and hand wounds. Good clinical evolution of the wounds and fractures, all of which evolved to consolidation, although M3 fracture malunion was verified as well as deficit of thumb abduction and extension of 3rd–5th fingers. UEFI of 65/80.

Comments: The approach of polytrauma patients should be sequential, according to the ATLS protocol, preserving life, limb and function. Treatment of these lesions is complex and, if poorly managed, can be associated with high morbidity, as most patients combine severe and contaminated lesions, extensive skin loss, open fractures, postoperative infection. A sequential approach is required, which involves injury assessment, infection prevention, soft tissue treatment and fracture stabilization.

References: Asensio JA Degloving injuries.IN Current Therapy of Trauma and Surgical Critical Care. 2016. 2nd ed

Fig. 4

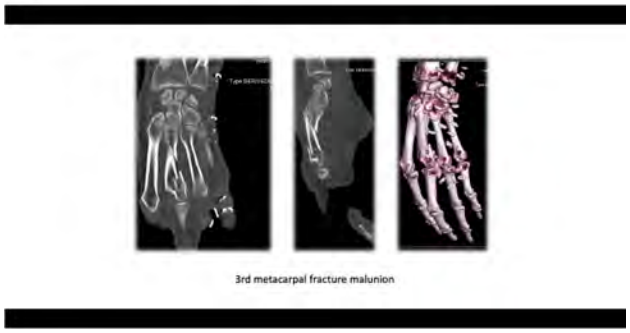

Fig. 5

Good clinical evolution of the wounds and fractures

PR 126

Pelvic fractures in severely injured trauma patients—An outcome Study

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Introduction: Pelvic fractures, though rare (3–8%), are often associated with high mortality (5–20%). The factual outcomes in polytrauma patients with the additional burden of pelvic fractures are unknown. The purpose of this study is to provide an in-depth analysis of pelvic fractures in seriously injured patients.
Material and Methods: This is a retrospective analysis of prospectively maintained trauma registry from 2012 to 2018. We included all trauma patients with ISS $\geq$ 16. Group I, which had an additional burden of pelvic fractures, was compared with group II, consisted of patients without pelvic fractures. A double-adjustment propensity score match (PSM) analysis was utilized to minimize confounding and unbiased estimation of the impact of pelvic fractures.
Results: Of 12,774 patients admitted during this period, 2976 (23.2%) patients had ISS $\geq$ 16 and out of this cohort 492 (3.8%) also had pelvic fractures. After PSM, the mean age of the group I and group II were similar (49.58 $\pm$ 20.69 vs. 50.56 $\pm$ 21.55 years, ASMD 0.05). On admission, patients in group I had lower systolic (121.71 $\pm$ 29.66 vs. 129.90 $\pm$ 32.37 mm Hg, ASMD = 0.26) and diastolic blood pressure (72.06 $\pm$ 18.95 vs. 75.81 $\pm$ 20.17 mm Hg, ASMD = 0.19) and higher ISS (26.21 $\pm$ 8.85 vs. 24.68 $\pm$ 10.86, ASMD = 0.15).Patients in group I had higher number of genitourinary surgery (p = 0.04), exploratory laparotomy (p = 0.03). Therequirement of angio-embolization was similar in between two groups (p = 1.00). While there were no difference in mortality (OR 0.69, 95% CI 0.31–2.15, p = 0.82), group I had higher odds of severe sepsis (OR 1.42 95% CI 1.19–2.92, p = 0.03) and ventilator-associated pneumonia (OR 3.64, 95% CI 1.74–9.72, p = 0.01)
Conclusions: Pelvic fractures in polytrauma patients did not translate into higher mortality. However, there was an increased risk of sepsis and VAP. Evidence-based management at tertiary care specialized centers can further enhance the outcomes.

PC 127

Blood transfusion in proximal femur fractures—when there is no other way

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Case history: Male patient, 62 years old, previously autonomous, Jehovah"s witness. Fall from stairs with left hip trauma. Pain and functional impairment; inability to bear weight.
Clinical findings: In the emergency room, the patient presented with a Glasgow Coma Score of 15; shortening and external rotation of the left lower limb; pain in passive motion. No vascular or neurological impairment.
Investigation/Results: AP pelvis x-ray reveals a complex left proximal femur fracture with neck and trochanteric extension. A CT-scan was obtained and showed a complex fracture pattern with subcapital and trochanteric extension. Blood analysis showed a hemoglobin of 8.6 g/dL.
Diagnosis:
Therapy and Progressions: At admission, patient refused erythrocytes" concentrate transfusion and was hospitalized for pain control and hemodynamic stabilization. Despite alternative measures such as intravenous iron supplementation and erythropoietin, hemoglobin values remained lower than 7.8 g/dL, thus preventing any surgical procedure. At day 12, patient finally decided to accept packed red blood cells and was then transfused. At day 14 and with a hemoglobin of 11.8 g/dL, the patient was finally submitted to a total hip arthroplasty with an uncemented revision femoral stem. At day 15, the patient initiated the rehabilitation protocol with hospital discharge at day 21 with a hemoglobin of 10.2 g/dL.
Comments: Proximal femur fractures arise as one of the major problems of present traumatology. Comorbidities frequently prevent surgical treatment within the golden hour (first 48 h) and thus limiting the postoperative results. In this particular case, a timely surgical approach would have made it possible to try a more conservative procedure with femoral osteosynthesis. The surgical delayed due to low hemoglobin values limited the surgical options and forced a more aggressive procedure.

PR 128

Routine versus on demand removal of the syndesmotic screw; a multicenter randomized controlled trial on functional outcome

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Introduction: Syndesmotic injuries are common, being present in approximately 15–20% of surgically treated ankle fractures[1]. One of the most commonly used ways of fixation is the syndesmotic screw (SS). Traditionally, this screw is removed after 8–12 weeks as it is

thought to hamper ankle function and cause pain. However, a recent study showed that implant removal does not always result in improvement of functional outcome[2]. With the relatively high complication rate of implant removal in mind, retaining SSs could be beneficial. We therefore aimed to investigate the effect of retaining the SS on functional outcome.

Material and Methods: In this multicenter RCT, patients were randomized between routine and on demand removal (upon patients request). The primary outcome was functional outcome at 12 months after SS placement, measured by the Olerud–Molander Score (OMAS) with a non-inferiority limit of 10 points (90% power, $\alpha = 0.025$). Secondary outcomes include quality of life, range of motion, complications and costs of SS removal.

Results: A total of 197 patients were randomized, of which 93 for routine removal and 104 for on demand removal. The mean age was 45 years old and 63% was male. Follow up of all participants will be completed in March 2020. Results of the primary outcome analysis are therefore not yet available, but will be at the conference.

Conclusions: If on demand removal of the SS is non-inferior to routine removal in terms of functional outcome, this will offer a strong argument to adopt this as standard practice of care. This means that patients will not have to undergo a secondary procedure, resulting in fewer complications and subsequent lower costs.

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PR 129

Pertrochanteric fractures of the hip: risk factors for varus deformity and impaction comparing dynamic hip screw and intramedullary fixation—A retrospective study

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Introduction: Treatment options for pertrochanteric fractures of the hip are extra- or intramedullary fixation. The aim of this study is to identify risk factors for the development of complications: varus deformity, neck shortening, revision and cut-out.

Material and Methods: Retrospective cohort study in which radiographs of patients with pertrochanteric fractures, treated at the UZ Brussel between 2008 and 2016, were reviewed. Fracture type, type of the device, cut-out and revision where noted. Measurements for the Centrum-collum-diaphyseal angle (CCD) of the two hips, impaction, Tip Apex Distance (TAD), Parker"s ratio were realized. Statistical analyzes were made with logistic and multiple linear regression analyzes.

Results: 248 patients were included. BMI (p = 0,043), type of osteosynthesis (p = 0,024), DHS + plate (p = 0,006), short nail (p = 0,011) and the TAD (p = 0,000) are independent risk factors for the development of varus deformity after consolidation. For impaction are BMI (p = 0,005), short nail (p = 0,000), long nail (p = 0,000) and fracture type A1 (p = 0,001) independent risk factors. We identified a marginal statistical significant risk factor for cut-out: TAD (p = 0,051).

Conclusions: 31,4% of the patients had varus deformity after consolidation. The risk of varus deformity rises with a higher BMI and a higher TAD. The risk for this complication was higher when using a nail. Neck impaction was shown more together with a high BMI and less in fracture type A1 and with the use of a short or long nail. In the prevention of cut-out, it is important to keep the TAD low.

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PC 130

Inter-peri-implant fracture: analysis, classification and treatment. A case report

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Case history: 85-year old female with previous distal femoral plating (17 years ago) and ipsilateral proximal femoral nailing (2 months ago) presented with a diaphyseal femur fracture.

Clinical findings: Extremity was swollen, painful, neurocirculatory intact, no shortening or external rotation was seen. She was unable to lift her leg. Scars showed no sign of infection.

Investigation: X-ray revealed a spiral fracture including distal PFNA locking screw, unhealed proximal femur fracture without loss of reduction, protruding PFNA blade and a healed distal femoral fracture.

Diagnosis: Peri-implant fracture classification proposed by the Singapore group presented a discrepancy between Nail type 1 subtype B and Plate type 2 subtype. By simplification, we disregarded the distal (healed) fracture to choose the first option.

Therapy: Firstly, the distal femoral plate was removed as the preoperative simplification dictated. Secondly, PFNA distal locking screw was removed and the PFNA blade shortened. After open reduction 2 cerclage wires were applied. A long LCP plate was initially fixed through the plate and PFNA locking hole, adjusted in line, fixed proximally with 8 screws through a locking attachment plate and 1 cerclage, distally 5 locking screws were used.

Comments: Distal femoral callus prevented the use of a long nail. As the proximal fracture was not yet healed, we avoided full implant removal. As the PFNA was unstable, fixation through the plate and PFNA distal locking hole enabled implant coupling to strengthen the construct. The plate covered the entire bone to bridge the possible loci minori left by the plate removal and minimize stress risers.

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Muller et al.; Peri-implant femoral fractures: The risk is more than three times higher within PFN compared with DHS; Injury, 2016 Oct; Vol 47:2189–2194

Fig. 1

Fig. 2

Fig. 3

Fig. 4

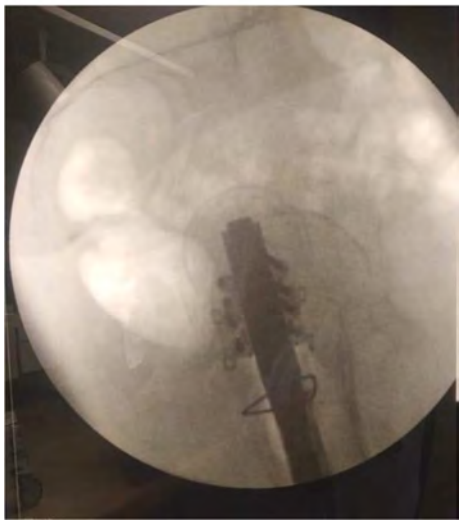

Fig. 5

PR 131

Evaluation for pharmacokinetics of local antibiotics administration to lower limb infection

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Background: We have been reported the usefulness of intra-medullary antibiotics perfusion (iMAP) and intra-soft tissue antibiotics perfusion (iSAP) for suppressing open fracture and bone infection. iMAP and iSAP was a method of antibiotics delivery with the continuous administration of high-dose aminoglycosides. However, the best dose was not obviously. The purpose of this study was to evaluate translation of aminoglycosides from iMAP or iSAP.
Methods: Between January 2016 and October 2018, we had used iMAP and iSAP for 19 open tibia open fracture to prevent infection and 2 infection after tibia open fracture. Demographic data was shown

as follows: 11 males and 8 females, average age was 54.9 years old, 10 intramedullary nails and 9 plates. One dialysis patient was including.
We measured concentration of gentamicin from iMAP, iSAP and in blood, outflow.
Results: Average administration concentration of all cases was 1236.67 μg/ml. Average blood concentration of all cases was 1 μg/ml and outflow concentration were 1107.77 μg/ml. Average blood and outflow concentration of each dosage were shown as follows: 600 μg/ml: 0.6 μg/ml, 868 μg/ml, 1200 μg/ml: 0.83 μg/ml, 1135.1 μg/ml, 1600 μg/ml: 1.9 μg/ml, 4800 μg/ml, 2400 μg/ml: 1.03 μg/ml, 547.5 μg/ml. In dialysis patient case, 1200 μg/ml administration lead concentration of blood as 2.46 μg/ml, outflow as 822 μg/ml. Side effect were not observed.
Discussion: Local antibiotic administration using iMAP and iSAP showed increasing blood concentration depend on administration dose. Under 2400 μg/ml administration dose showed safe blood concentration(< 2 μg/ml). On the other hand, 2400 μg/ml administration dose achieve trough concentrations over 100–1000 times of minimum inhibitory concentration. Furthermore, we need to pay attention for administration dose in dialysis patient case.
Conclusion: 2400 μg/ml administration dose achieved safe and effective local concentration.

PR 132

Outpatient follow-up after percutaneous Kirschner wire fixation of paediatric upper limb injuries—is a 2 week review necessary?

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Introduction: Distal radius fractures and supracondylar humerus fractures are two of the most common fractures seen in children. Most can be treated with non-operative treatment but a small number require operative reduction and surgical stabilisation, often with percutaneous Kirschner wires. This study aims to identify whether an early review is required before planned removal of the wires.
Materials and Methods: Retrospective review of paediatric patients undergoing surgical reduction and stabilisation with percutaneous Kirschner wires for upper limb injuries. Data collected over three-month period (June–August 2019). Number and type of outpatient reviews, imaging episodes and clinical interventions recorded.
Results: 45 consecutive patients with mean age 9 years (range 4–15). 35 distal radius fractures and 10 supracondylar humerus fractures. 3 patients transferred to another unit. 41/42 patients received a 2 week check and then a second review where the wires were removed. Mean time to first outpatient review 10.5 days (SD 7.6). At initial appointment all patients had a change of cast and a satisfactory radiograph. Mean time to second outpatient review was 26.9 days (SD 7.9). At the second appointment 33/41 patients had the wires and cast removed and subsequent satisfactory radiograph. 8/41 required a further period of casting. 19/41 had a third appointment. 4/41 required formal physiotherapy after cast removal. There was one transient anterior interosseous nerve palsy after supracondylar fracture stabilisation. Clinical union of the fracture and good functional outcome was seen in all cases.
Conclusion: The initial outpatient review at 1–2 weeks allows a lighter weight cast to be applied but in this series the radiograph taken after the cast was changed did not alter management. Our findings support a cast change alone at 2 weeks and then clinician review with radiographs at the time of wire removal.

PR 133

Functional Outcomes After Surgical Treatment Of Scapular Fractures

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Introduction: The aim of this study was to describe surgical technique, report on patient-based functional outcomes and complications following open reduction and internal fixation in patients with scapular fractures.
Methods: The study comprised 14 patients who were treated with open reduction and internal fixation (ORIF) of a scapular fractures between September 2010 and July 2018. Surgical indications were as follows: medial/lateral displacement greater than 20 mm; shortening greater than 25 mm; angular deformity greater than 40°; intraarticular step-off greater than 4 mm and double shoulder suspensory injuries (including fracture of clavicle, coracoid or acromion with displacement greater than 10 mm). All patients underwent X-ray examination (true AP, Y scapular view) and computed tomography (CT) scans. Fractures were classified according to the revised (AO/OTA) classification system. Functional outcome were measured using the Constant-Murley score.
Results: Seven patients had glenoid fossa fracture, six patients had scapular body fracture and one patient had acromion process fracture. All glenoid fossa and scapular body fractures were exposed via the Judet approach. Eleven of 14 patients were reviewed with Constant-Murley score at the final follow-up examination, three patients were lost for follow-up. The mean follow-up after injury was 44 months (6–92 months). We found in four patients infraspinatus muscle hypotrophy. Mean Constant-Murley score was 93.45 (± 8.93) for injured arm and 98.36 (± 2.91) for uninjured arm. Mean score between injured and uninjured arm was 4.91(± 6.49) which is excellent functional outcome according to grading the Constant-Murley score.
Conclusions: Open reduction and internal fixation of displaced scapular fractures is a safe and effective treatment option that results in reliable union rate and good to excellent functional outcome.
Key words: scapular fracture, functional outcome, open reduction internal fixation, Judet approach

PR 134

Intramedullary fixation of adult forearm fractures with interlocking nail

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Introduction: The aim of this study was to evaluate clinical and radiological results of intramedullary radius and ulna nails in treatment of adult forearm fractures.
Methods: The retrospective study included 21 patients who were treated with intramedullary nailing of forearm fractures between January 2010 and September 2017. The medical records and radiographic images of all patients, taken preoperatively and postoperatively, were reviewed. Fractures were classified according to

the AO/OTA classification system by reviewing the radiographs. We analayzed time to union, union rate, clinical outcome and complications.
Results: Primary intramedullary osteosynthesis were performed in 17 patients with forearm diaphyseal fractures. The average time to union was 2 months (range, 2–4 months) in primary osteosynthesis cohort. Secondary intramedullary osteosynthesis were performed in four patients following removal of plates and screws due to pseudoarthrosis. The average time to union was 4 months (range, 2–6 months) in secondary osteosynthesis cohort. Overall union rate was 95,24% in 21 forearms with fractures or pseudoarthrosis of the radius, ulna, or both bones, which were treated with intramedullary nail with compression screw. Overall complications were one nonunion, one postoperative rupture of the extensor pollicis longus tendon and one postoperative transitory radial nerve palsy.
Conclusions: Intramedullary nailing of adult forearm fractures is a safe and effective treatment option that results in reliable union rate and good to excellent clinical outcome.
Key words: forearm fractures, intramedullary nailing, biological fixation, union rate

PR 253

Humeral Shaft Fractures: Antegrade and Retrograde Nailing

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Introduction: The aim of this study to evaluate clinical results of antegrade or retrograde humeral shaft nailing depending of AO fracture type.
Material and Methods: The retrospective study includes 432 patients with humeral shaft fracture treated with antegrade or retrograde intramedullary nailing regarding AO type of fracture between 2003 and 2018. The medical records and radiographic images of all patients were reviewed. We analayzed clinical outcome and complications.
Results: Transverse or short oblique fractures of the middle third of the humeral shaft were treated using a retrograde approach. Spiral fractures of the middle third of the humeral shaft were treated through the antegrade approach. Comminuted fractures of the proximal third of the humeral shaft were treated mostly through the antegrade approach. Comminuted fractures of the distal third of the humeral shaft were usually treated using the retrograde approach. Whenever possible, we prefer retrograde insertion because the approach through the shoulder joint is avoided. Reduction with retrograde nailingnis easier because upper arm was placed on the radiolucent operating table extension. Interlocking screw insertion by freehand techique is also easier to perform because there is no danger of radial nerve injury. Nonunion was found in eight patients (1,8%). There were five patients (1,1%) with postoperative transitory radial nerve palsy that fully recovered within 6 months.
Conclusions: The choice of approach to the medullary canal depends on the fracture type and the fracture site. Therefore, antegrade nailing should be performed for proximal third humeral shaft fractures and complex middle third humeral shaft fractures, while retrograde nailing should be perforemd for distal third humeral shaft fractures and simple transvese or short oblique middle third humeral shaft fractures.
Keywords: humeral shaft fractures, intramedullary nailing, radial nerve palsy, nonunion

PR 254

The diaphyseal aseptic tibial nonunions after failed previous treatment options managed with the reamed intramedullary locking nail

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Introduction: In this article, we present our approach to the surgical treatment of noninfected tibial shaft nonunions.
Material and Methods: Between 2014 and 2016, 33 patients with aseptic diaphyseal tibial nonunion was treated by reamed intramedullary nailing and were retrospectively reviewed. All patients, preoperatively, were evaluated for the signs of the infection, by the same protocol.
Results: The time that elapsed from injury to intramedullary nailing ranged from 9 to 48 months (mean 17 months).Open intramedullary nailing was unavoidable in 25 cases (75,75%), while closed nailing was performed in 8 patients (24,25%). All patients were followed up in average period of 2 years postoperative (range 1–4 years), and 31(93,9%) patients achieved a solid union within the first 8 months.
Conclusions: In conclusion, a reamed intramedullary nail provides optimal conditions for stable fixation, good rotational control, adequate alignment, early weight-bearing and a high union rate of tibial non-unions.
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Fig. 1

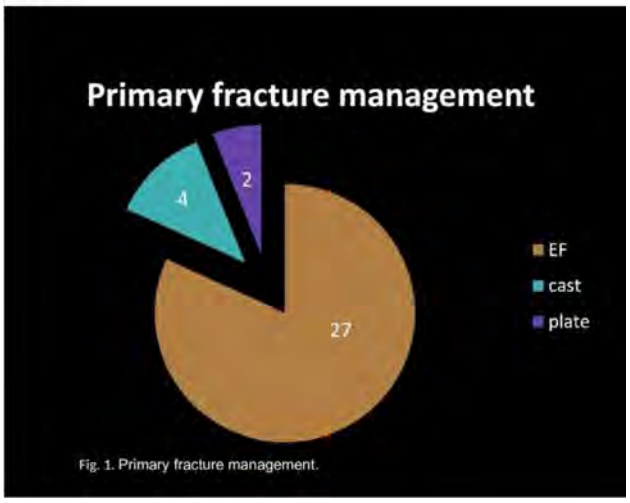


Fig. 1. Primary fracture management.

Fig. 3

Fig. 4. a)X ray-s of 35 years old male with high energy open tibia fracture Gustilo III B in motorcycle accident, b)treated in emergency room with debridement, irrigation, fasciocutaneous flap and unilateral external fixation. c) and d) After eight months, defect nonunion developed and reamed IM nailing with limited open autogenous bone grafting was performed. f) Solid bone union has been achieved after 8 months postoperative, with excellent alignment.

Fig. 2

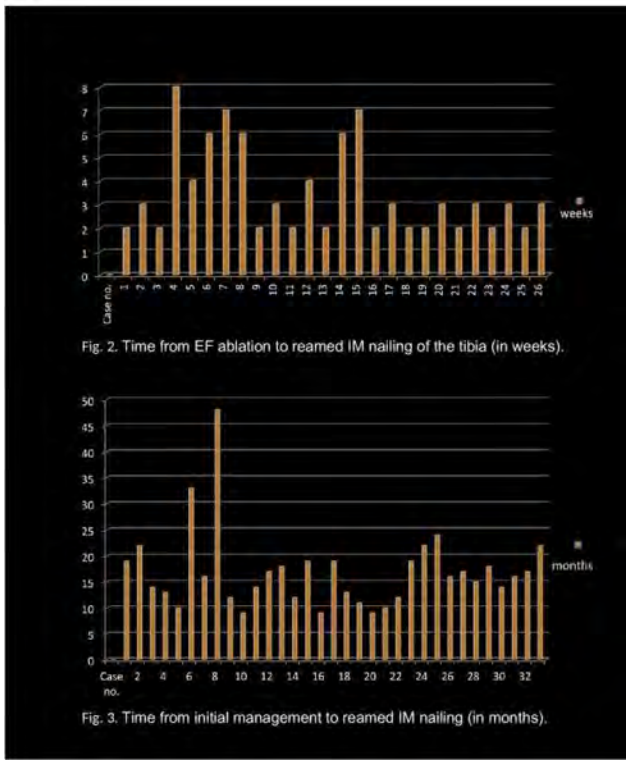
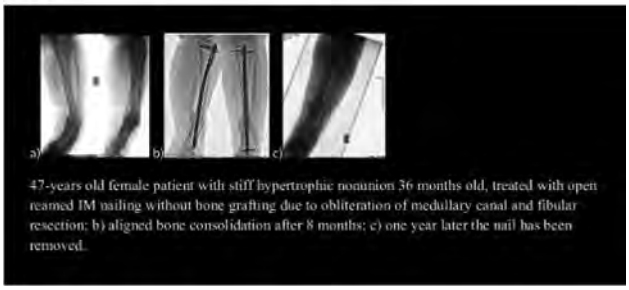


Fig. 2. Time from EF ablation to reamed IM nailing of the tibia (in weeks).

Fig. 3. Time from initial management to reamed IM nailing (in months).

Fig. 4



47-years old female patient with stiff hypertrophic nonunion 36 months old, treated with open reamed IM nailing without bone grafting due to obliteration of medullary canal and fibular resection; b) aligned bone consolidation after 8 months; c) one year later the nail has been removed.

Fig. 5

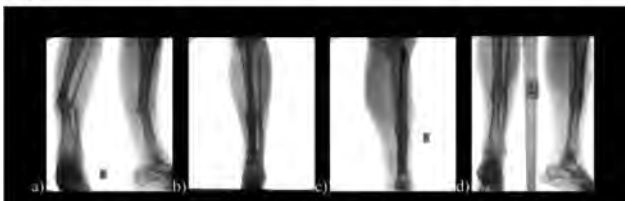


Fig. 7. a)32 years old male patient with mobile oligotrophic nonunion 14 months after failed cast immobilization;b) treated with an open reamed IM nailing without additional bone grafting; c)solid bone union and good alignment were achieved 6 months postoperatively; d)X ray after removing the nail showing good bone remodeling and anatomical alignment.

PR 255

Percutaneous figure of 8 suture as a novel technique for treating closed tendinous mallet injuries following failed splinting therapy.

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Introduction: Mallet injuries are common injuries affecting the hand. Majority of them are managed using conservative method, however a small percentage of patients that do not do well on conservative treatment need an operative intervention. We wish to evaluate the efficacy of percutaneous figure of 8 suture as a new technique for treating closed tendinous mallet injuries resistant to splinting therapy, as a minimally invasive treatment option.

Material and Methods: We present a case series of 5 patients who had persistence of more than 30 degree extensor lag, despite splinting minimally for 9 weeks. All of these were treated with a percutaneous figure of 8 suture placed across the dorsum of DIPJ, which provided splinting for further 4 weeks. This technique provides fixation for the DIPJ in hyperextension position by going through the periosteum on both sides and was done under local anaesthesia.

Results: The mean age of our patients was 40 years, with a single digit involved in all patients. All the five cases had nearly fully straight DIPJ with less than 10° extensor lag following 4 weeks of percutaneous stitch placement. There was no further recurrence with mobilisation or overlying skin necrosis.

Conclusions: Percutaneous figure of 8 suturing technique can be an effective, minimally invasive and safe technique to treat closed tendinous mallet injuries not responding well for conservative splinting.

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

PR 256

Complications of implant removal after healed hip fractures

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Introduction: Osteosynthesis of pertrochanteric fractures (PF) is a frequently performed procedure in orthopaedic trauma care. Dynamization of the osteosynthesis during fracture healing can lead to dynamization of the lag screw. Which can cause debilitating complaints. A spontaneous femoral neck fracture (SFNF) after implant removal was seen in 5 patients over a 6 month period. Based on these 5 cases we evaluate the different aspects of the pathophysiological and mechanical mechanisms of lag screw dynamization, complaints and complications in PF healing.
Material and Methods: Pubmed search on incidence of chronic pain, gait impairment associated with dynamization of osteosynthesis, risk factors for dynamization and complications after implant removal. Based on research data preventive recommendations are suggested.
Results: Literature describes complaints as reduced mobility, gait impairment and chronic pain in association with lag screw dynamization. An important risk factor is the AO-classification of PF, A2 type fractures are significantly associated with more dynamization and the onset of trochanteric pain and gait disturbances. Partial implant removal can reduce complaints in the majority of symptomatic patients, and induce symptoms in 20% of asymptomatic patients. Literature study shows a SFNF after lag screw removal with an incidence of 15%, affecting mostly vulnerable elderly patient resulting in a high mortality rate. Risk factors associated with an increased risk of this complication are pre-existing systemic osteoporosis, stress-shielding, pre-loading of the implant. Most importantly the removal itself, a SFNF with the implant in situ is very uncommon.
Conclusions: The clinical indications for implant removal in healed PF are not well established, and should be restricted to specific cases. After removal, partial weight bearing and good patient counselling is extremely important. Replacement with shorter lag screw should be considered.

Fig. 1

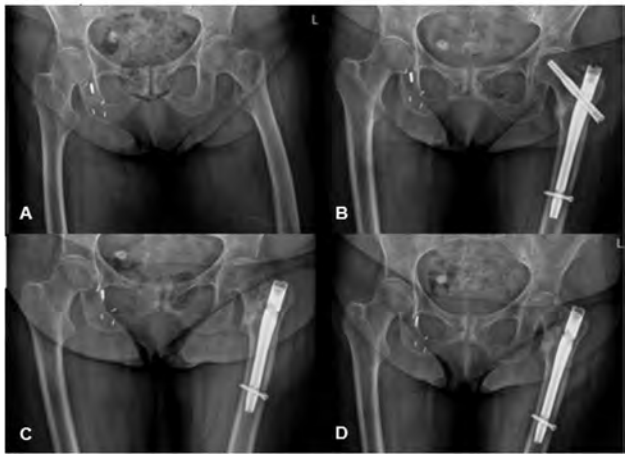

Fig. 2

Case	Sex	Age	Primary fracture	Implant	Complaint	Time until removal (months)	Time between removal and fracture (days)	Type of fracture		Dexa score (T-score)
1.	F	78	AO-A2	Gamma-nail	Trochanteric pain	12	2	Femoral fracture	neck	Na.
2.	F	82	AO-A2	Gamma-nail	Trochanteric pain	7	4	Femoral fracture	neck	-2.5
3.	F	86	AO-A1	Gamma-nail	Trochanteric pain gait disturbances	7	14	Femoral Fracture	neck	-3.1
4.	F	60	AO-A2	Gamma-nail	Trochanteric pain	11	2	Femoral Fracture	neck	-1.4
5.	F	72	AO-A2	Gamma-nail	Trochanteric pain	7	20	Femoral Fracture	neck	-3.0

PR 257

Metal osteosynthesis of pathological bone fractures with metastatic lesion of plates with a spray on their surface of hydroxyapatite and 1% silver

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Introduction: Surgical intervention in the case of pathological bone fracture against the background of metastatic lesion involves performing osteosynthesis. For more effective integration of the metal plate with the bone, a material based on bioactive glass was sprayed on their surface. Bioactive glass-based material is an osteoinductive and osteoconductive biomaterial that integrates quickly with bone, forms a bone-ceramic complex, and is transformed into bone over time.

Material and Methods: Metal osteosynthesis of pathological bone fractures with metastatic lesion of plates with spraying on their surface of hydroxyapatite and 1% silver was performed in 12 patients. The functional result of the operated limb was calculated on the MSTS scale. Evaluation of pain was performed on the scale of R.G. Watkins. The quality of life of patients was evaluated using the EORTC QLQ–C30 system. The evaluation of the integration of the plate with the bone was performed by radiological examination and by osteoscintigraphy.

Results: Postoperative complications were found in 1 (8,3%) patient, recurrence of metastatic tumor was noted in 2 (16,7%) patients. The functional result of the operated limb after metal osteosynthesis was 76,8%. The degree of pain decreased from 92,2% to 24,6%. The quality of life of patients after metal osteosynthesis improved from 38 to 74 points. X-ray examination revealed the formation of callus within a shorter timeframe, as evidenced by the more intense accumulation of radioisotope during osteoscintigraphy.

Conclusions: Metal osteosynthesis of pathological bone fractures by plates spraying hydroxyapatite and 1% silver on their surface leads to more stable fixation of bone fragments and accelerates bone formation at the fracture site.

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PR 258

The Effect of Lack of Rehabilitation Support After Discharge in Patients with Intertrochanteric Femur Fracture Above 70 Years Old

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Introduction: The aim of this study was to evaluate the results in patients who had heal intertrochanteric fracture but did not receive adequate mobilization and rehabilitation support.

Material and Methods: Sixty patients over 70 years old age were included in our study. The rehabilitation emphasized pain relief, muscle strength, range of motion, endurance, balance challenges, and proprioceptive enhancement for all patients. It started postoperative first day and was delivered twice a day by the physical therapist until discharge. Patients were discharged on average 7.4 days (2–20 days) after surgery. The mobilization of patients was evaluated with the Parker and Palmer mobility scoring system, the clinical evaluation was performed with the Haris Hip Scoring and daily living activities were evaluated with the Barthel Life Index before and at the end of the fracture.

Results:34 female 26 male patients were included in our study. The mean age was 75,2 (70–84) years and the mean follow-up period was 25,5 (10–40) months. 35 patients had A1 type, 25 patients had A2 type intertrochanteric femur fracture. In the last follow-up, all patients had fracture union. Patients' mobility, daily life activity and clinical evaluations were found to be statistically significantly worse in the last control than before surgery.

Conclusions: The success of the surgical treatment and the union of the fracture after fixation are not sufficient for the successful mobility,Daily life activity,and clinical results.The success in the functional results are significantly related with the ambulatory ability.Although early mobilization and rehabilitation support are important in intertrochanteric femur fractures after surgery,the continuity of mabilization and rehabilitation support after hospital discharge is more important.The rehabilitation which administered by the patient"s ralations after hospital discharge is not sufficient.Therefore,the importance of home-based rehabilitation is increased.

Fig. 1

	Before fracture	Final Control	P
Harris Hip Score	75,5±19,96	60,6±18,11	<0,0001
Barthel Life Index	70,5±19,39	53,5±19,14	<0,0001
Parker Palmer Mobility Score	6,06±1,83	4,55±1,68	<0,0001

Table 1: Data of Mobility Scores, Life Index and Clinical Scores

PR 259

The prognostic value of the hip screw position in trochanteric fractures

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Introduction: In our study, we analyzed one of the Hungarian population's most frequent injuries, the hip fracture, focusing mainly on the lateral femoral neck and the pertrochanteric fractures. According to the classification of the Swiss Association for Ostheosynthesis (AO), we focused on 31-A1 and 31-A2 fractures, the incidence of which increases by ageing.
Material and Methods: Between 2010 and 2016, we analyzed the data of 1179 patients. All of the fractures were stabilized with intramedullary nails. 992 patients received Stryker Gamma3®, whereas 187 patients' fractures were solved with Synthesis PFNA® nail. In all cases, closed reduction method was used with fluoroscopy on an extension table. The surgeries were done in general or epidural anesthesia and performed by traumatology residents or specialists using standard lateral exploration. Data were collected using GEPACS software and statistical analysis was done with MS Excel.
Results: Cut-out occurred in 33 cases (2,79%): out of that 21 (1.78%) were left sided and 12 were (1,01%) right sided. 29 (87.87%) patients were treated with Gamma3 nail, and in 4 (12,12%) cases PFNA nail was used. The average TAD-index was 18 mm.
Conclusions: According to recommendations of the TAD-index value, when using dynamic hip screw, it should be 20 mm or lower. The average index value was 18 mm which was equal in the complicated and non-complicated groups. Our study shows that the cut-out is independent from the TAD-index value, thus this recommendation cannot be applied for intramedullary nails.
References: Baumgaertner MR, Curtin SL, Lindskog DM, et al. The value of the tip–apex distance in predicting failure of fixation of peritrochanteric fractures of the hip. J Bone Joint Surg Am. 1995; 77: 1058–1064.

PR 260

Atypical dome impaction fragments in acetabular fractures: tips for diagnosis and intraoperative visualization

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Introduction: Dome impaction fragments (DIFs) in acetabular fractures are typically accompanied with anterior column fragments and recognized as the gull sign on plain radiographs. Meanwhile there are some DIFs which do not fit into typical DIFs. The aims of this study were to define atypical DIF and describe tips for diagnosis and intraoperative visualization.
Material and Methods: This study was a retrospective case review. We defined atypical DIFs as the fragments which were independent of anterior column fragments and did not show the gull sign on plain radiographs. From Jan 2012 to July 2019, there were 68 patients of acetabular fractures, and 15 patients (22.1%) had DIFs. Among them, 3 patients (4.4%) were identified as the cases with atypical DIFs. All of them were male. The ages were from 55 to 68.
Results: The atypical DIFs were not obvious on X-rays (Fig. 1). All three atypical DIFs were located at posteromedial weight bearing zones of the acetabulum. Case 1 and 2 were displaced in accordance with posterior column fragments, and were visualized clearly on the sagittal view of CT images (Fig. 2). Case 3 was impacted posteriorly into a posterior part of the ilium as a free fragment, and well visualized on CT sagittal and coronal views. Anterior intrapelvic approach was chosen in all patients to treat atypical DIFs. The iliac oblique view was useful to visualize the atypical DIFs intraoperatively in Case 1 and 2. In both cases, the reverse gull sign appeared after reduction of posterior column fragments (Fig. 3). In Case 3, the inlet view was useful to visualized the atypical DIF intraoperatively.The fragments were reduced and fixed with supra-acetabular screws (Fig. 4).
Conclusions: Atypical DIFs could be well diagnosed with reconstructed CT images. Oblique view and/or inlet view of image-intensifier would help us to visualize atypical DIFs intraoperatively.
References: Anglen JO et al. J Orthop Trauma. 2003 Oct;17(9):625-34.

Fig. 1

Fig. 2

Fig. 3

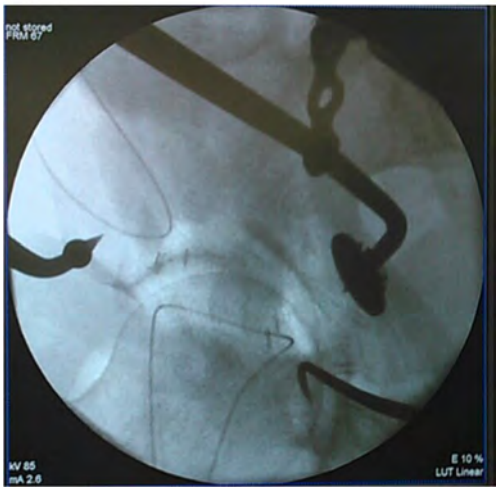

Fig. 4

Results: We found prospective two to 10 years after acetabular osteosynthesis 64,04% complications. AVN of the femoral head was present in 5,55% of the hips reduced within 24 h and 27,77% of the hips reduced more than 24 h after the injury [p = 0,013; × 2=4,94; OR = 25 (95% CI = 1,29–1121,5)]. Post-traumatic OA of the hip we found in 23,07% (Fig. 1) Infections we found in 5,1% (1 deep, 1 superficial), iatrogenic nerve palsy in 1 (2,56%), traumatic nerve palsy in 15,38% (6), DVT in 5,12% (2), and HO in 10,25% (4) cases. In one case (2,56%) revision surgery was done.

Conclusions: Acetabular fractures are followed with complications. Some complications depend on surgery, meanwhile others cannot be affected on (type of fracture, impaction of acetabulum, injury of the femoral head, dislocation of femoral head). Good knowledge of acetabular anatomy, surgical technique, experienced surgical team, early surgery, anatomical reduction and stable ORIF, early mobilization, can significantly influence excellent/good functional outcomes and reduce possibility for complications.

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Fig. 1

PR 261

Outcomes after surgical treatment of acetabular fractures: Our experiences

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Introduction: Early surgery, open anatomical reduction of dislocated acetabular fractures, stable internal fixation performed by an experienced surgical team, early rehabilitation, antibiotic and DVT prophylaxis remains the mainstay of treatment. Unfortunately, numerous complications after acetabular osteosynthesis still occur, cause disability and requires further surgery.

Material and Methods: We present the complications after 39 ORIF acetabular fractures. Fractures are classified according to Letournel/Judet classification.

PR 262

Postoperative reduction status in unsatisfactory cases of femoral trochanteric fractures

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Introduction: Reduction is one of the important factors in surgical treatment of femoral trochanteric fractures. In this study, postoperative reduction status was examined and the relationship between this reduction status and unsatisfactory cases was investigated.

Material and Methods: 135 cases of femoral trochanteric fractures over 65 years treated with PFNA-II were investigated. Postoperative

reduction status was evaluated in AP and lateral view of X-ray and CT. Anatomical reduction means medial or anterior cortex is reduced anatomically (abbreviation **Am** and **Aa**). Intramedullary reduction means medial or anterior cortex of proximal fragment is inside the shaft (**Im, Ia**). Extramedullary reduction is medial or anterior cortex of proximal fragment is overlapped to cortex of shaft (**Em**, **Ea**). Unsatisfactory cases were ununited cases until 6 months and excessive sliding cases over 10 mm. Reduction status of these cases was evaluated.
Results: Postoperative status was classified with combination of medial and anterior reduction status. So there are nine groups and number of each group are as follows; **Im-Ia**:6 case, **Im-Aa**:5 cases, **Im-Ea**:0 case, **Am-Ia**:14 cases, **Am-Aa**: 46 case, **Am-Ea**:4 cases, **Em-Ia**:17 cases, **Em-Aa**:32 cases, **Em-Ea**:12 cases. Non-united cases until 6 months were 29cases. Reduction status of non-united cases were; **Im-Ia**:2 cases, **Im-Ea**:3 cases, **Am-Ia**:4 cases, **Am-Aa**:6 cases, **Em-Ia**:8 cases, **Em-Aa**:6 cases. There was no case in extramedullary reduction of anterior cortex. Excessive sliding of blade over 10 mm was 11cases. There was also no case of extramedullary reduction of anterior cortex in these 11 cases (2 cases were cut out).
Conclusions: Our results show there are no ununited cases and excessive sliding cases in extramedullary reduction of anterior cortex. This means extramedullary reduction of anterior cortex is important to reduce unsatisfactory results in surgical treatment of femoral trochanteric fractures.

Fig. 1

Table 1. Postoperative reduction status of non-united cases until 6 months (29cases)

AP view / Lat view	Intramedullary	Anatomical	Extramedullary
Intramedullary	2	4	8
Anatomical	3	6	6
Extramedullary	0	0	0

PC 263

Combination of bone transplantation and chondral repair for large traumatic osteochondral defect of the knee joint

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Case history, Clinical findings: Case 1; 61 year old male injured open lateral condyle fracture of femur by to be bitten by a pig. After 5 months from initial debridement, I confirmed the size of bone defect was 3 cm(2) × 3 cm in depth. The same size of bone was harvested from iliac crest and transplanted in the bone defect area of lateral condyle of the femur. After 7 months from bone transplantation, I confirmed bone union and two 6.5 mm diameter osteochondral grafts and 4.5 mm diameter osteochondral graft were transplanted for the chondral defect lesion. Case 2; seventy year old male injured open lateral condyle fracture of femur by traffic accident. After 3 months from first debridement, I confirmed the bone defect (size 7 cm(2) × 3 cm in depth) and the same size of bone was harvested from iliac crest and transplanted in the bone defect area. And simultaneously two 10 mm diameter osteochondral grafts were transplanted for the chondral defect lesion. Case 3; 37 year old male injured open lateral condyle fracture of femur by traffic accident. I confirmed the size of bone defect was 6 cm(2) × 3 cm in depth. The same size of bone was harvested from iliac crest and transplanted in the bone defect area of lateral condyle of the femur. After 1 month from bone transplantation, he had undergone autologous chondrocyte implantation.
Investigation/Results: At last follow-up, average flexion angle of knee was 147 degrees. In all cases, Lysholm knee scoring scale was good.
Diagnosis: Large traumatic osteochondral defect of the weight-bearing articular surface of the knee
Comments: Treatment of large traumatic osteochondral defect of the weight-bearing articular surface of the knee is a difficult condition to treat. Combination of bone transplantation and osteochondral autograft transfer or autologous chondrocyte implantation is useful strategy for the injury.
References: Tegner Y., Lysholm J., Clin Orthop Relat Res., 198, 43-108, 1985

PR 264

Treatment of double tension band wiring method with AI wiring system for transcondylar distal humeral fractures

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Introduction: As AI wiring system is united the pin with the cable due to compressed sleeve, the pin is never deviated. We review the treatment of transcondylar distal humeral fractures with AI wiring system in geriatric patients.
Patients and Methods: 6 were identified as receiving this surgery. All patients were female and their mean age was 68 years. They were assessed union rate, range of motion for elbow joint, postoperative complication and functional outcome for Japanese Orthopedic score.
Results: Union rate was 100%. The mean arch of motion was 95° at latest follow-up. The complications were detected 3 cases which were temporary ulnar palsy for 2 cases and hardware failure for 1 case. The average of functional outcome was 73 points (73/100).
Conclusion: Tension band wiring of transcondylar distal humeral fractures with AI wiring system provides stable fixation for osteoporotic bone and tiny fragment.
References: Juan P et al. Low transcondylar fractures of the distal humerus: results of open reduction and internal fixation. J Shoulder Elbow Surg. 23, 573-578, 2014

PR 265

Comparison of two lag screw implant and anti-rotational blade implant in the treatment of trochanteric fractures

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Introduction: The purpose of this study was a comparative evaluation of the complications related to the treatment of trochanteric fractures using 2-screw proximal femoral nail (PFN) versus proximal femoral anti-rotational blade nail (PFNA).
Material and Methods: A retrospective review was conducted between March 2013 and March 2019. The study included 519 patients treated surgically for trochanteric fractures. The mean age was 79,8 ± 12,0 (24–100) years. Patients were treated by PFN (393 patients, 75,7%) or by PFNA (126 patients, 24,3%). Implant related complications were the primary objectives. Infection and revision surgery were also recorded.
Results: Complications were observed in 38 (9.7%) patients in PFN group and 7 (5,6%) patients in PFNA group (p = 0.15). Screw backout (n = 11) and cut-out (n = 11) occurred in 5,6% patients treated with PFN. In the PFNA group, cut-out occurred in 1,6% (n = 2) of cases. Infection (n = 3) represented 2,4% in PFNA patients and 2,3% (n = 9) in PFN group. There were no statistically significant differences in both groups considering implant-related complications (p = 0,14) and infections (p = 1.0). Revision surgery was performed in 7 (1,3%) patients.
Conclusions: Both type of nails are equivalent for the treatment of trochanteric fractures in the elderly regarding to postoperative complications.
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PR 266

Predictability of posterior malleolar fractures in midshaft spiral tibial fractures

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Introduction: Tibia shaft fractures are common and are often presenting with soft tissue complications.
Soft tissue problems are more likely in fractures due to high energy impact than Low energy type fractures. High Energy Type present with horizontal fractures of tibia and fibula (i.e. on the same Level), whereas in low energy type tibia fractures they present with spiral or oblique fracture patterns often associated with concomitant fractures of the posterior rim of the distal tibia (i.e. Volkmann's triangle).

Posterior malleolus fractures occur regularly but are often missed and seen only on CT scans obtained either for preoperative planning or to verify postoperative rotation.

In Literature these mostly undisplaced fractures are treated with screw fixation mostly from anterior. But is this really necessary?
Material and Methods: We retrospectively analysed 21 consecutive tibia shaft fractures operatively treated over the past 2 years at our Regional hospital analysing the fracture pattern.
Results: Out of 21 Patients with tibia shaft fractures 9 Patients presented with a posterior rim fracture of the Tibia. No routine stabilisation of the Volkmann fragment was performed, in all cases the posterior rim fragments healed uneventful.
Angles of 60° and above seem to present themselves with a concomitant fracture of the posterior malleolus. They are mostly undisplaced and the trauma mechanisms is low energy and torsion. None out of the 9 Patients had known osteoporosis.
Conclusions: Low energy and torsion-type tibia fractures with an angle of > 60° seem to have an accompanying undisplaced fracture of the posterior malleolus.
These fractures are usually undisplaced and do not need to be addressed.

As a consequence there seems to be no need to actively rule them out with CT scans prior to surgery.

Concomitant Ankle fractures including posterior rim fractures should be addressed like isolated ankle fractures.

PR 268

The Dangers of Bouncing: A prospecive cohort study of injuries associated with trampolines and bouncy castles over a 3 month period in a paediatric population.

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Introduction: Within the orthopaedic paediatric population, there is an increasing incidence of presentation of fractures associated with both trampolines & bouncy castles. Whilst this phenomenon has been depicted frequently within the media in recent years given the dramatic upsurge in trampoline and bouncy castle usage, there have been few studies documenting either the incidence of fractures associated with either.
Materials and Methods: This was a prospective cohort study conducted within our institution over a 3 month period June to August inclusive 2019. All paediatric patients who sustain a fracture and present to the National Childrens" Hospital are referred to the orthopaedic department either whilst as an inpatient or as an outpatient depending on the assessment of the severity of injury.
A standardised mixed questionnaire was given to all parents"/guardians which recorded the type of injury, type of trampoline/bouncy castle, inherent awareness of safety precautions governing the usage of either and application of same was recorded. The type of fracture was corroborated via examination of x-ray in addition to the recording of any complications via examination of clinical chart records.
Results: There were 88 patients who sustained a fracture directly related to the usage of either a trampoline or bouncy castle for which the majority required operative intervention. There was wide variability in the nature of injuries recorded; supracondylar/radial fractures were the most common whilst more complex injuries such as an open fracture of the femur was rarer.
Conclusions: Awareness and application of necessary safety precautions was low (38%) amongst parents" supervising parents"/guardians highlighting the need for greater public awareness of same. Furthermore, the incidence of severe injury relating to usage of trampolines/bouncy castles is not uncommon highlighting the high risk activity that trampolining is.

PR 269

Postoperative Complications of Minimally Invasive Intramedullary Nail Fixation Versus Plate Fixation for Distal Fibular Fractures in Elderly Patients: A Retrospective Double Cohort Study in a Geriatric Trauma Unit in The Netherlands.

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Introduction: Conventional plate fixation (PF) of distal fibular fractures in elderly patients is associated with a high risk of wound and implant related complications. Intramedullary fixation (IMF) using a fibular nail is a minimally invasive alternative to PF that provides superior biomechanical strength and allows immediate full weight-bearing postoperatively.
Aim: To compare the postoperative complications of minimally invasive intramedullary nail fixation to conventional PF for Lauge-Hansen supination external rotation type 4 fractures in patients aged 65 years or older treated in a single geriatric trauma unit in The Netherlands.
Methods: A retrospective cohort study was performed including unstable ankle fractures in patients aged 65 years or older treated with either IMF or PF between 1 January 2017 to 1 January 2019. The primary outcome measure was the total number of wound related complications.
Results: A total number of 58 patients were included with a mean age of 73.9 years (range 65 to 95). The IMF-cohort (n = 13) had a significantly higher mean age (82.5 versus 71.4 years, $p = 0.002$) and Charlson Co-morbidity Index (4.7 versus 3.6, $p = 0.005$) compared to the PF-cohort (n = 45). The total number of postoperative complications was lower after IMF (31%) compared to PF (53%), although this relative difference was not statistically significant ($p = 0.152$). All 4 complications observed in the IMF-cohort were wound related but demanded no debridement or implant removal. Wound related complications did not differ significantly from PF (31% versus 44%, $p = 0.378$). No implant related complications, hospital-acquired complications or mortality were observed after IMF.
Conclusion: Despite the higher mean age and co-morbidity status of patients treated with a minimally invasive intramedullary nail, the total number of postoperative complications was lower after IMF compared to PF. This technique might be a promising alternative in a selected group of patients.
The authors declare that they have no commercial associations that might pose a conflict of interest. No funding or other compensation was received for the research, authorship or publication of this article.

PR 270

Study of the treatment and complications of (AO) 43-C Tibial Plafond Fractures

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Introduction: Treatment and postoperative outcomes after tibial plafond fractures are conditioned by soft tissue involvement. The aim is to describe the characteristics and surgical management of AO43C fractures and to evaluate the conditions of postoperative complications and clinical outcomes.
Material and Methods: We assembled 44 fractures AO43C from 2011 to 2018 (minimum follow-up 6 months). The variables measured were Gustilo classification, days of delay until surgery, approach (anterior, posterior or combined) and postoperative complications (soft tissue damage, deep infection, neurovascular lesion and nonunion). The lateral distal tibial angle (LDTA) and the degree of osteoarthritis (Van Djik) have also been measured. Multivariate analysis has been carried out to establish the relationship between the characteristics of the fracture, its treatment and the development of complications.
Results: The average age was 44 years, 77.27% men. 13 open fractures, 6 Gustilo type II and 4 Gustilo type III fractures. The treatment protocol was external fixation at admission and definitive osteosynthesis with plate at 15 ± 7 days. a single approach to the tibia was performed in 32 patients, and a combined anterior and posterior approach was used in 9. The incidence of complications was 50%: 15 cases of poor soft tissue evolution, of which 7 were infections. 9 patients evolved to nonunion. Osteoarthritis appeared in 100% of patients (70.73% grade 3), and only one patient needed arthrodesis. 15.91% had a valgus LDTA ($< 86°$) and 38.64% a varus deformity ($> 92°$). We found a significant relationship between the history of open fracture and the development of complications ($p < 0.05$). We found no relationship between the incidence of complications and the approach.
Conclusions: Tibia AO43C fractures have a high percentage of complications and evolve to well-tolerated osteoarthritis. Open fracture seems to significantly influence the poor postoperative outcomes of these patients.

PC 271

Masquelet technique and antibiotic cement-coated nail as definitive treatment in a young patient with open femur fracture with 10 cm bone defect

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Case history: Young male who suffers a traffic accident while driving a quad at 60 km/h on the island of La Palma, where he is treated until his transfer to the University Hospital of Canary Islands for the definitive treatment.
Clinical findings: A 24-year-old male, who suffers a closed chest trauma with pneumothorax, right pulmonary contusion and poor pneumoperitoneum. Also a grade IIIA open fracture of the right femur, with a 10 cm bone defect.
Investigation/Results: Upon arrival at the hospital, he needs orotracheal intubation, as well as blood transfusion with 9 red blood cell concentrates. External fixator is placed on the right femur.
Diagnosis: A IIIA grade diaphyseal open fracture of the right femur with 10 cm bone defect, bearing external fixator with one broken proximal pin and positive culture for S maltophila in the distal pin.
Therapy and Progressions: Antibiotic treatment and medical optimization are performed, cemented intramedullary nailing (T2-Stryker) with antibiotic (vancomycin-tobramycin), as well as cement spacer with antibiotic (Masquelet's first stage) in the defect area. In second time, withdrawal of spacer and contribution of RIA autograft of contralateral femur and allograft respecting membrane.
The patient begins the protected weight bearing with two crutches immediately, without using them 3 months after the surgery. Bone consolidation without pain or limitation after 1 year.
Comments: The induced membrane technique is a simple and effective technique for the reconstruction of segmental bone defects and can be used as a first time technique together with the initial stabilization, leaving the defect ready for graft delivery in the second time.
References:
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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 272

A rare case of carpal metacarpal dorsal dislocation from D2 to D4: Case report

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Introduction: Carpal metacarpal dislocation is a rare entity that accounts for less than 1% of all carpal injuries. Dorsal dislocations are the most common and occur most frequently after violent trauma in young individuals and are easily overlooked and may lead to long-term sequelae.

Material and Methods: We present the case of a carpal metacarpal dislocation from D2 to D4. Male, 40 years old, no relevant personal history. Brought to the emergency service after a motorcycle accident with projection. He had a symphysis pubis diastasis, a distal radius

fracture on the right wrist and a fracture of the left forearm bones. No other apparent injuries associated. At week 4, he presented edema and dorsal deformity of the left hand associated with limited finger movements. Neurovascular assessment was normal. The radiological evaluation showed a carpal metacarpal dislocation from M2 to M4. It was an unstable reduction so open reduction was performed, with debridement of fibrous material, until exposure of the articular surfaces, and reduction and fixation with K wires of the three metacarpals (from D2 to D4). Similarly, M5 was stabilized with a K-wire due to clinical instability observed intraoperatively.

Results: It is necessary to reduce and stabilize these lesions to avoid vasculonervous compression and skin distress. Open reduction is indicated in irreducible cases allowing debridement and excision or OS of small osteochondral fragments and fixation of associated fractures.

Conclusions: Combined dislocation of multiple metacarpals is a rare lesion that compromises the functional prognosis of the hand in the absence of adequate treatment. Instability and post traumatic arthrosis are among the sequelae of this lesion. Identify the lesion to allow the appropriate treatment usually leads to good results.

References: Total carpometacarpal joint dislocation combined with trapezium fracture and hamate fracture; R. Gvozdenovic et al.; Chirurgie de la main; 2015

Fig. 1

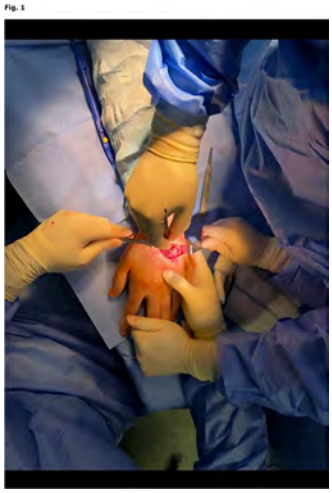

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PC 273

Rupture of the long extensor of the thumb following a rolling fracture in the adolescent—an unexpected expectation complication

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Case history: 16-year-old suffered direct trauma to his right hand after falling off his bicycle.
Clinical findings: On physical examination showed edema and bruising from the base of the thumb and thenar eminence, tenderness over the CMC joint and functional disability speacialy in pincer grasp. No neurovascular injuries
Investigation/Results: The x-ray revealed a comminuted fracture of the base of the thumb metacarpal.
Diagnosis: We identifed a rolando fracture.
Therapy and Progressions: On the day after the trauma, he was submited to open reduction and osteosinthesis with lateral-palmar plate and screws, through radiopalmar aproach of the thumb base.
Intra operatively no dorsal fragments werefound to be left undisplaced.

Two months after surgery, the patient went back to the hospital for sudden pain and inability to extend the thumb.

Clinically with rupture of the long extensor of the thumb. On the x-ray, the fracture was aligned.

The latero-lateral tenorrhaphy with kessler suture was preformed and intraoperatively a bony spicule was identified in the proximal stump of the tendon, which was removed.

6 months after the initial trauma, the patient has a consolidated neck and no limitation of the mobility of the thumb.
Comments: Rollando fracture is relatively rare in adolescents. The aim of treatment should be exact reduction usually with open technics.
The main complications are stifness and early arthrosis.

There are also records of conflicts with the plates and even rupture of the extensor tendon, so the radiopalmar placement of the plate was chosen.

Nevertheless, the rupture occurred due to conflict with an unidentified bone fragment during surgery causing an unexpected complication in this case.

The immobilization necessary after tenorrhaphy could have caused joint stiffness, but in this case the teenager fully recovered after physical therapy

PC 274

Medial femoral MIPO Approach in Periprosthetic-Peri-Implant Fractures: A less-invasive solution to consider

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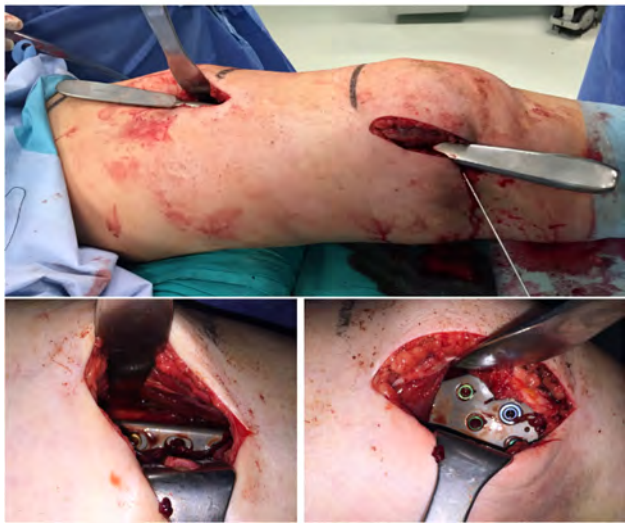
Case history: Periprosthetic and periimplant femoral fractures are an increasingly frequent pathology. In many cases they are a challenge with limited or too aggressive therapeutic options. It is important to investigate new approaches that increase the arsenal of the orthopedic surgeon. The recently described MIPO (Minimally Invasive Plate Osteosynthesis) approach for the medial aspect of the femur may seem like a dangerous procedure because of the anatomical structures that run along the medial aspect of the thigh, but it is a viable and useful option in selected cases.
Clinical findings: We present the case of a 54-year-old patient with a total hip replacement who presented a first periprosthetic Vancouver B1 fracture of the femur that was treated with a lateral blocked plate. Subsequently the patient presented a second supracondylar femur fracture below the first plate (Vancouver C).
Investigation/Results: After thinking over the possible therapeutic options, we decided to treat our patient by means of the medial femoral MIPO approach with a long medially placed blocked plate, managing to stabilize the fracture and superimpose the plate on the previous implants without the necessity of removing the previous lateral plate.
Diagnosis: Periprosthetic and periimplant supracondylar left femoral fracture.
Therapy and Progressions: We used the surgical technique of the medial femoral MIPO approach as described by Apivatthakakul[1].
Comments: We consider that the medial femoral MIPO approach is a useful therapeutic tool to consider. It seems a safe and low-invasive option for the resolution of cases in which the lateral MIPO approach is not a feasible option.
References: [1]C. Jiamton y T. Apivatthakakul, « The safety and feasibility of minimally invasive plate osteosynthesis (MIPO) on the medial side of the femur: A cadaveric injection study » , *Injury*, vol. 46, n.o 11, pp. 2170–2176, nov. 2015.

Fig. 1

Fig. 2



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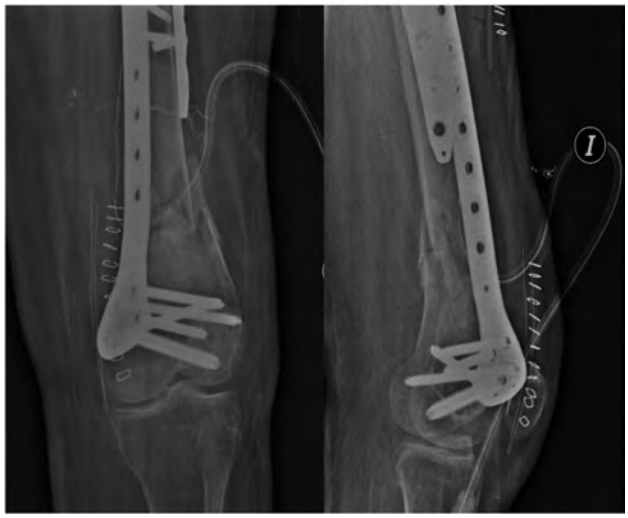

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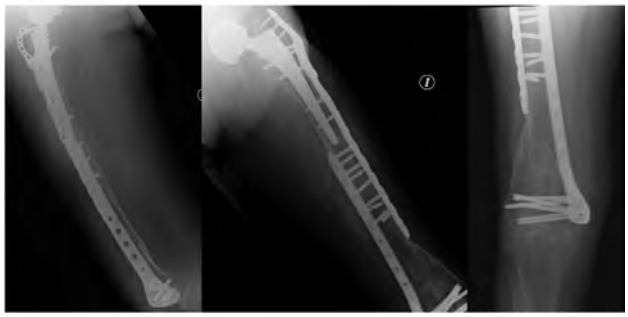

PC 275

Posterior knee dislocation with neurovascular injury associated—A Case Report

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Case history, Investigation and Diagnosis: A 58-year-old male was brought in after 4 h following a heavy straw bale fall. He presented with a posterior knee dislocation that had already been reduced and an open wound in the popliteal fossa. The limb was flushed and pale on the extremity, with absence of the pedis and posterior tibial pulses. Stability tests revealed unstable knee in all axes. An anterior shoulder dislocation was diagnosed and reduced.

Therapy and Progressions: An emergent surgery was performed, involving a transarticular external knee fixation and a femoro-popliteal bypass above the knee (angiogram revealed a stop sign at the level of the interarticular popliteal artery). He developed circulatory shock and was admitted to the intensive care unit. On the 1stpostoperative day(po) was diagnosed a compartment syndrome that was treated with fasciotomies. These incisions showed a slow but progressive evolution, that required vacuum dressings and underwent autologous skin graft on the 34thpo day. The external fixator was removed on the 41stpo day and rehabilitation was started. On a 5-month follow-up, the patient had a good evolution of the wounds, but a knee with valgus and anteroposterior laxity and severe complete peroneal, tibial and sural neurological injury, confirmed with electromyography, and neuropathic pain.

Comments: Knee dislocation is a rare (up to 0.2% of all orthopedic trauma), potentially limb-threatening, knee injury. Most often caused by high energy trauma, it can also result from low energy trauma. The incidence of open knee dislocations varies 15–35%. Rapid identification of the injury, reduction, and definitive management are necessary to minimize neurovascular damage.

References: Chowdhry M, et al. Knee dislocation and associated injuries: an analysis of the American College of Surgeons National Trauma Data Bank. KSSTA. 2019; Lachman JR, et al. Traumatic Knee Dislocations: Evaluation ,Management, and Surgical Treatment. Orthop Clin North Am. 2015

Fig. 1

Fig. 2

Fig. 3

PR 276

Long-term results of isolated iliac wing fractures

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Introduction: Isolated iliac wing fractures represent only a small part of all pelvic fractures. These fractures are associated with severe injuries, but are considered benign. The literature lack information about the function and quality of life of these patients. Our objective was to evaluate the long-term effects of isolated iliac wing fractures.
Material and Methods: Patients with pelvic fractures treated at Oslo University Hospital, Ullevaal, in the time period 2006-2016, were extracted from the local fracture registry. 403 patients were registered in this period. A search was also made in the hospital"s administrative electronic database for patients registered with diagnose code S32.3 in ICD-10 in the same period. 37 patients were identified. In total, 13 patients had an isolated iliac wing fracture, and these were invited to a follow-up examination, including PROMs (EQ-5D-3L and Majeed score), clinical examination, and pelvic X-ray.
Results: Nine patients agreed to participate in the study, median 7 years after the fracture (range 4–13). All of them were injured from high energy trauma, with mean NISS 18,3 (range 5–66). Four of the fractures were open, and seven of the patients had associated injuries. Five were treated with internal fixation. The mean EQ-5D VAS was 84 (range 75–99). Five patients reported pain, one of them related to the pelvic fracture. The mean Majeed score was 87 (range 64–100). Seven patients had sensory deficit in the lateral thigh. One patient had difference in range of motion between the two hips. The X-rays showed healed fractures in all the patients. Eight of them showed ectopic ossification.
Conclusions: Our study confirms previous studies that isolated iliac wing fractures are results of high energy trauma with severe associated injuries. However, the majority of this group of patients seem to have a good general state of health, which is in accordance with the general assumption of the injury as a benign one.

PC 277

Fenton's syndrome—A case report of a common underdiagnosed entity

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Case history: A right handed 54-year-old male, construction worker, was admitted in our emergency department, after a 3 meters fall. The authors report a case of Fenton's syndrome in a politrauma scenarium.
Clinical findings: Both right elbow and left wrist were painful, swollen and with a remarkable restriction of the range of motion (ROM). Patient also reported lower back pain. No neurovascular injuries were detected.
Investigation/Results: X-ray and CT scan confirmed a fracture of a lumbar vertebra, fracture of the right olecranon and, on is left wrist, a carpal fracture-luxation Mayfield 4 of both scaphoid and capitate associated with rotation of the last one proximal pole—Fenton"s syndrome.
Diagnosis: This syndrome is an atypical presentation of perilunate fracture dislocation and, therefore, difficult to diagnose. Few reports were found in literature.
Therapy and Progressions: After an open reduction of the fractures, a definitive fixation with headless Herbert screws was achieved. Percutaneous KW and immobilization of the wrist were performed to further stabilization of the lunotriquetral joint. 12 weeks later consolidation was noted. A decrease of 15° in extension and flexion were detected when compared with the contralateral wrist. Grip strength test was similar on both hands. Osteosynthesis of the right olecranon was also realized.
Comments: A careful neurovascular assessment is important. Although it is rare, injuries of median nerve were already reported associated to this complex fractures. Open reduction and osteosynthesis are necessary due to the great instability and the risk of non-union and osteonecrosis of the rotated proximal segment.
References: 1. Cisneros, L.N. (2012) Fenton syndrome. Rev Es de Cir Orto y Trauma. 2. Ameziane, L. et al. (2003) Fenton's syndrome or scapho-capitate fracture (a case report). Chir Main. 3. Arbter, D. et al. (2009) The scaphocapitate fracture syndrome (Fenton). Handchir Mikrochir Plast Chir

Fig. 1

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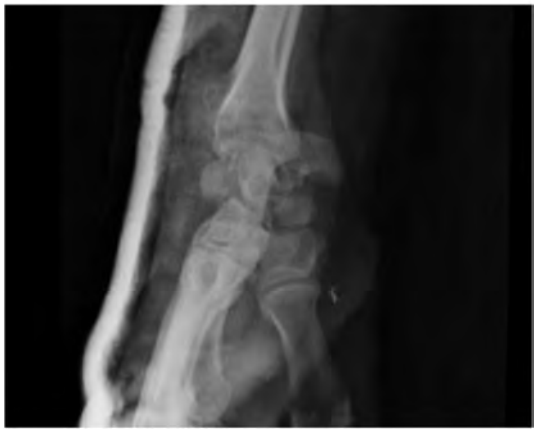

Fig. 3

PC 278

Chronic Osteomyelitis Treatment With Papineau Method: A valid option

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Case history: 66 year old man who had suffered an accident 44 years ago, with right leg trauma due to compression, resulting in comminuted open fracture of the proximal 1/3 tibial shaft. Skeletal traction was applied for 3 months and then closed plaster cast immobilization, developing infection. He underwent osteosynthesis with plate and screws and vascularized flap. Five years after the accident, he began to have swelling and drainage, being diagnosed with osteomyelitis. After 20 years he relapsed, with frequent episodes of drainage, until 2 years ago, when he got an aortic biological valvuloplasty and orthopedic guidance was required.
Clinical findings: Ulcer with devitalized tissue, without bone exposure, with 4 × 2 cm of dimension and fistula draining purulent content in moderate quantity, associated pain and 2 cm shortening of the right lower limb.
Investigation/Results: Analytically negative inflammatory parameters. Preoperative culture of the exudate was positive for Pseudomonas aeruginosa and was treated with ceftazidime. CT showed bone defect, about 2 × 1 cm, with destruction of the anterior cortex
Diagnosis: Chronic Osteomyelitis of right tibial shaft
Therapy and Progressions: The patient underwent debridement, curettage and filling of the dead space with an autologous iliac crest cancellous graft by Papineau's technique, in two different surgical times. Intraoperative culture of bone tissue remained positive for Pseudomonas. The patient underwent vacuum wound treatment and directed antibiotic therapy, with resolution of the clinical condition, without recurrence at 2 years of follow-up.
Comments: The treatment of chronic osteomyelitis with the Papineau technique emerges as a currently available and highly successful therapeutic gesture, at a time when there is extensive study and several therapeutic options, not always with the best results.
References: Maffulli et al. The management of osteomyelitis in the adult. The surgeon. 2016.

Fig. 1

Fig. 2

Fig. 3

PR 279

Femur geometry Analysis for development of implant

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Introduction: Intramedullary nailing has been popularly applied for the femoral shaft fractures. The current study aimed to analyze the femur geometry for development of implant design with 3 dimensional skeletonization.

Material and Methods: We acquired computed tomography (CT) images of both femur reviewed in a single center from 2015 to 2017. The total 1400 participants were enrolled and they were divided into subgroups according to age (decades) and gender. Each subgroup included 100 persons, respectively. These images are used to produce 3D samplings. With the skeletonization, we obtained the geometry parameter; (1) femur shaft length from the tip of the greater trochanter to the bicondylar line, (2) the minimum diameter of the medullary canal and its location, (3) anteroposterior (AP) diameter and lateral diameter of the entire femur, (4) radius of curvature (ROC) of the femur (bowing). We compared all parameters according to sex and age.

Results: The average age of the participants were 54.0 years (range 20–89 years) and the number of each gender was exactly same. The femur length was 425.5 ± 37.6 mm (range, 337.4-516.0 mm) and the femur shaft length was 383.0 ± 35.6 mm (range 301.3–466.5 mm), both of them were longer in male ($p = 0.002$, < 0.001). The minimum diameter of the medullary canal was 9.4 ± 1.9 mm (range 5.0–18.1 mm). The ROC was 810.7 ± 202.5 mm (range 338.3–1491.8 mm). The rate of the minimum diameter less than 8 mm and 7 mm was 26.0% and 9.4%, respectively. The rate of ROC with less than 750 mm and 700 mm was 28.5% and 21.3%, respectively.

Conclusions: This geometry analysis showed that there are mismatch problem between the current nail and the medullary canal in 9.4% and the ROC of the femur was smaller than that of the current nail systems (1000–1500 mm). The result indicates potential mismatch problem in clinical cases and the problem can be resolved with newly designed nail system.

References:

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PR 280

Safe zone of the infracacetabular screw: Virtual mapping of 362 three-dimensional hemipelvises for quantitative anatomic analysis

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Introduction: An infra-acetabular screw can provide increased stability in fixating acetabular fracture. We conducted this study to define the incidence of the safe corridor for infra-acetabular screw and to determine the correlation between the safe corridor and other demographic factors such as age, sex and height.

Material & Methods: Pelvis computed tomography (CT) of 182 participants was extracted with evenly age- and sex- allotted. 362 virtual three-dimensional (3D) model was generated. A search was performed to find the maximum-with corridor connecting two points. The entry and exit point was displaced in the template. The maximum diameter of each corridor was measured in automatic procedure. A minimum 5 mm corridor diameter, sate corridor, was defined as a cutoff for placing a 3.5 mm cortical screw in clinical setting. All data were presented as mean and range or mean and standard deviation. Two-sample *t* test and regression analysis were used to compare difference between groups based on sex, age, and height.

Results: Among 354 hemipelvis, 250 hemipelves (70.6%) satisfied a minimum safe corridor diameter of 5 mm. When divided into a subgroup by the patient's gender, the incidence of the safe corridor of a male group was statistically higher than a female group (82.0% vs 59.1%), with the mean corridor diameter of 6.24 mm (95% CI, 0.2) and 5.44 mm (95% CI, 0.2), respectively ($p < 0.001$). In Correlation analysis, only the height showed a positive correlation with the diameter of the safe corridor of a total population ($r = 0.25$; $p < 0.001$).

Conclusions: The study provided the safe corridor was found in 81% of male and 69% of female, and the taller had the higher incidence of the safe corridor. The patient''s height was correlated with the

corridor diameter of the infra-acetabular screw, whereas the patient"s age did not correlate with the corridor diameter.

PR 281

Femoral neck fractures and cementless total hip arthroplasty

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[1]General Hospital Sarajevo, Department of orthopedic surgery and traumatology, Sarajevo, Bosnia And Herzegovina, [2]Medical Faculty, University Sarajevo School of Science and Technology, Sarajevo, Bosnia And Herzegovina

Introduction: Femoral neck fractures in middle-aged and older patients represent one of the most common orthopedic conditions. Osteosynthesis, as a primary treatment option for femoral neck fractures has shown to have successful outcomes. However, this is not the case for old fractures.
The purpose of this study was to evaluate the outcomes of treatment of femoral neck fractures in which cementless total hip arthroplasty was indicated. The aim of our study was to analyze the prosthetic failure, i.e., the reasons for unsuccessful outcome, in order to suggest the indications for primary osteosynthesis which could guide the femoral neck fracture management.
Material and Methods: A total of 120 patients were analyzed in this study, with femoral neck fracture treated with osteosynthesis. Reviewing the radiological findings, as well as the course of the treatment, we set up the criteria, on the basis of which we could advice the immediate implantation of total hip prosthesis for the femoral neck fracture.
Results: Old fractures, varus deformity of the femoral head and neck, dislocation, as well as the comminuted fractures, are all factors affecting the surgical outcomes of osteosynthesis. Additionally, medical and technical equipment of medical institution, personnel competence, and minutious surgical technique affect the treatment outcomes.
Conclusions: Results of this study point out the importance of surgical reasoning in setting-up the indications, as well as the choice and tactics of surgical method.
References:
Konstantoulakis C, Anastopoulos G, Papaeliou A, Tsoutsanis A, Asimakopoulus A. Uncemented total hip arthroplasty in the elderly. Int Orthop. 1999;23:334–6.

Phedy, P., Ismail, H. D., Hoo, C., & Djaja, Y. P. (2017). Total hip replacement: A meta-analysis to evaluate survival of cemented, cementless and hybrid implants. *World journal of orthopedics*, *8*(2), 192–207.

PR 282

Development and biomechanical analysis of an intramedullary nail osteosynthesis for proximal ulnar fractures

T. Nowak[1], J. Hopf[1], D. Mehler[1], D. Gruszka[1], C. Arand[1], P. M. Rommens[1]

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Introduction: Proximal ulnar fractures are usually osteosynthesized by means of angle stable plate osteosynthesis. Despite good functional results of this procedure, complications such as high access morbidity and disruptive osteosynthesis material with a high rate of material removal are described. The aim of our study was the development of a new locking nail and test setup for comparison with a plate osteosynthesis on artificial bones.
Material and Methods: In our biomechanical laboratory, a Jupiter 2B fracture of the proximal ulna was standardized on 20 sawbones and stabilized by means of the newly developed nail or angle-stable posterior plate osteosynthesis. a servopneumatic testing machine, the specimens were flexed under a cyclic load (30–300 N) in the physiological range of movement of the elbow from 0° to 90°.The maximum elastic deformation of the specimens and the loosening of the implants were evaluated after 608 test cycles.
Results: The primary stability of the constructs at the anterior cortical bone after nail osteosynthesis was significantly greater (0.29 ± 0.13 mm) than in the angle-stable plate osteosynthesis (0.97 ± 0.30 mm, $p < 0.001$).After passing through the test cycles, both implants showed a low loosening rate. In the area of the anterior cortex, the locking nail showed a significantly lower rate of loosening (nail 0.08 ± 0.06 mm, plate 0.24 ± 0.13 mm, $p < 0.001$). At the dorsal cortex, there were no differences between plate and nail in both series of measurements.
Conclusions: Intramedullary implants provide biomechanical benefits in fracture stabilization. Good biomechanical results have already been shown in the literature after nailing olecranon fractures2. Nevertheless, due to the complex anatomy and the resulting difficult implantation technique, ulnar nails could not prevail in practice. The presented nail allows a safe stability with simple surgical technique.

Fig. 1

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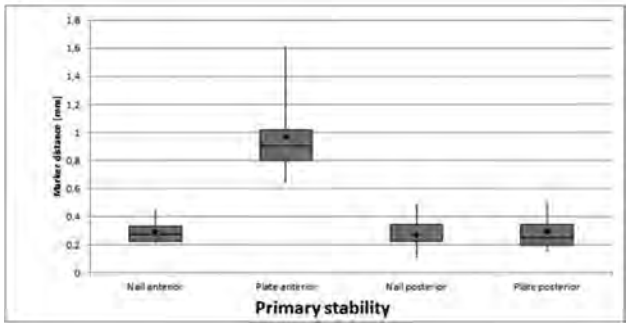

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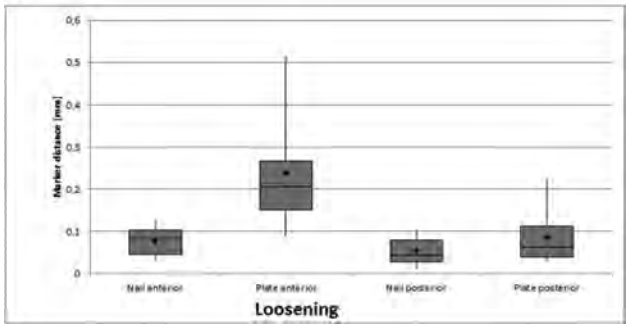

PR 403

3D fracture assessment of tibial plateau fractures can predict the occurrence of total knee arthroplasty at follow-up

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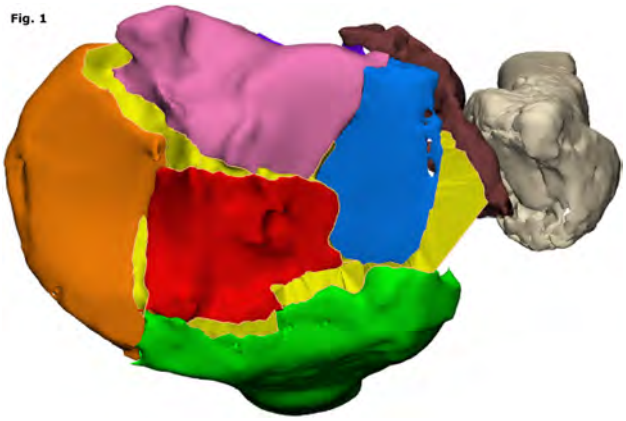
Introduction: Adequate treatment of tibial plateau fractures is crucial to minimize patient disability, development of posttraumatic arthritis and subsequent need for a total knee arthroplasty (TKA). However, due to the complexity of the fracture, adequate reduction cannot always be achieved which could result in the early conversion to a TKA. In this study we introduce a quantitative 3D fracture assessment method and investigate whether it could help to identify patients that are at risk of conversion to a TKA.

Material and Methods: We retrospectively included 135 patients, who were treated for a tibial plateau fracture between 2003 and 2017. 16 patients developed severe posttraumatic arthritis and underwent conversion to a TKA. From all patients, 3D models were created using the pre-operative CT-scans. For each patient, the 3D gap area between the fracture lines, representing an innovative combined gap and step-off measurement in 3D, was determined in order to quantify the displacement (Figure 1). ROC curve analysis was performed to determine a critical cut-off value for the 3D gap area. Kaplan–Meier survival curves were created to assess the association between 3D fracture anatomy and risk on a TKA at follow up.

Results: A critical cut-off value of 700 mm^2 was found to give highest combined sensitivity and specificity for 3D gap area and the risk of TKA at follow-up. Kaplan–Meier survival curves showed 98.9% knee survival (no TKA) at 2 year follow up in the group with a gap area of < 700 mm^2, whereas in the group with a gap area of ≥ 700 mm^2 a knee survival of 82.5% was found. At 10 year follow up knee survival was 97.9% and 63.8%, respectively, for the two groups (< 700 mm^2 and ≥ 700 mm^2).

Conclusions: We developed an innovative method to quantify the amount of displacement in 3D. Pre-operative 3D fracture assessment could be used as an addition to the current fracture classification methods to help identify patients who have a high risk on conversion to TKA at follow-up.

Fig. 1



PR 404

Total Quadricectomies in High Grade Soft Tissue Sarcomas: Presentation of a Case Series

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Introduction: Soft tissue sarcomas (STS) in the anterior compartment of the thigh are frequent. The extent of quadriceps resection is controversial. The aim of the present study is to communicate our results in complete quadricectomies due to high-grade STS.

Material and Methods: We present 8 STS, in stage IIIB of the AJCC, with a mean craniocaudal diameter of 15 cm (9-25). There were 4 women and 4 men, with a mean age of 58 years (35-79). Six were undifferentiated pleomorphic sarcomas, 1 myxofibrosarcoma and 1 clear cell sarcoma. In every case, total quadricectomy was performed with wide margins. Posterior reconstruction with local muscle transfers was performed, expect for the younger patient, who received a vascularized contralateral vastus lateralis transplant. In all cases, complementary radiotherapy was indicated, and in 4 patients adjuvant chemotherapy.

Results: Three patients required Friedrich due to necrosis of the edges of the surgical wound. One patient died 50 months after the intervention as a result of multiple metastasis, and two due to medical complications after 1 week and 4 months, respectively. The average follow-up time for the rest was 28 months (3–71), with no local recurrence. As for functional outcomes, mean MSTS score was 20 (14–30), with deficit of active knee extension in most of them. The functional result of the patient with the vascularized muscle transplantation was excellent. All of them were satisfied with the results of the treatment.

Conclusions: Quadricectomy provides good functional and acceptable cancer results, although it is not exempt from complications in frail patients. Vascularized muscle transplantation, though complex, can improve functional results, especially in younger patients.

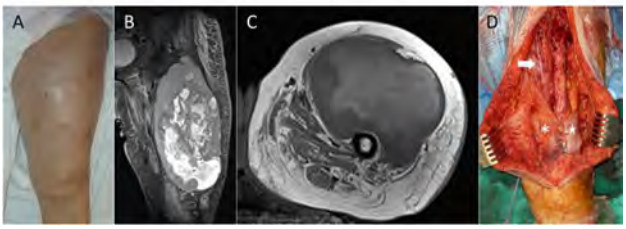
References:

Ek EW, Rozen WM, Ek ET, Rudiger HA. Surgical options for reconstruction of the extensor mechanism of the knee after limb-sparing sarcoma surgery: an evidence-based review. Arch Orthop Trauma Surg. 2011 Apr; 131(4):487–95.

Fig. 1

Patient	Age	Sex	Occupation	MRI centimeter size (L-AP-T)	Histological type	AJCC stage	RT	ChT
1	55	M	Limited Society	15-9,5-6,5	Pleomorphic undifferentiated sarcoma	IIIB	Postoperative	Postoperative
2	66	M	Limited Society	14x8x19,5	Pleomorphic undifferentiated sarcoma	IIIB	Postoperative	Postoperative
3	53	F	None	14x11x6,3	Pleomorphic undifferentiated sarcoma	IIIB	No	No
4	74	F	Retired	18x6x13	Pleomorphic undifferentiated sarcoma	IIIB	Postoperative	No
5	79	M	Retired	25x10x13	Mixofibrosarcoma	IIIB	No	No
6	35	M	Judge	9,4x4,2x9,4	Pleomorphic undifferentiated sarcoma	IIIB	Preoperative	Pre and Postoperative
7	46	F	Businessman	10,6x9,6x12,5	Pleomorphic undifferentiated sarcoma	IIIB	No	Postoperative
8	48	F	Businessman	16x10x12	Clear cell sarcoma	IIIB	No	No

Fig. 2



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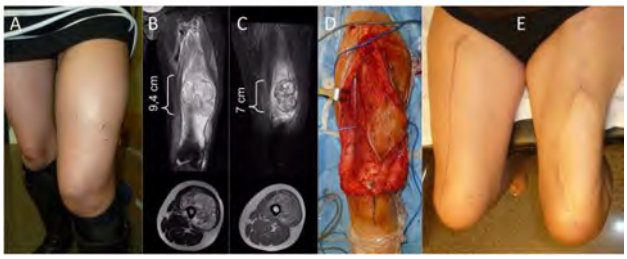

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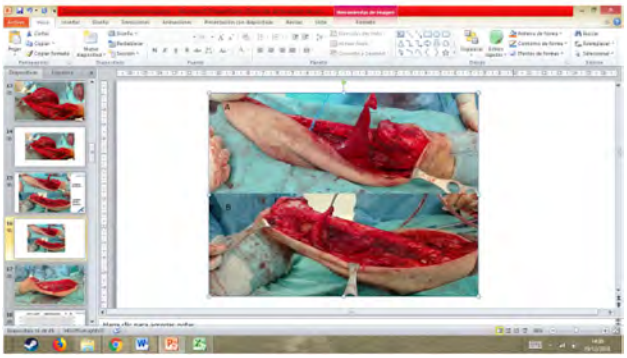

PR 267

Treatment of proximal and/or middle one-third diaphyseal humeral fractures with a helical plate: one year results

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Introduction: Operative treatment is a valuable option in displaced proximal and/or middle one-third diaphyseal humeral fractures. Although plate osteosynthesis is preferred to intramedullary nailing, surgery can be complicated by radial nerve palsy. A helical plate could avoid this high-impact complication. To date there is however a lack of published evidence in literature, although recent Asian case reports show promising results.

Material and Methods: We retrospectively reviewed 16 patients who were treated with open reduction and internal fixation with a helical plate consecutively from October 2016 until August 2018 at AZ Groeninge, Kortrijk. A deltopectoral approach was used in combination with a distal anterolateral incision, whether or not in continuity. A self-molded long PHILOS plate was used in the first 9 patients, while in our last 7 patients the A.L.P.S plate (Zimmer®) was used. Standard radiographs were obtained pre- and postoperatively. We retrospectively searched for complications, e.g. radial nerve palsy, infection and/or loosening. In autumn 2019, 12 patients were reassessed. Patient"s general health status was evaluated using the EQ-5D-5L score. Constant-Murley scores and DASH scores were used for evaluating shoulder function and disability measures consecutively.

Results: All humeral fractures consolidated at 3 months. There were no radial nerve palsies due to surgery. One plate was removed after 1 year due to a late infection. With a minimum follow up of 1 year, the mean DASH score was 22 (0–93) and the mean Constant-Murley score was 68 (33–95). The DASH score was inversely proportional with the Constant-Murley score and patient"s general health status.

Conclusion: A Helical Plate avoids neurological complications with similar healing rates and good to excellent shoulder function at 1 year follow up in the treatment for proximal and/or middle one-third diaphyseal humeral fractures.

PR 405

The use of antibiotic-impregnated cancellous bone grafts in one-stage surgery for chronic orthopaedic infection: Preliminary clinical results

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Introduction: The use of cancellous bone allografts is an established technique in reconstructive orthopaedic surgery. Unfortunately, its use is generally avoided in the presence of a local infection. Antibiotic impregnated cancellous bone grafts has shown its effectiveness as an local antibiotic delivery system[1–3]. In this clinical study, we report our first personal experience with the use of vancomycin-impregnated cancellous bone grafts in one-stage surgery for periprosthetic joint infections (PJI) and fracture-related infections (FRI).

Material and Methods: Between December 2015 and March 2019 nine patients were treated during a one-stage surgery with vancomycin-impregnated cancellous bone grafts, containing 1 g vancomycin per 10 cc bone. Regular clinical, laboratory and radiographic follow-ups were performed for at least 6 months after surgery.

Results: The procedures included revision of 5 PJIs (Hip and Humerus) and 4 FRIs (Tibia, Femur and Clavicula). One tibia required further revision because of recurrent infection and one hip has an uncertain infection state, however the remaining 7 patients stayed free from infection during a follow-up of at least 6 months. Interestingly, in one patient the vancomycin concentration could be determined in the drainage fluid from the wound. Radiographic examination revealed no signs of osteolysis or loosening, good incorporation of the bone graft and progressive consolidation.

Conclusions: Within the limits of the study, the use of vancomycin-impregnated cancellous bone grafts in one-stage surgery to treat PJI and FRI yielded positive outcomes in terms of clinical, laboratory and radiographic follow-up. This technique might offer new treatment strategies in often devastating injuries.

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PR 406

Follow-up examination of the introduced surgical technique for the replacement of the posterior cruciate ligaments

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Introduction: A new surgical technique for the replacement of the posterior cruciate ligament after rupture was introduced. Now we present the follow-up examinations of the operated patients.
Material and Methods: In the examination, we included 4 patients, which were operated with the open tibia inlay technique (group A) and 7 with the modified arthroscopic approach (group B). The prospective follow-up included the Lysholm score, the subjective questionnaire of the IKDC score and the specifically extended OAK score for clinical evaluation. The Rolimeter® was used to test the translational mobility of the knee joint. The statistical significance level was set at 5%.
Results: The follow-up was 28.5 ± 19.60 months and 30.6 ± 26.26 months postoperatively in group A and B, respectively. The subjective scores were tested. Group A and B achieved a mean Lysholm score of 70.3 ± 5.32 and 69.6 ± 19.82 points respectively. In the subjective IKDC assessment, group A achieved 67.3 ± 7.76 points and group B 65.9 ± 12.35 points. The clinical OAK score was 77.5 ± 6.10 points in group A and 75.3 ± 11.31 points in group B.

The following values could be recorded for the stability of the posterior cruciate ligament: The side difference in the rear drawer test was 1.75 ± 1,192 mm in group A and 2.50 ± 2.160 mm in group B. In the reversed Lachman test, a difference of 2.37 ± 2.175 mm and 3.22 ± 2.059 mm was measured in group A and B, respectively. All values mentioned were comparable between the two evaluated groups.
Conclusions: The results of the two surgical techniques were comparable. Therefore the arthroscopic approach is the preferred method in our institute.

PR 407

Simple correction technique of femoral malrotation after PFN-A osteosynthesis of trochanteric fracture

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Introduction: Malrotation after intramedullary nailing in femoral shaft fractures are well known. But malrotation after nailing of trochanteric fractures is an underestimated problem. During surgery the axial alignment can easily be evaluated by fluoroscopy in both planes. But the torsional alignment is difficult to assess especially with the patient placed on the traction table. In literature a malrotation after PFNA is described in up to 25% of the cases. A revision with replacement of the blade, especially in patients with poor bone quality, may result in a reduced stability. To our knowledge there is no publication till to date to give a treatment pathway for this problem. We developed a rather easy technique to derotate a malrotated femur after PFNA fixation.
Material and Methods: The basic idea is to leave the usually well placed blade insitu in the femoral head, just rotating the distal main fragment around the nail. Therefore, a small U-shaped osteotomy with a chisel is performed in the femoral cortex just anterior of the entry site of the blade. The length (l) of this osteotomy can be calculated, following the formula: $l = \mathbf{d} \times \pi \times \alpha/360$ (d = diameter of femur, α = angle of malrotation). Then the distal locking bolt is removed, the leg derotated and finally locked again. The procedure is controlled by two Schanz"screws separately inserted in both main fragments angulated to each other in the angle "α".
Results: Since 2014 3 patients were detected with a clinically relevant femoral malrotation. All patients had an internal malrotation from 30 to 40 degrees confirmed and measured by CT scan. All of them were successfully revised in the above described technique 5–9 days after initial fixation.
Conclusions: First, we believe that malrotation after trochanteric fracture fixation is an underestimated problem. And second our method is a simple salvage procedure for malrotated trochanteric fractures after PFNA, leaving the blade in situ in the femoral head.

Fig. 1

PR 408

Optimal intramedullary nailing for trochanteric fractures: The importance of distal locking screw and reduction position

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Introduction: Distal locking issue for trochanteric fractures is still controversial. Therefore, the purpose of this study was to investigate the complications between distal unlocked group and distal locked group. Further, the relationships were evaluated between these complications rates and their reduction positions after operation.
Material and Methods: 365 operations were performed for trochanteric fracture (AO 31A1 +A2) from 2012 to 2018. Of these, patients with f/u periods > 3 month were 218. Gamma3 IM Nailing System (Stryker) was used for all patients. 146 patients (Unlocked group) from 2012 to 2016 operated without distal locking screw. 72 patients (Locked group) from 2016 to 2018 operated with distal locking screw. We retrospectively analyzed those patients who suffered complications such as delayed healing and postoperative peri-implant fractures and cut-out of the lag screw. Further, in lateral view of their radiographs, we evaluated the position of the proximal fragment compared with distal fragment. The reduction positions were

divided into 3 groups: anterior (subtype-A), neutral (subtype-N), and posterior (subtype-P).
Results: In Unlocked group, complication was shown in 94 patients (Complication group). Delayed healing was shown in 94/146 (64.4%) in Unlocked group and 12/72 (16.7%) in locked group. Peri-implant fracture was shown in 3/146 (2.1%) in Unlocked group and 0/72 (0%) in locked group. Cut-out of the lag screw was shown in 4/146 (2.7%) in Unlocked group and 1/72 (1.3%) in locked group. In Complication group, subtype-P was more than Non-complication group.
Conclusion: In the current study, higher number of complications was seen in the distal unlocked group. And, our study showed the reduction position might be associated with post-operative complications. We concluded that nailing without distal locking screw might be dangerous and subtype-P should be avoided.

PR 409

Surgical resection of severe heterotopic ossification after open reduction and internal fixation of acetabular fractures: four case reports

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Introduction: Heterotopic ossification (HO) after acetabular fracture surgery has been one of the common complications and often limits function with the range of motion severely. Surgical resection is challenging and only effective treatment for established HO. We herein report four cases who underwent surgical resection and mobilization for HO after acetabular fractures surgery.
Material and Methods: Four cases with severe HO after acetabular fracture surgery were included in this study. The mean age at operation was 45 years old, and all patients were males. In Judet–Letournel classification, there were three cases classified as posterior wall fracture, and one case as transverse and posterior wall fracture. Two of four cases were combined with posterior dislocation of the hip. In all cases, the first operation was performed using with the Kocher–Langenbeck (KL) approach.
Results: Surgical resection of HO was performed using with the KL approach at 8.4 months (range 5–12 months) after the first operation. The median operating time and intraoperative bleeding were respectively 4.5 h and 3130 ml. Intraoperative 3D navigation was used in one case. As postoperative complications, one case developed sciatic nerve palsy and another case sustained the iatrogenic femoral neck fracture. All cases have no recurrence with a follow-up of 4.9 years after the surgical resection.
Conclusions: Surgical resection is the only treatment for symptomatic HO. But that requires preoperative planning and must be performed carefully because the extent of resection is still controversial and that may develop severe complications such as nerve palsy and iatrogenic fractures. By using navigation, we can determine the extent of resection easily and operated safely.
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PC 410

Transcaphoid-transradial-styloid-perilunate volar dislocation: a clinical case

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Case history: 18-year-old male, previously healthy, turned to the hospital after a motorbike crash, resulting in high energy direct trauma of the right wrist.
Clinical findings: Upon admission, cranial, thoracic, abdominal and other traumatic injuries were excluded. The patient presented with pain, swelling and visible deformity of the right wrist and hand, hypoesthesia of the 5th finger, and no perfusion deficits.
Investigation/Results: X-Rays showed volar perilunate carpal dislocation with associated comminuted scaphoid fracture, radial styloid avulsion, and metacarpal phalangeal dislocation of the 5th digit. Under sedation, closed reduction of the metacarpal phalangeal joint was accomplished, and reduction of the carpal dislocation was attempted unsuccessfully. The wrist was temporarily immobilized in a cast and taken to the OR.
Diagnosis: Transcaphoid-transradial-styloid-perilunate volar dislocation
Therapy and Progressions: Surgical treatment comprised loose bodies removal, reduction of the perilunate dislocation, ORIF of the scaphoid using a Herbert screw, and stabilization of the carpal rows using two percutaneous Kirschner wires. After surgery, a thumb spica cast was applied. Post-operatively, neurovascular status was normal. At 6 weeks, X-rays showed signs of bone healing, the cast and K wires were removed, and physical therapy was initiated. At 6 months, scaphoid fracture consolidation was achieved. The patient remained with a mild deficit in wrist extension but reported no pain nor important limitation in daily living activities.
Comments: Perilunate injuries with displacement or dislocation usually require surgery. Persistent instability is a described complication, often progressing to secondary post-traumatic arthritis of the wrist and carpus, termed scapholunate advanced collapse.
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Fig. 1

Fig. 2

Fig. 5

Fig. 3

Fig. 4

PR 412

20-years of Operative treatment of Displaced intra-articular calcaneal fractures in a Level one trauma center in the Netherlands

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Introduction: This study was conducted to study the patient characteristics, classification, treatment, complications and functional outcome of operatively treated displaced intra-articular calcaneal fractures (DIACF) in a level 1 trauma center in the Netherlands

Material and Methods: Patients with an DIACF, classified as Sanders $\geq$ 2 and operatively treated with Percutaneous Screw Fixation (PSF) or Open Reduction and Internal Fixation (ORIF) between January 1998 and December 2017 were identified. Pre- and post-operative radiological assessment was performed. Functional outcome, range of motion and change in footwear were evaluated with the use of the American Orthopaedic Foot & Ankle Society (AOFAS) score and the Maryland footscore. General health and patient satisfaction was assessed using the Short form-36 (SF-36) and the Visual analogue scale

Results: In total, 116 patients with an operatively treated DIACF were identified. 67 patient with 76 DIACF completed the questionnaires. There were 52 males and 15 females, mean age at trauma was 45 years. Average follow up was 11 years. 17 were classified as Sanders type 2, 31 and 19 as respectively type 3 and 4. 36 were joint depression and 38 were tongue-type fractures. There were no differences in Sanders Classification between the group treated with ORIF and PSF. For ORIF and PSF there were (25–25%), (52–42%) and (22–33%) for respectively Sanders Type 2, 3 and 4 fractures. Mean AOFAS, MFS, SF-36 and VAS was (75–74), (79–78), (59–66) and (7–9) for respectively ORIF and PSF. Mean pre- and post-Bohler angle was (11–24) and (15–22) for respectively PSF and ORIF. 7 underwent an ankle arthrodesis. Surgical site infection and deep infection occurred in (12,5–25%) and (12,5–8%) in respectively PSF and ORIF

Conclusions: Long-term comparison shows no significant differences between ORIF and PSF in treatment of Sanders fracture type, Bohler angle reduction, on functional outcome or complication rates

PR 413

Seymour Fractures, What We Know About It? Case Report : Hoverboard As A New Trend In Injury

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Introduction: The prevalence of hand injury in the pediatric population is attributed to their curiosity, limited fear of pain and diminuted motor coordination. The Seymour fracture, which was first reported by Seymour in 1966, represents a transverse extra-articular open fracture of the distal phalanges associated with nail bed injuries. The fracture includes Salter-Harris type I and II fractures as well as juxta-epiphyseal injuries.
Material and Methods: The aim of this report is to present a case of a Seymour Fracture in a young boy and describe the injury mechanism associated with misuse of the newly emerging vehicle, the hoverboard.
Results: Our patient was treated promptly and provided with appropriate management following the standard of care in our Hospital for such injuries: disimpaction and repair of the nail bed, reduction of the fracture, and K-wire fixation across the distal interphalangeal joint. The patient was discharged with a volar slab and was prescribed an oral antibiotic. The patient recovered well with no major deficits.
Conclusions: The timely recognition and management of Seymour fractures is crucial. The surgical treatment has good results however, conservative management can be an option in some specific cases. Antibiotics are always required. We report a case of a fracture pattern resulting from the improper use of an hoverboard. Although improper use was a factor, design fault also plays a role in causing the injury. Hoverboards are a new transport technology that has been introduced in recent years. Because of the number of injuries that have resulted from hoverboards, they should be used in the most controlled way possible to prevent any unnecessary injuries.
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I have no actual or potential conflict of interest in relation to this program/presentation.

PC 414

Knee monoarthritis: from lymphoproliferative syndrome to osteoarticular tuberculosis. A case report

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Case history: We report the case of a 32 years old male from Bangladesh, with 6 months of progressively increasing pain, limited range of motion and swelling on his left knee, with 6 kg of weight loss and inguinal lymph nodes.
Clinical findings: Knee radiography and MRI of the knee demonstrated a voluminous soft tissue mass surrounding the distal femur with intraarticular and posterior extension. A toracic-abdominal-pelvic CT showed supra and infradiaphragmatic lymph nodes. C-reactive protein level was 5,72 mg/dl.
Investigation/Results: The clinical picture suggested a lymphoproliferative syndrome. A biopsy was performed, revealing 100 cm^3 of purulent material. Synovial fluid had 548 leucocytes/uL, 70% of polymorphonuclear cells, 30% of mononuclear cells and undetectable glucose. Acid-alcohol resistant bacilli test and PCR test for *Mycobacterium* tuberculosis were positive.
Diagnosis: *Mycobacterium tuberculosis* knee arthritis
Therapy and Progressions: The patient was treated with polytherapy consisting on rifampin, isoniazid, pyrazinamide and ethambutol. 6 months later, the patient reports no pain, and tumor size has decreased.
Comments: *Mycobacterium tuberculosis* infection is not a common disease in developed countries. However, the incidence in Europe is increasing due to immigration. Even though the lung is the most affected organ, osteoarticular tuberculosis represents around 10% of extra-pulmonary cases.
Tuberculosis simulates several diseases. Because of non-specific symptoms and radiological signs, it can be difficult to diagnose. In a patient with chronic knee pain and limited range of motion, tuberculosis infection should be kept in mind, among other differential diagnoses, such as fibromatosis, pigmented villonodular synovitis or soft tissue sarcomas.
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Fig. 1

Fig. 2

Fig. 3

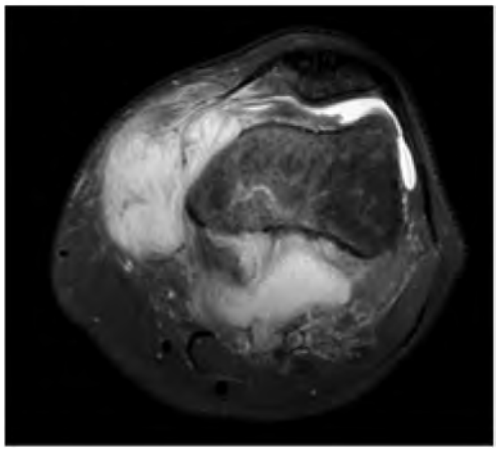
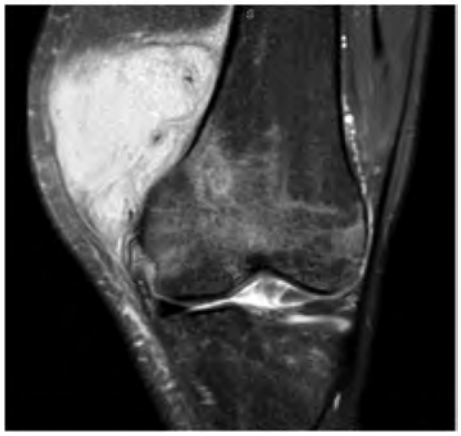


Fig. 4



PC 415

Lateral dislocation of the knee with an uncommon mechanism of injury

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Case history: A 78-year old male presented in the ER being hit by a sheep on the lateral side of his left knee.
After sustaining a direct blow to the lateral side of his left knee, which resulted in lateral dislocation of the knee. MRI demonstrated MCL, ACL and PLC injury.
Clinical findings: The patient presented with a valgus deformity of the knee, the medial femoral condyle protuding on the medial side of the knee. Neurovascular status was intact.
Investigation/Results: Xray revealed lateral dislocation of the knee. MRI revealed MCL, PCL and ACL rupture.
Diagnosis: Knee dislocation (KD) grade III (Schenck).
Therapy and Progressions: The patient underwent emergent closed reduction. Neurovascular status was intact after resuction. Due to important oedema and blisters, the lower limb was immobilized with a brace to allow for skin surveillance. After 3 weeks, the brace was replaced by a long leg cast for 2 more weeks. After 6 months, the patient maintained residual pain, ROM − 5/855 and minor instability.
Comments: KD are unusual injuries, associated with high energy trauma, therefore they often result in disruption of at least 3 major ligaments and associated injuries, from soft tissue to vascular structures. Emergent reduction is mandatory, and definitive treatment can be conservative, or early/late surgical repair/reconstruction of the ruptured ligaments. There is a lack of large prospective clinical studies comparing the different types of treatment. Even so, data tend to associate early surgical treatment with better functional outcomes, though there is no statistic evidence supporting its improvement of the range of motion or stability. Long term complications most frequently include residual pain, instability or rigidity. Rarely the knee returns to its pre-injured state, independently of the treatment used.
References: Dwyer, T., et al. (2012). Outcomes of treatment of multiple ligament knee injuries. *The journal of knee surgery*, *25*(04), 317-326.

Fig. 1

PR 416

Advising a reduction after a fracture of the Distal Radius, reliability with and without use of expert based criteria

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Introduction: Distal radius fractures (DRF) are common, however many aspects of its management remain subject of debate[1]. This study assessed the interobserver reliability of surgeons concerning the recommendation for a reduction and the improvement of expert based criteria for reduction.

Material and Methods: We sent out 2 surveys to members of the science of variation group. The first survey divided participants in 4 groups, each rated 23–24 radiographs of DRF. Resulting in 95 rated fractures by 80 participants. Each observer indicated whether they would advise a reduction or not. The second survey randomized participants (68 surgeons) to either receive or not receive criteria for reduction and participants indicated if they would recommend reduction.

Results: The reliability for advising a reduction was poor, kappa 0.31 (95% CI 0.23–0.39). Multivariable linear regression analyses indicated that each additional degree of dorsal angulation increased the change of recommending a reduction by 3% (beta 0.03, 95% CI 0.02–0.03 $P < 0.001$). Criteria for reduction did not increase interobserver reliability for recommending reduction (no criteria kappa 0.43 95% CI 0.26–0.59 vs. criteria 0.47 95% CI 0.33–0.61). The likelihood of recommending a reduction was higher in the group using the criteria (0.61 vs 0.68, $P = 0.009$).

Conclusions: Poor interobserver reliability is associated with greater practice variation. Dorsal angulation is the main drive for recommending a reduction. The liberal use of the criteria in combination with a specific focus on dorsal angulation leads in our opinion to less variation in treatment recommendation for distal radius fractures. This is something future study could assess for distal radius fractures in actual practice.

References: 1. Bentohami, et al. Incidence and characteristics of distal radial fractures in an urban population in the Netherlands. Eur J Trauma Emerg Surg. 2014.

David Ring has or may receive payment or benefits from Skeletal Dynamics, Wright Medical for elbow implants, Biomet, Acumed, Illuminos, Deputy Editor for Journal of Hand Surgery, Deputy Editor for Clinical Orthopaedics and Related Research, Universities and Hospitals, Lawyers outside the submitted work.

Further no relationship or conflic of interests

PR 417

Femoral fractures around antegrade nails used in the synthesis of pertrochanteric hip fractures. Our experience and results

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Introduction: The number of pertrochanteric hip fractures increases proportionally to the increase in life expectancy. Currently, the most used treatment in these fractures is the antegrade nailing. Suffering a second fracture in the same femur around an antegrade nail is an uncommon complication, but it has a great impact on the patient.

The aim of this study is to describe the type of perinail femoral fractures observed in our center, the treatment performed and the medium-term results.

Material and Methods: Between 2013 and 2018, 14 patients presented a perinail femoral fracture. 13 were women and one was male, with an average age of 83. Initial fractures were classified according to the AO classification: 6 were 31A1, 5 were 31A2 and 3 were 31A3. 8 of them were synthesized by short PFN-A (Synthes), 3 with short PFN (Synthes) and 3 with Gamma3 (Stryker). The average time since osteosynthesis of the proximal femur fracture and the perinail fracture was 3.5 years (1 month–12 years).

Results: 11 of the peri-implant fractures occurred at the level of the nail tip or the distal locking screw. The remaining 3 fractures occurred in the distal femur. These 3 supracondylar fractures and 2 of the fractures at the level of the nail tip were synthesized with a VA condylar plate (Synthes), overlapped with the nail. In the rest of the fractures around the tip of the nail, the short nail was removed and replaced by a long PFN-A nail. One of the patients died in the immediate postoperative period. Two patients died during the first year. In the rest of the patients, a complete consolidation of the fracture was observed, and their previous baseline situation was recovered.

Conclusions: Peri-implant femur fracture is a rare but very severe condition, which requires good surgical planning, and is not without complications.

References: Skála-Rosenbaum. Distal locking in short hip nails: Cause or prevention of peri-implant fractures? Injury, Int. J. Care Injured 47(2016)887–892

PR 418

Computer-aided diagnosis system for detection and visualization of hip fractures using artificial intelligence—multicenter study

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Introduction: Hip fracture is a leading worldwide health problem for the elderly. A missed diagnosis of hip fracture on radiography leads to a dismal prognosis. The application of a computer-aided diagnosis (CAD) system using artificial intelligence (AI) to detect hip fracture can potentially improve the accuracy and efficiency of hip fracture diagnosis.
Material and Methods: CAD system using AI was trained using 4851 cases, 5242 plain frontal pelvic radiographs (PXRs) between 2009 and 2019 from each institution. The accuracy, sensitivity, false-negative rate, and area under the receiver operating characteristic curve (AUC) were evaluated on 500 independent PXRs. The authors mixed ResNeXt as classification algorithm and SSD as object detection algorithm to train CAD system.
Results: The algorithm achieved an accuracy of 94.1%, a sensitivity of 96.2%, a false-negative rate of 1%, and an AUC of 0.94 for identifying hip fractures. The visualization algorithm showed an accuracy of 97.9% for lesion identification.
Conclusions: Our CAD system using AI not only detected hip fractures on PXRs with a low false-negative rate but also had high accuracy for localizing fracture lesions. The CAD system using AI might be an efficient and economical model to help clinicians make a diagnosis without interrupting the current clinical pathway.
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PR 419

Reconstruction of posttraumatic bone deformities and limbs discrepancy by the use of unilateral 3d external fixation device

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Introduction: Bone reconstruction and limb lengthening usually refers to application of Ilizarov or other ring external fixation devices1. We present here series of posttraumatic reconstruction and limb lengthening, by the use of new concept of 3D unilateral external fixation device.
Material and Methods: As a clinical material, we present series of 59 patients with different posttraumatic deformities (28) and limbs discrepancy (31) as a result of severe traffic accidents and wars. All patients have been treated by specially designed unilateral 3D external fixation system. That system is not bulky and it is more comfortable in comparison to ring fixators. Procedure is relatively simple, so patients handle the device by themselves. During biomechanical testing, it was found that stability of this device is similar to ring systems. The last version of the device includes computer program and two sensors.
Results: All deformity corrections have been achieved successfully. Sliding graft procedure has successfully been performed in all 9 patients with bone defect reconstruction from 5 to 11 cm. In one patient with complex deformity and shortening, correction couldn"t be achieved during one procedure, so additional operations, by the use of the same system have been performed and correction completed. Superficial pin tract infection rate was 11.1% and we didn"t have deep infection. There were no other complications including DVT, joint stiffness, neurovascular injuries.
Conclusion: Unilateral external fixation device with balanced 3D stability provides the same success of bone reconstruction and limb lengthening as ring fixators, but it is more comfortable and more easy for handling.
References:
Treatment principles in bone reconstruction and limb lengthening of the lower extremity. Olesen UK, Nygaard T, Kold SV, Hede A. Ugeskr Laeger. 2017 Nov 20;179(47)

At this moment author has licence agreement with the producer of external fixation devices.

PR 421

Concomitant hip and upper extremity fracture in elderly patients: Prevalence and clinical implications

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Introduction: This study aimed to describe the prevalence and clinical implications of the concomitant hip and upper extremity fractures in elderly.
Material and Methods: We evaluate 1018 patients aged > 65 years who were surgically treated for femoral neck or intertrochanteric fractures between March 2008 and December 2018. 35 patients (3.4%) with a hip fracture combined upper extremity fracture. All patients were classified into the isolated hip fracture and the concomitant fracture. We analyzed these patients" characteristics such as age, gender, bone mineral density (BMD), body mass index (BMI), Korean version of Mini-Mental State Examination (MMSE-K), injury mechanism, and length of hospital stay.
Results: The most common site of upper extremity fracture was distal radius fracture of 15 patients (42.8%), followed by proximal humeral fracture of 8 (22.8%). Concomitant fractures occurred on the same side in 30 patients (85.7%). The mean age of patients with a concomitant fracture was younger than that of patients with an isolated hip fracture ($p < 0.05$). Mean preinjury MMSE-K was 22.7 in isolated hip fracture and 25.6 in concomitant fracture patients ($p < 0.05$). Mean length of hospital stay was statistically significant different between two groups ($p < 0.05$). According to fracture site of hip, there was no statistically different prevalence of upper extremity fracture in femoral intertrochanteric fracture compared to the neck fracture.
Conclusions: We found a 3.4% prevalence of concomitant hip and upper extremity fractures. It was found that the younger the age with preserved cognitive ability in elderly patients with a hip fracture, the higher the prevalence of upper extremity fracture. In addition, it is important to keep in mind that patients with a concomitant fracture have a longer hospital stay and difficulty in rehabilitation.

PC 422

Management of both bone forearm open fracture with loss of bone stock—case report

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Case history: A 24 year-old male sustained a fall from 2 m height with resulting polytrauma, including injury to his right forearm.
Clinical findings: The patient had an extensive wound on the ulnar surface of his right forearm. No neurologic or vascular injury was present.
Investigation/Results: Radiographs demonstrated a right diaphyseal fracture of the radius and ulna, associated with a fracture of the radial neck and distal radius fracture.
Diagnosis: Open diaphyseal fracture of the radius and ulna (grade IIIA), fracture of the right radial neck and fracture of the right distal radius.
Therapy and Progressions: The patient underwent emergent extensive debridement of the wound and open reduction and plate osteosynthesis of the radius. After debridement, there was a 5 cm bone defect of the ulna, so it was fixed with a Steinamn pin to maintain alignment and length. After fixation of the fractures, a primary closure of the wound was possible. After 3 months, he underwent reduction and plate osteosynthesis of the ulna, using autologous tricortical iliac bone graft to fill the defect. The fractures of the proximal and distal radius where treated conservatively.
Comments: In the approach of the polytrauma patient, after treating the life threatening injuries, it's the limb-threatening ones that should be the priority. Aggressive surgical debridement is crucial in the management of open fractures, even if it implies the sacrifice of great amounts of soft tissue or bone stock. At the same time, if definitive treatment of the fractures is not possible, one should provisionally stabilize them in order to maintain alignment and prevent further injuries to the surrounding soft tissues and neurovascular structures. Definitive treatment must then be delayed in order to avoid additional complications as necrosis or infection.
References: Azar, Frederick M., S. Terry Canale, and James H. Beaty. Campbell's operative orthopaedics e-book. Elsevier Health Sciences, 2016.

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 423

Clinical Results of anterior approach(Ilio-iguinor approach and Modified stoppa approach) for acetabular fractures

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Introduction: Surgery for acetabular fractures using Ilio-iguinor Approach (IL), Mofifid IL (M-IL) and Modified Stoppa Approach (M-Stoppa) is high learning curve. We show our results of acetabular fractures operated by anterior approach, from 2009 to 2014 (Early Phase:Group E) and from 2014 to 2018 (Late Phase: Group L) and examined whether treatment experience affected surgery of acetabular fractures.

Material and Methods: Acetabular fractures underwent surgery at our center from 2009 to 2018 were 102 fractures. And 55 cases were operated with an anterior approach. The group E was 19 cases (14 males, 5 females: average 60 years), and Group L was 36 cases (29 males, 7 females: average 56 years). Fracture type in group E, anterior column(AC): 4 cases, anterior wall(AW): 1 case, Transverse: 1 case, Tshaped: 1 case, both colums: 12 cases, and in the late group, 2 posterior columns(PC) AC: 11, AW: 2 cases, Tshaped: 3 cases, Transvers +PW: 1 case, PC + PW: 3 cases, Both column: 15 cases. We examined these approach operation time, blood loss, postoperative CT, and JOA Hip Score 1 year after surgery.

Results: All cases were IL in the first term group, IL: 3, M-IL: 11, M-Stoppa: 22 in Group L. The operation time was 174 min (Group E) and 204 min (group L), which was significantly prolonged in group L. On the other hand, the amount of bleeding was 658 ml in group E and 792 ml in group L, and there was no significant difference between the two groups. Poor cases on postoperative images were 30% in group E and 11% in group L, and the JOA Hip Score was 68.4 (groupE) and 91.2(Group L). In Clinical results is significantly improved in Group L.

Conclusions: The treatment results improved significantly in Group L. As the number of experienced cases increased from these results, the reduction accuracy and treatment results improved, so experience was considered important for improving the treatment results of acetabular fractures.

PR 424

The additional value of the weight-bearing and gravity stress radiograph in determining stability of isolated type B ankle fractures

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Introduction: The goal of the current study is to investigate whether the weight-bearing and gravity stress radiographs have additional value in determining stability in isolated type B fibular fractures. This in order to make the important distinction between fractures that need surgical treatment and fractures that can be safely treated conservatively.

Material and Methods: 90 patients with an isolated type B ankle fracture, without medial or posterior fracture, and a medial clear space (MCS) < 6 mm on the regular mortise radiograph were included. In the Emergency Room, a gravity radiograph was performed (in accordance with out protocol). Within 1 week, an additional MRI scan was made. At this moment, in 51 patients a weight-bearing radiograph was performed too. The MCS measurements of these regular mortise, gravity and weight-bearing radiograph were compared with the MRI findings. The MRI scan was set as reference standard to detect injury of the deltoid ligament in order to determine (in)stability.

Results: Mean MCS on mortise radiograph was 3.3 mm (range 1.7–5.9); in 12 (13.3%) patients the MCS was > 4 mm and in 15 patients (18.3%) the superior clear space (SCS) was > MCS + 1

mm. In 2 (2.4%) patients, the SCS > MCS + 2 mm. On the gravity stress radiograph, 14.4% of the patients had a MCS > 6 mm. The weight-bearing radiograph showed a MCS > 4 mm in 3 (5.9%) patients. In 4 (4.4%) patients, the MRI showed a complete rupture of the deltoid ligament. In 21 (23.3%) patients a partial rupture was seen. 10 patients (11.1%) received surgical treatment. In all conservatively treated patients, no secondary dislocation occurred and there was no need for postponed surgical treatment.
Conclusions: The gravity stress view has a tendency to overestimate the MCS. Thus, potentially too many stable fractures are incorrectly diagnosed instable and receive unnecessarily surgical treatment (with additional costs and risks). The weight-bearing radiograph, on the contrary, does not overrate the medial injury and can safely be used in the decision making process of treating conservatively and weight-bearing (for example by using a brace)

PR 425

Effect of Intravenous iron supplementation on transfusion demand following surgery of a hip fracture in elderly

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Introduction: The purpose of this study was to identify the effect of the intravenous iron supplementation on demand of perioperative blood transfusion and post-operative hemoglobin recovery in geriatric hip fractures.
Material and Methods: A retrospective cohort study was performed on patients who underwent surgery with proximal femoral nail for hip fracture and age 60 years old or older between Jan 2018 and May 2019 in a single center. The participants were divided into 2 groups according to preoperative intravenous iron supplementation (iron isomaltoside, Monofer®, Pharmacosmos, Holbaek, Denmark); Group 1 (n = 25) with Monofer 400 mg before surgery and group 2 (n = 33) without Monofer. Transfusion was preformed when the Hgb was less than 8 mg/dL). Primary endpoint was incidence of perioperative transfusion. Secondary endpoints were various hemoglobin (Hgb) levels.
Results: The average age of the participants were 77.4 years old, and average body mass index (BMI) was 22.8. Demographic data including age, sex, BMI, comorbidity (Charlson comorbidity index) of each group showed no difference. The Complications from intravenous iron administration were not occurred. The preoperative Hgb was 11.4 mg/dL (group 1 11.9 ± 2.1 vs, group 2 10.9 ± 1.9, p = 0.591). The Hgb at the postoperative day 2 was 10.2 mg/dL (group 1 10.5 ± 2.1 vs group 2 9.9 ± 1.8, p = 0.273). The average Hgb at the postoperative 1 month was 11.6 mg/dL (group 1 11.7 ± 1.7 vs group 2 11.5 ± 1.5, p = 0.431). Transfusion rate was 51.7% (30/58) and the rate showed no difference between 2 groups (40.0% vs 60.6%, p = 0.120. The recovery of Hgb between post-operative 1 month and preoperative state showed statistically difference (group 1 0.166 vs group 2 − .0579, p = 0.049), and iron supplementation group had more recovery.
Conclusions: Intravenous Iron supplement before the hip fracture surgery in elderly helped to recover Hgb at postoperative 1 month.

PR 426

Comminuted subtrochanteric femur fractures—our experiences

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Introduction: Subtrochanteric femoral fractures account for approximately 25% of all the hip fractures and their treatment represents a challenge because of the short proximal fragment and high-energy forces.
Material and Methods: A total of 17 patients with subtrochanteric, highly comminuted fractures, were included in this study, with age range from 30 to 60 years. The mechanism of injury in all patients was high-energy trauma. In each case we applied a long gamma nail (Limma LTO) without focus opening.
Results: In all patients, good clinical and radiologic results were accomplished, in addition to early weight-bearing, without shortening of the legs, or consequences on the state of the hip and morbidity in general.
Conclusions: Although the comminuted subtrochanteric femur fractures represent a challenge for the orthopedic surgeons, osteosynthesis using long gamma nail without the focus opening provides outstanding results.
References: Joglekar SB, Lindvall EM, Martirosian A. Contemporary Management of Subtrochanteric Fractures. Orthop Clin N Am 46 (2015) 21–35 http://dx.doi.org/10.1016/j.ocl.2014.09.001

PR 427

Association between Postoperative Reduced Positions and Sliding in Unstable Trochanteric Fractures

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Introduction: This study analyzed the association between the postoperative reduced position obtained on using short femoral nails (SFNs) and the amount of sliding after fixation in unstable trochanteric fractures.
Material and Methods: This retrospective study included 12 patients with unstable trochanteric fractures with posterolateral support deficiency who underwent osteosynthesis with SFNs and were followed-up for 3 months or longer. The study included 6 men and 6 women with a mean age of 76.3 years at the time of fracture. Closed or open reduction was performed to achieve anatomical to medial type position on frontal view and anatomical to extramedullary type position on lateral view, followed by fixation with SFNs. Immediately and 3 months after surgery, patients were examined for reduced position, amount of sliding, presence or absence of excessive sliding, and complications
Results: In the lateral view, the reduced positions were intramedullary type in 1 patient, anatomical type in 7 patients, and

extramedullary type in 4 patients immediately after surgery. Three months after surgery, the reduced position worsened from the anatomical to intramedullary type in 2 patients. According to the reduced positions at 3 months after surgery, the mean amount of sliding was 8.7 mm in patients with intramedullary type, 3.3 mm in those with anatomical type, and 3.7 mm in those with extramedullary type. The amount was larger in those with intramedullary type than in those with anatomical and extramedullary types. Moreover, excessive sliding was observed in 1 patient with intramedullary type.

Conclusions: To prevent excessive sliding by ensuring anteromedial bony support in unstable trochanteric fractures with posterolateral support deficiency, open reduction should be aggressively performed to overcorrect to the extramedullary type when reduction performed on a traction table results in either anatomical or intramedullary type positioning.

Fig. 1

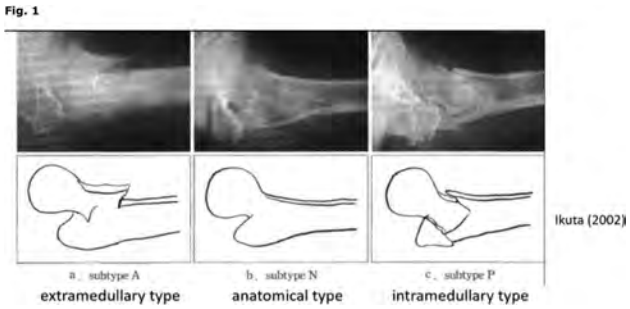

Fig. 2

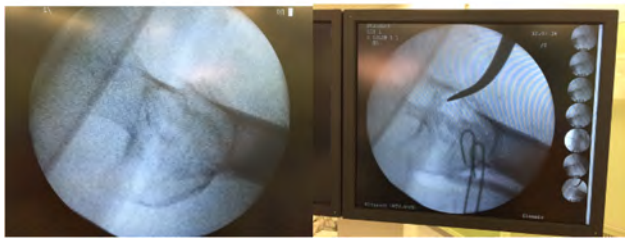

Fig. 3

reduced position after surgery

lateral view	intramedullary type	anatomical type	extramedullary type
immediately after surgery	1	7	4
Three months after surgery	3	5	4

Fig. 4

amount of slidingat 3 months after surgery

Mann-Whitney's U test
*P<0.05

reduced positions at 3 months after surgery	amount of sliding mean(sd)
intramedullary type（n=3）	8.7(2.4)mm
anatomical type（n=5）	3.3(1.8)mm
extramedullary type（n=4）	3.7(0.7)mm

PR 428

Chronic osteomyelitis of long bones in lower extremities caused by high-energy missile trauma – 25-year follow-up

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In this paper, we report 31 patient previously studied for osteomyelitis caused by high-energy missile trauma, in 1996. That study involved a total of 120 patients with osteomyelits, divided into two groups, according to the treatment protocol applied. The group 1 included patients treated using classic surgical methods, including debridement, curretage, forage, perfusion drainage and sequestration. The group 2 included patients treated using recommended surgical methods and used PMMA antibiotic beads. 25 years after, we tried to contact all of the 120 patients, for the purpose of follow-up. However, only 31 patient was available for analysis. Among 31 patients we followed-up, 11 were treated using recommended surgical protocol, while the remaining 20 patients were treated using classic surgical methods. We present the patients' general status, as well as the local surgical status and radiographic analysis, 25 years after. We obtained long-term results of both treatment protocols applied. From the group 1, 9 patients developed chronic recurrent osteomyelitis, while only one patient from the group 2 developed such condition.

PR 429

Anterior subcutaneous internal fixation for the pelvic ring fractures: Complications and improvement strategy

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Introduction: The aim of this study was to evaluate the treatment results using anterior subcutaneous internal fixation(INFIX) for the pelvic fractures and to consider an improvement strategy for the complications.

Material and Methods: From 2013 to 2019, 31 pelvic fractures were enrolled. There were two males and 29 females. The average age was 80 years. There were 26 fragility fractures and five high energy fractures. Our operative procedure was as below: The connection between screws and rod was just above the fascia of the sartorius muscle. The connection bar was pre-bended before the operation using the initial axial CT scan. We assessed bone union, additional fixation, the distance between the femoral artery and connection rod (DAR), the distance of protruded bar lateral to the connection (DPB), and complications.

Results: Bone union achieved in 27 out of 31 cases. There was one nonunion and three early deaths because of medical complications. Seventeen out of 31 cases required additional posterior fixations. The average DAR was 17.1 (3.2–49.2 mm), and the DPB was 10.1 (0–24) mm. Thirteen out of 31 cases (41.9%) had complications. There were seven lateral femoral cutaneous nerve (LFCN) symptoms (3 required

implant removal (IR)), two infections (1 required IR), one hematoma (IR), one irritation (IR), one heterotopic ossification, one loosening (re-operation). There were no femoral vessels and nerve-related symptoms. To release LFCN and surrounding soft tissues decreased the nerve symptoms.
Conclusions: To connect the screws, and the rod just above the sartorius fascia could avoid major vessels and nerve complications, and also irritations. Although this study found a high complication rate of INFIX, to release the LFCN and around soft tissue could decrease the complications.
References:
Gardner MJ, et al. Anterior pelvic reduction and fixation using a subcutaneous internal fixator. J Orthop Trauma. 2012;26:314–21.

PR 430

Angular stable devices do not reduce postoperative complications in posterior tilted undisplaced femoral neck fractures.

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Introduction: Several studies have reported that posterior or anterior tilt increases the risk of reoperation in undisplaced femoral neck fractures (Garden I/II) after internal fixation performed using non-angular stable devices such as pins and multiple screws. However, to the best of our knowledge, there is limited research involving angular stable devices. The present study aimed to investigate the clinical outcomes in undisplaced femoral neck fractures after internal fixation using angular stable devices.
Material and Methods: This retrospective study included 35 patients (mean age, 79.2 [range, 65–95] years) who underwent internal fixation using angular stable devices between January 2011 and January 2019. Undisplaced femoral neck fractures with Garden alignment index (GAI) $\leq 170°$ (posterior tilt angle $\geq 10°$) or GAI $\leq 190°$ (anterior tilt angle $\geq 10°$) were included (posterior: 34, anterior: 1) in this study. Patients were followed up for at least 3 months (mean, 16.3 [3–83] months). We analyzed the preoperative and last-followed GAI on lateral radiographs, non-union, and late segmental collapse (LSC).
Results: Among the 35 patients, non-union was identified in 2 (5.7%) and LSC was observed in 4 (11.4%). The mean preoperative GAI was 159.8° (range, 125°–203°), and the mean last-followed GAI was 164.5° (158°–182°). The overall complication (non-union and LSC) rate was 17.1% (6/35 patients). Among 16 patients with GAI $\geq 20°$, LSC occurred in 3 (18.8%).
Conclusions: In undisplaced femoral neck fractures, preoperative posterior $\geq 10°$ is a risk factor for postoperative complications even when internal fixation is performed using angular stable devices; thus, primary arthroplasty may be considered.
References: Filip C DOLATOWSKI.Preoperative posterior tilt of at least 20° increased the risk of fixation failure in Garden- I and -II femoral neck fractures. ACTA ORTHOP. 2016; 87: 252–256.

PC 431

Atypical femoral fracture with bone metastasis after receiving antiresorptive drug in breast cancer patient: A case report

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Case history: The patient is a 77-year-old female who had undergone lumpectomy at the age of 53 when she was diagnosed with breast cancer. She had antiresorptive drug therapy for bone metastasis, since 10 years after the lumpectomy. She fell down from standing height and was diagnosed as right femoral subtrochanteric fracture. Her femur was fixed with short femoral nail. She complained left hip pain at age 77.She complained left hip pain from July 2018.
Clinical findings: She could walk with crutch.ROM of left hip was normal.
Investigation/Results: Breast surgeon took MRI and there was metastasis in the proximal part of femur. He thought the cause of pain was this metastasis. However, there was fracture line at the height of lesser trochanter when she visited our department.
Diagnosis: Atypical fracture was strongly suspected, however, fracture line was little higher as normal atypical fracture.
Therapy and Progressions: Osteosynthesis with long femoral nail was performed 4 months after first visit to our department because of increasing pain. Pathological findings were metastasis and fracture. After surgery, radiation to femur was performed. She can walk without pain by crutch and fracture line is almost disappeared on 11 months after surgery.
Comments: Atypical femoral fractures (AFFs) are recently observed as a complication of antiresorptive drugs for bone metastasis. However, there were metastasis and atypical fracture in this case.

PR 432

Complex tibial plateau fractures treated with Illizarov external fixator and CT evaluation of articular surface reduction

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Introduction: In the present study we aim to evaluate the articular surface reduction quality by means of postoperative computer tomography (CT), in complex tibial plateau fractures, treated with an Illizarov frame.
Materials and methods: This retrospective case series covers the period from 03-2010 to 10-2018. Forty-four patients with a mean age of 39 years (range 19–65 years), with a complex intrarticular proximal tibia fracture were included. Fracture types III to VI according to Schatzker's classification were included. The majority were closed injuries, apart from 2 cases (a Gustilo Anderson type 3a and a type 2).

All patients were placed on a fracture table. A mini-open reduction of the articular surface was followed by application of a knee spanning Illizarov frame. Post-operatively all patients were subject to CT of the injured knee. Outcomes were measured using the American Knee Society Score.

Results: Mean outpatient follow up was of at least 12 months (range of 12–21 months). Mean time for fracture consolidation 15.5 weeks (ranging from 13 to 19 weeks). According to the degree of post-operative articular surface depression patients were grouped as follows: 8 had under 2 mm, 19 had 2–4 mm and 17 over 4 mm of depression. Those with less than 3.5 mm of collapse had 95% chances of an excellent result according to AKSS. On the contrary, those with more than 4.5 mm of articular surface collapse had 100% chances for low scores and functional results. The achievement of a mechanical axis within 5° of the contralateral limb was positively correlated with good functional results but did not have a correlation with the AKSS.

Conclusions: Complex tibial plateau fractures may be treated successfully with mini open reduction and the application of an Illizarov frame. Post-operative CT denotes the exact degree of displacement of the articular surface, which is prognostic regarding outcome. Post-operative x-rays may be misleading, since they can underestimate articular surface collapse.

TRAUMA SYSTEMS

PR 135

Shortened initiation time of trauma laparotomy improved the outcome of trauma patients

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Introduction: A new trauma center building was constructed in March 2016, and the process from the trauma bay to the operation room is faster. We hypothesized that this process improved the survival rate of trauma patients in need of trauma laparotomy.

Material and Methods: The new trauma center separates the trauma bay from the emergency room, and the trauma team exam patients initially. It also has a separate operation room that is always available for emergency surgery. Therefore, the decision to perform laparotomy and time to operation has been shortened. From January 2011 to December 2018, trauma patients who underwent emergency laparotomy were included. Those younger than 18 years, who had delayed operation, underwent surgical observation, delayed admission by patient, or underwent angiography first were excluded. Patients were dichotomized to the before-trauma-center (BC) and after-trauma-center (AC) groups, and their characteristics and clinical outcomes were compared.

Results: Of 644 patients, 349 were included in the BC group and 295 were included in the AC group. The times from admission to operation (BC 137 [101–182] min vs. AC 83 [64–118] min, $p < 0.001$) and from injury to operation (BC 288 [205–406] min vs. AC 215 [158–310] min, $p < 0.001$) decreased. The intensive care unit length of stay (ICU LOS) (BC 9 [4–18] days vs. AC 5 [2–14] days, $p < 0.001$) improved, but mortality was not significantly different (BC 23.2% vs. AC 17.6%, $p = 0.081$). However, among patients who transferred from other hospitals, both mortality (BC 22.1% vs. AC 13.3%, $p = 0.030$) and ICU LOS (BC 10 [5–26] days vs. AC 5 [2–15] days, $p < 0.001$) improved.

Conclusions: The shortened initiation time of trauma laparotomy improved clinical outcomes, especially in transferred patients.

Fig. 1

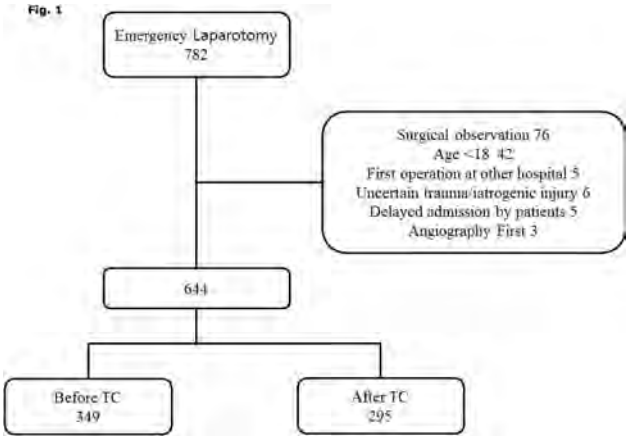

Fig. 2

General characteristics

	Before TC (n=349)	After TC (n=295)	p
Sex M	263 (75.4%)	234 (79.3%)	0.232
F	86 (24.6%)	61 (20.7%)	
Age	49 [38 – 58]	49 [37 – 58]	0.958
Mechanism Blunt	294 (84.2%)	217 (73.6%)	0.001
Initial sBP (mmHg)	108 [84 – 127]	115 [96 – 133]	0.001
Initial HR (/min)	91 [80 – 109]	95 [80 – 110]	0.440
Transfer from other hospital	222 (63.6%)	158 (53.6%)	0.010
Initial lactate (mmol/ml)	3.62 [2.33 – 5.49]	3.47 [2.07 – 6.10]	0.784
ISS	22 [16 – 32]	20 [13 – 29]	0.015
AIS Abdomen	4 [3 – 4]	3 [3 – 4]	0.014
GCS	15 [9 – 15]	14 [9 – 15]	0.006

Fig. 3

Clinical outcomes of emergency laparotomy

	Before TC (n=349)	After TC (n=295)	p
Injury to Operation (min)	288 [205 – 406]	215 [158 – 310]	<0.001
Admission to Operation (min)	137 [101 – 182]	83 [64 – 118]	<0.001
Mortality (n, (%))	81 (23.2%)	52 (17.6%)	0.081
30 days mortality	68 (19.5%)	43 (14.6%)	0.100
ICU LOS (days)	9 [4 – 18]	5 [2 – 14]	<0.001
Open abdomen	204 (58.5%)	117 (39.7%)	<0.001

Fig. 4

Clinical outcomes of transferred patients

	Before TC (n=222)	After TC (n=158)	p
Injury to Operation (min)	335 [248 – 457]	268 [199 – 388]	<0.001
Admission to Operation (min)	124 [83 – 168]	74 [59 – 97]	<0.001
Mortality (n, (%))	49 (22.1%)	21 (13.3%)	0.030
30 days mortality (n,(%))	40 (18.0%)	16 (10.1%)	0.032
ICU LOS (days)	10 [5 – 26]	5 [2 – 15]	<0.001
Open abdomen (n (%))	135 (60.8%)	62 (39.2%)	<0.001

PR 136

Acute Care Surgery in the Netherlands; outcomes of a national survey

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Introduction: Acute care is a growing worldwide burden with increasing visits to the Emergency Department (ED). The acute care system in the Netherlands is almost overloaded and costs are increasing. Almost 50% of ED visits have surgical disease. There is no nationwide Acute Care Surgery (ACS) model implemented yet, and resources and infrastructure are organized differently in almost every hospital. This study provides an overview of the existing systems nationwide, and basis for a national uniform model.
Material and Methods: An online survey was distributed through the Dutch Surgical Society and sent to all Dutch hospitals. After sending a reminder, the survey was closed and results were analyzed.
Results: Thirty-two hospitals (41%) participated in the survey. In 78% a surgeon (trauma, vascular or gastro-intestinal) was assigned as consultant and responsible for ED admissions, emergencies in-house, and in some cases also emergency surgeries. 59% of hospitals have an ED observation unit (EDOU). A dedicated emergency surgery operating room (ESOR) is available in 69% (24/7 available in 73%), and used efficiently in 55% primarily due to the following challenges: elective surgery scheduled at ESOR (59%), necessary stop of ESOR when elective programs are delayed (64%). In hospitals without an ESOR, the emergency surgeries are scheduled in between elective surgeries resulting in extending programs into the evening. Finally, 90% of respondents was familiar with ACS, with 62% being positive about exploring options of implementing such a model in our country, and 77% of the respondents opts for more focus on ACS in surgical residency.
Conclusions: In the Netherlands the organization of acute care varies. The main common bottleneck is the logistics around the OR. Implementation of a dedicated ESOR and unconditional availability 24/7 of this OR seem to be the most important factors for optimal efficiency. Although there needs to be more focus on ACS in general, implementing a uniform model nationwide seems challenging at this moment.

PR 137

Trauma team activations (TTA) at an European Trauma Center: 1029 cases analyzed

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Introduction: The North Estonia Medical Centre (NEMC) is the largest trauma center in Estonia with evolving capabilities. However, studies scrutinizing trauma team activations (TTA) are currently lacking. Thus, we initiated an investigation to document TTA profile and outcomes.
Material and Methods: All TTA patients admitted to the NEMC between 1/2016 and 12/2018 were retrospectively identified. Data collected included demographics, injury severity score (ISS), management, hospital length of stay (HLOS), and in-hospital outcomes. Primary outcome was 30-day mortality.
Results: Overall, 1029 patients were included. Mean age was 39.3 ± 20.4 years and 74.2% were male. Penetrating and blunt trauma accounted for 11.5% and 88.5% of the cases, respectively. Non-ground level falls were the predominant mechanism of injury constituting 32.1% of the admissions. Mean ISS was 10.3 ± 11.5 and 24.7% of the patients were severely injured (ISS > 15). Blood alcohol level (BAL) was positive at 31.1%. A total of 21.1% of the patients had an emergent operation. Mean HLOS was 8.0 ± 15.2 days.Overall 30-day mortality and mortality of severely injured patients was 5.1% and 19.3%, respectively.
Conclusions: The current investigation documents comparable outcomes with established European trauma facilities [1, 2]. Blunt injury patterns predominate, however, high penetrating trauma incidence for European settings was noted. High rate of positive BAL in TTA patients warrants national preventive measures.
References:
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PR 138

Potential and progress of acute care surgery worldwide: a systematic review

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Introduction: The Acute Care Surgery (ACS) model was initially developed as a dedicated service for the provision of high quality 24/7 non-trauma emergency surgical care. After implementation in the United States (US), the model has been adopted in several variations around the world.In this systemic review we investigated which components are essential for a potential uniform ACS model, by

giving an overview of the current available ACS models worldwide and their state of implementation.

Material and Methods: A literature search (2000–2018) was conducted using PubMed, MEDLINE, EMBASE, Cochrane library and Web of Science databases following the PRISMA guidelines. All relevant data of ACS models were extracted from included articles.

Results: Sixty-five articles describing ACS models in 12 different countries were included in this review. The majority consist of a dedicated surgical service, providing non-trauma emergency surgical coverage, with daytime on-site attending coverage by an attending surgeon who is cleared from elective duties, and 24/7 in-house resident coverage. Emergency department coverage and access to an acute care operating room varied widely across countries. Critical care is fully embedded in the original US model as part of the acute care chain (ACC), while in most other countries it is still a separate unit. While in most European countries ACS is not a recognised specialty yet, there is a tendency towards more structured acute care, with training and separation from elective practice.

Conclusions: ACS is gradually implemented worldwide. However, large national and international heterogeneity exists in the structure and components of the model. Critical care is still a separate unit and specialty in most systems while it is essential to be part of the ACC in order to provide the best peri-operative care of the physiologically deranged patient. Universal acceptance of one global ACS model seems challenging, however a global consensus on essential components would benefit any healthcare system.

PR 139

Management of surgical emergency cases in a Greek University Hospital: an alerting outcome

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Introduction: The recent financial crisis in Greece is coped mainly with reformations towards cost effectiveness and rationality in the management of public expenses. The goal of the study is to evaluate the cost and time effectiveness in the management of the surgical patients admitted in Emergency Department (ED).

Methods: For a period of 8 h/day in 8 consecutive days, surgical cases presented in the ED of a tertiary University Hospital of Athens were followed. Inclusion criteria were need for laboratory tests or imaging examinations or an immediate resuscitative intervention. Data recorded regarding demographics, vitals, critical time points, disease and management. Physician related data and cost of examinations were also collected. Case severity was calculated by Early Warning Score[1].

Results: The average waiting time for each patient was 51 min and the average total time until final decision was 3:02 h. Blood tests costs reached an average of 17,59€ per case and imaging an average of 77,88€. The striking finding was that only one out of 60 patients was of medium clinical risk, while all the others were of low. Thus, substantial symptoms and clinical findings were lacking and as the "tertiary care" character of the hospital was mandating conclusive diagnosis, exams were ordered. This approach absorbs time and funds putting at risk the very few severe cases which are the target population for the magnitude of the facility.

Conclusions: The current study indicates that the use of a tertiary hospital as a Primary Health Care Center by the public, is disorganizing the system, and increase the cost in time, funds, and preventable morbidity and mortality. A pre-hospital triage and management of the low severity cases system is pending to be established in our environment and becomes top priority in an era of prolonged financial crash.

References: 1. Williams, B, et al. *National Early Warning Score (NEWS),* London: The Royal College of Physicians, 2012.

Fig. 1

Table 1: Cost of lab examinations

General Blood test	Biochemical blood tests	CRP	Coagulation panel	Blood-type & crossmatch or b-hCG
1.99 €	32.04 €	4.85 €	34,55€	25.02 €

*(**CRP**=C-Reactive Protein, **b-hCG**=Human Chorionic Gonadotropin)*

Fig. 2

Table 2: Cost of imaging examinations

X-Ray	Ultrasound	Computer Tomography
4.05 €	35.49 €	71.11 €

Fig. 3

Table 3: Vital signs and severity of disease of evaluated patients

Parameters	Cut-off points	Number of patients
Age	< 45 years	24
	> 45 years	36
BMI	18-25	21
	25-30	28
	> 30	11
SBP	< 100 mm Hg	3
	> 100 mm Hg	57
DBP	< 60 mm Hg	4
	> 60 mm Hg	56
HR	< 100 bpm	51
	> 100 bpm	9
SaO_2	< 95%	5
	> 95 %	55
RR	< 12 bpm	1
	12 < R.R. < 19 bpm	57
	> 19 bpm	2
T	< 36,4 ° C	5
	> 36,4 ° C	55
AVPU	Alert	59
	Verbal	1
	Pain	0
	Unresponsive	0
Need for emergency management	Yes	4
	No	56
EWS	< 3	59
	> 3	1

*(**BMI**=Body Mass Index, **SBP**=Systolic Blood Pressure, **DBP**=Diastolic Blood Pressure, **HR**=Heart Rate, **SaO_2**=Oxygen Saturation, **RR**=Respiratory Rate, **T**=Temperature, **AVPU**=Alert Verbal Pain Unresponsive, **EWS**=Early Warning Score)*

Fig. 4

Table 4a: Early Warning Score (EWS)

Score	3	2	1	0	1	2	3
RR *(bpm/min)*	>35	31-35	21-30	9-20			<7
SaO_2 *(%)*	<85	85-89	90-92	>92			
Temperature *(ºC)*		>38.9	38-38.9	36-37.9	35-35.9	34-34.9	<34
SBP *(mmHg)*		>199		100-199	80-99	70-79	<70
HR *(bpm/min)*	>129	110-129	100-109	50-99	40-49	30-39	<30
AVPU				Alert	Verbal	Pain	Unresponsive

Table 4b: Clinical risk

EWS	Clinical Risk
0	Low
Aggregate 1-4	
RED score (individual parameter scoring 3)	Medium
Aggregate 5-6	
Aggregate 7 or more	High

Table 4c

EWS	Number of patients	Clinical risk
0	44	Low
1	9	Low
2	6	Low
3	1	Medium *(based on individual 3)*

Fig. 5 Table 5: Certainty for diagnosis, time and outcome

Certainty for diagnosis	Time until diagnosis	Admission	Discharge	Referrals	Number of patients
1	2:50	2	16	26	44
2	3:52	3	5	4	12
3	2:30	2	1	1	4
		7	22	31	60

PR 140

The Successful Implementation of a Trauma and Acute Care Surgery Model in a Tertiary Care Center in a Middle-Income Country

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For years, surgical emergencies in Ecuador have been managed without significant standardization. Scarce numbers of specialists, lack of a constant presence of full-time teaching faculty versed in emergency surgery and lack of continuity with surgical trainees led to variability in clinical and surgical decision-making. To address these issues, the Regional Hospital Vicente Corral Moscoso (HVCM) adapted and implemented a model of "Trauma and Acute Care Surgery" (TACS) to the reality of Cuenca, Ecuador.

A cohort study was carried out, comparing trauma and acute care surgery patients exposed to the "traditional care model" before the implementation of the TACS model. Variables assessed included: surgical wait times, number of hospital visits, number of surgical interventions, number of surgeries performed per surgeon and in-hospital mortality.

Higher mortality was found in the traditional care model (RR of 1.29, $p \leq 0.05$) compared to the TACS model. We observed a statistically significant decrease in surgical wait time (10.6–3.2 h for emergency general surgery, 6.3–1.6 h for trauma, $p \leq 0.05$). Length-of-stay decreased in trauma patients (9–6 days $p \leq 0.05$). The total number of surgical interventions increased (3,919.6–57,445.8, $p \leq 0.05$); by extension, the total number of surgeries performed per surgeon also increased (5.37–223.68, $p \leq 0.05$).

The implementation of TACS model in a typical resource-restrained, tertiary care hospital in Latin America had a positive impact by decreasing surgical waiting time in trauma and emergency surgery patients, and length-of-stay in trauma patients. We also noted a statistically significant decrease in mortality. While cost could not be objectively evaluated with the available data, savings to the overall system and patients can be inferred by decreased mortality, length-of-stay and surgical wait times. To our knowledge, this is the first implementation of an TACS model that has been described in Latin America.

Fig. 1

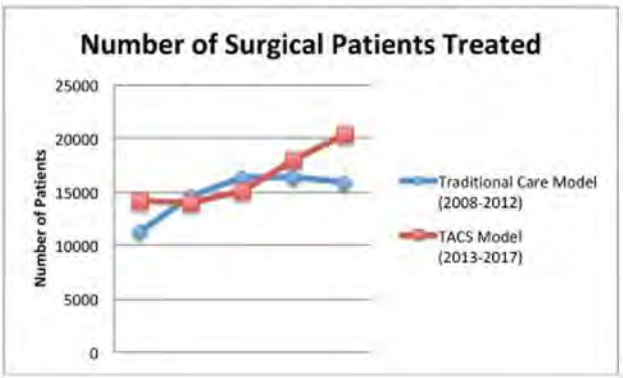

Fig. 2

Mean Wait Time for Operating Room and Length of Stay

Variable	Traditional Model	ACS Model	p Value
Surgical wait time for emergency general surgery patients	10.6 hours	3.2 hours	<0.001
Surgical wait time for trauma patients	6.3 hours	1.6 hours	0.00
Length of stay for emergency general surgery patients	4 days	3 days	0.43
Length of stay for trauma patients	9 days	6 days	0.03

Fig. 3

Comparison of Mortality by Model

Model	Total Mortality	Percent Mortality	*RR*	CI 95%	p Value
Traditional	124/11,234	1.1%	1.29	1.01-1.64	0.03
ACS	144/16,792	0.86%			
Model	**Mortality ≥48 hours**	**Mortality ≤48 hours**	**RR**	**CI 95%**	**p Value**
Traditional	87.9%	12.1%	1.02	0.93-1.13	0.55
ACS	85.4%	14.6%			

PR 141

IDART: Impairing drugs and alcohol as risk factors for traumatic injuries

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Introduction: Traumatic injuries constitute one of our major public health challenges. The most effective means to reduce the impact trauma has on individuals and society is primary injury prevention, reducing the incidence of traumatic events, which relies on detailed knowledge of risk factors. The aim of this study is to facilitate targeted injury prevention through improved data collection and analysis on impairing substances as risk factors for traumatic injuries.
Material and Methods: IDART is a national prospective observational study including analyses of the toxicological profile of all patients ≥ 16 year of age admitted via trauma team activation to any Norwegian trauma hospital (*n*38) during a 12 month study period. Residual blood from routinely drawn blood samples at trauma admission is analyzed for alcohol, illegal and psychoactive drugs. Toxicological data will be linked to clinical data from the National Trauma Registry.
Results: The study period started March 1st, 2019, and during the first 6 months 2689 patients were included from 34 trauma hospitals. More than 30% of the included patients tested positive for psychoactive substances according to preliminary data. Data on the prevalence of different psychoactive substances disaggregated by mechanism of injury, demography and geography from the 12 month study period will be presented.
Conclusions: The IDART study will provide a detailed descriptive analysis on the prevalence of alcohol, illicit and medicinal drug use among all patients admitted to a Norwegian hospital with suspected severe injury. Subgroup analyses will include prevalence of alcohol and other substances in subgroups analyses on patient and injury characteristics and geographical variations. Analyses will aim to identify high risk groups according age, gender, circumstances of the injury, geographical location and type of psychoactive substance.

PR 142

The Dutch Nationwide Trauma Registry: the value of capturing all acute trauma admissions

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Introduction: Twenty years ago the Dutch government decided to reform the trauma care system and designated 11 level 1 Regional trauma centers (RTCs). These centers, in collaboration with ambulance services and regional hospitals, have managed to set up regionalized inclusive trauma systems. Moreover, they set up the Dutch National Trauma Registry (DNTR) as a quality evaluation and epidemiology resource. In this resource all acute hospital admissions were included, in order to measure the hospital and prehospital processes and outcomes. In the current study we demonstrate its current status and compare it with national trauma registries from the UK and Germany.
Material and Methods: The DNTR includes all injured patients treated at the ED of 98% of all hospitals in the Netherlands within 48 h after the trauma followed by direct admission, transfer to another hospital or death at the ED. A representative descriptive analysis of extracted data from 2018 is demonstrated.
Results: Between 2007 and 2018 a total of 865,460 trauma cases have been registered in the DNTR. Hospital participation has increased from 64% up to 98%. In 2018 alone, a total of 77.529 patient were included, 50% concerned males, the median age was 64 years. 6% of all admissions had an ISS ≥ 16, of which 70% was treated at a RTC. From this cohort, in comparison, only 5% and 32% of the DNTR patients met TR-DGU or TARN inclusion criteria. Particularly children, elderly and patients admitted at non RTCs are not captured in the TR-DGU or TARN. Also, part of ISS ≥ 16 and fatal cases do not meet TR-DGU or TARN inclusion criteria.
Conclusions: The DNTR has evolved into a comprehensive well-structured nationwide population-based trauma register, with an annual number of 80,000 cases being entered in the database the DTR has grown to be one of the largest trauma databases in Europe. The registry enables studies on the injury burden and quality and efficiency of the entire trauma care system encompassing all trauma-receiving hospitals.

PR 143

A comparison of the trauma mortality in the northern part of the Nordic countries

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Introduction: Trauma mortality is not distributed evenly. Rural areas have higher incidence rates of trauma mortality than urban areas. The rural northern part of the Nordic countries have common challenges with sparsely populated areas, long distances, and an arctic climate. The aim of this study was to compare the cause and rate of fatal injuries in the northernmost area of The Nordic countries over a five-year period.
Material and Methods: In this retrospective cohort we used the Cause of death registries and collated all deaths from 2007 to 2011 with an external cause of death (ICD-10, V01-Y98, except Y40-84 and T80-88). The study area was the three northernmost counties in Norway, the four northernmost counties in Finland and Sweden and the whole of Iceland. We used 95% confidence intervals (CI 95) to test for differences between the countries.
Results: There were 4308 deaths in the study area during the 5-year period. Low energy (LE) trauma constituted 24% and High energy (HE) trauma 76% of deaths. Northern Finland had the highest incidence for both High Energy trauma and Low Energy trauma. Iceland had the lowest incidence for high-, and low energy trauma. Iceland had the lowest prehospital share of deaths at 74% and the lowest incidence of injuries occurring in a rural location. The incidence rates for HE trauma death was 36,1/100.000/year in Northern Finland, 15,6/100.000/year in Iceland, 27,0/100.000/year in Northern Norway and 23,0/100.000/year in Northern Sweden.
Conclusions: There were significant and unexpected differences in the epidemiology of trauma death between the countries. The differences suggest that a comparison of the trauma care systems and preventive strategies in the countries is required.

PR 144

The diurnal and seasonal relationships of pedestrian injuries secondary to motor vehicles in young people

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Introduction: There remains a significant morbidity and mortality in young pedestrians that are hit by motor vehicles, even in the era of pedestrian crossings and speed limits. The aim of this study was to compare incidence and injury severity of motor vehicle-related pedestrian trauma according to time of day and season in a young population. We hypothesised that injuries in young people would be more prevalent during dusk and dawn and during autumn and winter.
Material and Methods: Data was reviewed from patients in the 10-25 year old age group in the Trauma Audit and Research Network (TARN) national database, who had been involved as a pedestrian in a motor vehicle accident between 2015 and 2018. The incidence of injuries, their severity (using the Injury Severity Score [ISS]), hospital transfer time and mortality were analysed according to the hours of daylight, darkness and seasons.
Results: 64.5% of injuries occurred during time of darkness post sunset, while 35.5% occurred during daylight. The incidence of injuries in motor vehicle accidents, in absolute terms, was highest during *1630–2400,* with a second peak at *1500–1630.* The greatest injury rate (number of injuries/hour) occurred during *0730–0900* and *1500–1630* with respective rates of 5.3 and 8. Injuries scoring an ISS over 15 occurred 21.7% at 1500–16300 and a further 42.9% until 2400. Mortality was greatest during *1500–1630* involving 4 out of the total 7 deaths. Autumn was the predominant season and lead to 40.3% of injuries, with a further 22.6% in winter. This demonstrated a clear difference to 19.4% and 17.7% in spring and summer.
Conclusions: We have identified a relationship between reduced daylight and the frequency and severity of pedestrian trauma in young people suggesting that reduced visibility may play a significant role which could be addressed through a targeted public health approach to implement change.

PR 145

Enhancing Cost Effectiveness in a System in Crisis: a 7,581 patient study

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Introduction: To date, there is no national trauma database in Greece. The goal of our study is to record and evaluate trauma management at our University hospital as well as to measure the associated healthcare cost, while laying out the foundations for a national database.
Material and Methods: Retrospective study of trauma patients (N = 7,581) between 2014 and 2019. Demographic information, injury patterns and severity, outcomes and cost were recorded.
Results: The proportion of patients that were transferred to the hospital by the National Emergency Medical Services was 28,6%, whereas 3873 (51%) of our trauma patients did not meet the US trauma field triage algorithm criteria. Over-triage of trauma patients to our facility ranged from 90.7 to 96.7%, depending on the criteria used. 299 (3.9%) of our patients received operative management and 22% (65) of them had postoperative complications. An ISS > 15 was seen in 228(3%) of our patients and their mortality was 19,3%. The overall non-salary cost for trauma management was 3.118.625 Euros. The cost resulting from the observed over-triage ranged from 419.501 to 1.742.748 Euros. Furthermore 1108 (14.6%) of our patients underwent at least one CT scan that did not show any significant Traumatic lesion. The cost of hospitalization of these patients was 592.508 Euros.
Conclusions: The prehospital triage of trauma patients in the Greek National Health system is ineffective, with significant over triaging, leading to excessive costs. Appropriate use of criteria for diagnostic procedures and algorithms may lead to a, much-needed, reduction of these costs.
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Moore E E (2010). "American Association for the Surgery of Trauma Organ Injury Scaling: 50th anniversary review article of the Journal of Trauma." J Trauma 69(6): 1600–1601.

PR 146

Fact-finding survey of traffic fatalities in Chiba prefecture

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Introduction: In Japan, there are 290 emergency and critical care centers nationwide (one center for approximately every 500,000 people), and a system is in place to accept local critically ill patients 24 h a day, irrespective of whether their conditions are intrinsic or extrinsic. However, manpower and medical care systems differ depending on the emergency and critical care center, and the establishment of a system for consolidating severe trauma patients has been particularly problematic.
Material and Methods: This study examined 518 cases where the patient had some sign of life when encountered by ambulance teams of the 1278 cases of traffic accident deaths that occurred in Chiba prefecture between 2009 and 2015. Thirteen emergency and critical care center representatives in Chiba prefecture met to verify each case based on data from the police, fire department, and medical institutions. The cases were classified into (1) Preventable Trauma Death (PTD) cases, (2) Suspected PTD cases, and (3) non-life-saving cases; the problems (causes of PTD) in each case were examined.
Result: There were 115 cases (22%) of PTD and suspected PTD. Sixty-eight of these cases were transported to emergency and critical care centers. The most common cause of death was bleeding, accounting for 78 cases and the locations where the problems that caused PTD occurred were outside of the hospital (n = 11) and in the hospital (n = 67). The problems that occurred in the hospital (including duplications) include circulatory management (n = 42, 54%), the treatment plan (n = 32, 41%), delay of lifesaving surgery (n = 28, 36%), and delay of diagnosis (n = 20, 26%). Most of these occurred in the initial emergency care room.
Conclusion: This study clarified that PTD still occurs in relation to bleeding control in the current trauma care system in Chiba prefecture. It is vital to establish a national "trauma center" and to thoroughly consolidate trauma cases to eradicate PTD.

PR 147

Analysis of the impact of the implementation of a trauma team in a trauma center from an upper-middle-income country

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Introduction: Trauma teams (TT) improve the care process and the outcomes. A multidisciplinary TT was conformed in September 2015 to achieve a rapid response by specialists in emergency medicine, trauma surgery, diagnostic imaging services, and blood bank in a Level I trauma university hospital in southwestern Colombia.
Objective: To evaluate the impact of a TT implementation in terms of times of attention and mortality.
Material and Methods: Retrospective study. All the patients with the highest level of TT activation treated in the 15 months after the TT implementation were included. The subjects triaged to the trauma center in the 15 months pre TT were taken as controls. Four hundred sixty-four patients were included, 220 before the implementation of the TT (BTT) and 244 after (ATT). Demographic data, trauma characteristics, times to tomography, and trauma surgery and mortality were recorded. The analysis was made on Stata 15,1®. Categorical variables were described as quantities and proportions—continuous variables as mean and standard deviation or median and interquartile range (IQR). Categorical variables were compared by Chi2 or Fisher's test. Continuous variables with Student's T or Wilcoxon–Mann–Withney. A multiple logistic regression model was created to evaluate the impact on mortality if being treated ATT, adjusted by age, trauma severity, and physiologic response on admission.
Results: The time from admission to the CT scan was 56 min (IQR 39–100) in the BTT group and 40 min (IQR 24–76) in the ATT group, p < 0.001. The time to trauma surgery was 116 min (IQR 63–214) in the BTT group and 52 min IQR 24–76) in the ATT group, p < 0.001. Mortality in the BTT group was 18.1% and 13.1% in the ATT group. Adjusted OR was 0.406 (0.215–0.789) P = 0.006
Conclusions: The implementation of a multidisciplinary trauma team associated with a reduction of the times to tomography and surgery and with a decrease in mortality risk.
no

Fig. 1

Table 1. Impact of the implementation of a trauma team.
General characteristics

	BTT, n=220	ATT , n=244	p value
Age**	29 (23-39)	28 (23-37)	0,371
Gender, n(%)			
Male	191 (86.8)	206 (84.4)	0,464
Penetrating trauma, n(%)	135 (61.4)	107 (43.9)	<0,001
ISS**	16.5 (9-34)	19 (11-26)	0,234
ISS >15	141 (64.1%)	174 (71.3%)	0.096
RTS	12 (9 – 12)	11 (10 – 12)	0.334
RTS <12	79 (35.9)	97 (39.9)	0.375
Glasgow coma scale**	15 (7-15)	15 (7-15)	0,788
Heart rate**	90 (76-110)	101 (82-117)	0,002
Systolic blood pressure**	121 (100-133)	109 (82-128)	<0,001
Oxygen saturation**	97 (93-99)	96 (90-98)	0,006

** Median (ICR)
**Wilcoxon-Mann-Whitney
CT: computer tomography, ICR: Interquartile range, BTT: Before trauma team, ATT: After trauma team

Fig. 2

Table 2. Multiple logistic regression for risk factors of mortality

Variable	OR	CI 95%	p
BTT group	0.406	0.215 - 0.769	0.006
ISS ≥16	24.79	3.350 - 183.42	0.002
Heart rate (beats/min)	0.999	0.899 - 1.089	0.839
Systolic blood pressure (by 10 mm Hg)	0.878	0.799 - 0.966	0.007
Oxygen saturation (by 10%)	0.686	0.566 - 0.832	<0.001
AUROC 0.860 (0.817 – 9.04) Hosmer-Lemeshow p= 0.684			

BTT: Before trauma team, CI: confidence interval

Fig. 3

Table 3. Time to tomography by subgroups

	Group		p value
	BTT, n=150	ATT , n=154	
Penetrating trauma **	57 (35-135)	50 (24-87)	0,2761
<16	56 (41-104)	42.5 (21-74)	0,0091
>=16	56.5 (39-93)	40 (25.5-76)	0,0033
Glasgow coma scale**			
>=9	55 (39-107)	40 (23-79)	0,0043
<9	57,5 (42.5-87.5)	37,5 (24-55.5)	0,0008
Orotracheal intubation**			
No	54.5 (38-101)	40 (23-65)	0,001
Yes	58 (42.5-97.5)	43 (24-85)	0,0289

** Median (RIC)
**Mann-Whitney
BTT: Before trauma team, CI: confidence interval

Fig. 4

Table 4. Time to surgery by subgroups

	BTT, n=79	ATT, n=115	p valor
Penetrating trauma **	112 (56-211)	40.5 (20-191.5)	0,0128
ISS ≥16			
<16	203.5 (121-370)	189.5 (32-588.5)	0,3767
>=16	104.5 (54.5-160)	49 (25-104)	0,0027
Glasgow coma scale **			
>=9	121 (64-247)	51 (32-110)	0,0001
<9	105 (21-143)	57.5 (19-339)	0,7886
Orotracheal intubation **			
No	123 (56-218)	49 (24-181)	0,0016
Yes	112 (83-160)	62.5 (40-334)	0,3016

** Median (RIC)
**Mann-Whitney
BTT: Before trauma team, CI: confidence interval

TRAUMATIC BRAIN INJURIES

PR 148

Prediction of an unfavourable outcome after surgical treatment of chronic subdural hematoma patients using machine-learning

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Introduction: Chronic subdural hematomas (cSDH) are expected to become the most frequent neurosurgical disease by the year 2030.1 Although often perceived as a "benign" condition, considerable rates of mortality and poor outcome have been reported. We therefore evaluated factors associated with an unfavorable outcome after surgical treatment of cSDH patients by developing a predictive model using machine-learning.

Material and Methods: Consecutive patients treated for cSDH with surgical evacuation between 2006 and 2018 at a single institution were retrospectively analyzed. Potential demographical, clinical, imaging and laboratory predictors were assessed and a decision-tree predicting unfavorable outcome (GOS 1-3) was subsequently developed using the Classification and Regression Tree (CART) algorithm. Out-of-sample model performance was evaluated using repeated cross-validation (fivefold with 200 repetitions).

Results: 755 eligible patients were analyzed. Median age was 75 (IQR 68–81) years and 69% were males. Mortality rate was 1.6% and rate of unfavorable outcome was 14.3%. The developed decision-tree to predict unfavorable outcome had 5 splits and included the following 4 clinical variables (in descending order of calculated importance): GCS, comorbidities, Hb, and age. After cross-validation, the following model performance metrics were obtained: a model accuracy of 0.88 (0.85–0.90), sensitivity of 0.35 (0.19–0.51), and specificity of 0.96 (0.94–0.99).

Conclusions: GCS, comorbidities, Hb, and age were identified as the most important clinical predictors for an unfavorable outcome in cSDH patients after surgery. The developed model was simple and still displayed a high accuracy and very high specificity, the sensitivity was however rather low. Our results might help clinicians to better assess the prognosis in patients with cSDH.

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PR 149

Emergency Neurosurgery in Low resource Settings- Its worth the effort!

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Introduction: In most developing countries access to tertiary care neurosurgical setup is uncommon. Majority trauma including Neurotrauma & Medical conditions requiring emergency neurosurgical interventions present to a general surgeon. This study is an attempt to highlight the importance of Emergency Neurosurgery as a skill amongst general surgeons & also focus on the challenges in managing such cases in austere environments

Material and methods: This study was a retrospective analysis of progressively collected data of trauma patients with a specific focus on head injuries & emergency neurosurgical interventions for both traumatic & non Traumatic Indications in a level 2 trauma centre in a semi urban area over a period of 2 years from August 2016 to September 2018

Results: A total of 720 patients of trauma were analysed out of which 392 were head injuries. Road traffic accidents accounted for nearly 77% of head injuries. Atypical trauma especially in rural setup e.g. train collision, animal related causes were also seen. Males accounted for majority (M:F = 2.6:1). Mean Age was 37 yrs. 104 patients had

Imaging findings suggestive of severe head injury. Acute SDH was the commonest post traumatic finding and MCA territory infarct in non traumatic group. 22 Patients underwent emergency neurosurgical intervention with a survival of 61%. Factors associated with poor outcome were delayed presentation ($p < 0.05$), SDH with Diffuse axonal injury. Alcohol consumption was a significant factor.

Conclusions: Emergency Neurosurgery is an essential skill for general surgeons. Performing such cases in a low resource environment in absence of modern day facilities for Imaging, ICP monitoring & powered equipment presents a significant challenge. General surgeons should be able to perform operative interventions with basic handheld instruments. Operative management whenever indicated should be done & helps improve outcomes.

Fig. 1

Fig. 2

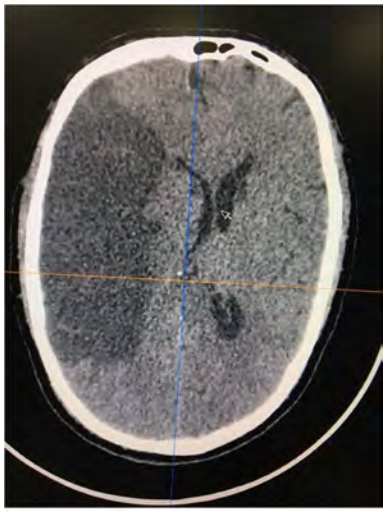
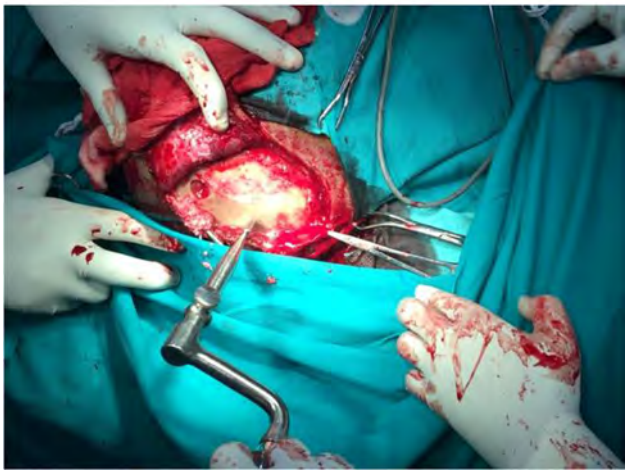


Fig. 3

Fig. 4



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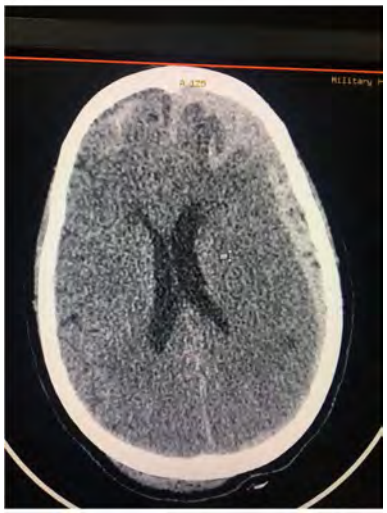

PR 150

Head trauma in polytraumatized patient. Analysis of risk factors and neurological prognosis

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Introduction: Severe trauma is one of the most frequent causes of death and disability and traumatic brain injury (TBI) in polytrauma is the main cause of death and disability in survivors. The aim of this study is to analyze mortality associated to TBI in the last 25 years, prognostic factors associated with it and neurological outcomes in survivors with TBI.
Methods: Retrospective observational study that includes risk factors and functional neurologic evaluation in polytrauma patients attended in Gregorio Marañon Hospital between 1993–2018. Inclusion criteria were severe trauma patients (ISS $\geq$ 15) with a TBI and abnormal CT of the head. We analyzed mortality trend in two periods: 1993–2005 and 2005–2018, and neurological evolution and outcome at discharge with functional scores (Ramkin Scale and GOS) in the second one.
Results: From 1993 to 2018, 2818 severe trauma patients were admitted, 788 (27,9%) with brain or central nervous system injuries visible on head CT. Median age was 37'5; 71.4% were men. The global mortality of the cohort has been 34,1%, 27.6% of them for neurological causes. Ischemic heart disease, anticoagulation, abnormal pupils or eye opening, the need for surgery, shock, GOS, ISS, NISS, cranial AIS are significant associated with higher mortality ($p < 0,05$).The mortality rate due to neurological causes decreases in the second period from 19,5 to 14,8%, this descent being statistically significant ($p = 0,017$). Between 2005 and 2018 27,9% patients died from CNSI, and 4,2% of TBI survivors had a vegetative status at discharge, 16,7% had major disability, and 33,9% had a good neurological recovery.
Conclusions: Mortality due to TBI decreased in the last 12 years, but this improvement after TBI was at the expense of a high rate of vegetative status and great disability, showing the need for continuous research in this area.
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PR 151

Decompressive craniectomy in severe non-penetrating traumatic brain injury

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Introduction: Severe traumatic brain injury (TBI) constitutes one of the most frequent causes of intensive care unit admissions and is a major cause of death and disability among young people. Decompressive craniectomy (DC) is a life-saving measure used to relieve intracranial pressure (ICP). This procedure is related with low mortality rates and poor functional outcomes. The aim of this study is to analyze the survival rates and prognostic factors related with functional outcomes after DC for severe TBI.
Material and methods: Retrospective, single center study of 60 patients with severe TBI in whom a DC was performed between the years 2006 and 2016. Demographic features, clinical parameters, radiological findings and clinical outcomes were included in the study. For the statistical analysis we used ANOVA, Chi-Square, Kaplan Meyer, Cox regression and Logistic Regression. A P value of less than 0.05 was considered to indicate statistical significance.
Results: The mean initial Glasgow Coma Scale was 5,65 $\pm$ 1,69 and the mean initial motor response (iMR) was 3,20 $\pm$ 1,48. The mean ICP after DC was 9,75 $\pm$ 3,35. The 30-day survival after DC was 65%. Twenty percent of the patients improve ate least 1 point in the Glasgow Outcome Scale (GOS) between 6 and 24 months after surgery. Twelve patients improve from unfavorable GOS to favorable GOS. At 24-month follow-up, 30% of the patients has GOS > 3. Younger age, high iRM a post-operative ICP were the factors significantly associated with a higher chance of outcome improvement.
Conclusions: DC is useful for the management of refractory intracranial hypertension related to severe TBI, and in selected patients is associated with good functional outcomes.
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PR 152

Impact of preinjury antithrombotic therapy on survival of traumatic brain injury (TBI) patients ≥ 65 years

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Introduction: Antiplatelets and anticoagulation, commonly referred to as antithrombotic therapy, are frequently used in patients $\geq$ 65 years. The use of antiplatelets and anticoagulation are associated with increased incidence of intracranial bleeding (1, 2). There are two research questions addressed in this study: (1) Does preinjury antithrombotic therapy affect survival in elderly patients with TBI? (2) Are direct oral anticoagulants (DOACs) associated with better survival than vitamin K antagonists (VKA) in TBI patients on anticoagulation?
Materials andMethods: Retrospective cohort study based on data extracted from The Oslo TBI Registry. Included in the study are TBI patients $\geq$ 65 years admitted to OUH with cerebral-CT showing signs of acute trauma (hemorrhage, fracture, vascular injury) in the time period 2014–2019. The impact of age, comorbidity, antithrombotic medication and antithrombotic reversal protocol for survival will be explored.
Results: The patient inclusion is ongoing. Preliminary data will be presented at the 21 st ECTES in April 2020. The estimated number of TBI patients $\geq$ 65 years with cerebral-CT showing signs of acute trauma in the study period is $\sim$ 850. In this patients group, the expected preinjury use of antiplatelet and anticoagulation medication is $\sim$ 33% and $\sim$ 23%, respectively.
Conclusions: The knowledge regarding impact of preinjury antithrombotic therapy on survival in elderly TBI patients is clinically relevant, and may improve patient management in the acute phase of injury.
References:

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PR 153

Surgically evacuated Traumatic Acute Subdural Hematoma; a population based consecutive series from Norway

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Introduction: Traumatic acute subdural hematoma (ASDH), especially the large ones in need of surgical evacuation, is associated with high mortality. Contemporary population-based series of surgically treated ASDH are sparse. The two main aims of this single-center study from Oslo University Hospital (OUS) were to estimate incidence of surgery for ASDH in the population of Helse Sør-Øst, and estimate in-hospital and 1-month survival of these patients. Treatment of TBI at OUS adheres to the Brain Trauma Foundation guidelines, with ICP controlled therapy and evacuation of ASDH when GCS < 14 and hematoma volume $\geq 30\ cm^3$ or midline shift ≥ 5 mm or hematoma width > 10 mm. The goals of TBI treatment for adults have been to maintain ICP < 22 mmHg and cerebral perfusion pressure (CPP) ≥ 60 mmHg.
Methods: From 01.01.2015 all patients with Traumatic Brain Injury (TBI) with positive head CT, admitted to OUS, living in Helse Sør-Øst (3.0 million inhabitants) and having a Norwegian social security number, have been included in our approved TBI-Quality Register. Included in the present study are all patients with ASDH undergoing evacuation of the hematoma within 7 days of trauma. The following data were extracted from the register; demographic variables, date of injury and trauma mechanism, severity of head injury according to HISS grade, Rotterdam CT score, surgical procedures, multitrauma, Glasgow outcome scale at discharge and date of death.
Results: 116 ASDH patients were operated in the 4-year period 2015–2018, 72% males, mean age was 58 years (10–92), the most frequent trauma mechanism was falls (60%), 29% were under influence of ethanol, 58% had severe TBI and 28% had multitrauma. The incidence of surgically treated ASDH in Helse Sør-Øst was 1/100.000/year. In-hospital and 1-month mortality was 9.5% and 15%, respectively.
Conclusion: The presented data for incidence and mortality will be compared with earlier reports.

PR 154

Age-related difference in impacts of coagulopathy in patients with isolated traumatic brain injury: an observational cohort study

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Background: Age and trauma-induced coagulopathy (TIC) have been reported to be the predictors of poor outcome following traumatic brain injury (TBI). Whether the impact of brain injury induced coagulopathy on outcomes have age related differently is unknown.
Objectives: We evaluated the age-related difference in the impact of TIC on outcomes in patients with isolated TBI.
Methods: A retrospective observational study was conducted in two tertiary emergency critical care medical centers in Japan from 2013 to 2018. The patients with isolated TBI [head Abbreviated Injury Scale (AIS) ≥ 3, and other AIS < 3] were included. We evaluated the impact of coagulopathy (international normalized ratio ≥ 1.2, and/or platelet count $< 120 \times 109$/L, and/or fibrinogen ≤ 150 mg/dL) on the outcomes [Glasgow Outcome Scale-Extended (GOS-E) scores, in-hospital mortality and ventilation free days (VFD)] in both group using univariate and multivariate models. Furthermore, we visualized the impact of coagulopathy on GOS-E according to age, by using a generalized additive model.
Results: Of the 1036 patients studied, they were divided based on their age: non-elderly group (n = 501, 16–64 years) and elderly group (n = 535, age ≥ 65 years). Although, in the multivariate model, age and coagulopathy were significantly associated with lower GOS-E, in-hospital mortality and shorter VFD in the non-elderly group, significant impact of coagulopathy was not observed for all the outcomes in the elderly group. The correlation between coagulopathy and lower GOS-E decreased with age after round 70 years old.
Conclusions: In patients with isolated TBI, impact of coagulopathy on functional and survival outcomes was lower in geriatric patients.

PR 155

No difference in mortality between isolated TBI and polytrauma with TBI: It is all about the brain

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Introduction: Despite improvements in trauma and critical care mortality caused by Traumatic Brain Injury (TBI) remains high.[1] As polytrauma is naturally associated with increased mortality, this study compared mortality rates in isolated TBI (iTBI) patients and polytrauma patients with TBI admitted to ICU.
Material and methods: A 3-year retrospective cohort study included both consecutive trauma patients with iTBI with AIS head ≥ 3 (AIS of other body regions ≤ 2) and polytrauma patients with AIS head ≥ 3 admitted to a level-I trauma center ICU. Patients < 15 years of age, injury caused by asphyxiation, drowning, burns and transfers from and to other hospitals were excluded. Patient demographics, shock and resuscitation parameters, Denver Multiple Organ Failure scores and acute respiratory distress syndrome (ARDS) data were collected.[2] Data is shown as medians with interquartile ranges. p-values < 0.05 were statistically significant.
Results: A total of 259 patients were included. The median age was 54 (33–67) years, 177 (68%) patients were male, median ISS was 26 (20–33). Seventy-nine (31%) of all patients died. Polytrauma patients developed more often ARDS (7% vs 1% p = 0.041) but had similar MODS rates (18% vs 10% p = 0.066). Polytrauma patients stayed longer on the ventilator (7 vs. 3 days $p \leq 0.001$), longer in ICU (9 vs. 4 days $p \leq 0.001$) and longer in hospital (24 vs. 11 days $p \leq 0.001$). There was no distinction in in-hospital mortality of iTBI and

polytrauma patients (35% vs. 24% p = 0.06). TBI contributed to all deaths in iTBI patients and all but three deaths (89%) in polytrauma patients.

Conclusions: TBI was the main cause of death in both groups. There was no difference in mortality rates between polytrauma patients with TBI and iTBI patients, even though polytrauma patients were more severely injured.

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No significant relationships or conflict of interests.

PR 156

How modeling the brain ventricles could help brain trauma understanding

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Introduction: The ventricle geometry changes with age (1). In pathological cases as in hydrocephalus, or in brain trauma, it is likely that each patient's ventricle structure has an impact on the way they behave. For instance, a shock wave may turn out differently according to the ventricle's shape. This can explain why for a same shock, the clinical translation is not the same. The aim of the study is to implement a finite element model of the cranio-cerebral system and to analyse the impact of a trauma simulation.

Material and methods: This is amonocentricretrospective study from 2018. The database contains 33 CT scans of healthy patients. We used ITK-SNAP software to segment the ventricles and Matlab to implement the model.

Results: The mean volume of the 33 total ventricles is 43 mL (SD = 31). The median is 31 mL (Table 1).To identify the correlation between the parameters acquired we performed a Pearson test. We found multiple significant correlations and one of the most relevant one is between the ventricular volume and the width of the third ventricle (Table 2). Showing that the total ventricular volume is statistically correlated to the width of the third ventricle is clinically interesting. We could potentially simplify our analysis of the ventricular system in head trauma by measuring less coordinates and yet come up to an accurate prognosis.

Conclusions: The ventricle volumes are used as neuroimaging marker of brain changes in health and brain trauma. To our knowledge, it is the first time they are studied in vivo on CT-scan. This study and the existing correlations are relevant for the configuration of the finite element model on going. It can surely help the comprehension of the interaction between the structural parts of the cranio-cerebral system during brain trauma.

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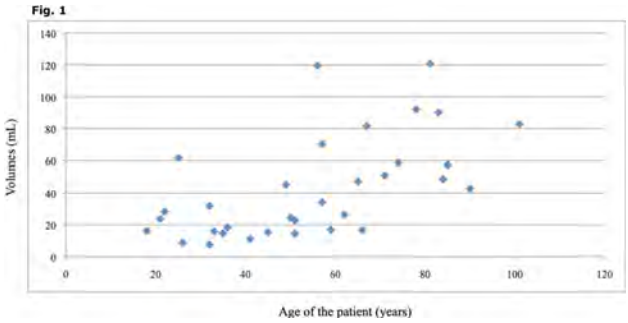

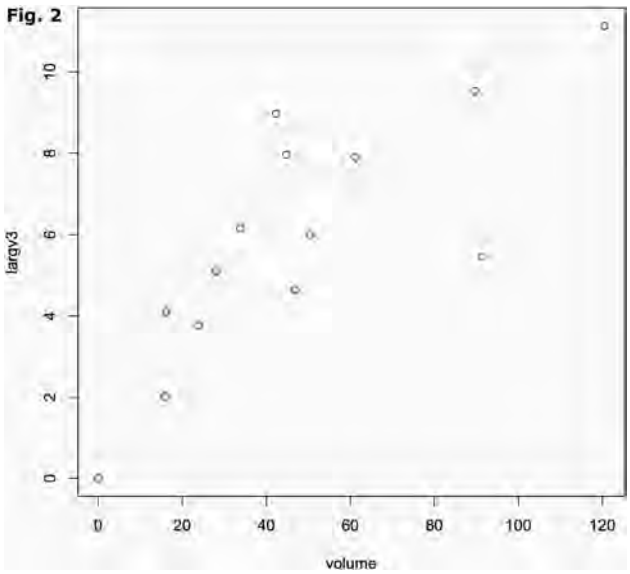

PR 157

GABA concentration in posterior cingulate cortex: preliminary pediatric acute mTBI research

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Introduction: Mechanisms underlying functional disorders in central nervous system (CNS) caused by mild traumatic brain injury (mTBI) require intensive research. The balance of major neurotransmitters

(excitatory—glutamate, and inhibitory—γ-aminobutyric acid, GABA), is crucial for the normal cerebral functioning. GABA concentrations vary in different cerebral zones [1] responsible for different cerebral tasks. In this study, [GABA] is measured in the posterior cingulate cortex (PCC) of children with acute mTBI.

Material and methods: 8 acute mTBI patients (< 70 h since injury, 15.7 ± 1.9 y.o) and 12 healthy controls (19.3 ± 0.7 y.o). MRI scanner Philips Achieva 3T was used. Standard MRI protocol for TBI revealed no pathological lesions in brain of any subject. Magnetic resonance spectroscopy (MEGA-PRESS [2]) was applied to obtain GABA signal without macromolecules. Spectroscopy voxel is demonstrated on fig. 1. Intensities of GABA, glutamate + glutamine, creatine and water signals were calculated in Gannet program [3]. Absolute concentrations were calculated. Mann-Whitney was used to reveal the statistical significance of between-group differences.

Results: Typical GABA spectrum processing in Gannet is demonstrated on fig. 2. No changes in Glx were found. The values of [GABA] in PCC are demonstrated on fig. 3: the increase in GABA is **not** statistically significant.

Conclusions: This is the first study of [GABA] in PCC of children with acute mTBI. The result of current work disagrees with our previous study, where GABA was increased ($p < 0.005$) in the anterior cingulate cortex of children with mTBI [4]. This indicates to a necessity of further data collecting in order to reveal any [GABA] alterations in various cerebral loci. This would help to identify the causes of an inhibition/excitation imbalance and to predict possible dysfunctions of CNS following mTBI.

References:

[1] 10.1002/nbm.3170
[2] 10.1002/mrm.24391
[3] 10.1002/jmri.24478
[4] 10.1134/S0006350917060161

Fig. 1

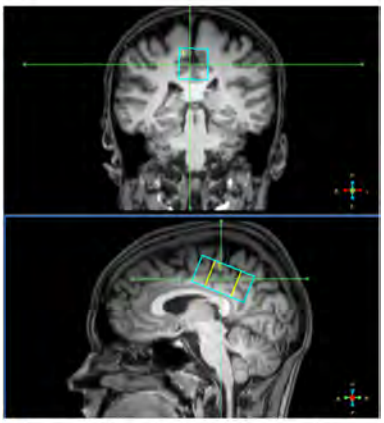

Figure 1. Voxel location in posterior cingulate cortex (45x25x25 mm)

Fig. 2

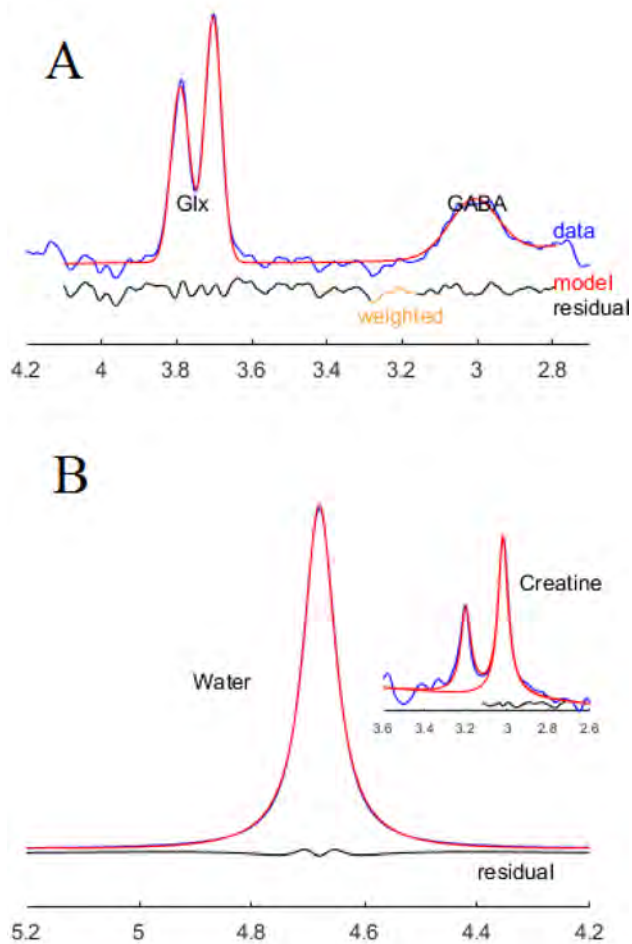

Figure 2. A – GABA spectrum processing in Gannet. The signal-to-noise ratio of GABA signal is sufficient for processing (error of GABA fitting is ~8%). B – creatine and water signal processing in Gannet

Fig. 3

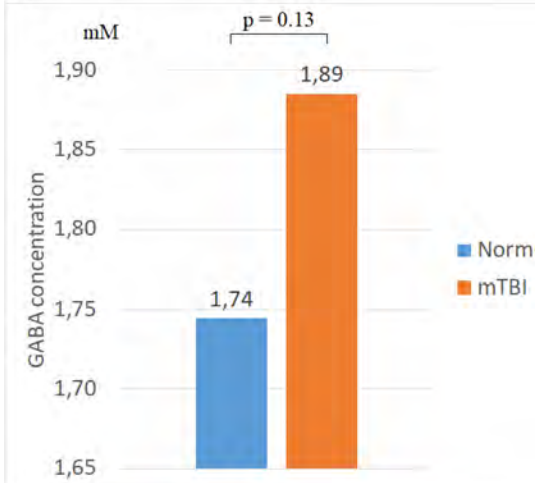

Figure 3. Median GABA concentration in the norm (blue bar) and in mTBI (orange bar) groups. The difference is not statistically significant (Mann-Whitney criterion)

PR 158

Measurement of [NAAG], [NAA], [Asp] and [Glu] after pediatric mild TBI in acute phase using ^{1}H MRS

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Introduction: In the work we measured NAAG, NAA, Asp Glu concentrations in the white matter (WM) using J-editing technics in patients with mild TBI in acute phase.
Material and methods: Twenty-four patients with closed concussive head injury (14 ± 3 y.o.) and twenty-nine healthy volunteers (16 ± 2 y.o.) were enrolled in the current study. For extended 1H MRS examination patients and controls were equally divided into two subgroups. In subgroup 1 (12 patients/15 controls) NAAG and NAA concentrations were measured in WM separately with MEGA-PRESS [1](TE/TR = 140/2000 ms; for NAA δ_{ON}/δ_{OFF} = 4.84/4.38 ppm, for NAAG δ_{ON}/δ_{OFF} = 4.61/4.15 ppm). In subgroup 2 (12 patients/14 controls) Asp and Glu concentrations were acquired with MEGA-PRESS (TE/TR = 90/2000 ms; δ_{ON}/δ_{OFF} = 3.89/5.21 ppm) and TE-averaged PRESS [2] (TE from 35 ms to 185 ms with 2.5 ms increment; TR = 2000 ms;) sequences, respectively.
Results: tNAA and NAAG concentrations along with stable NAA concentration were found to be reduced in patient group. Reduced Asp and elevated mI concentrations were also found.
Conclusions: The main finding of the study is that tNAA signal reduction in WM after mild traumatic brain injury is associated with the drop of the NAAG concentration rather than of NAA one, as it was thought previously. This highlights the importance of separation of these signals at least for WM studies to avoid misinterpretations of the results. NAAG plays an important role in its selective activation of the mGluR3 receptors, thus providing neuroprotective and neuroreparative function immediately after mTBI. It might have potential for the development of new therapy strategy for patients with injuries of various severity.
References:
1. Mescher M. et al. 1998 Simultaneous in vivo spectral editing and water suppression //NMR in Biomedicine, 11(6), 266–272.
2. Hurd, R. et al. 2004 Measurement of brain glutamate using TE–averaged PRESS at 3T. *MRM*, *51*(3), 435–440.

PR 159

Introduction of Oslo traumatic brain injury registry: neurosurgery

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Introduction: Traumatic brain injury (TBI) is globally recognized as a major health and socioeconomic issue. However, reported numbers vary and often represent subgroups. The number of hospital-admitted TBI has an important impact on hospital resources. Thus, the monitoring of hospitalized TBI patients is needed. In 2015, Oslo Neurosurgical TBI registry was established and includes patients admitted to Oslo University Hospital (OUH) with traumatic intracranial injury identified by neuroimaging. The aim is to introduce the registry; describe the patient group and volume.
Material and methods: Descriptive study from Oslo Neurosurgical TBI Registry.
Results: 1701 patients from South-east region were included in 2015–2018 (population 3 million). Mean age was 52 years (SD 24), 69% were males. Most frequent cause of injury was falls (55%), increasing with age. 27% was influenced by alcohol at time of injury. Preinjury antithrombotic therapy was common (25%). Most of the patients had multiple pathologies on CT caput, e.g. simultaneous cranial fracture, SDH, tSAH and brain contusion (four most frequent). Accompanying injuries were found in 48%. 37% was transported to OUH directly form accident scene. 27% was classified as severe TBI upon arrival OUH, 35% was intubated, and trauma team was activated in 77%. Median annual and monthly numbers of cases were 419 (range 384–480) and 36 (range 17–49), respectively. No clear change in case load between years and months, except a slight decline in March. Admission rate peaked during the weekend. Patients were continuously admitted throughout day and night, > 50% between 18:00 and 06:00.
Conclusions: Patients included in the Registry were older than those included in previous TBI studies. The numbers of cases admitted were stable across the months and years. However, the majority of patients were admitted during weekends and nights; thus handled by duty staff.

PR 160

Relationship between brain-body temperature difference and neurologic outcomes in patients with severe head trauma

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Introduction: Brain is one of the most vulnerable organ to temperature. The association between core body temperature(CT) and neurologic outcomes in patients with post-cardiac arrest, severe head trauma and stroke has been reported. There were few reports comparing brain temperature(BT) with CT and peripheral temperature(PT). We investigated the association of differences among BT, CT and PT with neurologic outcomes in patients with severe head trauma.
Material and methods: We retrospectively reviewed data for patients with severe head trauma who underwent monitoring intracranial cerebral pressure(ICP), BT, CT and PT simultaneously between January 2012 and December 2018.
Results: We evaluated 6 patients with a median age of 32 years (range 20–71 years). Glasgow Outcome Scale(GOS) at discharge were as follows: good recovery(GR) 2, severely disabled(SD) 1, vegetative state(VS) 2, death(D) 1. Table 1 showed the average values of ICP, cerebral perfusion pressure(CPP), BT, CT, PT, differences between each temperature (BT-CT, CT-PT, BT-PT) and GOS in each patients. There was remarkable difference between BT and CT in the dead patient, whereas less differences were found in the other alive patients. We found greater difference between BT/CT and PT in the VS patients than GR patients.
Conclusions: Greater differences between BT/CT and PT can be related to poorer neurologic outcomes

Fig. 1

Patiant(age, sex)	20♀	21♀	38♂	26♂	71♂	58♀
ICP(mmHg)	18.4	14.5	14.0	15.6	9.6	33.0
CPP(mmHg)	53.4	84.3	69.7	63.1	68.2	17.0
BT(°C)	37.5	37.0	36.5	36.8	35.9	33.1
CT(°C)	37.4	36.8	36.7	36.6	35.6	35.6
PT(°C)	36.7	35.6	33.2	33.7	29.6	35.3
Δ(BT-CT)(°C)	0.2	0.3	-0.2	0.2	0.3	-2.4
Δ(CT-PT)(°C)	0.7	1.1	3.5	2.9	6.0	0.2
Δ(BT-PT)(°C)	0.8	1.4	3.4	3.2	6.4	-2.2
GOS	GR	GR	SD	VS	VS	D

Abbreviations: BT, brain temperature; CT, core body temperature; PT, peripheral temperature

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Rossi S et al. J Neuerol Neurosurg Psychiatry 71: 448–454, 2001

PR 161

Neurosurgical traumatic brain injury (TBI) caseload in South-Eastern Norway

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Introduction: In Europe TBI is a leading cause of death and disability. The major trauma hospital in South-Eastern Norway is located at Oslo University Hospital (OUH). Around 3.000.000 inhabitants live in the catchment area, and the only neurosurgical service is located at OUH. Thus, all TBI patients needing neurosurgery in this region are transferred to OUH. To gain insight into the caseload of neurosurgical TBI a prospective registry has been implemented at the Dept. of Neurosurgery. Here we present some early results from the first years of registration.

Material and methods: From 01.01.15 all TBI patients admitted to OUS with a positive initial head CT and a Norwegian social security number have been included in the OUS TBI Registry, which is approved by the data protection officer. Relevant data were entered in the MedInsight database.

Results: In the period 01.01.15–31.12.18 a total of 1701 TBI patients with positive initial head CT were admitted to OUS, of them 31% females. According to Head Injury Severity Scale 29% were severe. The main pathology was traumatic subarachnoid hemorrhage, acute subdural hematoma, and brain contusion. On average 207 TBI procedures were performed each year, of them the most frequent indications were ICP monitoring (23%), craniotomy with evacuation of mass lesion (16%), and CSF diversion (7%). ICU treatment was necessary for 69% of the patients and for a median of 3 days.

Conclusions: The estimated incidence of neurosurgical TBI was 14.1/100.000. A high number of patients demanded ICU treatment and advanced neuroimaging. In line with other studies we find that TBI is a silent and resource-demanding epidemic needing attention from society and health administrators.

PR 162

Mild traumatic brain injury: head CTs at a busy emergency department

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Introduction: Minor head traumas are difficult to assess even with guidelines, hence head CTs are often requested. As head CTs are increasingly accessible, the demand on the radiology department often exceeds its capacity. There has been an increase in head CTs at the Oslo emergency department (OED), Norway. The Scandinavian guidelines for initial management of head injuries in adults (SG) is standard practice in the OED when assessing patients with head trauma.The aim of this study is to assess the number of patients with traumatic brain injury, evaluate guideline compliance and false negative initial reports by junior radiologists.

Material and methods: A consecutive cohort of 2000 patients from Jan-June 2016 who received a head CT at OED due to minor head trauma was assessed. Data was gathered from the CT request form, radiology report and CT images. The data points analyzed were: type of trauma, GCS, anticoagulants, loss of consciousness, nausea and vomiting, positive traumatic CT findings, and number of head CTs within a 5 year period.

Results: Intracranial bleeds were reported in 100 (5%) patients, 5 (0.25%) required neurosurgical intervention. Skull fractures were reported in 10 (0.5%) patients, however no intracranial bleeds were present. It was impossible to assess guideline compliance because 40% of the referrals lacked adequate clinical information. Ten bleeds were missed, however no further action was needed. 20% received more than 2 head CTs in 5 years

Conclusions: Head injury guidelines can improve clinical practice and reduce unnecessary CT scans; thus minimizing radiation exposure. Based on the low number of positive findings, we hypothesize that SG compliance can be improved at OED. Compliance was not assessable for nearly half of the patients, due to vital clinical factors missing. Implementation of a standardized CT referral form based on the SG and educating junior ED doctors may decrease the number of unnecessary head CTs.

References: No references.

Fig. 1

Type of hemorrhage	Number of patients	Intervention
Epidural hematoma	10	1 craniotomy 1 burr hole evacuation 7 control CT
Subdural hematoma	32	1 craniotomy 2 burr hole evacuation 1 operation 20 control CT
Traumatic subarachnoid hemorrhage	36	22 control CT
Contusion	7	6 control CT
Intracerebral hemorrhage	4	3 control CT
Combined	11	10 control CT
Skull fracture	10	3 control CT

NEW TECHNIQUES AND FUTURE DEVELOPMENT

PR 193

"The rationale for the use of bone allograft impregnated with an antibiotic"

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Introduction: To date, there is no ideal allograft that provides local antibiotic release. Along with this, existing fillers are expensive material, which complicates their application in practice. All this leads to the need to look for new ways to solve this problem.
Material and methods: Gentamicin was used as an antibacterial drug because of its wide spectrum of action and thermal stability. For the study, Staphylococcus aureus ATTC 1518 was used as a microbial strain. The antibiotic release from the studied materials was determined by equilibrium dialysis over the entire observation period. Gentamicin antibiotic concentration was determined by HPLC.
Results: An allograft impregnated with an antibiotic, prepared according to the Marburg system in the area of the subcortical part of the bone, suppresses the Staphylococcus aureus ATTC 1518 strain twice as much as Perossal. When comparing bone allografts impregnated in various ways, the longest release time showed a perforated allograft.A bone graft impregnated with an antibiotic by incubation showed a 9% longer release time compared to Perossal granules ($p < 0.05$).When in vitro incubation of the antibiotic gentamicin with the drug "Perossal", the dissociation rate is more than 97% in the first two days. When the antibiotic gentamicin with a bone allograft is incubated in vitro on the second day, dissociation into the extracellular space makes up more than 56% of the drug from the previously bound ($p < 0.05$), which also indicates a longer release time from the bone allograft.
Conclusions: In vitro, a bone allograft impregnated with an antibiotic is able to reversibly bind the antibiotic gentamicin and gradually release it over a period of 7 days. The use of a bone allograft impregnated with an antibiotic suppresses the growth zones of Staphylococcus aureus strains.
References: Rudenko A., Impregnation of the bone allograft: Comparison of heads coloring. European Journal of Trauma and Emergency Surgery 2019 (Suppl) P.70

Fig. 1

Fig. 2

PR 194

Acute appendicitis and pregnancy: from incidence to modern management: literature review and proposal for consensus ESTES experts guidelines

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Introduction: Acute abdominal pathology during pregnancy has historically been a challenging decision for the emergency surgeon, that had to deal with 2 patients at same time. Acute appendicitis has probably the highest prevalence of all. Early involvement of the gynaecological team was considered paramount and the ongoing debate laparoscopic versus open intervention, has been more recently challenged by case reports where antibiotics alone have been a successful strategy.
Material and methods: Literature review has been conducted by the investigating team, using the following search algorithm: 2 reviewers screened PubMed portal to conduct a thorough search of the 3 most important medical databases, Cochrane's Library, Medline and Embase. Case reports and low quality case series have been excluded from the literature review.
Results: There is currently no general consensus in regards to operative strategy in acute appendicitis during pregnancy, but most authors described safety of laparoscopic intervention in the first 2 trimesters and favoured open approach in a mother closer to term. The antibiotic treatment alone can only be considered in presumed early appendicitis, where there are no features of pending perforation, presence of phlebolith or established peritonitis and should be done under the close monitoring of experienced general surgeons.
Conclusions: An expert consensus is required in first instance, (set of questions submitted to audience at end of presentation for their expert opinion) regarding optimal treatment strategy in acute appendicitis during pregnancy, followed by a multicenter prospective randomised control trial, which we are hopeful to engage with help of numerous European hospitals where ESTES members activate.

PR 195

Tension relief system and regulated oxygen and irrigation negative pressure wound therapy (ROI-NPT) for primary closure of large deep tissue pressure injuries

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Introduction: Deep tissue pressure injuries (DTPI) are complex and difficult to treat. The higher prevalence is observed in paraplegic and elderly populations. Primary closure of large, stage-4 DTPIs is rarely feasible and flap closure is customarily applied. Presented is a technique using tension relief system (TRS; TopClosure® tension relief system) and regulated oxygen and irrigation negative pressure wound therapy (ROI-NPT; Vcareα®) to facilitate simple primary wound closure of DTPIs.
Methods: Large, stage-4 DTPIs were closed by a limited surgical procedure entailing conservative debridement, en-bloc primary wound closure based on the application of TRS and ROI-NPT.
Results: Details of the closure of consecutive 10 large DTPIs in 9 patients is presented. Immediate primary closure was achieved in 7 cases, while three others were closed over 6–45 days. Surgery time ranged between 1.5 and 3 h and hospitalization between 8 and 37 days. Following a median follow-up of 19 months (range 1–42 months), all wounds healed with one late recurrence. Post-operative wound infection observed in one patient was successfully treated with systemic antibiotics. Minor skin damage inflicted by the tension sutures at the anchoring sites healed spontaneously. Gradual return to partial loading of the operated area was enabled within 1–4 weeks and full weight-bearing was achieved within 4–6 weeks.
Conclusions: TRS extends skin stretching capacities and secures wound closure. Local cleansing and decontamination of infected wounds are achieved through ROI-NPT. Both TRS and ROI-NPT allow for early or immediate primary closure of DTPIs by a simplified surgical procedure.
Moris Topaz is the inventor and patent holder of TopClosure® and Vcareα®

PR 196

Evidence-based strategies for the prevention of chronic pain after traumatic injuries

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Introduction: Chronic pain is a disabling condition affecting 50–85% of trauma patients. [1]Considering the burden of chronic pain, interest in interventions to prevent this disorder after trauma has grown. A descriptive review of literature was undertaken to assess the evidence on these interventions.[1]
Material and methods: Medline, CINAHL and Cochrane Library databases were searched to identify interventional studies published up to August 2019. Websites of injury, critical care and pain organizations were also consulted to retrieve relevant guidelines. The literature search used combinations of Medical Subject Headings and keyword under the themes of pain, trauma, surgery and preventive interventions.
Results: Many knowledge syntheses relevant to the population of trauma published between 2016 and 2019 were found. [1]Low to moderate level of evidence was reported for pharmacological interventions such as the administration of ketamine, neuropathic pain medication and multimodal analgesia. Local or regional nerve block in the presence of factures was associated with a high level of evidence. Very low to low evidence was described for non-pharmacological interventions including cryotherapy and early mobilization. Finally, psychological interventions were associated with a low to moderate level of evidence and multimodal pain management interventions (pharmacological and non-pharmacological) with a high level of evidence.

Conclusions: Research is still needed to define the role of interventions to prevent chronic pain in trauma patients. Thus far, multimodal pain management interventions involving multidisciplinary team management appear to be the most promising. Implementing such interventions could reduce the negative consequences associated with chronic pain.

References:

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PR 197

Tapering opioids to prevent chronic use after trauma: is it possible?

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Introduction: Chronic use of opioids has been documented 60% of trauma patients.[1] Accordingly, the Tapering Opioids Prescription Program in Trauma (TOPP-Trauma) was developed.[2] The aim of this study was to assess the feasibility of TOPP-Trauma and explore the efficacy of TOPP-Trauma in reducing opioid use.

Material and methods: A 2-arm pilot RCT was conducted in patients presenting a high risk for chronic opioid use. We aimed to recruit 50 participants to receive either TOPP-Trauma or an educational pamphlet. TOPP-Trauma comprised educational and counseling sessions. The feasibility assessment of TOPP-Trauma was based on the ability to provide its components. The morphine equivalent dose (MED) per day as well as pain intensity and pain interference with activities were measured at 6 and 12 weeks following discharge.

Results: Preliminary findings based on data collected in 30 participants showed that 4 counseling sessions were most frequently needed to completely taper opioids. Sessions attendance reached 70%. Nearly 70% of eligible patients accepted to participate and an attrition rate of 23% was found. Even though the experimental group consumed a higher MED 24 h prior to hospital discharge compared to the control group (77.1 vs 54.8), its MED/day intake was lower at 6 weeks (1.0 vs 9.20) and 12 weeks (0 vs 3.8). These self-reported data were validated by the total MED delivered by participants" pharmacy at both time points (500.6 vs 561.3 at 6 weeks; 500.6 vs 949.3 at 12 weeks). Minimal mean score differences were observed in both groups with regard to pain intensity and interference with activities.

Conclusions: Data collected until now provided evidence on the feasibility of TOPP-Trauma and on the program potential efficacy. Challenges that will require to be addressed in future RCT include the acceptance to take part in the study and participants' drop out.

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Pagé et al. (2019). Ann Surg.
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PR 198

Femoral Neck System: first clinical results of a new technique in surgical fixation and stabilization of femoral neck fractures

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Introduction: Head preserving surgical treatment for AO-type 31B fractures with little to no dislocation consists of three canullated screws or a Dynamic Hip Screw (DHS). There is a new alternative: the femoral neck system (FNS). The FNS has some advantages over DHS. The anti-rotation screw provides extra rotational stability because of the diverging design. Furthermore, the incision is smaller in FNS and only one locking screw is necessary for plate fixation.
We present the first results of this new surgical fixation of femoral neck fractures with FNS.

Material and methods: During the period of November 2018 until October 2019, all patients with femoral neck fractures treated with FNS, were included in this prospective single center cohort study. Patient characteristics, fracture classification (AO, Garden, Pauwel), perioperative parameters and postoperative complications were registered. Patients were allowed to mobilize based on the principle of permissive weightbearing. Follow up was planned after 6 weeks and 12 weeks. Primary outcome measure was cut-out rate within 3 months.

Results: Twenty-four patients with a femoral neck fracture (AO-type 31B) were surgically treated with FNS. Median age was 58, (range 47–75). Median operation time was 33 mins (range 16–49). Mean duration of in hospital stay was 4 days (range 1–12 days). Twenty-two (91,67%) patients completed the regular follow up of 12 weeks. One patient (4%) had a reoperation due to a cut-out. During follow up one patient developed a wound-infection (4%) which was treated with intravenous antibiotics

Conclusions: Femoral Neck System as surgical treatment for femoral neck fractures shows promising first results. Low cut-out rate, limited operation time, low mortality and short duration of in-hospital stay make this device a possible alternative for DHS of canullated screws. Definitive conclusions should be made after studying long term results in larger cohorts.

References: None.

PR 199

New personalized approach to enteroatmospheric fistulas using 3D bioprinting device

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Introduction: Enteroatmospheric fistula is a challenge for surgeons. It presents a great clinical variability. This diversity means that, despite having tried multiple devices and techniques to achieve local control of the intestinal effluvium over the rest of the wound, there is currently no technique that can solve this problem in all patients. 3D printing is a novel therapy that allows the customization of the devices according to the needs of each patient.

The aim of this study is to describe the technique of manufacturing a custom device designed by bioscanner imaging and manufactured using a 3D printer for use in the management of enteroatmospheric fistula. We describe our initial results.
Materials and methods: We present four patients with enteroatmospheric fistula. The intestinal segment involved, the dimensions of the wound, the intestinal debit and the size of the exposed intestinal surface are substantially. All require an average of 4–5 daily cures by the nurse. After obtaining images of each fistula with a bioscanner, a personalized device was designed and made by a 3D printer. The polycaprolactone device was placed including inside the fistulous orifices and surrounding it with NPWT in order to accelerate the healing of the wound to ostomize the fistula or achieve its definitive closure.
Results: Four devices with different designs have been manufactured. The wound remained isolated from the intestinal contents after placement, favouring the granulation of the surrounding tissue with NPWT and thus avoiding contamination of the wound. The system remained without leaks for an average of 48 h, reducing the need for daily cures, improving patient comfort and avoiding complications.
Conclusions: The use of a manufacturing model using 3D bioprosthesis printing in order to create a personalized device that fits the characteristics of the patient's wound is feasible and offers promising results in the management of enteroatmospheric fistulas.

PR 200

New approaches in bone tissue engineering: innovative scaffold design for principle unlimited size bone substitutes

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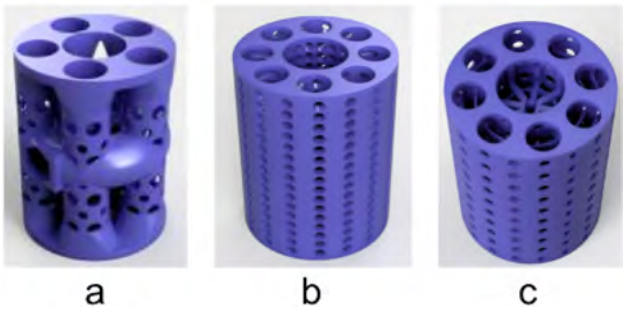
Introduction: In Bone Tissue Engineering (BTE), autologous bone-regenerative cells are combined with a scaffold for large bone defect treatment. Microporous, polylactic acid scaffolds showed good healing results in bone defects in small animals. Transfer to large animal models, however, is challenging and not easily achieved simply by upscaling the design. Increasing diffusion distances has a negative impact on cell survival and nutrition supply. This can lead to cell death and ultimately implant failure.This approach focuses on scaffold architectures, that meet all the requirements for a modern bone substitute. Biological-functional, porous subunits in a load-bearing, compression-resistant frame structure characterise the innovative design. An open, macro- and microporous internal architecture provides optimal conditions for oxygen and nutrient supply in the inner areas of the implant by diffusion.
Material and methods: During the design process, 3 prototypes (Temple (Figure a), Grid (Figure b), Onion (Figure c)) were 3D-printed (Fused Filament Fabrication) using polylactic acid (PLA). - After incubation with Saos-2 (Sarcoma osteogenic) cells for 14 days (measurements on days 1, 7, 14 and 21), cell morphology, distribution and survival (fluorescence microscopy, LDH-based cytotoxicity assay), metabolic activity (MTT test) and osteogenic gene expression were determined.
Results: All designs not only showed cell colonization, but cells also sustained their ability to differentiate (already after 14 days) and to divide.
Conclusions: The open, hierarchical-structured design, with its innovative porous structure, provides a good basis for cell settlement and proliferation. The modular design allows easy upscaling and offers potential solutions to previous limitations scaffold developement in Bone Tissue Engineering.
References:

Fig. 1



PR 201

The value of 3D reconstructions in determining post-operative reduction in acetabular fractures: a pilot study

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Introduction: In patients with acetabular fractures, the reconstructed three-dimensional (3D) model of the contralateral acetabulum could be used as a mirrored template for the anatomic configuration of the affected joint. This has not been validated.
Material and methods: Computer Tomography (CT)-scans of twenty patients with unaffected acetabula were used. The symmetry of the generated 3D models was evaluated through; (1) mirroring of the acetabulum; (2) initial rough matching; (3) automatic optimisation of the matching via surface-based matching; (4) calculation of distances between surfaces by evaluating the Euclidean (straight-line) error distance between the closest points between left and right. The percentages of surface-points of the left and right acetabulum with a distance smaller than 0.5, 1.0, 1.5 and 2.0 mm were calculated and evaluated, in relation to Matta's criteria, for acetabular fracture reductions. The analysis was performed using the mirrored left acetabulum matched onto the right original structure (left mirrored to right original; "LM2RO") and the right mirrored to left original (RM2LO). To determine the inter-observer agreement the procedure was repeated by a second assessor for the first ten patients.
Results: Patients had a mean ± SD age of 39.6 ± 15.6 years, 56% was male. The mean distance deviation was less than 0.75 mm in all 40 comparisons. The calculated distances in 90.7% of the surface points of the left and right acetabulum were below the tolerance threshold of 1.0 mm, based on Matta's anatomical reduction critera (table 2). Absolute differences between assessors were< 0.5 mm per patient with an overall moderate agreement of 70%.
Conclusions: 3D reconstructed models of healthy left and right acetabula are highly similar and could potentially be used as mirrored duplicates. The next step will be to investigate these results in patients with reduced acetabular fractures.

References: Matta, J. (1996).*J Bone Joint Sur Am. 1996;78:*1632–45

Fig. 1

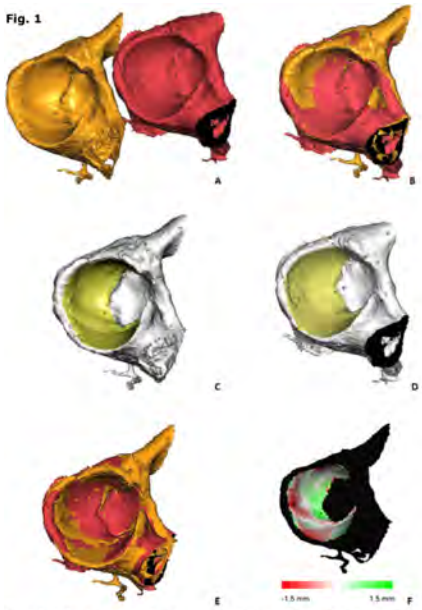


Figure 1: A) Original right (red) and mirrorred left (orange). **B)** Rough registration using point-based registration. **C-D)** Selection of the articular surface of the acetabulum (orange) used for the ICP algorithm. **E)** Refined matching as a result of applying the surface-based registration. Black parts in the model are excluded from further analysis, as they are not part of the articular surface.

Fig. 2

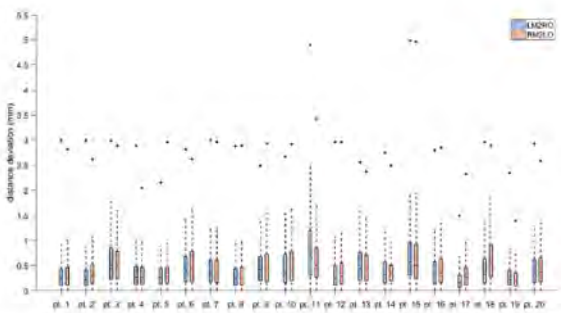


Figure 2: Boxplot of the calculated distances between the two 3D models. Blue represents LM2RO registration, and red represents the RM2LO registration. The asterisk symbols represent the maximal values in the dataset.

Fig. 3

Table 1: The mean error, standard deviation, 95th percentile and the average of the maximal deviations for the symmetry comparison, computed for both separate registration groups and the combination of groups.

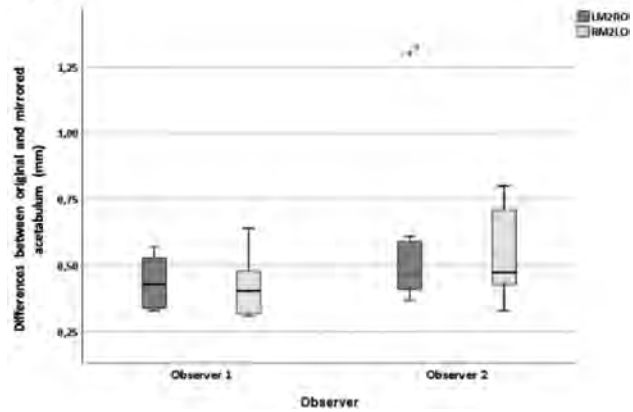
Registration group	Mean error (mm)	Standard deviation (mm)	95th percentile (mm)	Average of maximal deviations (mm)
RM2LO	0.45	0.44	1.28	2.93
LM2RO	0.46	0.42	1.24	2.80
LM2RO & RM2LO	0.46	0.43	1.26	2.86

Fig. 4

Table 2: Symmetry parameters calculated for both groups (LM2RO & RM2LO).

Tolerance threshold	Mean surface (%)	Standard deviation (%)	Maximal surface (%)	Minimal surface (%)
0.5 mm	66.7	12.8	86.7	37.5
1 mm	90.7	7.3	99.0	64.8
1.5 mm	96.9	3.1	100	87.4
2 mm	98.7	1.6	100	94.1

Fig. 5



PR 202

Minimally invasive plate osteosynthesis technique for distal humeral fracture: a cadaveric study

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Introduction: In our study we want to evaluate the feasibility of minimally invasive plate osteosynthesis (MIPO) technique for distal humeral fracture using anatomically precontoured double plate osteosynthesis.

Material and methods: Eight elbows from four Thiel fixed cadavers were included. On unfractued cadavers we tested the minimally invasive approach with two separate incisions, one at the lateral and one at the medial epicondylus. The preformed plates were inserted directly into the bone on sides and fixed with percutaneous screws. Then we created an AO Type A3 and C3 fracture. The reduction was performed under X-ray control and stabilized with K-wires. Then we also inserted the plates in MIPO technique. In the case of an intraarticular fracture, an olecranon osteotomy was additional performed in a minimal invasive way to control the distal humeral joint surface. After finishing reduction and fixation the approach were extended to control the fracture alignement, position of the plates and to expose the ulnar nerve.

Results: The plate position was satisfactory and we could not detect any major soft tissue damage or ulnar nerve injury by using the minimally invasive plate osteosynthesis technique.

In the extraarticular fractures, reduction was achieved with K-wires and was acceptable in all cases. The intra-articular fractures were controlled by an additional olecranon osteotomy using the MIPO technique with a good view on the joint surface of the distal humerus.

Conclusions: The findings of the present study show that MIPO technique in distal humerus fracture is feasible and save especially for AO type A fractures. In AO type C fractures the olecranon osteotomy provided enough visibility to evaluate the distal humeral joint surface.

The surgical technique is demanding, and care must be taken not to injure the ulnar nerve.
Never the less it is an effective surgical treatment method and an alternative option to open techniques.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 203

Correlation between pelvic incidence and acetabular orientation in anteversion and inclination—an analysis based on a 3D statistical model of the pelvic ring

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Introduction: The pelvic ring is a complex bony structure with a central role for the human"s mobility building the connecting part between the upper body and the lower extremities. Pelvic incidence and acetabular orientation are two important parameters used in the description of pelvic anatomy and are of central importance for understanding the biomechanical interaction of spine, pelvis and hip joints.
The objective of the study was the analysis of a potential correlation between pelvic incidence and acetabular orientation.
Material and methods: A 3D statistical model of the pelvic ring consisting of 100 individual CT scans of european adults without bony pathologies was used to analyse pelvic incidence and acetabular orientation in anteversion and inclination. An additional analysis on the correlation between those parameters was performed using the software SPSS.
Results: A slight positive correlation between pelvic incidence and acetabular anteversion could be shown ($r = 0.223$; $p = 0.019$) as well as a strong positive correlation between anteversion and inclination ($r = 0.570$; $p < 0.001$). Pelvic incidence and acetabular inclination showed none statistically significant correlation ($r = 0.102$; $p = 0.311$).
Conclusions: The results of the study might contribute to a better understanding of the biomechanical interaction between the axial skeleton and the lower extremities and deliver valuable information concerning preoperative planning in orthopaedic and trauma surgery of the lumbar spine, the pelvis and the hip joints like for example reconstructive surgery after trauma, operative treatment of congenital or acquired deformities or total joint arthroplasty.
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PR 204

New treatment option for comminuted distal clavicle fractures: the Lockdown device

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Introduction: The majority of distal clavicle fractures (DCFs) are displaced fractures and are prone to delayed- or non-union.[1] There are several options for surgical reconstruction, open reduction and fixation or hook plate, but in patients with a comminuted or small fracture they are known to have a high complication and failure rate, and secondary surgery for removal is often necessary. We hypothesize that resection of the distal fracture fragment and subsequent stabilization with the Lockdown device, is an alternative for selected patients with DCFs.
Methods: Eleven patients with a comminuted DCF were treated with a Lockdown device. Data on pain and range of motion were documented and the Constant shoulder score (CSS), Oxford Shoulder Score (OSS) and Nottingham clavicle score (NCS) were assessed at one year follow-up.
Results: Eight patients underwent surgery within 2 weeks, compared to 3 patients where the surgery was delayed (> 2 weeks) due to persisting pain and delayed-union. None of the patients had postoperative complications. In 3 months after treatment, 10 patients were complaint-free. One patient had hardware removal due to pain at the site of the screw head. Four patients were assessed after one year follow-up. The mean pain score was 3.2. The mean flexion 142,5°, abduction 120,5°, exorotation 56° and extension 54°. The CSS had a mean of 21.75, OSS 43.75 and the NCS a mean of 70.
Conclusions: All 11 patients had a good short-term clinical outcome and hardware complications did not occur. We are the first to describe the use of the Lockdown device in DCFs. This device is not dependent on fracture healing and secondary surgery is not necessary, therefore it can be an alternative in the treatment of DCFs. A larger series and longer follow-up is necessary to confirm this conclusion. In this ongoing study, the remainder seven patients will be included and presented at the ESTES.
Reference: 1. Kihlstrom C et al. *BMC Musculoskelet Disord*. 2017;18(1):82.

PR 205

Evaluation of the accessibility of the tibial plateau areas by the different approaches: a cadaver study

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Introduction: The most important aspect in the treatment of tibial head fractures is the anatomical reconstruction of the joint surface.

Moore type I tibial head fractures are one of the most challenging fractures to treat.

Material and methods: We performed the following approaches on eight thiel fixed cadavers: the anterolateral (with an osteotomy of the tuberculum Gerdyi, a subcapital fibula-osteotomy and an osteotomy of the tuberositas tibia), the medial approach (with submeniscal arthrotomy and a dissection of the medial collateral ligament) and the posterior approach with a submeniscal athrotomy. The reachable borders of the articular joint surface have been marked by a k-wire. The visual joint surface has also been radiographically documented by inserting K-wires into the tibia head. Finally the results have been photo documented on the exarticulated joints.

Results: The reachable areas of the articular surface have been defined and documented. The combination of the subcapital fibulaosteotomy and the submeniscal arthrotomy showed the most increase in accessibility to the articular surface in the dorsal part. An additional osteotomy of the tuberculum Gerdyi increased the vision on the entire lateral and anterior articular surface. The submeniscal arthrotomy, at the medial approach, has not a good view on the surface. The posterior approach showed only a limited view on the lateral and medial articular surface at the dorsal part. None of the surgical approaches sufficiently visualizes the intercondylar region.

Conclusions: A fracture-specific approach strategy is critical for the preoperative planning of complex tibia-head fractures. Subcapital fibula osteotomy is the most efficient surgical approach to reach the posterior and lateral articular surface. For the anterior articular surface, the best overview was achieved by an osteotomy of the tuberculum Gerdyi. It was not possible to see and control the intercondylar region with any approach.

Fig. 1

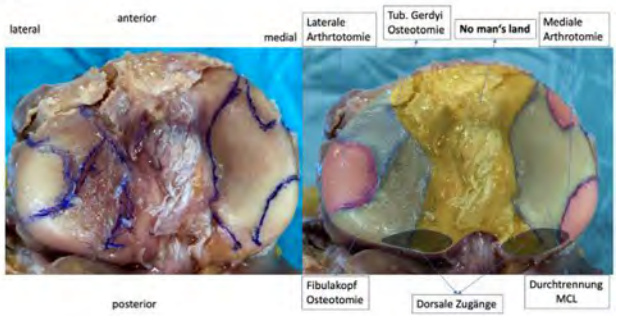
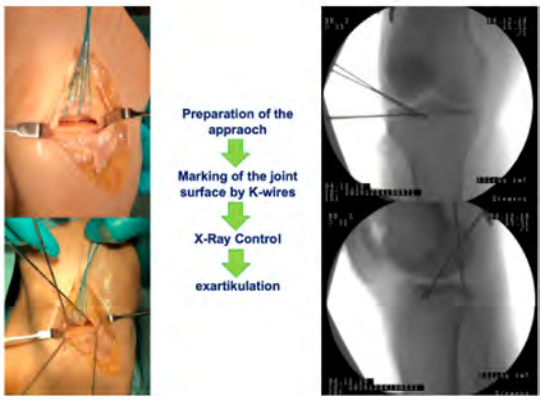


Fig. 2



PR 206

Treatment of osteosarcoma cells: cold atmospheric plasma and its influence on the membrane integrity

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Introduction: Osteosarcoma (OS) is the most common bone carcinoma in humans. At the time of the first diagnosis are already in about 20% metastases present. The current treatment strategies include above all radical surgical resection and chemotherapy. In the search for alternative therapy methods. Treatment with cold atmospheric plasma (CAP) shows promising prospects. At the cellular level, this leads to various cellular mechanisms and finally to induction of anticancerogenic effects such as growth inhibition, apoptosis, and changes in the cell-cell interactions. The impact of CAP on the Integrity of the Cell Membrane of OS cells, however, is unknown.

Material and methods: Suspended cells from two human osteosarcoma cell lines (U2-OS, MNNG) were treated for 10 s, 30 s, and 60 s with CAP. *Cell proliferation* was determined after 4 h, 24, 48, 72, 96 and 120 h using CASY Cell Counter. Dye Loss Assay was performed by using fluorescein diacetate (FDA). This was followed by indirect treatment with CAP for 60 s. In the cell-free supernatant was determined by TECAN Multireader the dye emission. Flow cytometry assay was used after CAP treatments and incubation with FDA. The mean FDA fluorescence intensity of individual cells in the flow cytometer was measured.

Results: Cell kinetics showed significant inhibition of cell proliferation in both cell lines after CAP treatment. The assays for determination of the dye level showed a significantly increased membrane permeability of both cell lines after CAP treatment. The significant effect on the membrane integrity correlated with treatment duration.

Conclusions: This confirms a modulating influence of CAP on the functionality of the cell membrane and may support the anti-proliferative effect of the CAP treatment. Thus, CAP is a promising therapy option, especially for chemotherapy-resistant entities

PR 207

Cold atmospheric plasma as a possible supplementation in the therapy of osteosarcoma

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Introduction: Osteosarcoma (OS) is the most common bone cancer in humans. Standard therapy includes radical surgical resection and chemotherapy, but due to strong toxic effects, new treatment options are urgently needed. Currently, there is a discussion about expanding the oncological therapy spectrum and treat with cold atmospheric plasma (CAP). It is a reactive ionized gas rich in radicals, photons, and electromagnetic rays. Its biological effects are primarily mediated by reactive oxygen and nitrogen species (RONS). Due to its low temperature, CAP is suited for medical applications. In vitro studies

have shown the antitumoral effect of CAP also for pancreatic cancer, melanoma, ovarian, breast, and colon cancer.
Material and methods: Human OS cell lines U2-OS and MNNG/HOS were used. *Proliferation assay.* The growth of CAP-treated cells was examined using a CASY Cell Counter. *Caspase 3/7 assay.* Following CAP treatment, the activities of Caspase-3 and Caspase-7 were measured using a specific substrate peptide coupled with a fluorescent dye (CellEvent™). *Single-cell gel electrophoresis Comet assay*. DNA damage after CAP treatment was identified using alkaline microgel electrophoresis. DNA migration was measured using Comet Score Software. The percentage of tail DNA was used to indicate the relative fluorescence intensity of the head and tail. *TUNEL assay*. After CAP treatment TUNEL analysis was performed.
Results: The results revealed that the CAP treatment of OS cell lines leads to significant inhibition of cell growth. Subsequently, the activation of Caspases and the induction of apoptotic DNA fragmentation was demonstrated. The treatment of OS cells with CAP leads to an induction of apoptosis and a reduction of cell growth.
Conclusions: CAP treatment of OS cells lead to inhibition of cell growth CAP-treatment and influenced the cell cycle regulation by inducing apoptosis. These properties of CAP are promising as a potential therapy of osteosarcoma.

POLYTRAUMA

PR 208

Extra peritoneal packing for exsanguinating pelvic hemorrhage: should we do it in the emergency room?

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Introduction: Extra peritoneal packing (EPP) is a quick and highly effective method to control pelvic hemorrhage. We hypothesized that this procedure may be as safely and efficiently performed in the emergency room (ER) as in the operating room (OR). Methods: Retrospective study of 29 patients who underwent EPP in the ER or OR in two trauma centers in Israel between 2008-2018.
Material and methods: Retrospective study of 29 patients who underwent EPP in the ER or OR in two trauma centers in Israel between 2008-2018.
Results: 29 patients were included in our study, 13 in the ER-EPP group and 16 in the OR-EPP group. The mean injury severity score (ISS) was 34.9 ± 11.8. Following EPP, hemodynamic stability was successfully achieved in 25 of 29 patients (86.2%). A raise in the mean arterial pressure (MAP) with a median of 25 mmHg (mean 30.0 ± 27.5, P = 0.000009) was documented. All patients who did not achieve hemodynamic stability after EPP had multiple sources of bleeding or fatal head injury and eventually succumbed. The overall mortality rate was 27.5% (8/29) with no difference between the OR and ER-EPP groups. Patients who underwent EPP in the ER showed higher change in MAP (P = 0.0458). No differences were found between ER and OR EPP in the amount of transfused blood products, surgical site infections and length of stay in the hospital. However, patients who underwent ER EPP were more prone to develop deep vein thrombosis (DVT): 50% (5/10) vs 9% (1/11) in ER and OR-EPP groups respectively (P = 0.038).
Conclusions: EPP is equally effective when performed in the ER or OR with similar surgical site infection rates but higher incidence of DVT. Level of evidence: Retrospective cohort study, level IV.

Fig. 1

Figure 2: Mean arterial pressure (MAP) before and after EPP in all the cohort

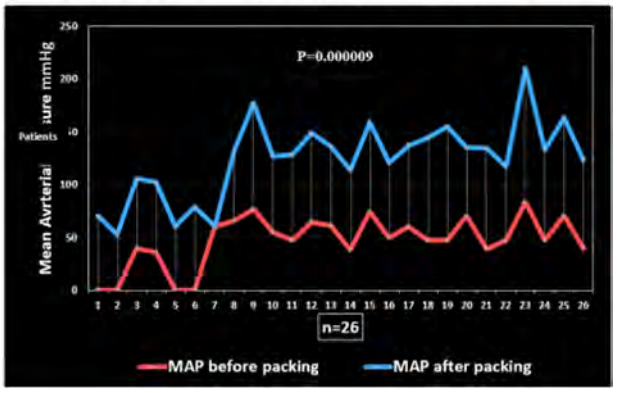
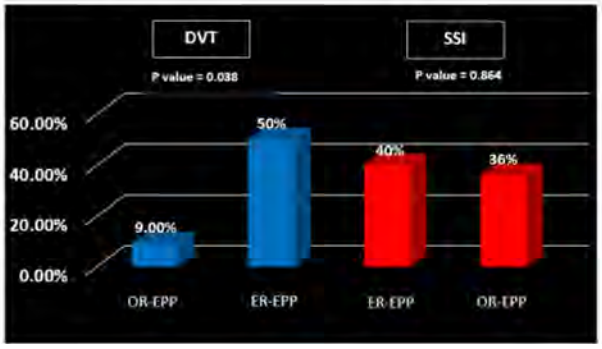


Fig. 2

Figure 3: Deep vein thrombosis (DVT) and surgical site infection (SSI) rate after EPP



PR 209

Supraacetabular schanz screw insertion with the 2-2-2-20-20 concept

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Introduction: Application of supraacetabular Schanz screws is usually performed under image intensifier guidance. The aim of this study was to perform it without imaging, with the hypothesis that, respecting anatomical landmarks, pre- and intraoperative fluoroscopy can be avoided.
Material and methods: Insertion of the supra-acetabular Schanz screws was performed in 14 human adult cadavers. With cadavers placed in supine position, the anterior superior iliac spine (ASIS) was palpated. Starting from this landmark, 2 cm were measured in a distal and 2 cm in the medial direction. At this point, a 2 cm long oblique skin incision was performed. Through this approach, 150 mm Schanz screws were drilled bilaterally into the supra-acetabular corridor with an angulation of 20° to distal as well as 20° to medial. Combined obturator oblique-outlet views (COOO) were taken bilaterally to prove the screw position. Six of the specimens underwent a 3D-CT-scan. Images were evaluated concerning correct screw positioning. Skin and subcutaneous tissues were removed in the ilioinguinal region and possible lesions to the lateral femoral cutaneous nerve (LFCN) or to the joint capsule were evaluated.
Results: During radiographic evaluation of the COOO-scans (14 specimens) and the 3D-scans (6 specimens), the Schanz screws were placed inside the supra-acetabular corridor in all specimens (14/14). During dissections, no intracapsular screw placements or LFCN lesions were found.
Conclusions: Using our technique, all Schanz screws could be sufficiently inserted without intraprocedural X-ray imaging.
References:
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2. Mears, D. and F. Fu, External fixation in pelvic fractures. Orthop Clin North Am, 1980. 11: p. 465–479.
3. Mears, D. and F. Fu, Modern concepts of external skeletal fixation of the pelvis. Clin Orthop, 1980. 151: p. 65–72.

PR 210

Epidemiology of self-inflicted major trauma

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Introduction: In the United Kingdom, severely injured patients are taken directly to a Major Trauma Centre (MTC). Whilst deliberate self harm (DSH) is a known mechanism for this, there is limited prior research. 1-9% of major trauma is thought to be self inflicted[1,2]. Our aim was to describe the epidemiology of presentation to our MTC resulting from DSH.
Material and methods: Retrospective review of patient records in our MTC for adult trauma team activations between 01/07/2016 and 30/06/2018. Data was collected on patient demographics, location type, injury severity score (ISS), mechanism of injury and mortality.
Results: 194 episodes of DSH made up 6.4% of all trauma cases, involving 180 patients; 2.6% re-attended. Z-scores show no change in incidence over time, but significant variability month by month, with 6/24 months > 1SD from mean. Mean patient age 37 years (range 16-78). 67.8% were male. 64.9% came from residential location and 8.2% from prison. Most common mechanism was penetrating trauma (51.5%). In-hospital mortality was 10% (13.4% in males vs 3.4% in females, Chi^2 $p = 0.04$).
Conclusions: This is the largest review of self inflicted trauma cases in a UK MTC, with a similar incidence to prior studies. There was no observed correlation with season or trend over time. Mortality was higher in male patients, in keeping with national statistics on suicide, whilst DSH in females was linked to less severe injury; severity is related to mechanism of injury. Injury from self stabbing/cutting was most common in patients from residential locations, whilst hanging was more common in prisoners. This study identifies preventable risk factors for major self inflicted injury.
References:
Shepherd, L (2018) An audit of suicide attempt admissions over a four-year period in a UK Major Trauma Centre *Trauma*, *20*(2)94–99
Scottish Trauma Audit Group https://www.stag.scot.nhs.uk/Research/_docs/Major%20Trauma%20due%20to%20deliberate%20self%20harm%20%20QEUH%20study.pdf

PR 211

Decreased mortality in severely injured trauma patients during a 25-year period in a major Spanish trauma center

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Introduction: The distribution of trauma deaths was classically described following a trimodal pattern. During the last decade improvements in trauma care as damage control resuscitation (DCR) have minimized resuscitation injury. We hypothesized that the implementation of DCR in severely injured trauma patients is associated with less mortality and modifies mortality pattern.
Material and methods: We performed a 25-year (1993–2018) retrospective cohort analysis of all severely injured trauma patients (NISS $\geq$ 35) who underwent surgery at our Level 1 trauma center. Since 2005, DCR was implemented including damage control surgery, minimizing crystalloids and increasing the use of blood products. Our patients were stratified into two phases: pre-DCR (1993–2004) and post-DCR (2005–2018).
Results: A total of 308 patients were identified. There were 172 patients (55.84%) in the pre-DCR group and 136 patients (44.16%) in the post-DCR group. Mean age (35.17 vs 39.49, non significant (NS)), mechanism of injury (blunt trauma: 89.53% vs 86.76%, NS) and shock on admission (35.46% vs 36.02%, NS) were similar between groups. There is a significant reduction in the rate of overall mortality (44.18% vs 33.82%, $p < 0.05$). While early deaths from traumatic

brain injury (47.36% vs 47.82%, NS) and hemorrhage (39.47% vs 41.62%, NS) are alike, mortality secondary to multisystem organ failure (MSOF) is lessened (13.15 vs 6.52%, $p < 0.05$).
Conclusions: DCR has helped in reducing overall mortality and mortality due to MSOF in our severely injured trauma patients.

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PR 212

The mangled extremity severity score fails to be a good predictor for limb amputation in Central Europe

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Introduction: The Mangled Extremity Severity Score (MESS) was constructed as an objective quantification criterion for limb trauma. A MESS of or greater than 7 was proposed as a cut-off point for primary limb amputation. Opinions concerning the predictive value of the MESS vary broadly in the literature. The aim of this study was to evaluate the applicability of the MESS in a contemporary civilian Central European cohort.
Material and methods: All patients treated for extremity injuries with arterial reconstruction at two centres between January 2005 and December 2014 were assessed. The Mangled Extremity Severity Score (MESS) and the amputation rate were determined.
Results: Seventy-one patients met the inclusion criteria and could be evaluated for trauma mechanism and injury patterns. The mean MESS was 4.97 (CI: 4.4–5.6). Seventy-three percent of all patients (52/71) had a MESS ≤ 7 and 27% (19/71) of ≥ 7. Eight patients (11%) underwent secondary amputation. Patients with a MESS ≥ 7 showed a higher, but statistically not significant secondary amputation rate (21.1%; 4/19) than those with a MESS ≤ 7 (7.7%; 4/52; $p = 0.20$). The area under the ROC curve was 0.57 (CI 0.41; 0.73).
Conclusions: Based on these results, the MESS seems to be an inappropriate predictor for amputation in civilian settings in Central Europe possibly due to therapeutic advances in the treatment of orthopaedic, vascular, neurologic and soft tissue traumas.
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PR 213

Do the time courses of the levels of the tissue-type plasminogen activator and the plasminogen activator inhibitor type-1 raise hopes of a therapeutic strategy for the acute respiratory distress syndrome in polytraumatized patients?

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Introduction: In polytrauma victims the acute respiratory distress syndrome (ARDS) is a major cause of morbidity and mortality. It presents a complex pathophysiology that is characterized by pulmonary activated coagulation and reduced fibrinolysis. Due to the fact that the pulmonary endothelium is considered a key modulator of ARDS and that tPA in plasma is predominantly synthesized and secreted by vascular endothelial cells, we hypothesized that the time courses of serum tissue-type plasminogen activator (tPA) and its main inhibitor, the plasminogen activator inhibitor type-1 (PAI-1), might indicate a clinical approach to preventing ARDS in polytrauma victims.
Material and methods: Twenty-eight consecutive polytraumatized patients with concomitant thoracic trauma, age ≥ 18 years, ISS ≥ 16, who were directly admitted to our level I trauma center, were evaluated. Blood samples were taken initially and on day 1, 3, 5, 7, 10, 14, and 21 during hospitalization. Luminex multi-analyte-technology was used for analysis of tPA and PAI-1 antigen levels.
Results: Both levels were particularly high at admission. Although they significantly declined within three and seven days, respectively, they remained elevated throughout three weeks. Throughout this observation period mean tPA antigen levels were higher in polytrauma victims suffering ARDS than in those without ARDS, whereas mean PAI-1 levels were higher in polytrauma victims sustaining pneumonia than in those without pneumonia. Noteworthy, in each patient, who developed ARDS, the tPA antigen level raised up to the onset of the syndrome and declined afterwards.
Conclusions: The development of ARDS has to be expected in a polytrauma victims if the tPA antigen level continues to rise after admission. Potentially, in patients with a low risk of excessive bleeding the onset of the syndrome might be prevented by the timely administration of recombinant profibrinolytic proteins.

PC 214

Motocross is a dangerous business: small bowell perforation case report

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Case history: A 19 year-old male, previously healthy, was admitted to the ED after being involved in a motorcross accident. He suffered blunt abdominal trauma.
Clinical findings: At admission, patient presented pale but haemodinamically stable. Physical examination was unremarkable except for an evident abdominal wall hematoma and abdominal guarding over the left quadrants.
Investigation/Results: Abdominal ultrasound showed an intestinal loop with decreased peristalsis with a small amount of liquid adjacent (Fig 1). Due to the patient's haemodynamic stability, CT scan was

performed (Fig 2.) which showed liquid in the left flank and iliac fossa, but without an identifiable intrabdominal lesion.

Diagnosis: The patient was admitted to the Operating Theatre with acute abdomen.

Therapy and Progressions: Intraoperatively fecal peritonitis was evident from a 3 cm-hole on the antimesenteric border of the jejunum, The enterotomy was closed and profuse lavage was done; the abdominal wall closed without drainage. The patient went through an empirical antibiotic cycle. Liquids per os were started on the first postoperative day and the patient progressed without issues. He was discharged at the 5th postoperative day. The remaining follow-up was uneventful.

Comments: Small bowel perforation after blunt abdominal trauma is rare. SBMI has a high morbidity and mortality that increase with delayed diagnosis; however, clinical and radiographic signs of perforation are often absent, like in the case presented. CT is considered the gold-standard. In our specific situation, the small bowel perforation did not produce any pneumoperitoneum in a young patient with very good physiologic status that kept him hemodynamically stable.

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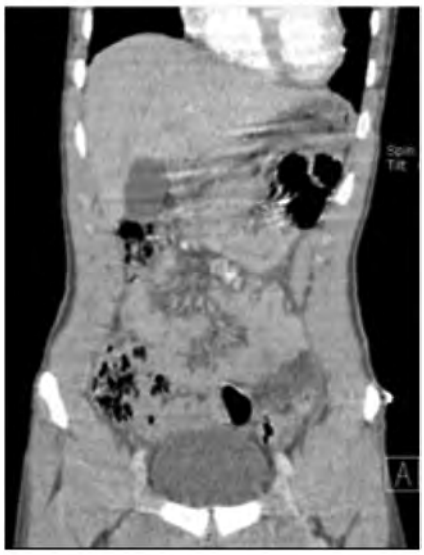
Fig. 1

Fig. 2



PR 215

The prognosis of pelvic injury is closely related to the severity of vascular injury rather than the complexity of bony fracture

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Introduction: Pelvic injuries are among the most dangerous and deadly trauma. Although complex pelvic fractures are often associated with vascular injuries, it is still unclear regarding the impact of the severity of vascular injury to the outcome of patients. We hypothesized that, in addition to the complexity of bony fracture, the severity of pelvic vascular injury plays a more decisive role to the patients" outcome.

Material and methods: Medical records of patients with pelvic fracture in a single trauma center between Jan 2016 and Dec 2017 were retrospectively reviewed. Those who had an abbreviated injury scale (AIS) ≥ 3 other than pelvis were excluded. Based on CT results, the type of pelvic fracture was classified according to Young-Burgess classification, and the severity of vascular injury were recorded as minor (fracture with or without hematoma) or severe (hematoma with contrast pooling or extravasation). The patient demographics, clinical parameters, and outcome measures were compared between the groups.

Results: Among the 156 patients, severe vascular injury were noted in 26 patients. Patients with severe vascular injuries had significantly increased amount of red blood cell transfusion (RBCT) (11.8 vs. 3.8 units, $p = 0.002$), longer ICU stay (IS) (3.1 vs. 1.0 days, $p = 0.011$) and total hospital stay (HS) (15.8 vs. 11.0 days, $p = 0.023$) compared to minor vascular injuries. On the other hand, those with complicated pelvic fracture (LC type II/III, APC type II/III, VS and combined type) had similar amount of RBCT and IS compared to that of simple pelvic fracture (LC type I, APC type I) except a longer HS (13.4 vs. 10.1 days, $p = 0.036$).

Conclusions: Our results indicated that the severity of vascular injury is more closely correlated to the outcome of patients with pelvic fractures than the type of bony fracture does. In addition to the type of bony fracture, the grade of vascular injury should be considered as an important part of pelvic injury classification.

Fig. 1

Table 1. The demographic data of all included patients.

	Pelvic fracture n=157
Age (yr)	44.4 ± 21.5
Sex (F/M)	85/72
Systolic blood pressure (mmHg)	125.4 ± 28.0
Heart rate (/min)	93.5 ± 17.9
ISS	8.07 ± 4.92
RTS	7.72 ± 0.41
TRISS	0.983 ± 0.023
Fracture type	
LC1	66 (42.0%)
LC2	41 (26.1%)
LC3	5 (3.2%)
APC1	5 (3.2%)
APC2	6 (3.8%)
APC3	0 (0.0%)
Vertical shearing	2 (1.3%)
Combined	22 (14.0%)
Unspecified	9 (5.7%)
CT findings	
Fracture only	38 (24.2%)
Soft tissue hematoma	93 (59.2%)
Hematoma with contrast pooling/ contrast extravasation	26 (16.6%)
Mortality	0 (0.0%)
ICU length (days)	1.4 ± 3.9
Hospital length (days)	11.8 ± 9.8

ISS, injury severity score; RTS, revised trauma score; TRISS, trauma injury severity score; LC, lateral compression; APC, anterior-posterior compression; VS, vertical shearing; CT, computed tomography.

Fig. 2

Table 2. Comparison of clinical parameters and outcome of minor and major vascular injury of pelvic fracture patients.

	Minor vascular injury n=131	Major vascular injury n=26	p value
Age (yr)	44.6 ± 20.8	43.6 ± 25.1	0.860
Systolic blood pressure (mmHg)	125.8 ± 27.1	123.8 ± 32.5	0.739
Heart rate (/min)	91.6 ± 15.9	102.9 ± 24.2	0.030*
ISS	6.9 ± 3.5	14.1 ± 6.6	<0.001*
RTS	7.757 ± 0.340	7.547 ± 0.628	0.109
TRISS	0.986 ± 0.013	0.964 ± 0.045	0.016*
ICU length (days)	1.01 ± 3.87	3.12 ± 3.55	0.011*
Hospital length (days)	11.01 ± 9.74	15.77 ± 9.05	0.023*
Blood transfusion (units)			
ER RBC	0.38 ± 1.51	2.42 ± 3.51	0.007*
ER FFP	0.34 ± 1.70	2.08 ± 3.22	0.012*
ER PLT	0.18 ± 1.48	0.92 ± 3.26	0.267
Total RBC	3.84 ± 11.10	11.846 ± 11.37	0.002*
Total FFP	2.16 ± 8.68	8.54 ± 13.85	0.031*
Total PLT	1.83 ± 10.36	10.15 ± 19.99	0.048*

ISS, injury severity score; RTS, revised trauma score; TRISS, trauma injury severity score; ER, emergency room
* Significant difference ($p<0.05$)

Fig. 3

Table 3. Comparison of clinical parameters and outcome between fracture types.

	Simple pelvic fracture n=80	Complicated pelvic fracture n=76	p value
Age (yr)	45.8 ± 22.5	43.0 ± 20.5	0.415
Systolic blood pressure (mmHg)	127.4 ± 25.8	123.8 ± 30.1	0.422
Heart rate (/min)	92.6 ± 18.4	94.2 ± 17.7	0.614
ISS	7.9 ± 4.7	8.3 ± 5.2	0.636
RTS	7.724 ± 0.459	7.719 ± 0.351	0.940
TRISS	0.982 ± 0.269	0.983 ± 0.190	0.708
ICU length (days)	1.14 ± 4.34	1.61 ± 3.39	0.456
Hospital length (days)	10.16 ± 9.17	13.43 ± 10.18	0.036*
Blood transfusion (units)			
ER RBC	0.63 ± 2.29	0.83 ± 1.94	0.549
ER FFP	0.45 ± 1.80	0.82 ± 2.43	0.289
ER PLT	0.30 ± 1.89	0.32 ± 1.93	0.959
Total RBC	4.36 ± 14.4	6.00 ± 7.37	0.377
Total FFP	2.80 ± 11.92	3.70 ± 7.49	0.576
Total PLT	3.30 ± 14.41	3.16 ± 10.98	0.945

ISS, injury severity score; RTS, revised trauma score; TRISS, trauma injury severity score; ER, emergency room.
* Significant difference ($p<0.05$).

PR 216

Associated abdominal injuries do not influence reduction quality in operatively treated pelvic fractures—a multicenter cohort study from the German Pelvic Registry

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Introduction: Pelvic fractures are rare but serious injuries. The influence of a concomitant abdominal trauma on the time point of surgery and the quality of care regarding quality of reduction or the clinical course in pelvic injuries has not been investigated yet.
Material and methods: We retrospectively analyzed the prospective consecutive cohort from the multicenter German Pelvic Registry of the German Trauma Society in the years 2003–2017. Demographic, clinical and operative parameters were recorded and compared for two groups (isolated pelvic fracture vs. combined abdominal/ pelvictrauma).
Results: 16.359 patients with pelvic injuries were treated during this period. 21.6% had a concomitant abdominal trauma. The mean age was 61.5 ± 23.4 years. Comparing the two groups, patients with a combination of pelvic and abdominal trauma were significantly younger (47.3 ± 22.0 vs. 70.3 ± 20.5 years; $p < 0.001$). Both, complication rates (21.9% vs. 10.0%; $p < 0.001$) and mortality (8.1% vs. 1.9%;$p < 0.001$) were significantly higher. In the subgroup of acetabular fractures, the time until definitive surgery of the pelvis was

significantly longer in the group with the combined injury (5.7 ± 4.8 vs. 4.7 ± 4.0 days; $p < 0.001$). The grade of successful anatomic reduction did not differ between the two groups.

Conclusions: Patients with a pelvic injury have a concomitant abdominal trauma in about 20% of the cases. The clinical course is significantly prolonged in patients with a combined injury, with increased rates of morbidity and mortality. However, the quality of the postoperative results is not influenced by a concomitant abdominal injury.

PC 217

Laryngopharyngeal trauma

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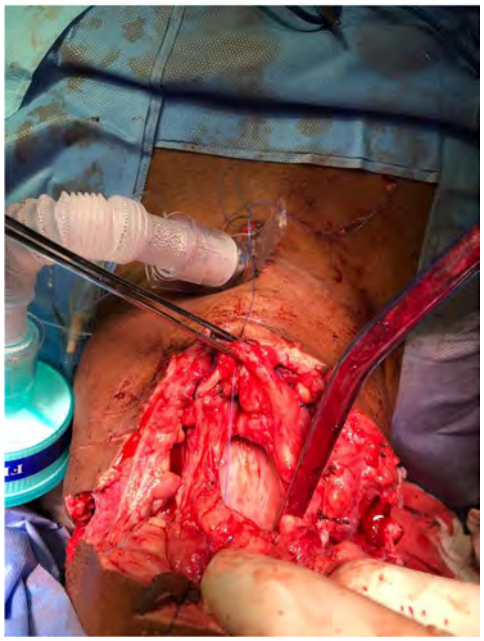
F.F.C., male, 27 years old, was admitted to the trauma center about 12 h after a stabbing wound in the neck. Upon examination the patient was mechanically ventilated and hemodynamically stable, with an exposed sectioned trachea, which had a tracheostomy tube applied. The penetrating injury itself was mostly allocated in zone II. He had a CT angiography and was referred to the OR for surgical treatment. The cervicotomy found that both the external and internal right jugular veins had been injured alongside the sternocleidomastoid, sternohyoid and homohyoid muscles, the thyroid cartilage, just above the vocal cords, which had exposed the anterior larynx and the epiglottis The right anterior jugular vein and smaller tributaries of the right internal jugular vein, were ligated; a tracheostomy was performed and the thyroid cartilage and anterior laryngopharyngeal wall were reconstructed with the epiglottis implantation, sternoid, homohyoid and sternocleidomastoid muscle sutures, after which the platysma was closed but not the skin, left to secondary healing. Patient was extubated within 48 h, discharged from ICU on the fifth postoperative day. Thickened oral diet was introduced on the 16th day, and by the 21th day he was discharged without the tracheostomy tube, with a normal diet. Comments: The cervical region is an area susceptible to serious injury due to the presence of vital structures, with massive hemorrhage, airway obstruction, cervical spine injuries and cerebral ischemia as the leading causes of death. Initial management of penetrating injuries follows the principles of trauma care with airway control initially. References: Bhatt NR—Penetrating neck injury from a screwdriver: Can the No Zone approach be applied to Zone I injuries? BMJ Yan Wang—Penetrating neck trauma caused by a rebar—A case report. Medicine (2018) 97:16 (e0468) A.F.T. Brown—Chainsaw penetrating neck injury. Journal of the Accident and Emergency Medicine 1995 12, 134–137

Fig. 1

Fig. 2

Fig. 3



PR 218

Mortality after falls in Amsterdam; data from a retrospective cohort study

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Introduction: Annually, approximately 3,600 people decease as a result of a fall in the Netherlands, according to the Statistics Netherlands. The aim of this study is to evaluate the demographic parameters, fall characteristics and resulting injury patterns of this group in the region of Amsterdam.
Methods: All patients deceased as a result of injury due to a fall in the period July 1st 2013 until July 1st 2018 in the region of Amsterdam were included. Data were collected from the database (Formatus) of the Department of Forensic Medicine (Public Health Service Amsterdam).
Results: During the study period 1,258 patients deceased after a fall. The mean age was 83 years (0–103 years) and 41% was male. A psychiatric disease was diagnosed or suspected in 44% of the population of which cognitive impairment, including dementia, was encountered in most of the cases (82%). The majority of the falls happened at home (47%) or at nursing facilities. A minority (1.3%) was work related. Over 81% of the falls was from standing position, 17.6% was not from standing position of which 80.1% regarded falls from stairs, the majority was male. Multitrauma patients accounted for 17.1% of the population. From the remaining 1,040 patients, 61.7% sustained one or more injuries to the pelvis or extremities. Central nervous system (CNS) injuries were described in 31.3% of the patients. Mortality was in 26.8% of the cases due to primary CNS injury, 62.3% was due to complications of which clinical deterioration (58.7%) and infection (17.1%) were the most common.
Conclusions: In the region of Amsterdam the majority of deaths due to a fall regards the geriatric population. Fall from standing position and mortality due to complications, mainly clinical deterioration, accounted for the majority of deaths. Intervention to prevent falls and thereby complications need more awareness to reduce mortality.

PR 219

Results from a multidisciplinary blunt splenic injury protocol

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Introduction: The majority of splenic injuries are currently managed non-operatively. Failure of non-operative management includes grade IV or V splenic injury or vascular abnormalities that are suitable for embolization. The primary indication for operative management of blunt splenic injury is hemodynamic instability. In our center, the last twenty splenic injuries, admitted during two years, were not managed according to published guidelines. Ten patients (50%) underwent splenectomy, being unstable only 2 of them (10% of the whole sample).
Material and methods: Staff from anesthesiology, interventional radiology and trauma surgery came up with a joint protocol. Grade III splenic injury non-operatively management, including fluid responsiveness (achieving shock index (HT/BP) below 0.9 after a bolus of colloids) and, focus placed only on hemodynamic stability instead of on vascular abnormalities are our principal modifications regarding already published protocols.
Results: Seventeen patients with blunt spleen trauma were admitted after starting up our protocol. Six (2 grade III, 2 grade II and 2 grade I) splenic injuries were successfully managed non-operatively. Prophylatic embolization was performed in five patients: 3 were grade IV spleen trauma and 2 were grade III spleen trauma with vascular abnormalities. One grade III splenic trauma was embolized due to a pseudoaneurysm detected in CT scan performed 72 h post injury. Five grade V spleen trauma required urgent surgery. 4 of them presented with shock index > 0.9.
Conclusions: Our multidisciplinary protocol has helped in improving outcomes in blunt splenic injuries. We have achieved an almost full compliance to our protocol.
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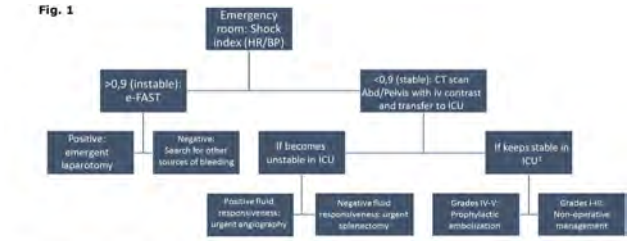
Fig. 1



1: If vascular abnormalities detected on CT, consider prophylactic embolization. Repeat CT scan with contrast 48-72 hours post injury to rule out pseudoaneurysm in all grades except from grade I.

PC 220

Tranexamic acid: indications in severely injured trauma patients

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Case history: 82-year old male experienced severe blunt trauma after a bus accident.
Clinical findings: He is found alert (GCS = 15), hemodynamically stable and with a patent airway. He presented catastrophic lower left limb where tourniquet was applied. 1 gram of tranexamic acid (TXA) and 500 mL of crystalloids were administered. He was intubated in the site of injury and transfered to our center, being always hemodynamically stable. On hospital admission he was normotensive (BP = 140/70 mmHg, sinus rithm 85 ppm), shock index < 0.9. He suffered uneventfully amputation of the limb with no need for blood products transfusion. His past medical history was only pertinent for hypertension.
Investigation/Results: Following urgent damage control surgery, CT scan was performed where acute bilateral pulmonary embolism was diagnosed.
Diagnosis: Asymptomatic acute bilateral pulmonary embolism
Therapy and Progressions: During ICU stay, the patient kept hemodynamically stable. Endotracheal tube is removed one day later and he is successfully transfered to the ward three days later.
Comments: Hypercoagulability can occur after severe tissue injury, that is likely related to tissue factor exposure and impaired endothelial release of tissue plasminogen activator (tPA). In contrast, when shock and hypoperfusion occur, activation of the protein C pathway and endothelial tPA release induce a shift from a procoagulant to a hypocoagulable and hyperfibrinolytic state with a high risk of bleeding. It can be inferred that a patient presenting with severe tissue injury without shock is at high risk of perioperative thrombosis and TXA might not be administered.
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PR 221

To study the epidemiology, management, outcome and factors predicting mortality in patients with pelvic trauma at a level 1 trauma center of India

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Introduction: Pelvic traumas are most severe and life threatening orthopaedic injuries (1–3%) (1). It signifies high energy force, representative of severe overall trauma. Study reported mortality of blunt pelvic trauma to reach 4.8–50% (2). Injury severity score (ISS), hypotension, head injury, posterior fracture & haemorrhage have been implicated (3). However, there is a paucity of data in developing countries. This study identifies the problem burden, management outcomes and factors predicting mortality.
Material and methods: 568 patients had pelvic trauma, retrospectively from Jan 2014 to Dec 2017 and prospectively from May 2018 to April 2019. 501 patients was included after excluding less than 18 years and coagulation disorder
Results: Majority were males (78.2%),with a mean age of 34.8. Mechanism was RTI (72.3%) followed by Fall from height (18%), Railway accidents (4.8%). Mean ISS & RTS was 17.37 and 7.41 respectively. Associated injury were long bone fractures (34.3%), chest injuries (33.53%).Head injury (10.4%). Lateral compression (63.9%), was the most common followed by anteroposterior compression (17%) & combined (11.17%).Majority underwent operative intervention (56.5%) for pelvis or associated injury. The mortality rate was 15.7% secondary to haemorrhagic shock (49.4%) and sepsis (34.2%). The factors were male gender, age, ISS, RTS, head injury, unstable pelvis. However, no association with haemoglobin, long bone fracture, and massive transfusion protocol was found
Conclusions: Our study showed a mortality of 15.7% which is comparing with previous study
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Fig. 1

PR 222

Predictors for serious and fatal injury in bicycle trauma

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Introduction: The number of patients admitted to Oslo University Hospital (OUH) due to bicycle trauma is increasing. We aimed to identify possible predictors of serious and fatal bicycle injury.
Material and methods: The OUH trauma registry was searched for patients treated for bicycle trauma between 2005 and 2016. Data extraction included putative predictors of serious and fatal injuries, defined as ISS $\geq$ 9 and death within 30 days, respectively. Univariate analyses were performed and reported as odds ratios (OR). $P < 0.05$ was regarded as statistically significant.
Results: 1543 bicyclists were admitted, 72% were males, median age was 40 years (range 3–91). Injury mechanisms were single bicycle crash in 68%, collision with a motorized vehicle in 27%, bicycle vs. bicycle in 4% and others in 1%. Serious injuries were seen in 63% and 2.3% died. Predictors for serious and fatal bicycle trauma are presented in Figure 1.
Conclusions: We identified age $\geq$ 50, high comorbidity and loss of consciousness (GCS $\leq$ 12) as predictors for both serious and fatal injury after bicycle trauma. Single bicycle crash was the most common cause of serious bicycle injury in our trauma center.

Fig. 1

Univariate analysis (95% CI)	OR for serious injury	OR for fatal injury
Male : Female	**1.3 (1.02 - 1.6)**	0.8 (0.4 - 1.7)
Age ≥50 : Age ≤49	**2.4 (1.9 - 3.1)**	**5.6 (2.7 - 12)**
Night time (22-06) : Daytime	**1.5 (1.1 - 2.3)**	1.0 (0.3 - 3.3)
MVC : SBC	0.9 (0.8 - 1.2)	**2.3 (1.2 - 4.7)**
Pre-injury American Society of Anesthesiologists Physical Status (ASA-PS) 3 : Pre-Injury ASA-PS 1-2	**2.6 (1.6 - 4.7)**	**5.6 (2.5 – 13)**
Referred from another hospital : Primary admission	**12 (7.6 - 20)**	2.0 (0.99 - 3.9)
Glasgow Coma Scale (GCS) 13-14 : GCS 15	1.1 (0.8 - 1.5)	2.6 (0.2 - 29)
GCS 9-12 : GCS 15	**2.9 (1.5 - 5.6)**	**39 (6.7 - 216)**
GCS 3-8 : GCS 15	**7.1 (3.7 - 14)**	**197 (46 - 842)**

PC 223

Use of extracorporeal membrane oxygenation (ECMO) in polytrauma patients: three case reports from the intensive care unit (ICU) of Tondela-Viseu Hospital centre

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Case history and Clinical findings: (1) 45-year-old man, motorcycle crash, chest trauma with left hemithorax open wound, clavicle and multiple rib fractures, bilateral pulmonary contusion; cervicodorsal spine trauma. Postoperative intensive care unit (ICU) admission, complicated with ventilator-associated pneumonia. (2) 26-year-old male, fall from 8 m, chest trauma with 6 rib fractures, bilateral pneumothorax and left pulmonary contusion; lumbosacral spine and abdominal trauma with pelvic comminuted fractures. Admitted to the ICU after exploratory laparotomy with splenectomy and pelvic external fixation. (3) 59-year-old male, fall from stairs, left chest and abdominal trauma. Fracture of multiple left ribs responsible for respiratory failure leading to admission to the ICU.
Diagnosis, Investigation and Results: All case reports represent polytrauma patients with clinical worsening and admission to the ICU, with subsequent development of acute respiratory distress syndrome (ARDS) refractory to primary measures.
Therapy and Progressions: Different mechanisms led to the development of ARDS in the different cases. On a primary approach, standard measures such as curarization, recruitment maneuvers, prone positioning and PEEP increase were applied whenever possible. An absence of improvement led to an almost inevitable need of extracorporeal membrane oxygenation (ECMO) rescue therapy. All patients responded positively to this treatment without major complications and were eventually discharged from the ICU.
Comments: ARDS is a major cause of respiratory failure in polytrauma patients. Among the many therapeutic options, ECMO emerges as a powerful tool as rescue therapy in respiratory failure refractory to all other measures, being the present case reports corroborative examples of its efficiency.
References: Matsumoto, S. et al, "Pitfalls when using extracorporeal life support in trauma patients", Trauma Surg Acute Care Open 2019;4(1):e000298.

Fig. 1

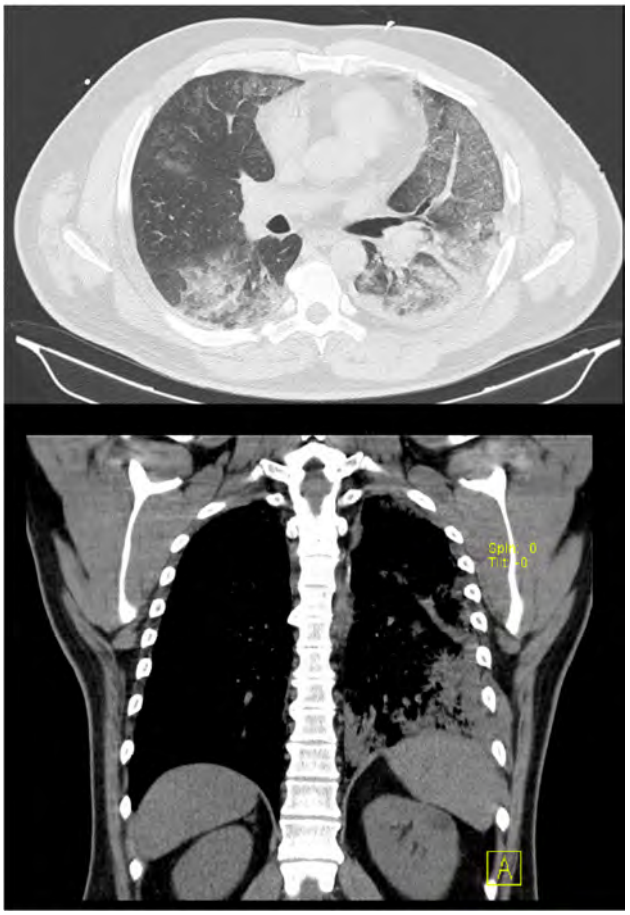


Fig. 2

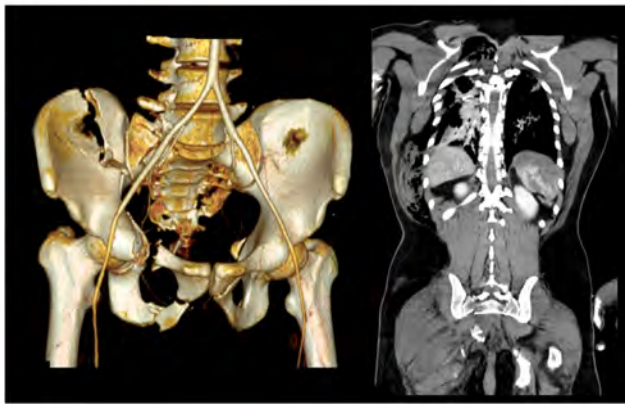
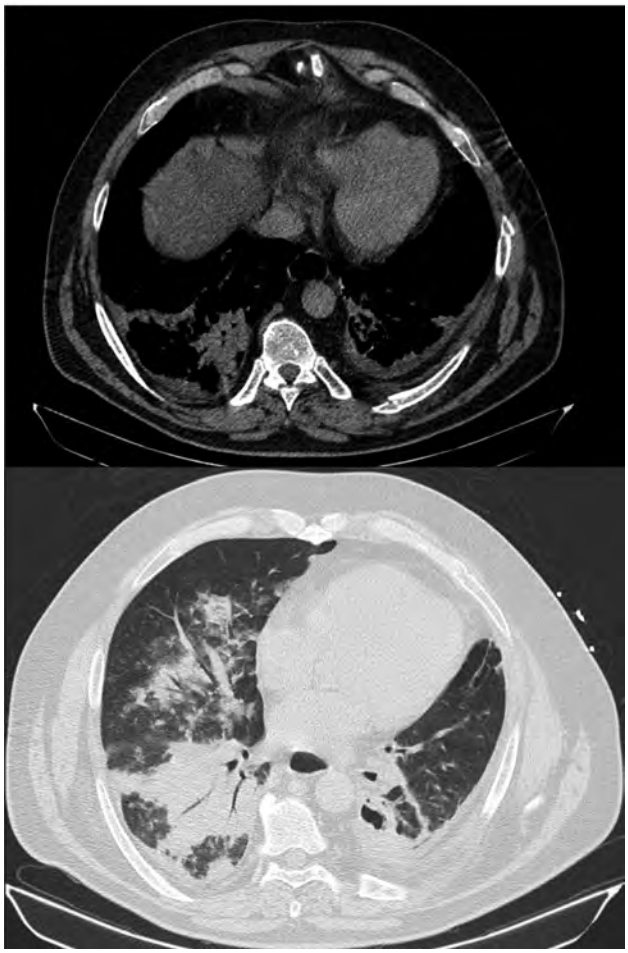


Fig. 3



PR 224

Polytrauma demographics, most common injuries mechanisms and outcomes in latvia

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Introduction: Nowadays when cities are improving fast and significantly, including transportation system, even more we encounter with high energy trauma . Still the most vulnerable on the roads are pedestrians.
Material and methods: The analysis of the data collected prospectively from January 2017 to October 2019 was performed including the mechanism and diagnosis of polytrauma, patient demographics and the main outcomes.
Results: In total, 903 patients were assessed according to the polytrauma protocol. The median age of the cohort was 43 years (IQR 30–55), male patients, 68.2% vs. 31.8% females, p = 0.045. The most frequent mechanism was a pedestrian struck by a vehicle in 33.9% cases, and falling from a height of over 2 m in 29.7%. Of those patients who had musculoskeletal injuries, in 31.1% the trauma mechanism was a fall from a height and in 28.2% pedestrians were struck by a vehicle, 36.1% of patients who fell from a height and 29.5% of those struck by a vehicle suffered visceral injuries. The most common cause of neurotrauma was a fall from a height in 33.7%, and pedestrians involved in car accidents in 29.8%. From the whole cohort, 27 patients were not saved, resulting in a 2.9% mortality rate. Most patients (25) who died had ISS > 50. The mortality reached 2.3% among pedestrians struck by a vehicle and 5.1% among patients who fell from a height of over 2 m.
Conclusions: The most common mechanism in the cohort was a pedestrian struck by a vehicle, followed by falling from a height, with a predominant involvement of male patients. Similarly, the most frequent cause of musculoskeletal injuries and visceral injuries was falling from a height and pedestrians struck by a vehicle, demonstrating an important direction for polytrauma prevention.

PR 225

Falls and fatality: insights for injury prevention with changing patterns of trauma

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Introduction: Recent reviews of UK trauma data show altering demographics. Patients are increasingly older and sustain lower energy injuries, with falls < 2 m being the most common (1).
Material and methods: Data collected over 5 years in a major trauma centre was used to calculate injury specific admission rates, case fatality rates and injury specific mortality attribution. Data on patient age, footwear, lighting, alcohol intoxication and previous admissions were collected in falls < 2 m resulting in mortality.
Results: Patients sustaining falls < 2 m represented 36% of admissions and 37% of mortalities. All falls represented 58% of admissions and 69% of mortalities. Case fatality of falls of < 2 m and > 2 m was 6.59% and 9.35%. All fall case fatality was 7.62%. This was

significantly higher than the case fatality of stabbings (1.0%) and RTAs (4.7%).
In falls < 2 m causing fatality, mean patient age was 71.7 years. 50% of patients aged 40–59 were under the influence of alcohol when falling, with 56% aged 60–79, but only 13% patients aged 80–99. 12% aged 40–59 who died when falling were wearing slippers. This increased to 31% in those aged 60–79, and 50% aged 80–99. 69% of falls occurred under daylight/full light. 13% of patients aged 40–59 who died after falling had been admitted to hospital within the last year, although this increased to 19% in those aged 60–79, and 27% aged 80–99.
Conclusions: Falls were the most common cause for hospital admission, had the highest case fatality of injury mechanisms and caused the most patient mortality. Alcohol intoxication was associated with falls in younger patients who died after falling, but this was less common in older patients. Wearing slippers was less common in the young but significantly associated with fatal falls in older patients. These results offer a range of therapeutic targets when developing fall prevention strategies.
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PR 226

Splenic trauma in the age of interventionism

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Introduction: The treatment of splenic lesions is determined by the hemodynamic situation, the degree of injury and the presence of bleeding. Arterial embolization has expanded the indications of the conservative treatment. Retrospective observational study on splenic traumatism and its therapeutic options.
Material and methods: A total of 60 patients with splenic injury have been treated at our centre between 2014 and 2018. 43 patients were hemodynamically stable: 11 were embolized and 32 received a conservative treatment. 17 patients were hemodynamically unstable: 6 had a good response to the resuscitation treatment so they were embolized, but there was one patient who deceased because of other causes. From these 17 patients, 10 patients received splenectomy.
Results: The main objective of this study is to review the management of the trauma patient with splenic injury. Of the total of 60 patients with splenic trauma, average ISS of 27, 17 underwent splenic embolization, 17 underwent urgent splenectomy and 26 were treated with conservative treatment. The 17 embolized, 6 were hemodynamic unstable at arrival but responded to the fluid therapy, 3 had a splenic lesion grade IV, 1 a grade III, 1 grade II and another a grade I. The success rate of embolization was 100% in the 17 embolized patients. 7 patient died, only one of them in the embolization group and was not related to the splenic trauma nor embolization, 4 were in the urgent splenectomy group due to severity of trauma, 1 died before receiving any treatment and 1 in the conservative treatment group due to other complications.
Conclusions: Patients who respond to volume or are hemodinamically with high-grade lesions, arterial embolization would be less aggressive treatment options with excellent results.
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PR 229

Early rehabilitation and longterm outcomes for multi trauma patients; a retrospective and a comparative prospective cohort study. A study protocol

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Introduction: During the past decades acute trauma care has improved through the development of highly specialized trauma centres and teams. Since patients are considerable young when being affected, trauma may lead to life-long physical, cognitive and emotional constraints interfering with an independent self-determined life (1,2). In 2016, a revised national plan for the treatment of trauma patients in Norway was published (3). The plan emphasizes the importance of rehabilitation and the need for early interdisciplinary rehabilitation. This study will examine in which extent patients receive rehabilitation in early phase after trauma as recommended in the norwegian national plan. In addition we will examine what follow-up patients receive after trauma, quality of life, functional level and use of health care and next- of kin resources.
Material and methods: Patients admitted to regional trauma center in mid- or western Norway in 2017 with NISS $\geq$ 12 are recruited to participate. Data will be collected from National Trauma Register, the Norwegian Patient Register, the Municipal Patient and User Register, data from Statistics Norway, the electronic patient record (EPJ) and the patient/relatives questionnaire.
Discussion: The results will be useful in the preparation of patient courses that comply with strong recommendations in the national trauma plan, ensuring equal treatment and raising awarness about rehabilitation for trauma patients.
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PR 230

Traumatic diaphragmatic injuries

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Introduction: Diaphragmatic lesions involve wounds and rupture of the diaphragm, through penetrating wounds or thoraco-abdominal trauma. Their incidence is 1–15%. The diagnosis may be late, despite the technical advances made by medical imaging. The choice of surgical approach and technique is still controversial. Mortality is usually related to the associated injuries. The present paper analyzes the incidence of diaphragmatic lesions that occur in thoraco-abdominal trauma, their epidemiology, diagnosis and treatment.

Material and methods: We performed a retrospective study over a 5-year period (2014–2018), in the surgical units of the Emergency County Hospital of Braila, including all patients diagnosed with diaphragmatic lesions.
Results: During the study period, 73 patients had thoracic-abdominal trauma. There were 41 cases of blunt trauma and 32 thoracic-abdominal trauma. Our study involved 9 cases of diaphragmatic injuries (12.3%), 7 by road accident and 2 by white weapon. The sex ratio was 4:1. The average age was 38 years. Chest radiography was a contributory preoperative diagnosis in 4 cases. The diaphragmatic wound was on the left side in 8 cases, and its average size was 5 cm. The surgical procedure involved the reduction in the abdomen of the herniated viscera and the monoplane suture of the diaphragm by non-absorbable "X" points in all cases. Chest aspiration was the rule. There was only one death in a complex polytrauma case.
Conclusions: Diagnosis of diaphragmatic rupture and wounds remains difficult and often intraoperative. Any blunt or penetrating thoraco-abdominal trauma can be accompanied by damage in the diaphragm. Surgery remains the only effective therapeutic solution.
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PC 231

The benefit of an all in one resuscitation room; Hybrid Emergency Room for the severe trauma patients

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Case history: We report the one case which performed TAE, angioplasty, thoracotomy, laparotomy and preperitoneal pelvic packing (PPP) in the hybrid emergency room (H-ER). The patient was male in the 60 s, who was riding on his motorcycle and fell from a 5 m height.
Clinical findings: He was in shock state.
Diagnosis: We scanned CECT and diagnosed subdural hematoma, traumatic subarachnoid hematoma, lt hemopneumothorax, lung contusion, multiple costal bone fracture, intercostal artery injury, splenic injury (gradeIII), Pelvic bone fracture.
Therapy: We inserted the drainage tube to the hemopneumothorax and did the TAE for the pelvic bone fracture and splenic injury. After TAE, he was in still shock state. The bleeding volume from the lt drainage tube increased, so trauma surgeons did the emergency thoracotomy and thoracic endovascular aortic repair (TEVAR) for intercostal artery injury. We suspected he also had abdominal compartment syndrome due to recanalization of TAE, and they performed the emergency laparotomy and did PPP for the pelvic bone fracture.
Comments: We install an IVR-CT system in our trauma resuscitation room in October 2017. We named it H-ER, as it enables us to do all examinations (sonography, CT and fluoroscopy) and treatments (IR, operation) required for trauma in a single room. We have to perform prompt diagnosis and treatment, especially in cases of severe polytrauma cases. A retrospective study proved that the H-ER had shortened the time of CT initiation and emergency procedure and that lead to improve mortality 1). H-ER is a novel trauma resuscitation room to do all treatments required in the only one room for severe traumatic patients.
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PR 233

Predictive value of the latest ATLS recommendation for the initial assesment of hypovolaemic shock—a single center retrospective analysis between 2016 and 2019

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Introduction: According to the previous Advanced Trauma Life Support (ATLS) guidance, the early assessment of trauma patients with haemorrhage were classified upon the vital signs. Recently, national trauma registry analyses suggested to extend the assessment criteria with the base deficit (BD), referring to the metabolic status. Our objective was to investigate the relevance of BD and to explore new prognostic factors in the early assessment of the severely injured.
Material and methods: Our study included 162 patients registered between 01.01.2016 and 11.09.2019 on our emergency ward for whom the trauma team was activated. They were grouped into severity groups (I–IV) according to either the vital signs (Classical) or the extended criteria with BD. The data were extracted from medical documentations of the early phase of treatment. As primary outcome, we compared the 24-h mortality rate of the patient groups. We studied the need for massive transfusion and intensive care unit care as secondary outcomes.
Results: According to the Classical assessment, 50% of the patients were assigned to group I (lowest risk for haemorrhagic shock) and 23% to group II. The remaining 27% were grouped into groups III and IV (higher risk). With taking BD into consideration, 58% were reassigned to a higher risk group; however, this change affected only groups I and II. The 24-h mortality changed only in group I (0.7% vs 7.7%; P = 0.002). BD did not affect the need for massive transfusion. In groups I and II, 3.5% of the patients, in groups III–IV 23% needed intensive care unit treatment.
Conclusions: BD is an effective prognostic factor in the early assessment of trauma patients. However, compared to the vital sign-based evaluation, it provides extra informaton only in less severe cases. According to our findings, it may help to assess the need for the administration of blood products. Grants: NKFI K120232; GINOP-2.3.2-15-2016-00015; EFOP-3.6.2-16-2017-00006.

PC 234

Dangers of an incorrect initial evaluation of politrauma patients. Missed diaphragmatic injury

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Case history: 56 years old male, with history of hypertension and dyslipidemia, suffered a backhoe accident and was admitted in a regional hospital. On initial assesment he presented contusion and two laceration wounds in left chest and in lumbar region. Body CT informed subcutaneous emphysema and left rib fractures from 6th to 11th, left hemidiaphragm edema, laminar left pneumothorax and contusive lung. Posterior lumbar hematoma and no intra-abdominal free fluid. Laceration wounds were partially sutured, with drainages through the wounds
Clinical findings: He was transferred to our emergency department, presenting dyspnea, tachycardia, sweating, painful LUQ and left hemithorax worsening with breathing
Investigation/Results: Reviewed by our radiologist, TC images showed herniation of abdominal organs into the chest
Diagnosis: Traumatic hernia in left costophrenic recess. Multiple rib fractures
Therapy and Progressions: The hernia contents (left colonic flexure and omentum) were reduced and defect closed with primary repair in Emergency surgery. Rib fractures treated by osteosynthesis.On 4th POD left renal artery dissection and renal infarction were evidence in a new CT.
Comments: Diaphragmatic injuries are caused by blunt or penetrating thoraco-abdominal trauma. Potentially life-threatening due to the herniation of abdominal organs and severe associated lesions. Clinical suspicion is important as prompt diagnosis and treatment are necessary for good outcomes.
In our case, the initial clinical assessment was incorrect and the transfer put the patient in danger as an emergency surgery should have been performed before transfer. This enhances the importance of a correct initial management of polytrauma patients.
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Fig. 1

Fig. 2

PR 235

ORIF of 79 Cases with displaced intra-articular fractures of the calcaneus. (DI-AFC)

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Introduction: The fractures of the calcaneus account for about 1-2% of all fractures of the human skeleton. The majority of these fractures (70%) are intra-articular and surgical intervention is a widely accepted way of treatment
Material and methods: The aim of this study was to evaluate the results of open reduction and internal fixation for DI-AFC.In a period of **24** years (**1995–2019**) **70** patients (**9** patients with bilateral fractures) with age range from **19 to 79** years old, were treated surgically using the lateral extensile approach. Follow-up was **1–24** years. The results were evaluated based on x-ray parameters (calcaneal morphology, Bohler"s and Gissane"s angles), active range of motion, footwear problems and time needed to return to work. The SF-36 health survey was used for outcome assessment.
Results: Fracture mean healing time was **15,6** weeks. The outcome was excellent in **32** cases, good in **28** cases and poor in **12** cases. The complications were malposition of fixation in **11** patients, superficial wound slough in **8** patients, reflex sympathetic dystrophy in **6** patients, deep infection in **2** patients who were treated with antibiotics and metalwork removal following union of the fracture. **One** patient resulted in metal breakage with consequent pseudarthrosis. Finally **one** patient developed chronic osteomyelitis and is under treatment.
Conclusions: The treatment with open reduction and internal fixation for DI-AFC is indicated, provided that the restoration of calcaneal shape, alignment and height is achieved. Long term functional results with mild pain, few alterations in activities of daily living or work, and essentially no footwear problems, can be expected from a properly performed open reduction and internal fixation.
References: Lim EV, Leung JP. Complications of intraarticular calcaneal fractures. Clin Orthop 2001. Aisha Razik, Mark Harris, Alex Trompeter, Calcaneal fractures: Where are now? Traum Limp Recon (2018).

Fig. 1

ORIF of 79 Cases with displaced intra-articular fractures of the calcaneus. (DI-AFC)

Introduction: The fractures of the calcaneus account for about 1-2% of all fractures of the human skeleton. The majority of these fractures (70%) are intra-articular and surgical intervention is a widely accepted way of treatment.

Objectives: The aim of this study was to evaluate the results of open reduction and internal fixation for DI-AFC

Methods: In a period of **24** years (**1995-2019**) **70** patients (**9** patients with bilateral fractures) with age range from **19-79**years old, were treated surgically using the lateral extensile approach. Follow-up ranged from **1-24** years. The results were evaluated based on x-ray parameters (calcaneal morphology, Bohler's and Gissane's angles), active range of motion,footwear problems and time needed to return to work. The SF-36 health survey was used for outcome assessment.

Results: Fracture mean healing time was **15.6** weeks. The outcome was excellent in **32** cases, good in **28** cases and poor in **12** cases. The complications were malposition of fixation in **11** patients, superficial wound slough in **8** patients, reflex sympathetic dystrophy in **6** patients, deep infection in **2** patients who were treated with antibiotics and metalwork removalfollowing union of the fracture. **Two** patients with delayed reconstruction resulted in malunion which was corrected with an osteotomy.**One** patient resulted in metal breakage with consequent pseudarthrosis. Finally **one** patient developed chronic osteomyelitis and is under treatment.

Conclusions: The treatment with open reduction and internal fixation for DI-AFC is indicated, provided that the restoration of calcaneal shape, alignment and height is achieved. Long term functional results with mild pain, few alterations in activities of daily living or work, and essentially no footwear problems, can be expected from a properly performed open reduction and internal fixation.

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PC 236

Extraperitoneal rectal injury in emodinamically unstable patient treated after DCS with external traction applied in an endorectal balloon

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Case history: A 46-year-old man was crushed between two vehicles while he was working. He arrived in ER hemodynamically unstable, so he underwent to emergency surgery.
Clinical findings: At rectal examination there was evidence of almost complete antero-lateral anorectal laceration. At abdominal examination there was evidence of anorectal full-thickness laceration and urethra full laceration.
Investigation/Results: no diagnostic was required in preop because of patient instabilty.
Diagnosis: Pelvic fracture with hemodynamic instability, severe rectal injury and complete prostatic urethra transection.
Therapy and Progressions: EL, lateral colostomy, pelvic paking, cistostomy and hip external binder. Damage control surgery was performed. On 3 POD second look was carried out and an almost complete extraperitoneal rectal injury was found during pelvic depaking. properitoneum was drained and a baloon probe was introduced in the rectum to allow the proximal rectal flap to advance to the distal rectum. stomal washes were performed with no rectal leak and rectal baloon traction mantained for 10 days. radiological and endoscopic check haven't shown any leak and a good mucosal reconstruction. MRI no sphincteral anatonical defects. waiting for EMG before stoma reversal.
Comments: The optimal managment for extraperitoneal rectal injuries remains controversial. An approach with lateral colostomy and conservative treatment of rectal lacerations with RECTAL TRACTION BALOON, could represent a safe treatment alternative in those cases with sphincter preservation, with a lower risk of complication.

PR 237

Exploring differences between ISS and NISS scores for 30-day mortality in adult and elderly trauma patients in a Norwegian national trauma cohort

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Introduction: Injury Severity Score (ISS) and New Injury Severity Score (NISS) with a threshold over 15 is commonly used to define severe injury and to define the study population in trauma registry-based studies for both adult and elderly trauma patients (1). For elderly patients ($\geq$ 65 years) this might be unreasonably high and might lead to exclusion of significantly injured elderly with increased risk of mortality. The aim of this study was to assess whether there were significant differences in 30-days mortality between adults and elderly trauma patients for different frequently used ISS and NISS thresholds
Material and methods: The Norwegian Trauma Registry was interrogated to identify all adult ($\geq$ 16 years) trauma patients included in the registry from January 2015 through December 2018. Data were dichotomized to age groups "adult" and "elderly" (16–64 and $\geq$ 65 respectively) with 30-days mortality as primary endpoint. Mortality rates were assessed for ISS and NISS thresholds of > 9, > 12 and > 15. We applied descriptive statistics and Chi-squared test for comparisons.
Results: 23768 patients with available information about age, 30-days mortality and ISS and NISS scores were included in the analysis, of which 16224 patients were 16–64 years old and 4706 patients were $\geq$ 65 years. 238 adult and 500 elderly patients died, giving overall mortality rates of 1.5% and 10.6% respectively. For ISS and NISS > 9 there was a significantly higher 30-days mortality in elderly trauma patients (17.3% and 15.2% respectively) than adult patients (4.7 and 3.8% respectively) ($p < 0{,}001$), as for all other ISS and NISS thresholds tested.
Conclusions: This study demonstrates that elderly trauma patients has a significantly higher mortality risk than adult trauma patients at all ISS or NISS-thresholds analysed. This group has a significant mortality even at ISS and NISS above 9.
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SCORING SYSTEMS AND OUTCOMES

PR 238

The yield of tertiary survey in patients admitted for observation after trauma

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Introduction: The trauma tertiary survey (TTS) is a widely accepted tool in the prevention of missed injury. Existing literature on its effectiveness focusses on multitrauma patients. This study investigates the yield of the tertiary survey in trauma who are admitted for TTS, without having any significant injury.
Material and methods: A single center retrospective cohort study was performed in a level II trauma center. Trauma patients without any clinically significant injury at the primary and secondary survey were included. The primary outcome was missed injury found during TTS (Type 1). Secondary outcomes were missed injury found after TTS but during admission (Type 2), mortality and hospital length of stay > 2 days.
Results: From 355 included patients, 11 patients (3.1%) had a type 1 missed injury. Alcohol consumption was associated with an increased risk for type 1 missed injuries (odds ratio = 5.49, 95% CI: 1.36–22.16). A type 2 missed injury was only found once, it concerned the only case of trauma related mortility. Out of 335 non-operated patients, 65 (19.4%) were admitted for more than two days. These patients were significantly older (71 vs. 39 years, $p < 0.001$) and had a higher ASA classification, 3–4 vs. 1–2 (47.5% vs. 12.7%, $p < 0.001$).
Conclusions: TTS showed missed injuries in only 3.1% of trauma patients who had no clinical significant injury found during primary and secondary survey. High costs of admission, together with a low yield found for this study's population the cost benefit of hospitalizing these patients is for discussion. Future research should therefore focus on the identification of predictors of a positive tertiary survey.
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2. Keijzers, et al., *The effect of tertiary surveys on missed injuries in trauma: a systematic review.*
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PR 239

The 4-h rule in the emergency department and its association with surgical mortality in one public hospital in Israel: retrospective study

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Introduction: In order to improve patient treatment the 4-h rule in the emergency department (ED) was introduced in many countries as well as in Israel. Within four h, patients attending the ED must be seen, treated, and a decision must be reached whether these patients are to be admitted or discharged. Though a popular performance-based measure, whether the 4-h rule in ED is associated with a decrease in mortality is controversial. The primary objective of this study was to evaluate the association between time in the ED and surgical mortality in one public hospital in Israel.
Material and methods: Included in this retrospective study were patients admitted to the ED of HYMC during 2017. Patients dying on the first day were excluded. (protocol HYMC-17-0123).
Results: Included in this study were 106,766 patients. Of these, 28,108 (26.3%) patients were hospitalized and the rest were discharged. Overall, 825 patients died. General Surgery accounted for 18,391 patients of which 73 died (8.8% of hospital deaths; 0.4% of all surgical patients; 1.9% of patients hospitalized in General Surgery). Internal medicine together with general surgery and orthopedic surgery accounted for 98.5%, 98.6% and 98.5% of the mortalities observed in patients with decisions made within 0–4 h, in patients with decisions made beyond 4 h and in all the patients respectively. Forty-five patients with decisions made within 4 h died compared to 28 with decisions made beyond 4 h. These represent 0.3% and 0.6% of all surgical patients in the ED (whether hospitalized or discharged) and 1.9% and 1.9% of those hospitalized.
Conclusions: General Surgery is the second largest contributor to hospital morality. In both absolute terms and relative terms, mortality was not increased by delays in decisions made beyond 4 h. The adoption of this performance-based measure should be questioned.

PR 241

Validation of new injury severity score in severe trauma patients from moldavian medical system. A retrospective research

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Introduction: Trauma is an important cause of mortality [1, 2]. Researchers are looking for optimal death/survival predictive models in trauma population. One way is to validate traumatic scores for different medical systems [1]. The aim of our study was to validate the New Injury Severy Score (NISS) in severe trauma (ST) from Moldavian population.
Material and methods: The retrospective study enroled 467 severe injuried patients (NISS > 15), admitted in Reanimatology department of Institute of Emergency Medicine. The regression analysis estimated NISS predictive power for ST adjusted for age and gender.
Results: Omnibus Test of Model Coefficients (χ^2 (df = 2) = 154.310 $p < 0.001$). The Nagelkerke R Square was 51.1%. Hosmer-Lemeshow test indicated an nonsignificant result (χ^2 (df = 8) = 4.478, $p = 0.784$). Variables in equation: NISS B = 0.142, $p < 0.001$, OR = 1,14 (95%CI 1.11–1.17) and Age B = 0.058, $p < 0.001$, OR = 1.06 (CI95% 1.04–1.08). Gender was nonsignificant. Sensibility = 81.3% (52 of 64 cases), specificity = 81.9% (327 of 403 cases), mean validation = 81.2% (cut-off 0.123). Area under the ROC curve = 0.900, 95% CI (0.857, 0.944), p
*p = 1/(1 + e^(9.179−0.58*Age−0.142*NISS)),* where
p – death probability in ST;
e (exponent)−constant equals to 2.71828

Conclusions: The NISS score, according to model caracteristics, has been validated for the ST patient's from the Moladavian medical system. Proposed model can/has to be improved in prospective research. Comparative evaluation of different traumatic scores or national models elaboration follows.

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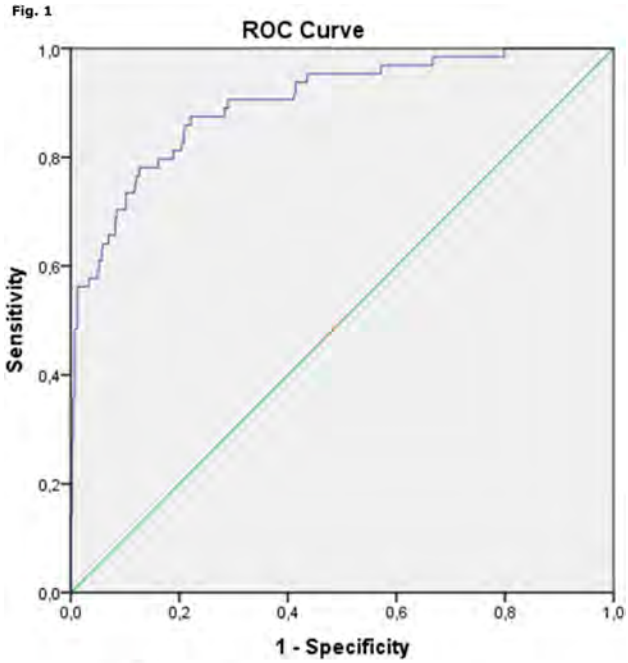
Fig. 1



Diagonal segments are produced by ties.

PR 242

Validation of International Classification of Diseases: based Injury Severity Score to predict in-hospital mortality in Greek trauma population

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Introduction: The International Classification of Diseases– based Injury Severity Score (ICISS) has been proposed as a reliable tool to measure trauma system performance especially in countries where a trauma registry has not been yet established. The purpose of this study is to assess the predictive capability for in-hospital mortality of ICISS with international and adjusted survival risk ratios (SRRs) in Greek trauma population.

Material and methods: This single center, retrospective cohort study was conducted in a Greek tertiary care hospital between January 2015 to December 2018. The trauma population was defined as hospitalized patients with a principal hospital discharge diagnosis in the range ICD-10 S00-T79. Duplicated injury ICD codes, readmissions, transfer to another hospital and missing data were excluded. The primary outcome was in-hospital mortality. Adjusted SRRs was calculated from patients with multiple injuries and the following two ICISS scores were evaluated: multiplicative-injury (ICISS) and single-worst-injury (SWI). The models were assessed in terms of their discrimination, measured by receiver operating curve (ROC) analysis and calibration measured using calibration curves.

Results: A total of 30195 patients were included in the study. Median age was 60 ± 22 years and mortality rate was 2,1%. Based on international SRRs, the area under the curve was 0,839 (95% CI 0.826–0.852) for ICISS-Multiplicative and 0,839 (95% CI 0.826–0.852) for ICISS-Worst Injury. Both modes had statistically significant better performance with adjusted Greek SRRs (AUR = 0,877 95% CI 0.867–0.887 and AUR = 0,880 95% CI 0.870–0.890, respectively).

Conclusions: This analysis has demonstrated the validity ICISS model for in-hospital mortality prediction in Greek trauma population. Further research is warranted to confirm the performance of ICISS using a sufficiently sized sample to define national SRRs.

PR 243

Early Kinetics of Pro-calcitonin with Point-of-Care Test in Predicting Post Appendectomy abscess: protocol for a pilot study

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Introduction: The occurrence of intra-abdominal abscesses is the most serious post-operative infective complication after appendectomy. A significant amount of research has been conducted in an attempt to identify those patients at greatest risk. PCT is initially described as an early, sensitive and specific marker for sepsis associated with bacterial infection. We hypothesize that PCT could serve as a predictor of the development of intraabdominal abscess and post-operative infective complication

Material and methods: The present study is a prospective, single centre, observational cohort study involving patients undergoing emergency appendectomy. All patients admitted to the acute care surgery ward for appendicitis were screened for study eligibility. PCT POC samples will be obtained preoperatively (T0) and post procedure (T1) at 24 h (T2), 48 h (T3), and 5 days (T3) post procedure.

Results: The primary objective of this study was to assess the diagnostic accuracy of Point-Of-Care testing for PCT in identifying post appendectomy abscess. The secondary objective was to determine the diagnostic accuracy in identifying any infective complication
Conclusions: We expect the incidence of abscess and infective complication to be increased in the PCT elevated group compared with the control group. Previous investigations indicate the overall morbidity related to infective complication is approximately 1–10% of patient undergoing laparoscopic appendectomy. Our pilot study revealed that the incidence could be as high as 15% in patients with prolonged elevated PCT levels.
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PR 244

The D-system: A novel way to streamline hand trauma

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Introduction: Hand trauma is a common cause for attendance to the accident and emergency (A&E), accounting for nearly 10-30% of all patients[1]. It is essential that accurate treatment and management is done as the implications of mismanagement are long term, which may lead to disability, loss of work and income, livelihood, and even psychological issues[1]. The presence of a specialised hand surgeon is essential for management of these injuries[2], but in the A&E setting it is not always possible to have such specialised care and there is a need for an efficient triage system.
Materials and Methods: We did an audit in our department and found a delay in the referral of patients from A&E to our trauma clinic, which was quite expected due to a high patient inflow. We devised a trauma pathway for the A&E, known as the D-system which outlines for them till what day from trauma is a particular hand patient safe to be sent to the hand clinic or who needs an urgent referral to a higher trauma centre, based on urgency of need of intervention. The pathway is in the form of a simple flowchart, which is easy to understand even for junior members of the team. We intend to do another audit after implementation of the pathway to assess change in practice.
Conclusion: It is essential to have simplified pathways for non-specialist areas in order to streamline treatment and offer the best care, in the limited availability of resources, especially at smaller hospitals. Our aim is to develop one such system and assess it's effective in delivering better care.
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PR 245

Evaluation and Comparison of MGAP and RTS to Predict Mortality of Multiple-trauma Patients at a Trauma Center in Rio de Janeiro, Brazil

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Introduction: A quantitative method for measuring trauma severity has many potential applications. The intent of this study was to evaluate the accuracy of the MGAP score and its components in prediction of in-hospital mortality versus the accuracy of the Revised trauma score RTS at a Trauma Center.
Material and methods: This study included 825 patients with trauma. Data regarding age, mechanism of injury, systolic blood pressure, Glasgow Coma Score and respiratory rate were collected at Trauma Center of Alberto Torres Hospital. MGAP and RTS scores were calculated, and their accuracy to predict survival/death outcome. Results The study included 825 patients, ranging in age from 2 to 89 years, 69% male. From the total sample, 159 patients who suffered from penetrating trauma and 666 patients who suffered from blunt trauma were observed. In the comparison of the scores, RTS and MGAP, there was no significant superiority in any of them for predicting the outcome - which in our study was hospital discharge or death - even when compared by trauma mechanism. The GCS proved to be a very sensitive criterion in both scores, especially in patients with traumatic brain injury, totaling 62 patients in our statistical analysis, of which 56,4% had a negative outcome. RTS was slightly superior than MGAP in patients classified by the score as high chance of mortality, with 75% versus 69% of assertiveness.
Conclusions: Up to the moment, there is no evidence to support the superiority of one of the analyzed scores as a predictor of mortality in the patients evaluated. Although the RTS score is more widely used in trauma centers, the application of the MGAP score is more feasible in pre or in-hospital care of polytrauma patients, since it does not use respiratory rate in its parameters.

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PR 246

Validation of D-dimer for screening for venous thromboembolism in pelvic and lower extremity trauma patients

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Introduction: Venous thromboembolism (VTE) is a life-threatening complication after major trauma patients. We previously reported that the patients with higher injury severity score (ISS) and lower extremity trauma had high risk for VTE. Additionally, High D-dimer levels (cut-off D-dimer value, 12.45 μg/mL) on day 10 were useful for screening for VTE in major trauma patients.
We validated D-dimer levels for VTE screening for patients with pelvic and lower extremity trauma.
Material and methods: A retrospective study was undertaken between April and August 2019 at the Okayama University Hospital. 19 patients with pelvic or lower extremity trauma were included (median ISS, 18). We collected following data; Age, sex, ISS, the number of operation times, value of D-dimer in screening, incidence of VTE and use of anticoagulants.
Results: Eleven patients showed high D-dimer levels in screening, furthermore, six patients were diagnosed VTE using contrast-enhanced computed tomography. Symptomatic pulmonary embolism was not occurred. Patients with VTE had undergone orthopaedic surgeries two or more times. fourteen patients received therapeutically or prophylactic anticoagulation therapies.
Conclusions: Measurements of D-dimer levels after pelvic or lower extremity trauma patients were useful for screening of incidence of VTE. Direct oral anticoagulants were convenient for treatment to VTE. Trauma patients often needed several times of surgeries, heparin was also useful in perioperative period.
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PR 247

How to detect a polytrauma patient at risk of complications: A validation and database analysis of four published scales

S. Halvachizadeh[1], P. Cinelli[2], R. Pfeifer[1], K. Sprengel[1], H. C. Pape[1]

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Introduction: Early assessment of the clinical status of severely injured patients is crucial for guiding surgical treatment. Several scales are available to differentiate between risk categories. We compared four established scoring systems in regard to their predictive abilities for early versus late in-hospital complications.
Methods: Database from a level I trauma center. The following four scales were tested: the clinical grading scale (CGS; covers acidosis, shock, coagulation, and soft tissue injuries), the modified clinical grading scale (mCGS), the polytrauma grading score (PTGS), and the early appropriate care protocol (EAC; covers acid–base changes). Admission values were selected from each scale and the following endpoints were compared: mortality, pneumonia, sepsis, death from hemorrhagic shock, and multiple organ failure.
Results: In total, 3668 severely injured patients were included (mean age, 45.8 ± 20 years; mean ISS, 28.2 ± 15.1 points; incidence of pneumonia, 19.0%; incidence of sepsis, 14.9%; death from hem. shock, 4.1%; death from multiple organ failure (MOF), 1.9%; mortality rate, 26.8%). istinct differences in the prediction of complications, including mortality, for these scores (OR ranging from 0.5 to 9.1). The PTGS demonstrated the highest predictive value for any late complication (OR = 2.0), sepsis (OR = 2.6, $p = 0.05$), or pneumonia (OR = 2.0, $p = 0.2$). The EAC demonstrated good prediction for hemorrhage-induced early mortality (OR = 7.1, $p < 0.0001$), but did not predict late complications (sepsis, OR = 0.8 and $p = 0.52$; pneumonia, OR = 1.1 and $p = 0.7$) CGS and mCGS are not comparable and should not be used interchangeably (Krippendorff $\alpha = 0.045$).
Conclusion: Our data show that prediction of complications is more precise after using values that covers different physiological systems (coagulation, hemorrhage, acid–base changes, and soft tissue damage) when compared with using values of only one physiological system (e.g., acidosis).
None of the authors have any conflicts of interest to declare.

PR 248

Mortality rate related to trauma mechanisms in trauma center at alberto torres hospital from January 2014 to July 2019

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Introduction: To demonstrate the healthcare services of the trauma center of Rio de Janeiro based on epidemiological data and on the specificity of the type of initial care delivered to multiple trauma patients, comparing the mortality rate at the second peak of death with the worldwide literature.
Materials/Methods: Retrospective study extracted from "CT HEAT" database. Polytraumatized patients of both sexes were included and the mortality rate was calculated taking into account the second peak of death from trauma, gender, age and primary mechanisms of injury.
Discussion: The data collected show 3% mortality in the second peak, with firearm projectiles (40%) followed by traffic accident and fall as the primary causes of death.
Conclusion: Because of the structural and health care profile of this trauma center, it was possible to reach the desirable mortality rate according to the worldwide literature (less than 5%).
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PR 249

Treatment futility in trauma patients: is there a way to predict it?

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Introduction: Trauma patients are sometimes in critical condition upon arrival and need aggressive treatments to survive. Despite all efforts many end up dying. It seems necessary to try to identify those patients with a very high risk of death to avoid futile treatments. The aim of our study was to develop a simple clinical tool to predict mortality in trauma patients that can be easily calculated in the ED.
Material and methods: we analyzed data from all trauma patients arriving at a Spanish trauma hospital from June 1993 to June 2018. Patient demographics, physiologic trauma scores, vital signs, and Glasgow Coma Scale (GCS) were recorded. Our primary outcome was mortality. Logistic regression analysis (LRA) was performed using three variables (age, shock index (SI), and GCS) to determine the appropriate weights for predicting mortality. Using them, we constructed a simple score to calculate mortality.
Results: 2678 patients were studied. The mortality rate was 15.9%. Our score was constructed using weights derived from LRA for age > 55y (2 points), SI > 1(3 points), and GCS
Conclusions: our score is easy and quick to calculate and could be a useful tool to predict mortality using early available parameters upon arrival in the ED. Acknowledging the ethics involved in this topic, this score could sort out patients with a very high risk of death and in whom aggressive therapeutic measures could be limited early or withdrawn in agreement with family members
References: Haider A, et al (2019) Developing a Simple Clinical Score for Predicting Mortality and Need for UCI in Trauma Patients. Ann Surg 85(7):733–737

PR 250

Emergency Surgeon of the Week and Surgical Emergency Assessment Unit (SEAU): Impact on surgical admissions

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Introduction: Ever growing elderly patient population and a finite budget, there is a constant pressure on NHS hospital beds. Data from Department of Health (2015–2016) states the average cost for an A&E attendance and non-elective inpatient stay is £138 and £1,609 respectively highlighting the importance for schemes to reduce hospital admissions. Assess impact of Ambulatory care, Surgical emergency assessment unit (SEAU) and "Emergency Surgeon of the Week" (ESW) on hospital admissions for surgical referrals (GP/A&E).
Material and methods: Retrospective analysis of prospectively collected data of hospital admissions from the Patient Centre Database before and after implementation of SEAU (in November 2014) and ESW (in November 2017), including the units" activities. Emergency general surgeon followed 1:5 (Monday–Thursday, 0800–1800) rota based at SEAU.
Results: Since 2014 (50 months), SEAU has reviewed 12451 (New 7543; Follow Ups 4908) patients. Surgical admissions (SA) pre and post implementation SEAU were 766* and 629*/month respectively, a drop by 18%. ESW helped a further drop by another 14% to 520*/month. 58% of new referrals were admitted and overall 35% of all patients reviewed were admitted. Juniors (ST3/ST4) and seniors (ST5-8/Staff Grades/Consultants) admitted 40% and 34% of the referrals respectively. 2950 USS and 1959 CT were performed in dedicated SEAU slots. 98% attending SEAU were likely to recommend the unit to friends or relatives.
Conclusions: In the face of unprecedented demand for hospital beds (more so in the winter), "Emergency Surgeon of the Week" based at SEAU could be the answer to relieving the capacity, financial pressures and providing high quality safe patient care for our already strained NHS.

PR 251

Surgical emergencies, an educational and medico-economic challenge

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Introduction: Surgical emergencies are a frequent reason for consultation in the emergency department and are responsible for significant morbidity and mortality.
Our study aims to present the number of patients admitted for a surgical emergency in a French level 1 trauma-center and the volume of patients operated in emergency depending on the different specialties.
Method: We conducted a retrospective, single-center study of the Hospital Emergency Department (UAS) of the University Hospital Center of Nice between January 2017 and December 2018. We studied the volume represented by surgical emergencies according to the different specialties.
Results: The emergency department welcomed 192,004 patients, of which 38,351 surgical emergencies patients accounted for 20% of the total activity; 14397 patients were operated on urgently, which represents 35% of all surgical procedures in our hospital.
Conclusion: Surgical emergencies are an important part of the activity of our hospitals. An academic definition is difficult to achieve. A regional organization is needed for the management and optimal care of these patients. The creation of regional centers, as for the Trauma Centers, seems indispensable, especially for the most serious patients, allowing both a better medico-economic and educational management of surgical emergencies.
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Fig.1

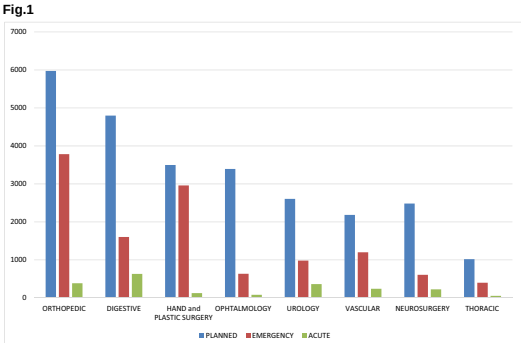

Figure 2: global activity in operating theatre in an adultfrench university hospital with level-1 trauma center

Fig.2

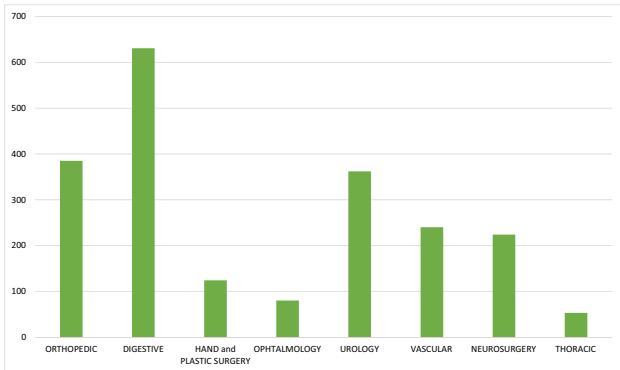

Figure 3: acute care surgery in an adultfrench hospital with level-1 trauma center

Fig.3

Diagnosis	Nb of cases	overall %
Medical	91,548	48%
Surgical	38351	20%
Trauma	42,197	22%
Psychiatrics	4,032	2%
Toxic	4,710	2%
Other	6,125	3%
Not available	43,392	23%
Total	**1,92,004**	

Table 2: diagnosis after ED consultation

Fig.4

SPECIALITY	PLANNED 26461 (65%)	EMERGENCY 12240 (30%)	ACUTE 2157 (5%)	TOTAL 40858
ORTHOPEDIC	5973 (59%)	3782 (37%)	385 (4%)	10140
DIGESTIVE	4798 (68%)	1604 (23%)	631 (9%)	7033
HAND and PLASTIC SURGERY	3498 (53%)	2960 (45%)	124 (2%)	6582
OPHTALMOLOGY	3394 (83%)	634 (15%)	80 (2%)	4108
UROLOGY	2606 (66%)	981 (25%)	362 (9%)	3949
VASCULAR	2184 (60%)	1199 (33%)	240 (7%)	3623
GYNECOLOGY	2969 (84%)	280 (8%)	270 (8%)	3519
NEUROSURGERY	2483 (75%)	607 (18%)	224 (7%)	3314
THORACIC	1018 (69%)	399 (27%)	53 (4%)	1470
OTHERS	507	74	58	639

Table 3: distribution of operative activity by specialty and according to the scheduled or urgent nature of surgical interventions
Planned means a surgical procedure scheduled at least one week before surgery ;
Emergency means a surgery required within 48 hours ; Acute means a surgery required in 12 hours.
Others included non-categorized procedures or hean and neck procedures

PR 252

A review of handovers on the intensive care unit at the Royal Gwent hospital

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Introduction: Every new admission to the ICU prompts a handover from the referring department to the ICU staff. This step in the patient pathway provides an opportunity for information to be lost and for patient care to be compromised.

Mortality rates in Intensive Care have fallen over the last 20 years, however, 20% of patients admitted to an ICU will die during their admission (1). Communication errors contribute to approximately two-thirds of notable clinical incidents; over half of these are related to a handover (2).

NICE have concluded that structured handovers can result in reduced mortality, reduced length of hospital stay and improvements in senior Clinical Staff and Nurse satisfaction (3).

Material and methods: A checklist was created to review to score the handover. This was created with Doctors and Nurses and is relevant for handovers between all staff members. Information was gathered prospectively by directly observing 17 handovers on the ICU.

Results: There is a notable discrepancy in the quality of handovers of new patients. This is true of handovers between Doctors, Nurses and a combination of the two. 41% (n = 7) of patients weren't handed over to a doctor. The most commonly missed pieces of information were details of the patient's weight (96%, n = 16), their height (100%, n = 17), whether the patient has previously been admitted to an ICU (78%, n = 15) and whether the patient has any allergies (71%, n = 12).

Conclusions: The handover of new patients to the ICU is often unstructured and important information is missed. This can be said for all staff members and grades, and for handovers from all hospital departments.

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Fig. 1

Handover Details

Date ..... Time ..... Department Transferred From .....
Role/Grade of Staff Member/s Making Handover.....
Role/Grade of ITU Staff Member/s Receiving Handover .....

Patient Details – Please indicate whether or not this information was received with a 'Y' or 'N', or N/A, rather than filling in any patient details.
Name ..... Age ..... Weight ..... Pre-Hospital Functional Status .....
Do they have any family and are they aware of the admission to hospital? ..... DNACPR .....
Passwords ..... Complex Social History to be Aware of .....

Admission Details – Please indicate whether or not this information was received with a 'Y' or 'N', or N/A, rather than filling in any patient details.
Date of Admission to Hospital ..... Diagnosis ..... Type and Grade of Airway .....
Main Risks ..... Catheters/Lines/Drains in Situ ..... Infection Risks and Alerts .....
Abnormal Test Results ..... Current Medications ..... 'To Do' List .....
Special Precautions (e.g. Spinal Immobilisation) .....

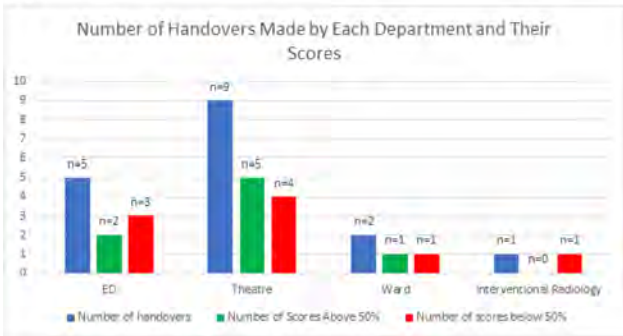
Medical History
Previous Medical History ..... Previous ITU Admissions and Discharge Notices .....
Allergies .....

Theatre Details – To be completed if the patient is a surgical patient. Please indicate whether or not this information was received with a 'Y' or 'N', or N/A, rather than filling in any patient details.
Procedure ..... Complications ..... Type of Anaesthesia Used.....
Blood Products Required ..... Antibiotics Given .....

Duration of Handover .....

Additional Comments
- Please use this space to write any comments about the handover, or to write any information that was missed that would have been useful.

Fig. 2



THE FRAIL PATIENT

PC 283

Cervical spine in head trauma: a true challenge in elderly patients

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Case history: Male patient, 70 years old, partially dependent. Fall from wheelchair with head trauma; no loss of consciousness. Head and cervical pain and worsening of numbness in hands (patient with previously diagnosed carpal tunnel syndrome). Recently diagnosed with upper airway infection, under azithromycin and non-invasive mechanical ventilation with need for oxygen supplementation.

Clinical findings: In the emergency room, patient presents in a wheelchair, no immobilization devices. Right supraciliary wound with minimal bleeding. Glasgow Coma Score of 15. Pain on palpation on upper cervical spine; no midline tenderness; cervical flexion/extension preserved but pain on lateral rotation. Numbness in hands;no motor impairment.

Investigation/Results: Cervical spine x-ray: atlanto-axial disruption. Cervical CT-scan reveals a comminuted fracture of the anterior arch and lateral mass of C1 and a type II fracture of the dens of the axis. No apparent radicular impairment.

Diagnosis: C1 Jefferson type IV fracture; C2 dens Anderson and D"Alonzo type II fracture.

Therapy and Progressions: Patient was admitted to an intermediate care unit and cervical stabilization was achieved with a Philadelphia collar. Given the unstable fracture pattern and the nocturnal agitation periods, a surgical procedure was proposed. At day 5, patient was submitted to surgical treatment of C1–C2 fracture: occipital plate + pedicular and translaminar C2 screws + lateral mass screws in C3 and C4. Intra-operative respiratory distress was observed and patient was transferred to our ICU due to inability to extubate. At day 8 and due to an improve in the respiratory function, patient was finally extubated and transferred to an intermediate care unit. At day 12 a new worsening in the respiratory function was observed and patient was again transferred to the UCI. Clinical worsening was observed and due to septic shock and multi-organ failure, patient died at day 15.

PR 284

Outcomes following bowel resection for acute mesenteric ischemia in the elderly: all is not lost

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Introduction: Bowel resection for acute mesenteric ischaemia (AMI) in elderly is associated with significant morbidity and mortality, and increasing age and frailty are associated with increased risk. This study aims to assess the short-term outcomes for elderly patients undergoing surgery for AMI, and to assess the accuracy of surgical risk calculators in this population, to determine their utility in pre-operative discussions.

Materials and methods: A retrospective review of patients aged $\geq$ 65 years undergoing bowel resection for AMI between 2014 and 2018. Reported outcomes included frailty index[3], morbidity, in-hospital mortality, intensive care unit (ICU) admission, length of stay (LOS) and discharge destination. Surgical risk was calculated using NELA[1] and ACS[2] calculators.

Results: Twelve patients were identified, 8 survived admission. Eleven were admitted to ICU, mean LOS 6 days. Mean total LOS was 17.5 days. All returned to prior residence, 3 following inpatient rehabilitation. All were frailer on discharge (Figure 1). Comparison of median risk as per surgical calculators for survivors and those who died shows NELA mortality 7% vs 12%, ACS mortality 7% vs 9%, and ACS serious complication 27% vs 29% respectively. The observed outcomes were 33% mortality and 50% serious complication.

Conclusion: Emergency surgery for AMI has high morbidity and mortality for elderly patients. However, for those surviving surgery, there is a positive outlook for returning to prior residence. Surgical risk can be estimated using available calculators.

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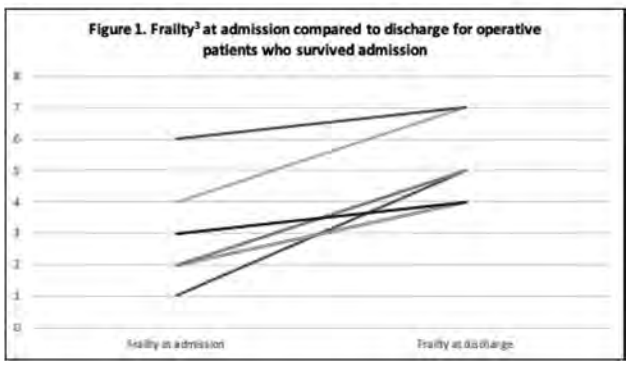
Fig. 1



THE FRAIL PATIENT

PR 285

Factors affecting functional prognosis in super elderly patients of intertrochanteric femoral fracture

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Introduction: Intertrochanteric femoral fracture of the super-elderly is often difficult to treat because good surgery does not always lead to good functional prognosis. We investigated the factors affecting the functional prognosis in patients with intertrochanteric fracture over 90 years old.

Material and methods: 94 cases of intertrochanteric fracture over 90 years old who had undergone surgical treatment at our hospital between December 2010 and September 2018 were examined. Nine men and 85 women, age at injury ranged from 90 to 101 years, with a median of 93 years. The average postoperative follow-up period was 3.7 months. For these cases, the mobility was classified into independent walking, assisted walking (cane, walker), wheelchair, bedridden, and the transition of pre- and post-operative mobility was analyzed. The significance test was performed using the Mann-Whitney U test, and $P < 0.05$ was considered significant.

Results: By fracture type, when Jensen classifications I and II were stable, III, IV, and V were unstable, mobility of unstable type was significantly reduced (P = 0.024). When the waiting period for surgery is divided by the median of 4 days, there was no difference in mobility reduction between groups of less than 4 days and groups of more than 4 days (P = 0.925). Although there was no significant difference in the presence or absence of preoperative rehabilitation intervention (P = 0.08), there was a tendency for less decline in mobility when preoperative rehabilitation intervention was performed.

Conclusions: In the treatment of this fracture, early surgical treatment after injury is recommended, but in the case of very elderly people, waiting is often required due to existing diseases and poor general condition . This study suggests the importance of preoperative rehabilitation intervention during the waiting period for surgery to prevent disuse disorders.

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PR 286

Older patients with traumatic shock exhibited lower pulse pressure compared with younger patients; an analysis of nationwide trauma data base in Japan

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Introduction: The study purpose was to assess the effect of age on the relationship between pulse pressure (PP) and systolic blood pressure (SBP) in patients with traumatic shock.

Material and methods: In this retrospective cohort study using nationwide trauma data base in Japan from April 2004 to May 2019, trauma patients 18 years of age and older with SBP < 90 mmHg were selected. Patients with severe traumatic brain injury (the abbreviated injury scale on head > 3) and cardiac arrest (HR = 0 and SBP < 60 mmHg) were excluded. Linear regression analysis assessed association between PP and SBP interacted by age group dichotomized as < 60 or ≥ 60 years old.
Results: During the study period, 12444 patients were included. The linear regression analysis indicated the significant association between PP and SBP in overall population (EC, estimated coefficient = 0.37 95%CI [0.33, 0.37], p < 0.001). Association between PP and SBP was significantly interacted by the age group (EC = 0.32 95%CI [0.29, 0.35] in younger group (5494 patients) versus 0.38 95%CI [0.35, 0.40] in older group (6950 patients), P for interaction < 0.05).
Conclusions: In this cohort study, older patients with traumatic shock exhibited lower pulse pressure compared with younger patients.

PR 287

Geriatric trauma in a tertiary hospital in Cape Town, South Africa: are we that different?

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Introduction: High rates of trauma in South Africa (SA) predominantly affect the youth, yet the geriatric population is not exempt.[1] In addition to inherent challenges of age, elderly trauma patients are further compromised by resource constraints.[2] We aimed to assess injuries and outcomes in elderly patients admitted to a tertiary Trauma unit in SA.
Material and methods: A retrospective record review was done of all patients 60 years and older, admitted to the Trauma unit over an 8-month period. Injury Severity Score (ISS), mechanism of injury (MOI), in-hospital complications and length of hospital stay were documented.
Results: 275 patients (mean age: 72 years; 57% female) were included with mean ISS of 8. The most frequent MOIs included non-traumatic falls (54%), falls from height (10%), motor-vehicle collisions (9%), pedestrian vehicle collisions (7%), and blunt injuries (8%, 87% intentionally inflicted). Eighty patients (30%) experienced at least one in-hospital complication. The mortality rate was 7%. The mean length of hospital stay was 7 days.
Conclusions: Despite the known vulnerablities of the elderly, the mortality rate and ISSs of this cohort were relativley low. However, when compared to first world literature, intentionally inflicted injuries and certain preventable MOIs (e.g. fall from height and pedestrian vehicle collisions) were common,[3–4] underscoring the importance of addressing the causative factors.
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PR 288

The impact of frailty on clinical outcomes in colorectal cancer surgery: a systematic literature review

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Introduction: The majority of new colorectal cancer is diagnosed in people > 65 years, yet the elderly are less likely to undergo curative surgery. Chronological age is poorly correlated with post-operative outcomes and is not an acceptable measure of risk. Conversely, frailty is a strong predictor of poor outcomes following surgery and presents an opportunity for patient optimisation. The aim of this systematic review is to assess the available evidence between frailty and outcomes in patients of all ages undergoing surgical resections for colorectal cancer.
Material and methods: Pubmed was searched for articles reporting outcomes for patients deemed frail undergoing elective or emergency colorectal cancer resection up until August 2019. The primary outcome was mortality (30 and 90 day). Secondary outcomes; length of stay, readmission, reoperation & post-operative complications.
Results: 143 studies identified, 17 studies were deemed eligible for inclusion. Study types, frailty assessments & outcomes measured were variable. Despite this heterogeneity, categorisation of "frailty" was associated with higher rates of post-operative mortality, complications, readmission, and length of stay.
Conclusions: Based on current evidence, frailty is a strong predictor of poor clinical outcomes in patients undergoing surgery for colorectal cancer. Standardisation of frailty assessment and measure of outcomes is needed for more robust analysis. Accurate risk stratification of patients will allow us to make informed treatment decisions and identify patients who may benefit from prehabilitation and intensive tailored post-operative care.
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PR 289

Is it possible to distinguish favorable or deadly course of pneumatosis intestinalis? A surgical dilemma in the frail patient

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Introduction: Pneumatosis intestinalis (PI) and hepatic portal venous gas (HPVG) are two radiological findings associated with a broad range of medical conditions. PI can be primary (15% of cases),usually with a benign course, or secondary (85% of cases),which results from obstructive or ischemic gastrointestinal diseases. Only a minority of PI is associated to free abdominal air. In literature there is no consensus on radiological and biochemical markers of favourable

outcome nor on treatment options- medical or surgical. We tried to identify prognostic markers in a series admitted to a single University Hospital.

Material and methods: The medical records of 36 patients with PI and/or HPVG admitted to Ospedale Maggiore Policlinico (Milan, Italy) in the period 2012–2019 were collected The CT scan were reviewed by a single radiologist.

Results: Mean age was 76.4 ± 14 years (43–94). PI was primary in 13,9% of the patients (N = 5), and secondary in 86,1% (N = 31).

At CT, PI was associated to portal gas in 13 patients (36%) (8 dead, 6 alive) and to free air in 7 patients (20%) (4 dead, 3 alive). Linear or rounded gas collections were equally distributed in primary and secondary PI. The colon was involved in 16 patients (44%), followed by the small intestine in 15 (41,6%),and the stomach (N = 2).

In 7 patients serum lactate was > 4, and 6 died. Leucocytosis (WBC > 11,000/mm^3) was present in 8 patients (1 alive).Four patients had peritonitis and 2 abdominal tenderness. Laparotomy was performed in 1 primary (alive) and 16 secondary PI (4 deaths).In two patients it was diagnostic; in 6 and 2 associated to right or left colectomy, in 3 to ileal resection and in 3 to other procedures.Surgery was judged futile in 12 patients; all died a few hours after Emergency Department access.

Conclusions: We could not found any relationship between clinical, biochemical and radiological findings and outcome of PI. Mesenteric and portal gas is a ominous finding, but did not reach significant value.

PC 290

Successful transcatheter arterial embolization for a giant pseudoaneurysm of gluteal muscle due to ground level fall in elderly woman with direct oral anticoagulants

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Case history: A 90's year-old woman using Apixaban fell on the ground and was transferred to previous hospital. Magnetic resonance imaging was taken and she was diagnosed as gluteal hematoma. She was treated conservatively but hemoglobin (Hb) level was gradually decreased. Although she was administered red blood cell as needed, anemia progressed. Contrast-enhanced CT showed expanding hematoma of gluteal muscle. She transferred our hospital for advanced treatment including surgery on 5th day on hospital.

Clinical findings: Vital signs were stable on arrival at our hospital. Extensive subcutaneous hematoma was found in the right thigh and gluteal lesion.

Investigation/Results: Laboratory test showed that Hb 6.6 g/dL and normal coagulation status. Contrast-enhanced CT showed a giant pseudoaneurysm inside the gluteal muscle.

Therapy and Progressions: Angiography showed a giant aneurysm of peripheral branch of internal iliac artery. We performed transcatheter arterial embolization (TAE) for it by gelatin sponge. After TAE, there was no complication and progressive anemia was stopped. She was transferred to another hospital for rehabilitation six days after TAE.

Comments: Increase use of direct oral anticoagulants in elderly people could induce severe hemorrhagic trauma by minimal mechanism. TAE is minimal invasive and safety procedure for such trauma case.

PR 291

Trauma in the very old age: experience at a spanish level i trauma center

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Introduction: The number of elderly people will increase during the next few decades. More importantly, the number of people aged 80 or above are projected to increase 100% in developed countries. In Spain, people over age 80 were 4.68% of the population in 2009, and this will increase to 6.19% in 2019. That has implications in the health services and in the management of trauma patients.

Material and methods: We did a retrospective cohort analysis of trauma patients ≥ 80 y.o. admitted to our Level I Trauma Center during the time-period of 2009–2019. Demographic data, ICU care, and mortality were assessed.

Results: 109 trauma patients ≥ 80 y.o. were admitted during that period. This is a 200% increase compared with the number of patients admitted during the previous decade (1999–2009).

Mean age was 84.8 ± 2.4 years, and median New Injury Severity Score (NISS) was 17 (interquartile range 13 to 27). 46% were male. The mechanism of injury was 50% falls, and 47% pedestrian run-overs. 48 patients were admitted to ICU, with median NISS of 25 and mortality rate of 38%. Among severely injured trauma patients (NISS ≥ 35) the hospital mortality rate of those ≥ 80 years was 90%, much higher than in the age group of 65–79 years (40%), with a significant difference ($p < 0.05$). No differences mortality rates between 65–79 years and youngers with the same NISS.

Conclusions: The geriatric trauma patient population is on the rise worldwide. This should be taken into account in our trauma centres in order to be able to adapt and try to improve trauma care in these patients.

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PR 292

Impact of frailty in surgical emergencies

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Introduction: Frailty is a geriatric syndrome which has been considered as a risk factor in the elderly, increasing adverse events in terms of global health, as hospitalization, increase of falls, need of institutionalization, and mortality.

The aim of this study is to evaluate relationship between frailty, and the presence of major complications in the postoperative course of patients older than 70 years undergoing emergency surgery.
Material and methods: Prospective, longitudinal, cohort study, using four different scales of frailty as a predictor of risk for short-term adverse events, for patients during the postoperative course of emergency surgery (May 2017–September 2018).
The sample is categorized according to four frailty scales (Clinical Frailty Scale, FRAIL score, TRST and Share-FI). We analyze the variables regarding diagnoses, clinical examination at admission, surgical procedures, and postoperative outcomes during the first 30 days. Clavien-Dindo classification was used in order to graduate the severity of complications.
Results: 92 patients were included with a mean age of 78,71 years (SD 6,26). 53,3% of the simple are women. Frailty prevalence ranges, according to the frailty scales, from 14,13% to 46%. Median hospital stay was 6 days (IQR 3,25–11,65).
All four frailty scales show statistical differences to predict major complication in our simple. TRST and FRAIL scales show the strongest measure of association (OR 7,69 and 5,92, respectively). The frail phenotype, is also related to an increased of mortality, and FRAIL scale is the frailty scale with largest OR (OR = 16,071).Only FRAIL show association with longer hospital stay (> 12 days), and reoperation rate.
Conclusions: Frailty represents a predictive marker of major complications and mortality, for patients older than 70 years undergoing emergency surgery. FRAIL score, shows the strongest relationship with mortality and complications.

PR 293

Trauma of the elderly: experiences from a Swedish level II trauma hospital

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Introduction: Age has been identified as a predictor of trauma mortality [1] and it is known that even low energy trauma may cause severe injuries in the elderly [2]. The aim of this study was to explore how the elderly trauma patients, and the care thereof, differ from the younger ones in a Swedish context.
Material and methods: The Swedish trauma registry (SweTrau) was used. Consecutive recorded trauma cases that presented at one level II trauma hospital during December 2019–August 2019 were included (n = 676). Patients were stratified into groups; those ≥ 65 and those
Results: In the ≥ 65 years group, sex distribution was more even (female 49.6 vs 34.9%, $p < 0.05$), physical status according to pre-trauma ASA classification was higher (mean 2.62 vs 1.45, $p < 0.05$) and the trauma mechanism was predominantly low-energy (falls from no height) as opposed to the
Conclusions: The trauma among elderly Swedish patients are more often of low energy compared to the younger population. In spite of this, the elderly are more severely injured, require more surgical interventions, and their short term mortality is increased 20-fold. Measures aimed at prevention of low energy trauma of the elderly are therefore much needed.

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PR 294

Hip function and health related quality of life in pertrochanteric fractures treatment by Selfdinamysible Internal Fixator and Gamma Nail

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Introduction: There are intramedullary or extramedullary methods in internal fixation od trochanteric fractures. Seldynamisalbe Internal Fixator with two sliding screws (SIF), as an extramedullary method, and Gamma Nail (GN), as an intramedullary method, are in routine trochanteric fractures treatment at our institution for last two decades.
Material and methods: Health related quality of life and hip function were assesed at least two years after surgery, in the series of 71 patients with a surgically treated AO 31A1 or 31A2 fracture type. There were two groups of patients: group treated by SIF and group treated by GN. Examination had been performed using SF-12 test, with its Physical Component Score (PCS) and Mental Component Score (MCS), and Harris Hip Score (HHS) tests.
Results: In SIF group, mean PCS was 59,7, mean MCS was 64,9 and mean HHS was 70,7. In GN group mean PCS was 68,2, mean MCS was 70,7 and mean HHS was 76,3. There was no significant difference regarding all these parameters between the groups of patients ($p > 0,05$). There was correlation between all evaluated parameters, both in groups of patients particularly and in all patients ($p < 0,05$).
Conclusions: Final functional results in the surgical treatment of pertrochanteric fractures are expected to be similar using Selfdynamisable Internal Fixator or Gamma Nail. Health related quality of life and hip function are correlated after union of pertrohanteric fracture internal fixation.
Keywords: pertrochanteric fracture, quality of life, hip function
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PR 295

Undertriage in fall injuries in the geriatric trauma population ≥ 60 years of age

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Introduction: A large group of elderly patients is admitted to hospital after falls, often low energy. Literature shows that this group tends to be severely injured and are often undertriaged.
We underwent a closer examination of this group as regards to undertriage and mortality.
Material and methods: Using our trauma register, we collected all patients ≥ 60 years of age with fall injury, admitted between 01.01.15–31.12.17. Statistical analysis using Chi squared test for categorical variables and Kruskal Wallis/Mann Withney test for continuous variables. All test two-sided with statistical significant values at p 0.05. Undertriage defined as ISS > 15 without trauma team.
Results: In this period we identified 341 patients ≥ 60 years of age with fall mechanism as cause of trauma. Males 55% (188/341) versus 45% (153/341) female. Younger males median 71 vs 78 years in females ($p < 0.001$). Median ISS in entire group was 9 and 29% (98/341) of the patients has ISS > 15. We identified undertriage in 31,6% (31/98). Falls from own height (0–1 m) was found in 54 patients with ISS > 15, 25/54 (46%) of them was found to have been undertiaged (p 0.004). We found an association between GCS < 15 and undertriage (p = 0.01). 60% (206/341) falls between 0–1 m and 30% (61/206) of these without trauma team. Falls between 1–5 m 12,5% (15/120) without trauma team. All 10 with fall > 5 m had trauma team. Mortality was 12% (41/341), no association between height of fall and mortality (p 0.237). Undertriage was not associated with increased mortality (p = 0,104). Median age in mortality group was 87 years versus 73 years in surviving group ($p < 0.001$). In univariate analysis there was association between prehospital BP < 90 (p 0.043), GCS < 15($p < 0,001$), ISS^{3}16 ($p < 0.001$), prehospital RR > 30, RTS < 12 ($p < 0.001$) ASA score > 1 ($p < 0.001$) and mortality.
Conclusions: We found significant undertriage in the geriatric trauma population with fall injuries. GCS < 15 and low energy falls was associated with undertriage but not with mortality.

PR 296

Laparoscopic direct repair of an incarcerated spigelian hernia

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Spigelian hernia occurs through a defect in the anterior abdominal wall adjacent to the semilunar line. It is in itself very rare and more over it is difficult to diagnose clinically. It has been estimated that it constitutes 0.12% of abdominal wall hernias. The majority of patients present with symptomatic incarceration of preperitoneal fat or intra-abdominal viscera. Radiographic studies are beneficial in confirming the diagnosis. The high rate of incarceration with or without strangulation mandates operative repair once the diagnosis is confirmed. The spigelian hernia has been repaired by both conventional and laparoscopic approach. Laparoscopic management of spigelian hernia is well established. Most of the authors have managed it by transperitoneal approach either by a direct repair or by placing the mesh in intraperitoneal position or raising the peritoneal flap and placing the mesh in extraperitoneal space. There have also been case reports of management of spigelian hernia by total extraperitoneal approach.

We present the case of an obese eighty-four y.o patient. complaining for a sudden onset abdominal pain in the right low quadrant, mimicking an appendicitis. The CT scan demonstrated a typical picture of a Spigelian hernia containing an intestinal loop. The loop showed classical signs of parietal wall ischemia. The video describes the surgical laparoscopic approach of this case which was able to confirm the diagnosis e to reduce the loop into the abdomen. The loop initially appeared diffusely ischemic, but after the intra-abdominal reduction some signs of vitality started to be noticed. However, they were incomplete; thus the loop was resected. The hernia defect was successively repaired in a direct way because of the small caliber (< 4 cm of diameter) and the possible contamination coming from the intestinal resection.

Post-operative course was particularly benign and the patient was discharged on the seventh post-operative day in good health.

PR 297

A review of elderly trauma using Clinical Frailty Scoring

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Introduction: Trauma Audit & Research Network (TARN) data shows older persons falling from standing height and sustaining significant injury has become the commonest trauma presentation in England and Wales[1]. We aimed to assess whether frailty predicts poor outcomes in the elderly.
Material and methods: Retrospective database review of TARN eligible patients > 65 years old admitted in a 19 week period with documented Rockwood Clinical Frailty Score[2]. Age, Injury Severity Score (ISS), length of stay (LOS) and mortality were noted. The in-hospital mortality group was sub-analysed. Logistic regression was performed (*Stata v15*), odds ratios and 95% CI reported.
Results: Older age was associated with higher CFS in the 263 patients studied. Increasing CFS was associated with increased overall mortality (CFS6-9 vs CFS1-5 OR 2.14; 95% CI 0.88–5.21), decreased likelihood of pre-hospital trauma alert and increased length of stay (CFS6-9 stayed 4 days more than CFS1-5).
All 22 deaths had CFS > 3 and head or chest injury. Adjusting for age and CFS those with chest injury were 1.15 times more likely to die (OR 1.15 95%CI 0.44–3.04). Mortality in those with rib fracture was 5 times higher in CFS6-9 vs CFS1-5 (OR 5.53 95%CI 1.21–25.28).
Conclusions: Increasing age and CFS (especially 6–9) are associated with poor outcomes in elderly trauma, thus CFS is a useful prognostic tool in severely injured elderly patients. Chest injuries are a major cause of mortality in this group, especially with increasing frailty. Major Trauma Centres must develop practice management guidelines to appropriately manage these patients.
References: 1) Major Trauma In Older People. England & Wales 2017. Trauma Audit & Research Network. https://

www.tarn.ac.uk/content/downloads/3793/Major%20Trauma%20in%20Older%20People%202017.pdf.
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Fig. 1

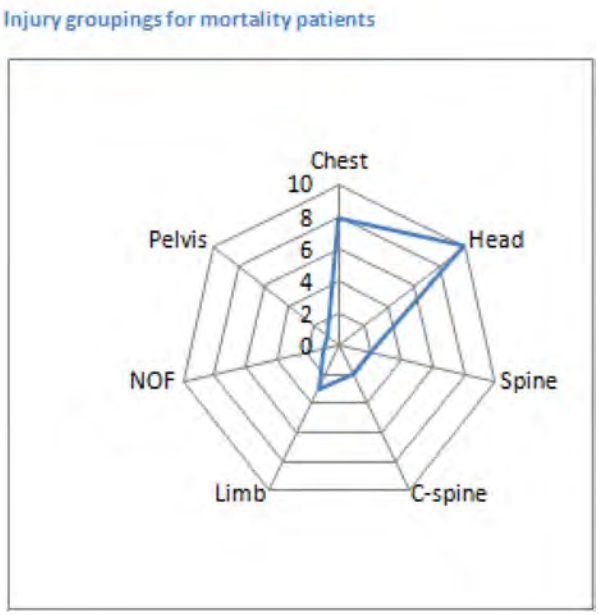

Fig. 2

CFS	Total	Median Age	Length of stay	% trauma called	ISS (Q1/Med/Q3)
1–3	84	78	10.6	65.4	9 / 16 / 25
4–6	132	83	14.8	32.3	9 / 16 / 25
7–9	47	87	17.8	14.6	8.5 / 9 / 16
Mortality	22	78.5	8.3	36.4	14.5 / 19 / 25

TRAUMA INITIAL MANAGEMENT AND RESUSCITATION

PR 298

Trauma and coagulation: circulating histons as predictors of coagulopathy in the severely traumatized patient

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Introduction: Bleeding remains one of the most important preventable cause of death in the severly traumatized patient, in particular if associated with coagulopathy. In the past, trauma induced coagulopathy (TIC) was considered as a consequence of the coagulation factors" dilution after a high-volume administration. Today TIC is more well know and it is recognized as a phenomenon related to the extent of tissue damaged and hypoperfuse. This takes to a derangement of coagulation mediated by cytokines and intra-cellular factors, among which histones

Material and methods: The aim of this work was to analyze the concentration of circulating histons in the clinical development of polytraumatized patients in a monocentric, prospective, experimental, non interventional study carried out in IRCCS San Raffaele Scientific Institute

Results: The 40 patients of the 2018 pilot study "Trauma and Coagulation" run in IRCCS San Raffaele Scientific Institute have been reviewed and analyzed in the times series of the clinical evolution of the patients. Some strange pattern have been recognized like "U shapes", with an increase of histons concentration after trasfusion of units of FFP, PLT and PRBC.This result was unexpected because the awaited was a reduction secondary to hemodilution. Very unexpectedly a histons concentration 70 times higher than the one in FFP, PLT and healthy control serum was discovered in PBRC

Conclusions: Histons concentration correlates with clinical scores of severity of trauma and risk of massive transfusion (ISS, ABC, TASH). Very unespectedly for cells without nucleus lile the RBC, these nuclear proteins are present in the PRBC.

References:

Cohen M. J. et al, *Coagulopathy of Trauma*, Critical Care Clinic 33 (2017) 101–118. DOI:10.1016/j.ccc.2016.08.003

Frith D., Brohi K. et al, *Definition and drivers of acute traumatic coagulopathy: clinical and experimental investigations*, J Thromb Haemost 8 (2010) 1919–25. DOI:10.1111/j.1538-7836.2010.03945

Maegele M. et al, *Early coagulopathy in multiple injury: An analysis from the German Trauma Registry on 8724 patients*, Injury, Int. J. Care Injured 38 (2007), 298–304. DOI:10.1016/j.injury.2006.10.003.

PR 299

Preoperative prevalence of and risk factors for venous thromboembolism in patients with a hip fracture: an indirect multidetector CT venography study

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Introduction: This retrospective cohort study investigated the prevalence of and risk factors for preoperative venous thromboembolism (VTE) in patients with a hip fracture and a delay of > 24 h from injury to surgery.

Material and methods: This observational study included 208 patients with a hip fracture surgically treated at 1 university hospital. Patients underwent indirect multidetector computed tomographic (MDCT) venography for preoperative VTE detection after admission. Overall VTE risk and median time from injury to CT scan were calculated. Age, sex, fracture type, time from injury to CT scan, body mass index, preinjury mobility score, previous anticoagulation treatment, previous hospitalization for VTE, varicose veins, and medical comorbidities were considered potential risk factors.

Results: The prevalence of preoperative VTE was 11.1% (23 of 208 patients). The mean time from injury to CT scan was 4.9 days. The delay from the time of injury to CT scan averaged 7.6 days for patients who developed preoperative VTE, compared with 4.2 days for patients who had not developed VTE. In the adjusted models, female sex, subtrochanteric fracture, pulmonary disease, cancer, previous hospitalization for VTE, and varicose veins were risk factors for VTE. The final multivariate logistic regression analysis

demonstrated that female sex (odds ratio [OR] = 5.86; 95% confidence interval [CI] = 1.21–28.21), subtrochanteric fracture (OR = 22.17; 95% CI = 4.02 to 122.06), pulmonary disease (OR = 21.10; 95% CI = 5.35–83.21), and previous hospitalization for VTE (OR = 16.36; 95% CI = 3.41–78.43) increased the risk of VTE.
Conclusions: Our findings show a high prevalence of preoperative VTE in patients with a hip fracture. Therefore, preoperative investigation for VTE should be routinely considered for patients in whom surgery is delayed for > 24 h. At this time, indirect MDCT venography seems to be effective and useful.

PR 300

Complement activation after major trauma

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Introduction: Major trauma causes activation of the complement system, which plays a key role in development of systemic inflammatory response syndrome and multiple organ failure. Complement is known to be activated early after trauma 1, but the relationship between outcome and the extent of complement activation during the first critical hours after injury is unknown. We hypothesized that complement activation in the first hours after trauma displays a highly dynamic pattern which is associated with outcome.
Material and methods: Complement activation was assessed by plasma terminal C5b-9 complement complex (TCC) using ELISA in a prospective cohort of 136 trauma patients. Samples were obtained at admission, after 2, 4, 6 and 8 h, and daily in the intensive care unit. The extent of complement activation was assessed as area under the concentration curves 3–6 h after injury (TCC-AUC3–6). The relative contribution of complement activation, base excess (BE) and new injury severity score (NISS) to outcome was analyzed by multivariable analyses.
Results: NISS and BE were associated with TCC-AUC3-6 in bivariate analyses (Spearmans rho (p) was respectively 0,23 (p = 0.01) and − 0.33 (p = 0.0003)). In multivariable analyses, NISS and initial TCC alone predicted 50% of the variability in ventilator-free days (VFDs), whereas initial TCC and TCC-AUC3-6 predicted 66%. TCC AUC3–6 alone contributed with 16% to the model. TCC-AUC3-6 was also significantly higher in patients deceased at day 30 (4.9; 2.1–17.9 (median; quartiles) vs. 2.4; 1.8–3.8, p = 0.048).
Conclusion: TCC-AUC3–6 is a significant explanatory variable for VFDs and 30-day mortality after trauma.
References: 1. Burk, A.-M. *et al.* Early complementopathy after multiple injuries in humans. *Shock* **37,** 348–354 (2012).

PR 301

Do massive transfusion protocols improve survival in trauma patients? An updated meta-analysis

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Introduction: Massive transfusion protocols [MTP] have been widely adopted for the care of bleeding trauma patients but their actual effectiveness is unclear. This study aims to conduct an updated meta-analysis to evaluate the effect of implementing an MTP on the mortality of trauma patients.
Material and methods: MEDLINE, PubMed, Google Scholar and Cochrane Library databases were systematically searched for relevant articles published from 1 January 2008, to 31 July 2019, using a combination of key words and additional manual searching of reference lists.
Three reviewers independently screened the articles for potential inclusion. Eligible articles were original articles in English, included trauma patients and compared mortality outcomes before and after institutional implementation of a MTP. Primary outcomes were 24 h and overall mortality.
Results: Nineteen studies met inclusion criteria, analyzing outcomes from 2,962 trauma patients. There was a wide range of outcome and process indicators utilized by the different authors. MTPs significantly reduced over-all mortality, pre-MTP-40.4% and post-MTP 32.6% [OR 0.7 (0.56–0.89)] for trauma patients. 24-h mortality was not significantly reduced [OR 0.87 (0.60–1.25)].
Conclusions: The institution of an MTP has a significant over-all mortality reduction for trauma patients. We encourage that researchers use standard nomenclature and indicators, provide more details regarding protocols and patient populations and incorporate advances in the management of bleeding trauma patients in all future MTP studies.
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PR 302

The impact of early administration of vasopressor agents for theresuscitation of severe hemorrhagic shock following blunt trauma

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Introduction: When resuscitating patients with hemorrhagic shock following trauma, fluid volume restriction and permissive hypotension prior to bleeding control are emphasized with good outcomes for penetrating trauma patients. However, evidence that these concepts apply well to the management of blunt trauma is lacking. This study aimed to assess the impact of vasopressor use in patients with blunt trauma in severe hemorrhagic shock.

Material and methods: In this single-center retrospective study, we reviewed records of blunt trauma patients with hemorrhagic shock and included patients with a probability of survival < 0.6. Patient's characteristics, examinations, severity and administrated therapies were compared between survivors and non-survivors. Data are described with median (25–75% interquartile range) or number.
Results: Thirty patients were included and median Injury Severity Score in survivors vs non-survivors was 41 (36–51) vs 45 (34–53) ($p = 0.49$), with no significant difference in probability of survival. Despite no significant difference in injury severity, non-survivors were administered vasopressors significantly earlier after admission and at significantly higher doses. Total blood transfusion amount administered within 24 h after admission was significantly higher in survivors (8310 [5800–9200] vs 6730 [4680–7810] mL; $p = 0.04$). Max catecholamine index was significantly higher in non-survivors (0 [0–8] vs 10 [11–16.5]; $p = 0.001$), and administered vasopressors were terminated significantly earlier (12 [4–28] vs 32 [8–74] h; $p = 0.028$) in survivors.
Conclusions: Vasopressor administration and high-dose use for hemorrhagic shock following severe blunt trauma are significantly associated with increased mortality. Although the transfused volume of blood products tends to be increased, early termination of vasopressor should be considered.
All authors have no significant relationships with regard to this study.

PR 303

Early amplitudes of citrated functional fibrinogen in thromboelastography to predict massive transfusion

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Introduction: This study aims to evaluate the role of early amplitudes of the thromboelastography measure of Citrated Functional Fibrinogen (CFF) to predict massive transfusion (MTx) defined as transfusion of ≥ 4 of any blood products within an hour of arrival to a major trauma centre.
Material and methods: Trauma patients ≥ 16 years requiring activation of the major haemorrhage protocol with TEG performed on a TEG® 6 s Hemostasis Analyser were eligible for inclusion. Exclusion criteria were arrival > 3 h after injury, pregnancy, bleeding disorder or anticoagulant use. Patient demographics and transfusion requirements were obtained from medical notes. TEG Manager was accessed to extract amplitudes at 5 min (A5), 10 min (A10) and end point (MA) in the CFF. Receiver operator characteristic (ROC) curves were plotted to evaluate each TEG amplitude as a predictor for MTx.
Results: 138 patients with a median age of 41 (IQR 26–58.5), Shock Index 0.81 (IQR 0.64–1.1), Injury Severity Score 22 (IQR 13–34) were included. There was correlation between CFFA5 & A10 (Rs = 0.992 [95% CI 0.984–0.996], p < 0.001), CFFA5 & MA (Rs = 0.606 [95% CI 0.136–0.980], p < 0.001) and CFFA10 & MA (Rs = 0.606 [95% CI 0.159–0.995], p < 0.001).The median (IQR) CFFA5 was significantly higher for those not receiving MTx compared to those who did; 13.2 (7.75–18.65) vs 10.73 (4.63–16.83), p = 0.007. The same was found for CFFA10 (No Mtx 16.3 (21.02–11.72) vs MTx 14.02 (7.43–20.76), p = 0.026) and CFFMA (No Mtx 17.7 (13.88–21.52) vs MTx 16 (9.65–22.35) p = 0.026).ROC curve analysis for MTx was similar across all three amplitudes; CFFA5 area under the curve (AUC) 0.679 (95% CI 0.556–0.801) p = 0.007, CFFA10 AUC 0.652 (95% CI 0.525–0.779) p = 0.026 and CFFMA AUC 0.652 (95% CI 0.525–0.779) p = 0.026.
Conclusion: This study demonstrated a positive relationship between A5, A10 and MA and that A5 and A10 amplitudes are equivalent to MA for the prediction of MTx. Further work needs to be done to determine appropriate values to predict MTx

PR 304

Cell free annexin A2 a potential marker for tPA mediated hyperfibrinolysis

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Introduction: Hyperfibrinolysis, remains a significant characteristic of acute traumatic coagulopathy induced mortality. S100A10, a cell surface protein, when shed creats an occult hyperfibrinolytic subtype. Annexin A2 (A2), a multicompartment protein that co-localizes with S100A10 and contains a tissue plasminogen activator (tPA) binding site has been shown to enhance tPA activity 100-fold and thus behaves as marker of hyperfibrinolysis. We hypothesize that increased concentrations of A2 in blood will enhance tPA fibrinolysis.
Material and methods: Blood was collected from (12) healthy volunteers. Recombinant A2 in concentrations 1, 25, 50, 75, 100, 125 μg/mL was added blood and then combined with tPA 75 ng/mL. Samples were assessed using thromboelastography (TEG). Blood samples were collected from trauma activations from 2014-current at a single, urban, Level-1 trauma center. Samples were assessed using a combination of rapid, citrated native and tPA challenge TEG. A2 levels were established via proteomic analysis.
Results: A2 50–125 (μg/mL) significantly increased tPA mediated Ly30% vs tPA alone (A2 + tPA [50–125] median 21.5% vs tPA 12.0% p < 0.01). A2 without tPA had no significant effect on Ly30% and was similar to the lysis of control (A2 75 μg/mL 0.7% vs control 1.2% p = 0.36). A2 75–125 (μg/mL) significantly increased R time from control and tPA alone (control normalized to 1 vs A2 median 1.77-fold increase in minutes p < 0.01 and tPA 0.68-fold decrease vs A2 median 1.77-fold increase p < 0.001). Rapid TEG for patient 1 vs patient 2 in our ongoing study was 3.4% vs 4.2% and 1.7% and 51.8% respectively on tPA challenge TEG. Proteomic analysis of A2 relative activity found a 6.6-fold A2 activity in patient 2 compared to patient 1.
Conclusions: Exogenous cell free A2 significantly increases tPA mediated fibrinolysis measured by TEG. Preliminary data from our ongoing trauma study evaluating A2 levels and hyperfibrinolysis coincide with our in vitro study.

Fig. 1

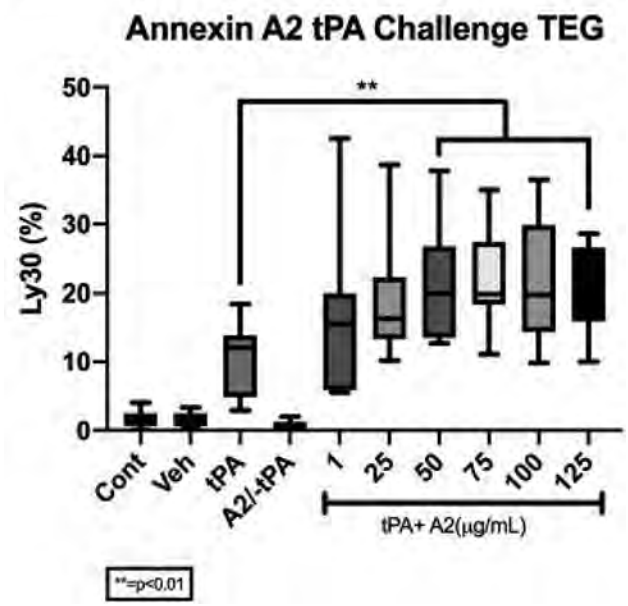

Fig. 2

Patient #	NESS	Type of Trauma	Systolic BP	Pulse	WBC	Hgb	pH	BE	INR	D-Dimer	Rapid-Teg Ly30%	tPA Challenge TEG Ly30%	A2 activity
1	17	Blunt	88	110	10	14	7.42	-6	1.82	0.8	4.2	1.70%	6.4E+06
2	75	Blunt	90	112	9.2	11.8	7.23	-10	1.15	20.01	3.4	51.8	4.2E+07

PR 305

Massive transfusion protocol, can it be improved? A clinical research

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Introduction: Massive transfusion protocol can be activated to mobilize the blood products resource in a timely and effective manner. Blood products, however, are still wasted or overused. We aimed to study what proportion of patients who met the ABC criteria for massive transfusion received 4 or more units packed RBC (PRBC).
Material and methods: A retrospective study all level I trauma patients admitted with arrival systolic blood pressure of 90 or less (July 2017 to May 2018) was recruited. Transfusion was complied with STTS. All clinical and laboratory findings, and management procedures were populated from the data registry.
Results: 214 of 1200 admitted trauma patients met the inclusion criteria. Of 214 patients who where admitted with hypotension, 39 of 95 patients (41.05%), who met the ABC criteria for receiving 4 or more PRBC were stabilized with 2 or 3 units. In other words, STTS enabled us to save 69 units of PRBC. Arrival data, i.e. blood pressure (cut of point: 83 mmHg and P value:0.01), shock index (Cut of point: 0.79 and P value:0.0009) and pulse rate (Cut of point:112 beat/min and P value:0.01) were significantly different in patients prescribed 4 or more units PRBC. After Initial Resuscitation, blood pressure (Cut of point:98 mmHg and P value:0.0001 shock index Cut of point: 0.9 and P value:0.001), pulse rate(Cut of poinan95 beat/min and P value:0.001) presence of pelvic fracture, positive FAST,and base deficit > 10 were significantly different in the group received 4 or more units PRBC.
Conclusions: Massive transfusion Protocol with ABC criteria may lead to wasted or overused blood products.Consideration of DCR continuation strategy complied with STTS along with the findings of this study has resulted in a refined protocol characterized by more effective and efficient blood product resource allocation.
References: 1- Chang R, Holcomb JB. Optimal fluid therapy for traumatic hemorrhagic shock. Critical care clinics. 2017 Jan 1;33(1):15–36. 2013

PC 306

Retropharyngeal hematoma: a threaten to the airway

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Case history: We present the clinical case of a female patient of 77 years old who had been taking aspirin. Mechanism of injury: a fall from her own height, resulting in head trauma.
Clinical findings: Dysphonia and stridor, having underwent an immediate orotracheal intubation.
Investigation/Results: She had a head CT done that was normal; and a cervical column and neck CT that showed a large retropharyngeal hematoma, without an associated vertebrae fracture.
Diagnosis: Large retropharyngeal hematoma.
Therapy and Progressions: She was admitted to the intensive care unit for mechanical ventilation. On 2nd day, she underwent a surgical tracheostomy. On 4th day, underwent weaning from mechanical ventilation. On 6 h day, was transferred to the ENT ward, had the tracheostomy tube removed and was discharged from hospital.
Comments: A hematoma in this potential space may constitute an immediately life threatening emergency due to airway compromise. In 1991, Thomas et al found only 29 cases described in the literature since 1966. The most common cause is the blunt cervical trauma (in 38% of the cases). Other causes are the cervical hyperextension injury, cervical vertebrae fracture, cough, sneeze, strain, blunt head trauma, swallow a foreign body, retropharyngeal infection, carotid artery aneurism, internal jugular vein puncture, metastatic disease, coagulopathy, anticoagulants, etc.
In the setting of trauma, the mechanism of injury generally permits explaining the presenting injuries. In this case, the clinical severity expressed by the patient seemed to be disproportional to the resultant injury. However, the presence of haemorrhage contributing factors associated with the existence of fascial spaces in the neck, should warn us of the possibility of formation of deep cervical hematomas that may cause an occult airway obstruction.
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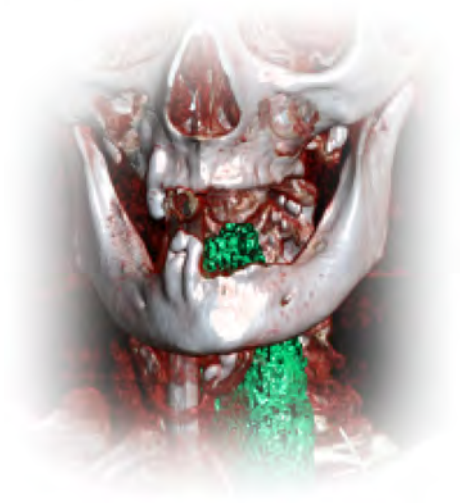
Fig. 1

Fig. 2



PC 307

Opioid-related compartment syndrome: a case report

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Case history: A 27-year-old male with a personal history of consumption of alcohol, cannabis, smoked cocaine and heroin. He was found in decubitus position and in a situation of cardiac arrest. The last time he was seen in his baseline situation was 48 h before. After performing CPR and administration of naloxone and flumacenyl, sinus rhythm was achieved.

Clinical findings: 24 h after admission, increased tension was observed in left leg, thigh and gluteal region. Absence dorsalis pedis, tibialis posterior and popliteal pulse was observed in a Doppler examination.

Investigation/Results: Intracompartmental pressure measurement revealed a result of 28 mmHg in the deep posterior compartment and 20 mmHg in the superficial (diastolic BP 40 mmHg). At admission K levels were 10.50 mEq/L, creatinine 2.24 mg/dL and CK 113438 U/L.

Diagnosis: Opioid-related compartment syndrome.

Therapy and Progressions: Urgent fasciotomies of the leg and thigh were performed 3 h after diagnosis with a posteromedial and anterolateral approach in the first case and with a lateral approach in the latter. Herniation and signs of poor viability in all the compartments were observed. After the surgery, he persisted with anuria and a CK peak of 288,000 U/ L, which was next normalized. 7 debridements were performedfor the next 25 days. Subsequently, after the isolation of *P. stutzeri* and *Mucor* in the wound and the absence of signs of vitality, a supracondylar amputation was performed. After, hemodynamic status improved. 2 weeks after the amputation it was possible to withdraw hemodialysis, which he had required since admission.

Comments: Opioid misuse is a topic of growing interest. Recent works have reported a worse prognosis in the case of opioid-related compartment syndrome. A high level of suspicion is necessary to make a prompt diagnose in these patients.

References: Rao S.S. et al. *Opioid-related compartment syndrome and associated morbidity*. Injury 2019 Aug; 50 (8): 1429–1432

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 308

A preclinically applied pelvic binder does not improve patient survival: a retrospective analysis

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Introduction: The pelvic binder is a mechanical device designed to compress instable pelvic ring fractures and minimize dead space in order to limit blood loss. It is generally recommended to apply a pelvic binder if an unstable injury is suspected and the patient presents with a "C-problem". The effectiveness remains questionable though.
Material and methods: A total of 1207 trauma patients between 2014 and 2018 were retrospectively evaluated regarding instable pelvic injury. 108 patients were admitted with a pelvic binder applied. The correct application was evaluated using CT scout. Four groups were generated: Group 1 with correct pelvic binder application, group 2 with incorrect placement, group 3 with no pelvic binder at time of admission, group 4 with pelvic binder applied in ER.
Total outcome was determined based upon ISS, age, preclinical time, time to CT, shock index, hemoglobin at admission, survival rate, administration of blood products as well as total hospital and ICU days.
Results: 43% of all pelvic binders were applied incorrectly. 30 patients (28%) suffered an instable pelvic fracture. Patient survival was not influenced by the preclinical application of a pelvic binder (80% group 1 vs. 81,82% group 3, p = 0,719). No significant statistical difference was found for total ICU days 9,08 vs. 11,56, p = 0,399; total hospital days 23,42 vs. 24,76, p = 0,630; RBC transfusion 5,87 vs. 3,63, p = 0,791; ISS 23,8 vs. 24,5, p = 0,815.
Conclusions: The correct application of a pelvic binder seems to pose problems preclinically. While the need to minimize blood loss is crucial, our collective did not benefit from this device. Additionally, survival rates of the patients that suffered an instable pelvic fracture were unaffected. The ISS remains the strongest predictor of total patient survival in pelvic trauma.

PR 309

Trauma resuscitation times in a Level 1 Trauma Center in The Netherlands: a prospective overview

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Introduction: In trauma, time is considered to be an important factor influencing patient's outcome. In the first hour after injury, appropriate care has the greatest effect on trauma patient's survival. Previous research showed that measuring in-hospital trauma resuscitation times, contributes to insights and improvement of the resuscitation process. However, despite developments of ATLS guidelines, no recent empirical knowledge regarding resuscitation times exists. The aim of this study is to examine in-hospital trauma resuscitation times in a level 1 trauma center in The Netherlands.
Material and methods: A prospective study was performed in level 1 trauma center Amsterdam UMC location VUmc, between May 2019 and August 2019. Trauma patients, aged ≥ 16, presented during daytime at the trauma resuscitation room were included. Information regarding patient's characteristics, trauma- and injury type, handover duration, duration till start of diagnostics and intervention, total resuscitation time, patient's disposition and survival were compared.
Results: In total, 50 patients were analyzed. Motorized traffic accident (42%) and blunt injury (92%) were the most common mechanism- and injury types. Median prehospital to in-hospital handover time was 3.40 min (IQR 1.20). Median duration till start of diagnostics and intervention were 8.01 (IQR 2.42) and 9.59 min (IQR

9.55) respectively. Median total resuscitation time showed to be 40.25 min (IQR 23.01). Mortality in trauma resuscitation room was 2% (n = 1).
Conclusions: This prospective study provides insights in time until different stages of the trauma resuscitation are started and completed. Total resuscitation time is similar compared to previous research. Future research is recommended to consider comparing times of the total trauma patient's prehospital and in-hospital chain to create a more enhanced view.
References:
Van Olden G, et al. Trauma resuscitation time. 2003 Injury.

PR 310

Pre-hospital tourniquets in civilians: a systematic narrative review

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Background: Terrorist attacks and civilian mass casualty events are frequent, and some countries have implemented tourniquets for uncontrollable extremity bleeding in civilian settings. We summarized current knowledge on the use of pre-hospital tourniquets in civilian settings to assess whether their use increases the survival rate in civilian patients with life-threatening hemorrhages from the extremities.
Methods: Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we searched Medline (Ovid), Embase (Ovid), Cochrane Library, and Epistemonikos in January 2019. All types of studies that examined the topic in a pre-hospital setting published after January 1, 2000, were included. The protocol was registered in PROSPERO (CRD42019123172).
Results: Among 3460 screened records, 55 studies were identified as relevant. Due to a lack of relevant civilian studies, military studies were also included. The studies were highly heterogeneous, with low quality of evidence. Most studies reported increased survival in the tourniquet group, but few had relevant comparators, and the survival benefit was difficult to estimate. Most studies reported a reduced need for blood transfusion, with few and mainly transient adverse effects from tourniquet use.
Conclusion: The data suggest that the use of commercial tourniquets in a civilian setting to control life-threatening extremity hemorrhage is probably associated with improved survival, reduced need for blood transfusion, and few and transient adverse effects.

PR 311

The effect of venous infusion by emergency medical service personnel on the prognosis of severe traffic accident patients: a nation-wide study in Japan

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Introduction: In Japan, the law of Paramedic was revised in 2014, and it became possible for paramedic in Japan to secure an infusion route before cardiac arrest for severe patients. However, the effect of this treatment on the prognosis of severe trauma patients has not been assessed. We assessed this effect on the prognosis of severe traffic accident patients with using population-based ambulance record and nation-wide hospital-based trauma registry in Japan.
Material and methods: This study was a retrospective observational study and the study periods was 2 years between January 2016 to December 2017. We linked the nation-wide hospital based trauma registry (JTDB) and the population-based ambulance record in Japan in case. In this study, we included the traffic accident patients with ISS score more than 16 and excluded cardiopulmonary arrest patients on the arrival of EMS on the scene and missing data cases. The Main outcome was cardiopulmonary arrest on hospital arrival. McNemar's test and conditional logistic regression analysis were used to assess the association between the securing a infusion route by EMS personnel and the primary outcome after one-to-one propensity score matching for securing a infusion route or not.
Results: 3502 traffic accident patients were eligible for analysis and 142 patients were dripped by EMS personnel. After one-to-one propensity score matching, the proportion of cardiopulmonary arrest on hospital arrival were 5.6% (8/142) in patients dripped by EMS personnel and 7.7% (11/142) in patients not dripped by EMS personnel, respectively (P = 0.648). The adjusted odds ratio for securing a infusion route was 0.727 [95% confidence interval; 0.293-1.808, P = 0.493].
Conclusions: In this study, there was no association between the securing a infusion route and outcome of traffic accident patients.

PR 312

The association between trauma patient characteristics and adverse laboratory values: which patient characteristics are most predictive?

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Introduction: In more than 60 countries worldwide, laboratory testing is protocol driven since 1978 when it was included in the practice guideline of the Advanced Trauma Life Support Course (ATLS). [1] However, it is not clear yet which patient characteristics are associated with unfortunate laboratory values. The aim was to create an overview of the characteristics that were associated with adverse laboratory values.
Material and methods: This cohort study was performed at Amsterdam UMC, location AMC (level 1 trauma center), including patients during a period of 2 years. Data concerning age, gender, ASA

scores, Injury Severity Scores (ISS), Glasgow Coma Scores (GCS), mechanism of injury, type of injury (blunt or penetrating) and the presence of Helicopter Emergency Medical Services (HEMS) were obtained. The hematology panel included hemoglobin, hematocrit, MCV, leucocyte and thrombocyte values. The coagulation panel included INR, PT, aPTT, fibrinogen and D-dimer values. Other panels include arterial blood gas, kidney and liver panels. The association between trauma patient characteristics and laboratory values were determined by using binary and multinomial logistic regression.
Results: A total of 1287 patients were included, consisting of predominantly men (66%) with a mean age of 46 years old. An increase in age and ISS was correlated with abnormal laboratory values ($p = 0.00$). Additionally, male gender, ISS > 16, blunt trauma and the absence of HEMS was associated with a deviation in laboratory values ($p < 0.05$). Other patient characteristics did not show a significant correlation with adverse laboratory values.
Conclusions: Patient characteristic including male gender, ISS > 16, blunt trauma and the absence of HEMS seemed to be associated with a deviation in laboratory values. However, additional research for more accurate results is recommended.
References: American College of Surgeons Committee on Trauma (ed). Advanced trauma life support course. 2012.

TRAUMATIC BRAIN INJURIES AND TRAUMA CRITICAL CARE

PC 313

Third nerve palsy caused by distal ICA aneurysm after surgery for treatment of pituitary macroadenoma apoplexy: case report

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Case history: A 47-year-old man presented with a classic case of pituitary apoplexy with a history of headache, nausea and vomiting.
Clinical findings: He was found to have a sellar and suprasellar mass with internal cystic and hemorrhagic component consistent with a pituitary macroadenoma.
Investigation/Results: He underwent transsphenoidal sugery for a pituitary macroadenoma. Because the tumor was invaded to left cavernous sinus, we left small portion of the tumor. Eighth day after surgery, he underwent gamma-knife surgery (GKS) for residual tumor. After two weeks, he complained of left ptosis. We considered the 3rd nerve palsy to be a post-radiation reaction at first. After 3 months, the symptoms had been continuous and MRI showed increased size of cystic lesion involving left cavernous sinus.
Diagnosis: CT angiogram demonstrated a saccular aneurysm at left distal ICA. Endovascular coil embolization was performed.
Therapy and Progressions: After 3 months of the intervention, the 3rd nerve palsy was partly improving.
Comments: Our case report emphasizes the necessity of cerebrovascular imaging before surgery for PA. MR angiography/CT angiography is not currently obligatory in patients with pituitary adenoma, but in cases with the symptoms of displacement of the neuro-vascular structures it can be of great value. Even in patients without such presentations, it may be helpful to evaluate the vascular involvement.

References:
1. Turk Neurosurg. 2015;25(3):469–74. "Pituitary Macroadenoma Coexistent with a Posterior Circulation Aneurysm Leading to Subarachnoidal Hemorrhage During Transsphenoidal Surgery"
2. **World J Surg Oncol.** 2015 Jul 30;13:228. "Pituitary adenoma apoplexy caused by rupture of an anterior communicating artery aneurysm: case report and Literature review"

PC 314

Transorbital penetraiting deep brain injury by high-speed spear-fishing steel

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Case history: A 16-year-old boy during the preparation for a fishing session was pierced to the left orbitary region by a high-speed spear-fishing steel.
Clinical findings: Upon arrival the patient was conscious and responsive with a GCS of 15, he followed commands appropriately and there were no motor of sensory deficits.
Investigation/Results: Plain skull radiographs showed the spear crossing the skull from the left orbit to the posterior part of the parietal bone.
Diagnosis: The patient was immediately intubated to prevent involuntary movement of the foreign body. CT scan showed the fracture of the left orbitary roof where a 30 centimetres long metallic object crosses the cerebral parenchyma of the left hemisphere and perforates the left parietal skull.
Therapy and Progressions: Under direct visualization via transorbital approach the foreign body was removed together with bone fragments, hemostasis was done and orbitary roof repaired. Serial cranial CT scan showed progressive reduction of frontal and parietal hematoma. The movement of the eye improved after a few days, normalizing with the regression of periorbital edema. Upon discharge at 11th postoperative day the patient had a GCS score of 15, no motor deficit and minimal visual loss.
Comments: Penetrating injury of the skull and brain are relatively uncommon events, representing about 0,4% of all head injuries. Orbital roof is relatively thinner part of the skull that can provide easy access to projectile objects, which can penetrate into cranial cavity and damaging the brain parenchyma. The principles of treatment are removal of bone fragments and foreign body, control of persistent bleeding and intracranial hypertension, prevention of infection though debridement of all contaminated and necrotic tissue and at the same time preservation of as much nervous tissue as possible.

PR 315

Multitraumapatients whith severe head injury (AIS ≥ 3) are more quickly carried out CT scan on than a patient without severe head injury

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Introduction: Trauma patients who are prone to severe head injuries during trauma may profit from obtaining a rapid clarification of the injury magnitude when using CT examination. In the case of a delayed CT examination, the consequence of the head injury could be more extensive. In this study, we wanted to see if those with severe head injury (AIS $\geq$ 3) received a faster CT survey than those who had no severe head injury.
Material and methods: Retrospective registry study of severely injured patients (ISS > 15) which had been hospitalized as a trauma patient at Haukeland University Hospital in the period 2015-2019. In the study, we have excluded all patients entered as Multitrauma but who have ISS < 16 and all patients who have not defined CT time. It turns out that over half of the patients lacked the registration of accurate time for the CT survey in the National Trauma Register. The number is still considered large enough to find a result.
Results: 2542 patients were received as Multitraumatic at Haukeland University Hospital during the period. Of these, 493 was severely injured. Of these, 265 patients had severe head injuries and they again had 52 head injuries as the only serious injury (AIS $\geq$ 3). Median time from arrival receipt to start CT, for this group was 27 min. In the control group that was severely injured but without severe head injury is the same time 33 min. There was 102 patients in the control group.
Conclusions: For the patients in this study who had severe injuries (N:493), the median time from the arrival in the emergency department to the CT starts was 6 min shorter for severe head injuries than for the group without severe head injuries.
References: Data dump 24.10.19, National trauma registry, all patients, hospital number 0 or 1, Haukeland University hospital

PR 316

Consideration about transfusion ratio for severe traumatic brain injury

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Introduction: The patients with severe traumatic brain injury (sTBI) who needs surgical intervention often experience acute traumatic coagulopathy (ATC). Earlier transfusion with high blood product ratios (plasma, platelets, and red blood cells via 1:1:1 ratio) is recommended for severely injured patients. However, recommended blood product ratio for sTBI is still controversial.
Material and methods: We retrospectively reviewed successive adult sTBI who underwent surgical treatment in our hospital between January 2016 and December 2018. We have transfused plasma aggressively to maintain blood fibrinogen above 150–200 mg/dL. We evaluated the total amount of transfusion and mortality. We exclude cases administered fibrinogen concentrate.
Results: 53 patients were enrolled. the amount of transfusion for 24h is RBC 4.2units, FFP 7.8units, PC 3.8units. sTBI with severe other trauma needs higher ratio of plasma.
Discussion: Tissue injury of sTBI causes severe coagulopathy and 1:1:1 transfusion was thought to be insufficient for sTBI in order to maintain fibrinogen. We agressively transfused plasma but we achieved fibrinogen value above 150 only in 20% of sTBI with severe other trauma. Agressive plasma transfusion had limitation for hyperfibrinolysis so we expect other product, for example fibrinogen concentrate.
Conclusions: 1:2:1 transfusion was needed for sTBI.
References: Zhang LM et al. world Neurosurg, 2017; 104:381–389 Hayakawa et al. Critical Care 2017;21:222.

Fig. 1

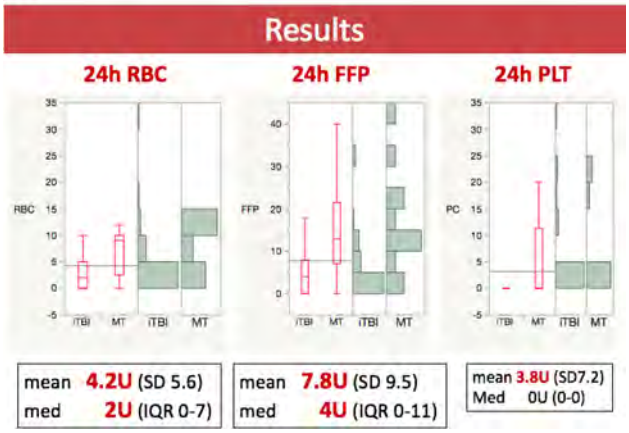

Fig. 2

Results

		all	iTBI	MT	P value
24h RBC	mean (SD) median (IQR)	4.2 (5.6) 2 (0-7)	7.8 (9.5) 2 (0-5)	6.8 (4.3) 9 (2-10)	0.07
24h FFP		7.8 (9.5) 4 (0-11)	5.5 (7.6) 4 (0-8)	15.3 (11.8) 13 (7-22)	0.001
24h PLT		3.2 (7.2) 0 (0-0)	2.8 (6.9) 0 (0-0)	4.6 (8.4) 0 (0-11)	0.46
3h RBC		1.8 (2.8) 0 (0-4)	1.4 (2.4) 0 (0-2)	3.4 (3.5) 3 (0-4)	0.026
3h FFP		4.1 (4.6) 4 (0-6)	3.1 (3.8) 2 (0-6)	7.4 (5.4) 6 (4-10)	0.003

Fig. 3

achieve 3-6h fibrinogen > 150

	all	iTBI	MT	
	58%	82%	24%	
3 - 6h fib median (IQR)	168 (105-215)	198 (144-265)	120 (85-147)	0.009

3-6h fib : follow-up fibrinogen 3-6hours after arrival

Fig. 4

		total n=53	iTBI n=41	MT n=12	p value
sex (male)	n(%)	30 (57)	24 (59)	6 (50)	0.6
age	median (IQR)	71 (54-82)	73 (56-82)	56 (39-73)	0.06
GCS	severe(3-8) n(%)	22 (58)	15 (58)	7 (58)	0.02
	moderate(9-13)	9 (24)	4 (15)	5 (41)	
	mild(14-15)	7 (18)	7 (27)	0 (0)	
HR	bpm	83 (65-95)	85 (65-92)	83 (60-110)	0.49
sBP	mmHg	154 (132-178)	151 (132-181)	155 (129-174)	0.46
Hb	median (IQR)	12.6 (10.2-14.1)	13 (10.3-14.8)	11 (9-13.5)	0.16
Plt	median (IQR)	19.6 (14.2-23.6)	19.4 (13.5-23.5)	19.9 (15.2-24.9)	0.86
D-dimer	median (IQR)	32.3 (10.3-67.3)	19.5 (5.8-48.2)	68.4 (51-160)	0.03
fibrinogen	median (IQR)	220 (185-316)	238 (190-357)	183 (125-237)	0.006
3-6h fib	median (IQR)	168 (105-215)	198 (144-265)	120 (85-147)	0.009
⊿fib	median (IQR)	−32 (-70-9)	−31.5 (-70-10)	−43 (-101-7)	0.5
24h fib	median (IQR)	270 (200-336	271 (197-346)	267 (217-300)	0.54
PT-INR	median (IQR)	1.09 (1.01-1.19)	1.07 (1.01-1.16)	1.14 (1.02-1.29)	0.69
APTT	median (IQR)	29.5 (26.65-35.6)	29.1 (25.9-33.1)	33.5 (27.6-40)	0.54
30d GOS	good n(%)	15 (28)	13 (32)	2 (17)	0.29
30d mortality	n(%)	11 (21)	7 (17)	4 (33)	0.24

PR 317

Risk adapted diagnostics and hospitalization following mild traumatic brain injury

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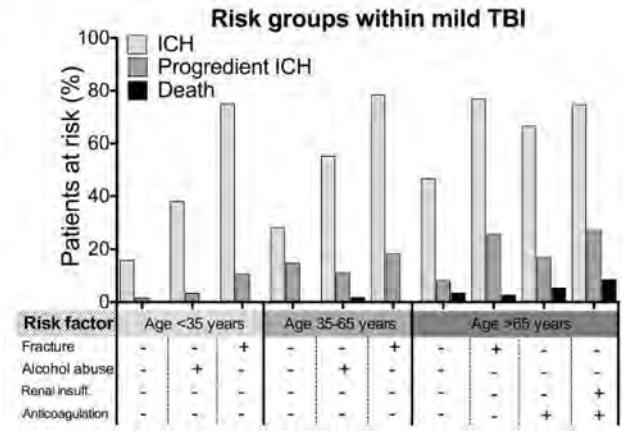
Introduction: Traumatic brain injury (TBI) remains a leading cause of hospital admission and mortality amongst trauma patients. Intracranial hemorrhage (ICH) can occur with TBI and presents a severe complication. Low complication tolerance in developed countries and uncertainty on actual risk cause excessive diagnostics and hospitalization, considered unnecessary and expensive.
Methods: TBI cases indicated for cranial computer tomography (CT) according to international guidelines, at our Level I Trauma Center between 2008–2018 were retrospectively included. Multivariate logistic regression was performed for ICH, progression and mortality predictors.
Results: 2036 TBI patients (m: 57.5; age at trauma: 57.6 ± 22.6), were included. CT was performed in 96.5%, skull fracture diagnosed in 18.6%, ICH in 51.9%, ICH progression in 28.4%. In patients < 35a, chronic alcohol consumption ($p = 0.004$) and neurocranial fracture ($p < 0.001$) were significant ICH risk factors in a multivariate analysis. In patients between 35-65a, chronic alcohol consumption ($p < 0.001$) and skull fracture ($p < 0.001$) revealed as significant ICH predictors. In patients > 65a, age ($p = 0.009$), anticoagulation ($p = 0.007$) and neurocranial fracture ($p < 0.001$) were significant risk factors for ICH, age ($p = 0.01$) was an independent risk factor for mortality. Late onset ICH only occurred in cases with at least 2 of 3 factors: age > 65, anticoagulation, neurocranial fracture. Overall hospitalization might have been reduced by 15.8% via low risk cases.
Conclusions: Triggered by decreasing error tolerance, international guidelines for mild TBI focus on safety maximization. Repeated CT in initially ICH negative cases should only be considered in high risk patients. Non-ICH cases aged < 65 years do not gain safety from observation or hospitalization. Recommendations from our data might, without impact on patient safety, reduce costs by unnecessary hospitalization and diagnostics.
References: To be added by the authors.

Fig. 1



PR 318

Evaluation of low-value clinical practices in acute trauma care: a multi-center retrospective study

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Introduction: Low-value clinical practices have been identified as one of the most important areas of excess healthcare spending and are associated with adverse health outcomes. The objectives of this study were to estimate the frequency low-value practices in injury care and assess inter-hospital variations.
Material and methods: We identified low-value clinical practices from internationally recognized clinical guidelines. We conducted a population-based retrospective cohort study using data from an inclusive Canadian trauma system (2010–2017) to calculate frequencies and assessed inter-hospital variations with Intra-class Correlation Coefficients (ICC).
Results: We identified 29 low-value practices of which 9 could be measured and validated using trauma registry data. The three low-value clinical practices with the highest absolute and relative frequencies were pelvic X-Rays in hemodynamically stable patients with a negative physical exam for pelvic injury (42.9%), head CT in adults

with minor head injury who were negative on a validated clinical decision rule (24.3%) and chest X-Ray in hemodynamically stable patients with a normal physical exam (6.9%). We observed high inter-hospital variation for surgical management of penetrating zone II neck injury without hard signs (ICC = 27%), and moderate variation for head CT in adults with minor head injury who were negative on a validated clinical decision rule (ICC = 6.3%).
Conclusions: We have developed and validated algorithms to evaluate nine potentially low-value clinical practices using trauma registry data. Highest frequencies were observed for imaging in the emergency department and the highest inter-hospital variation was observed for inappropriate surgical management. These data can be used to advance the agenda on low-value care for injury admissions.

PR 319

Dysfunction of functional connectivity between default mode network and cerebellar structures in patients with mTBI in acute stage. rsfMRI and DTI study

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Introduction: Mild traumatic brain injury (mTBI) occupies one of the first places in children injuries. Among all brain networks at the resting state, the Default Mode Network (DMN) is the most widely studied network. The aim of this study is to examine functional connectivity in normal-appearing cortex in acute period of mTBI using rsfmRI.
Material and methods: 34 MR negative participants were studied in age from 12 to 17 years (mean age—14.5 years). Group of patients consisted of 17 children with mild traumatic brain injury in acute stage. 17 age-matched healthy volunteers comprised control group. All studies were performed at Phillips Achieva 3.0T MRI scanner using 32-channel head coil. fMRI data were processed using functional connectivity toolbox CONN. Seed-based analysis was performed in order to reveal disturbances in functional connectivity. Statistical processing was performed using Statistica 12.
Results: DTI analysis didn't show any changes in values of apparent diffusion coefficient (ADC) and fractional anisotropy (FA) between two groups (see Fig. 1). No statistically significant differences in correlation strength between DMN parts were observed in two groups (see Fig. 2). Intergroup seed-based analysis revealed statistically significant ($p < 0{,}05$) difference in neural correlations between DMN parts and vermis (cerebellum structural part): positive link in control group and negative link in group of patients.
Conclusions: One of the most common symptoms of mTBI is dizziness as a result of impaired movements coordination. Vermis as an essential cerebellum part plays an important role in the vestibulo-ocular system which is involved in the learning of basic motor skills in the brain. Vermis aids in the synchronization of eye and motor functions in order for the visual field and the motor skills to function together.Our results show that mTBI appears to be a possible reason of connectivity malfunction in normal-appearing vermis.
References:

Fig. 1

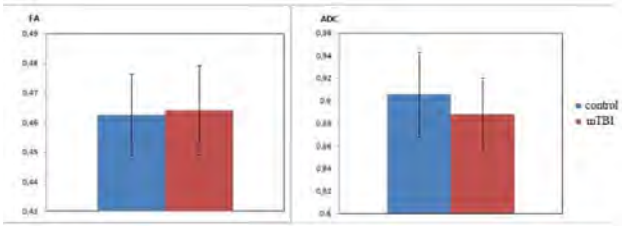
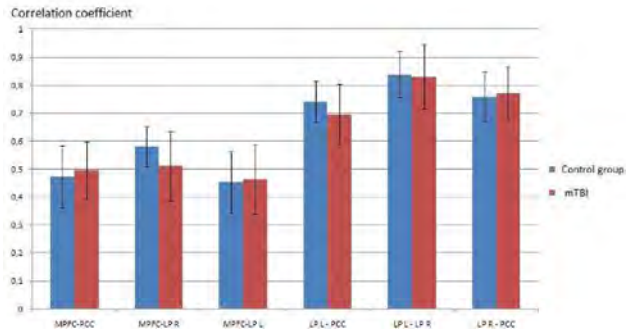


Fig. 2



PR 320

Predictors of developing post-traumatic endophthalmitis

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Introduction: Our objective in this project is to identify risk factors for developing endophthalmitis in cases of open globe injury using the National Inpatient Sample (NIS) Database.
Material and methods: This is a cross-sectional observational study of 13,513 cases of open globe injury (OGI) from the NIS Database. Descriptive statistical analysis and regression analysis were performed using IBM SPSS Statistics 25. Codes from the *International Classification of Disease, Ninth Revision* were used identify ocular findings and conditions. Variables with p-values less than 0.05 on univariate analysis were included in the multivariate regression model. To reduce the likelihood of type 1 error, Bonferroni Correction was applied on multivariate regression to determine a new alpha-cutoff for statistical significance.
Results: Of the 13,513 cases of OGI, 2822 (20.9%) cases occurred in the pediatric group (ages 0-20) (PG), and 10651 (78.8%) occurred in the adult group (21+) (AG); the average ages were 11.4 and 50.8 years, respectively. Overall, 244 (1.8%) cases developed post-traumatic endophthalmitis; of these cases, 52 (21.3%) occurred in the PG, and 192 (78.7%) occurred in the AG. Results of binary logistic regression showed that chorioretinitis, hypopyon, vitreous inflammation, corneal ulceration, orbital inflammation, and intraocular foreign bodies (IOFBs) were predictors of being diagnosed with endophthalmitis in cases of OGI. Interestingly, orbital fractures were associated with a decreased likelihood of being diagnosed with endophthalmitis.
Conclusions: Endophthalmitis was seen in 1.8% of pediatric and adult OGIs. Predictors of infection in OGIs included presence of chorioretinitis, hypopyon, vitreous inflammation, corneal ulceration,

orbital inflammation, and IOFBs whereas presence of orbital fractures imparted a protective effect on developing infection.

Fig. 1

Table 1: Demographic, Ocular, and Systemic variables used in Multivariable Regression Model for Post-Traumatic Endophthalmitis

Demographic	Ocular	Ocular	Systemic
Gender	Cataract	Orbital Inflammation	Septicemia
Age	Chorioretinitis	Phthisis	
	Hemorrhagic and Serous Choroidal Detachment	Hypotony	
		Conjunctivitis	
		Orbital Exophthalmos	
	Diabetic Retinopathy	Scleritis and Episcleritis	
	Retinal Detachment	Retinal Vasculitis	
	Iridocyclitis	Orbital Fracture	
	Hyphema	Aphakia	
	Hypopyon	Pseudophakia	
	Vitreous Hemorrhage	Lens	
	Vitreous Inflammation	Subluxation/Dislocation	
	Vitreous Prolapse	Penetrating Injury	
	Corneal Ulcer	IOFB	
	Keratitis	Rupture	
	Intraocular Tissue Prolapse		

Fig. 2

Table 2: Results of Univariate and Multivariate Regression with Bonferroni Correction (alpha cutoff for significance is 0.0025 (0.05/20)

Variable	Univariate OR (95% CI)	Univariate p-Value	Multivariate OR (95% CI)	Multivariate p-Value
Gender				
Men	1.00	REF	-	-
Women	0.99 (0.75 – 1.31)	0.94	-	-
Age (years)				
0-21	1.00	REF	-	-
22+	0.91 (0.68 – 1.22)	0.53	-	-
Diabetes Mellitus w/o Chronic Complications				
No	1.00	REF	1.00	REF
Yes	1.53 (1.03 – 2.28)	0.04	1.77 (1.12 – 2.78)	0.0143
Diabetes Mellitus with Chronic Complications				
No	1.00	REF	1.00	REF
Yes	2.40 (1.11 – 5.18)	0.03	2.89 (1.20 – 6.94)	0.0175
Cataract				
No	1.00	REF	1.00	REF
Yes	2.72 (1.90 – 3.88)	< 0.01	1.93 (1.25 – 2.97)	0.0029
Chorioretinitis				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**23.58 (6.06 – 91.75)**	**< 0.01**	**30.45 (6.10 – 151.91)**	**< 0.0001**
Serous and Hemorrhagic Choroidal Detachment				
No	1.00	REF	-	-
Yes	1.13 (0.42 – 3.06)	0.81	-	-
Diabetic Retinopathy				
No	1.00	REF	-	-
Yes	2.53 (0.79 – 8.10)	0.12	-	-
Retinal Detachment				
No	1.00	REF	1.00	REF
Yes	2.73 (1.69 – 4.41)	< 0.01	1.65 (0.94 – 2.90)	0.0830
Iridocyclitis				
No	1.00	REF	1.00	REF
Yes	51.53 (31.16 – 85.21)	< 0.01	2.66 (0.35 – 20.13)	0.3446
Hyphema				
No	1.00	REF	-	-
Yes	1.38 (0.34 – 5.65)	0.65	-	-
Hypopyon				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**298.16 (122.53 – 725.56)**	**< 0.01**	**105.42 (11.43 – 972.50)**	**< 0.0001**
Aphakia				
No	1.00	REF	1.00	REF
Yes	3.10 (1.25 – 7.70)	0.02	1.76 (0.48 – 6.45)	0.3931
Vitreous Hemorrhage				
No	1.00	REF	-	-
Yes	1.12 (0.66 – 1.90)	0.67	-	-
Vitreous Prolapse				
No	1.00	REF	-	-
Yes	1.47 (0.20 – 10.77)	0.70	-	-
Vitreous Inflammation				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**33.63 (12.73 – 83.61)**	**< 0.01**	**15.51 (4.22 – 56.99)**	**< 0.0001**
Glaucoma				
No	1.00	REF	1.00	REF
Yes	6.17 (2.63 – 14.48)	< 0.01	4.04 (1.54 – 10.64)	0.0046
Corneal Ulcer				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**17.12 (10.67 – 27.47)**	**< 0.01**	**14.22 (7.94 – 25.47)**	**< 0.0001**
Keratitis (Superficial and Deep)				
No	1.00	REF	1.00	REF
Yes	13.86 (5.16 – 37.23)	< 0.01	3.14 (0.75 – 13.16)	0.1170
Conjunctivitis				
No	1.00	REF		
Yes	5.65 (2.00 – 15.95)	< 0.01	0.70 (0.16 – 3.06)	0.6330

Fig. 4

Scleritis				
No	1.00	REF	1.00	REF
Yes	20.63 (5.44 – 78.25)	< 0.01	3.61 (0.64 – 20.37)	0.1467
Orbital Inflammation				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**33.68 (19.40 – 58.47)**	**< 0.01**	**28.58 (14.87 – 54.96)**	**< 0.0001**
Orbital Fracture				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**0.15 (0.07 – 0.30)**	**< 0.01**	**0.21 (0.10 – 0.43)**	**< 0.0001**
Orbital Exophthalmos				
No	1.00	REF	1.00	REF
Yes	2.49 (1.76 – 6.93)	< 0.01	2.56 (0.97 – 6.76)	0.0583
Penetrating OGI Without IOFB				
No	1.00	REF	1.00	REF
Yes	0.55 (0.42 – 0.71)	< 0.01	0.67 (0.47 – 0.94)	0.0195
Rupture OGI				
No	1.00	REF	-	-
Yes	0.70 (0.45 – 1.08)	0.11	-	-
IOFB				
No	**1.00**	**REF**	**1.00**	**REF**
Yes	**2.72 (2.04 – 3.63)**	**< 0.01**	**2.11 (1.42 – 3.14)**	**0.0002**
Phthisis				
No	1.00	REF	-	-
Yes	3.41 (0.45 – 25.81)	0.24	-	-
Pseudophakia				
No	1.00	REF	-	-
Yes	1.50 (0.55 – 4.08)	0.43	-	-
Hypotony				
No	1.00	REF	1.00	REF
Yes	5.01 (1.79 – 14.05)	< 0.01	3.22 (0.81 – 12.79)	0.0969
Prolapse of Ocular Tissue				
No	1.00	REF	-	-
Yes	0.70 (0.46 – 1.08)	0.11	-	-

PR 321

Prognostically significant 1H MRS pattern of irreversible cerebral damage in children

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Introduction: 1H magnetic resonance spectroscopy (1H MRS) allows to study structural and metabolic brain disorders in various pathological conditions in vivo. Non-invasive method determines its advantage for use in children in serious condition with acute cerebral injuries. This determined the purpose of the study: to identify criteria of irreversible brain damage based on the 1H MR spectra analysis in comatose children with acute traumatic brain injury (TBI) or anoxia.
Material and methods: 8 patients (6 months–16 years) were examined in the acute period of severe cerebral injury (GCS score 3–4): six were in acute and subacute period of severe TBI, one patient was examined on the seventh day after drowning, and one—a day after acute cerebral blood flow (hemorrhage). All patients died in 10–20 days after the study. Control group included 10 healthy children aged from 7 to 13 years. Single voxel 1H MRS and 2D 1H MRS was performed on 3T scanner. 1H spectroscopic voxel (TE/TR = 35/2000 ms, VOI = 3 cm^3, NSA = 32) was oriented on MRI intact areas: cortex of frontal, parietal and occipital lobes (Fig. 1), thalamic nuclei (Fig. 2), cerebellum, brainstem (Fig. 3). For 2D 1H MRS a spin-echo point-resolved spectroscopy (PRESS) sequence was used (TE/TR = 144/2000 ms) with the spectroscopic VOI of 150 cm^3 on frontal lobes.
Results: In all spectra lactate (Lac) signal, dominating all other signals, was detected. N-acetylaspartate (NAA) was reduced by 60% and creatine/phosphocreatine (Cr)—by 35%.
Conclusions: 1H MRS is a non-invasive prognostic method in patients with acute cerebral brain damage in coma. The cause of patients' death is the shift of cerebral glucose metabolism to an anaerobic type, as evidenced by the accumulation of Lac. Disturbance of energy metabolism causes a decrease of Cr and a decrease in the neuronal marker NAA. The combination of these patterns in acute cerebral injury, regardless of etiology indicates irreversible brain tissue damage.
References:

Fig. 1

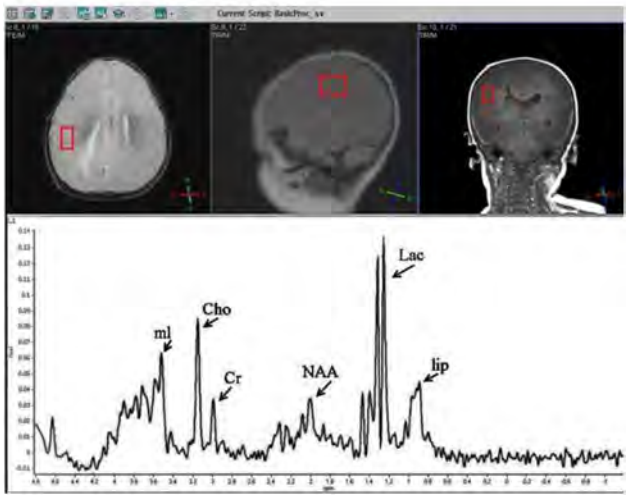


Fig. 2

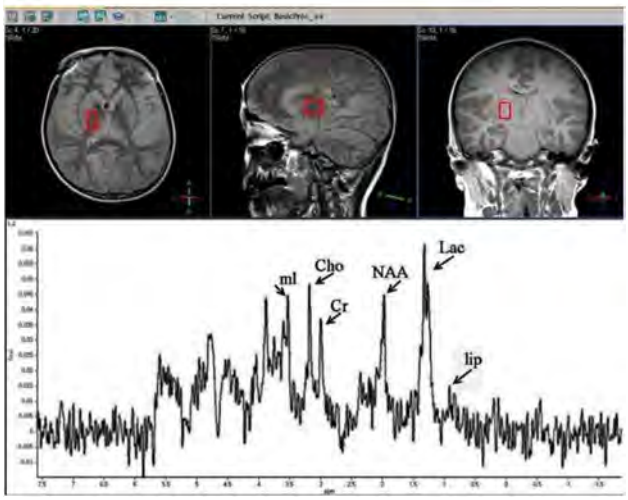
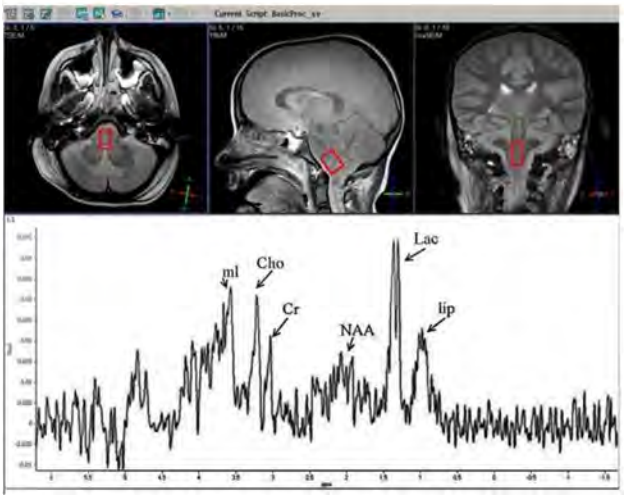


Fig. 3



PR 322

Comparison of scald, contact, and flame burns

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Introduction: Scalds and contact burns are the most common burn injuries both in children and adults. Data are conflicting regarding which type of burns are more severe. We compared scalds, contact, and flame/fire burns at our burn center to determine which type were more likely to result in full thickness injuries and prolonged length of stay (LOS).

Material and methods: We conducted a structured retrospective medical record review of all patient admissions to a regional burn unit over a 10-year period between 2000 and 2010. Data included demographic, clinical, and specific burn characteristics. The association between patient predictor variables and outcomes (full thickness burns, LOS) was explored using chi-square and stepwise logistic regression.

Results: There were 1,038 patients with either scald (n = 537, 52%), fire/flame (n = 434, 42%) or contact burns (n = 67, 6%). Burn depth was not available for 216 cases (21%). Mean (SD) age was 29 (25), 64% were male. Mean (SD) total body surface area (TBSA) was 10 (11)%. 24% of burns contained areas of full thickness injury. Patients with scalds were younger than those with contact or fire burns (22 ± 24 vs. 32 ± 28 vs. 38 ± 22 years respectively, $P < 0.001$). The percentage of burns that were full thickness by etiology were contacts (45%), fire/flame (34%) and scalds (13%); $P < 0.001$. After adjusting for age, location, and TBSA, scalds were less likely to result in full thickness injuries than contact burns (Odds ratio 0.23, 9%%CI, 0.11–0.48). Adjusting for multiple testing, univariate analysis (as well as the multivariate analysis) showed no difference in % 3rd degree burns between fire and contact burns, but scalds were significantly lower than each of those. LOS for scalds (8 ± 10) and contact burns (8 ± 11) was significantly shorter than for fire/flame (14 ± 25 days, $P < 0.001$).

Conclusions: While less common, contact and flame burns were more likely to result in full thickness injuries than scalds.

References:

PR 323

Epidemiology, treatment, costs, and long-term outcomes of patients with fireworks-related injuries (ROCKET); a multicenter prospective observational case series

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Introduction: The aim of this study is to provide detailed information about the patient and injury characteristics, medical and societal costs, and clinical and functional outcome in patients with injuries resulting from fireworks.

Material and methods: A multicenter, prospective, observational case series performed in the Southwest Netherlands trauma region, which reflects 15% of the Netherlands and includes a level I trauma center, a burn center, and an eye hospital. All patients with any injury from consumer fireworks, treated at a Dutch hospital between December 1, 2017 and January 31, 2018, were eligible for inclusion. Exclusion criteria were unknown contact information or insufficient understanding of Dutch or English language. The primary outcome measure was injury characteristics. Secondary outcome measures included treatment, direct medical and indirect societal costs, and clinical and functional outcome until one year after trauma.

Results: 54 out of 63 patients agreed to participate in this study. The majority was male (N = 50; 93%), 50% were children < 16 years, and 46% were bystanders. Injuries were located to the upper extremity or eyes and were mostly burns (N = 38; 48%) of partial thickness (N = 32; 84%). Fifteen (28%) patients were admitted and 11 (20%) patients needed surgery. The mean total costs per patient were €6,320 (95% CI €3,400 to €9,245). Patient-reported quality of life and functional outcome was not significantly different during follow-up compared with pre-trauma.

Conclusion: The most common injuries afflicted by consumer fireworks were burns, mostly located to the upper extremity, and eye injuries. Fireworks can result in severe injuries, for which 15 (28%) patients needed hospital admission and 11 (20%) patients needed surgical treatment. Although some injuries resulted in permanent disability, 1 year after trauma it in general did not have major or long-lasting impact on patients" self-reported quality of life or functional abilities.

PR 324

Persistent inflammation, immunosuppression and catabolism syndrome after polytrauma: a rare syndrome with major consequences.

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Introduction: More severely injured patients survive the critical first phase after trauma nowadays. A substantial portion of these patients require long-term critical care support and suffer from recurrent infections. This clinical condition fits in a syndrome referred to as "Persistent inflammation, immunosuppression and catabolism syndrome" (PICS). The aim of this study was to investigate the incidence of PICS and clinical outcomes of trauma patients with PICS in a level one trauma center.
Material and methods: All trauma patients $\geq$ 16 years admitted to the intensive care unit (ICU) for $\geq$ 14 days between 2007 and 2017, were included. Patients with isolated neurological injuries were excluded. PICS patients were identified by ICU stay $\geq$ 14 days, $\geq$ 3 infectious complications and increased catabolism. Infectious complications included infections during hospitalization and readmissions due to an infection. Increased catabolism was defined as weight loss > 10%, a body mass index.
Results: Of the 3,859 polytrauma patients, 194 patients had an ICU stay $\geq$ 14 days. After exclusion of patients with isolated neurological injuries, 78 patients were included. Of these patients, 18 developed PICS. PICS patients sustained 5 infectious complications on average (compared to 1 in the non-PICS group, $p < 0.001$) and 72.2% of the PICS patients developed sepsis. Also, PICS patients had a longer hospital stay (mean of 90 days versus 50 days, $p < 0.001$) and sustained more surgical procedures (mean of 13 versus 4 per patient, $p < 0.001$). Infectious readmissions occurred until 5 years after the initial trauma.
Conclusions: Patients who develop PICS experience long-term inflammatory complications that lead to frequent readmissions and surgical procedures. Therefore, despite its low incidence, this clinical condition forms a burden on patients and a substantial financial burden on society.

PR 325

Hyperbilirubinemia as a risk factor of the trauma ICU patient

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Introduction: Hyperbilirubinemia is common in the intensive care unit (ICU). Hyperbilirubinemia has been considered as a risk factor of the ICU patient. Hyperbilirubinemia can have various causes. The hyperbilirubinemia has never been studied for the trauma ICU patient. The aim of this study is to elucidate the incidence and effects of the hyperbilirubinemia for the trauma ICU patient.
Material and methods: Retrospective review of the Trauma ICU patients from 2017.01.01 to 2017.06.30. Initial bilirubin serum level, 48 h bilirubin level, 7 day bilirubin level, highest bilirubin level, overall morbidity and mortality and other clinical variables were identified and evaluated. The patients who have highest bilirubin level $\geq$ 3.0 mg/dl were defined as hyperbilirubinemia group.
Results: A total 78 patients were enrolled in this study. Hyperbilirubinemia above serum bilirubin $\geq$ 3.0 mg/dl were appeared in 26 patients. The mortality of the hyperbilirubinemia group was higher than the other group (71.4% vs 29.6%, p = 0.03). The ICU stay of the hyperbilirubinemia group was longer than the other group (12.4 day vs 7.1 day, p = 0.04). The hyperbilirubinemia group had more incidences of pneumonia, acute kidney injury, and sepsis than the other group (42.9% vs 57%, p = 0.01/ 33.3% vs 66.7%, p = 0.001/0% vs 100%, $p < 0.001$).
Conclusions: The hyperbilirubinemia is a risk factor of the trauma ICU. If the hyperbilirubinemia is appeared, the cause of the hyperbilirubinemia should be evaluated and make an effort to correct hyperbilirubinemia for the each cause of the hyperbilirubinemia.
References: The American Journal of Surgery 195 (2008) 304–307, Hyperbilirubinemia: a risk factor for infection in the surgical intensive care unit
Korean Journal of Anesthesiology 2018 71–1, Association of direct bilirubin level with postoperative outcome in critically ill postoperative patients, Masaharu Nagae, Moritoki Egi, Kenta Kubota.

PC 326

From firework to fasciotomy

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Case history: We present the clinical case of a male patient of 37 years old. Injury mechanism: a firework burst on his right forearm.
Clinical findings: Injury: a large area of carbonization of the muscles of the flexor compartment. Signs and symptoms: intense pain in the hand and forearm with local oedema and tension.
Diagnosis: Deep burn of the forearm.
Therapy and Progressions: Surgical debridement and fasciotomy of this compartment; followed by deferred and progressive primary closure by means of rubber bands that were tightened as the oedema diminuished—Shoelace technique. Evolution: discharged from hospital on the 8th pos op day; follow-up at 3rd and 6th month without functional impairment, with a good healing evolution.
Comments: Deep burns that reach the subfascial planes of the limbs, increase the pressure in the muscular compartments, and may progress to a Compartment Syndrome. There is no specific cutoff value of pressure for this diagnosis; consequently, the final decision to proceed with a fasciotomy relies on the clinical experience. Surgical debridement and fasciotomy may result in large wounds, sometimes difficult to close. Grafts and flaps result in another wounds and carry a risk of pain, infection, scar shrinking and necrosis.
The diagnosis of a limb Compartment Syndrome is almost always a clinical one and requires a high index of suspicion so as to the fasciotomy is done in time. The shoelace technique is a simple, reproducible and cost-effective method of deferred closure of a large wound, preserving functionality and resulting in a good final cosmesis.
References: Johnson LS et al, Management of extremity fasciotomy sites prospective randomized evaluation of two techniques, Am J Surg. 2018.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 327

The use of propranolol in the management of acute thermal burn injury: evaluation of the effect of fixed dosages in african patients

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Introduction: Propranolol has been shown to improve outcomes in burn patients. Its effects are achieved at doses that reduce the heart rate by 10–25%. Africans have a different propranolol pharmacogenetic profile as compared to other races. There is paucity of literary works on the use of propranolol in Africans with burns. In our study, we explored the effectiveness of fixed dosages of propranolol in Nigerian patients.

Material and methods: This was a prospective comparative study of adult burn patients; two test groups received propranolol 40 mg/day and 240 mg/day respectively. The average daily pulse rate prior to and after the administration of propranolol were compared.

Results: Patients in the control group had no effective reduction in their pulse rate. Patients who received propranolol at a dose of 240 mg/day had a reduction $\geq$ 10%. No adverse events were observed.

Conclusion: It is important to establish the effective dosage of propranolol in burn patients of African-descent and explore its potential benefits in their treatment. Although we cannot draw strong

conclusions from the study owing to its small sample size, it can serve as a pilot for a larger multicentre study.

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ABDOMINAL TRAUMA AND ABDOMINAL WALL RECONSTRUCTIONS

PC 328

Seat belt caused abdominal injury

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Case history: The authors present in their paper three cases of blunt abdominal injury caused by seat belt in car accident. In the first two cases there was no diagnostic problem thanks to clear clinical finding. In the third case there was no clinical correlation and even repeated auxiliary examinations did not indicate the need for surgical intervention of the abdominal cavity.

Clinical findings: Case No. 1—male 37 y. old, haemodynamic stability, thoracic an abdominal pain, FAST positivity, on CT free fluid in abdominal cavity, small spleen laceration, positivity of peritoneal symptomatology.

Case No. 2—male 42 y. old, haemodynamic stability, bilateral hypogastric pain without peritoneal symptomatology, FAST with small perihepatic fluid, on CT fluido-pneumoperitoneum.

Case No. 3—female 42 y. old, haemodynamic stability, thoracic pain, massive oedema on the right side of the neck and supraclavicular area, without abdominal symptomatology. FAST with small subhepatal fluid collection—4 mm, CT scan with large neck haematoma and fracture of 1st rib, apical pneumothorax—12 mm. Intraabdominal only subhepatal fluid stripe—18 mm, suspected of small hepatic laceration. After 3 days the clinical status rapidly changed, during 2 h peritoneal symptomatology occured. On control CT scan fluido-pneumoperitoneum was detected.

Investigation/Results: All patients underwent surgical procedure

Diagnosis: Bowel Mesenteric Injury

Therapy and Progressions: The first patient underwent ileo-caecal and Hartmann resection, by the second patient was small intestine and col. sigmoideum resection needed, and the last one underwent ileal resection and NPWT.

Comments: Despite the current diagnostic methods blunt abdominal injuries, unlike the penetrating ones, can present a certain diagnostic problem especially when they are accompanied by other serious conditions such as manifest chest injuries.

References: Smith J. et al., Abdominal trauma: a disease in evolution

Fig. 1

PR 330

Are there easy predictors of the simultaneous presence of hollow viscus organ lesions in patients with abdominal parenchymal organ lesions?

C. E. M. Pothmann[1], K. Sprengel[1], K. O. Jensen[1], H. P. Simmen[1], H. C. Pape[1], V. Neuhaus[1]

[1]UniversitätsSpital Zürich, Traumatologie, Zurich, Switzerland

Introduction: Patients with hypertension and peritonitis must undergo a laparotomy. In isolated parenchymal lesions of the liver, the spleen or kidneys interventional or conservative approaches are more frequently used. To miss a hollow viscus organ lesion, that would need an operative procedure, is a constant fear. It is the aim of this study to identify significant predictors of the simultaneous presence of a hollow viscus lesion in patients with parenchymal organ lesions.

Material and methods: Data of over 20'000 inpatients of a level-one-trauma centre between 2008 and 2016 were analysed. Only hemodynamically stable patients with a splenic-, liver-, or kidney injury (independent of grade) after blunt abdominal trauma were included. Significant predictors were detected in bi- and multivariant analysis.

Results: Of the 341 patients with an average age of 42 ± 20 years 43% (n = 148) had a splenic-, 49% (n = 168) a liver- and 23% (n = 79) a kidney rupture. The total ISS was 30 ± 16 points. In 52 patients (15%) a hollow viscus injury could be found (stomach n = 5, small bowl n = 29, colon n = 22, rectum n = 4). Injuries of the thorax (76%), the extremities (70%), the head (70%), the vertebra column (43%) and the pelvis (30%) were diagnosed as concomitant injuries. Due to multivariant analysis neither age, gender, heart frequency at admission, GCS, base excess, the coagulation parameters, the hemoglobin value nor the separate injury regions could be identified to be predictive factors for the presence of a hollow viscus lesion.

Conclusions: Clinical parameters taken at admission are not useful to predict hollow viscus injuries. The CT-scan is currently seen to be the

best possible imaging modality, but it can be false negative, especially within the first 60 min after trauma. Repetitive clinical examination is necessary. In doubt a diagnostic laparoscopy or even laparotomy has to be performed.

PR 331

Relevant abdominal injuries in polytraumatized patients

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Introduction: A heavy abdominal trauma is associated with a high morbidity and mortality. It is the aim of this study to show injury patterns in the abdomen and concomitant injuries in polytraumatized patients as well as to identify risk factors of the decease.
Material and methods: Data of over 20'000 inpatients of a level-one trauma centre between 2008 and 2016 were retrospectively analysed. Only patients with a relevant abdominal trauma (AIS abdomen ≥ 3) were included. The AIS score was determined either with a contrast enhanced computed tomography or intraoperatively. Significant risk factors were detected in bi- and multivariate analysis.
Results: 315 patients with an averaga age of 43 ± 18 years were included. 48% (n = 155) had an AIS abdomen of 3, 40% (n = 127) of 4 and 10% (n = 33) of 5. The overall ISS was 31 ± 16 points. The mechanism of injury was mainly blunt (87%). A splenic rupture was present in 40% (n = 128), a liver rupture in 35% (n = 112) and a kidney rupture in 26% (n = 68). Hollow viscus injuries were present in 13% (small bowl n = 44, colon n = 33, stomach n = 13, rectum n = 7, bladder n = 14). Concomitant injuries were determined in 88% of the patients. Of these 70% were diagnosed a thoracic injury, 66% injuries at the extremities, 55% head injuries. 47% spinal injuries and 31% pelvic injuries. The mortality was 16% (n = 51). A liver rupture ($p = 0.031$, OR 4.0), pelvic injuries ($p = 0.02$, OR 4.4), age ($p = 0.043$, OR 1.032), hypotension (systolic blood pressure < 90 mmHg) ($p = 0.003$, OR 8.2) and a low GCS at admission ($p < 0.001$, OR 0.67) were determined to be significant risk factors.
Conclusions: In our trauma department life threatening abdominal traumata are treated about every 10 days. Lethal abdominal injuries were mostly associated with serious liver ruptures or pelvic injuries. Due to our experience we recommend the use of an early CT-scan as thereby the injury severity can be fast and precisely assessed.

PC 332

Late primary fascial closure in open abdomen with a new fascial traction device

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Case history: A 44 yo female was tranferred to our ICU on day 2 of a severe acute necrotizing alchoolic pancreatitis with MOF. CRRT with Cytosorb was immediately started. On day 7 after onset (DAO7) an ACS with a new organ failure (lung) showed up. Open Abdomen (OA) and TAC with mesh-mediated/NPWT got a temporary improvement.
Clinical findings: On DAO10 (OA3), reopening of the mesh entailed a sudden fascial retraction of 6 cm. A new larger mesh was positioned. On DAO14 (OA7) the fascial defect measured both on CT slices and in OR was 26 cm. Provision of a longterm OA was done.
Therapy and Progressions: A new fascial traction device (Fasciotens®, Germany)1 was positioned on DAO14 (OA7), with a continuous traction weight of 6–8 kg. Revision was scheduled any 2-4 days, according to clinical needs, including combined anterior and retroperitoneal necrosectomy. Progressive traction allowed to get a 5 cm fascial gap under traction on DAO38 (OA31). Anterior CST was thus performed and fascia primarily closed. Completion of necrosectomy was done through the bilateral lumbar incisions and NPWT.
Comments: Early fascial closure is a goal in OA. Mesh-mediated traction/NPWT is the most effective strategy, but primary fascial closure is sometimes impossible. 2 The duration of OA is a key point. Fasciotens® allowed to overcome the failure of mesh-mediated option and avoided fascia retraction in a longterm OA. It was quickly managed by the nurse staff, allowed a easier access to the abdomen and a proper positioning of the protective film. Its effectiveness in this demanding case makes it an interesting option for shortening fascial closure in septic OA too.
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PR 333

Does a previous appendicectomy could change the management of adhesive small bowel occlusion?

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Background: Small bowel obstruction (SBO) caused by intra-abdominal adhesions is one of the main surgical emergencies. In most of the time, adhesions are created by previous abdominal surgeries. Without any severity signs, the medical treatment is first proposed to avoid superfluous surgery. We noticed that the failure of medical treatment is frequently seen in patients previously operated of appendicectomy. The purpose of this study is to determine the eventual relation between a previous appendicectomy and failure of medical treatment in SBO.
Methods: We conducted a retrospective data collection using a diagnostic code for bowel obstruction in patients who have consulted in emergency from 01.01.2011 to 01.01.2019 at the SALENGRO University Hospital in Lille. Using the administrative database, 1194 patients were identified. We excluded all children, patients with wrong diagnosis and those whose outcome was not known.
Finally, 324 patients with SBO on intra-abdominal adhesions confirmed on CT-scan were reviewed. The patients were separated in two groups. The group 1 (G1) included patients who required surgical management during hospitalization (107 patients) and Group 2 (G2) patients with successful medical treatment (217 patients). We compared the rate of previous appendectomy in these two groups using a Pearson's chi-squared test. In a second step, we tried to find out if there were others factor associated with failure of medical management.
Results: There was significant difference between the two groups with a higher rate of appendectomy in the surgical management group G1 ($p = 0.00773$).

This difference was even more pronounced if appendectomy was the only surgical history.

In the subgroup analysis of patients with previous appendicectomy, the laparoscopic approach or laparotomy didn't influence the outcome of the management of the SBO.

Conclusion: This study shows the difference between the two groups of SBO, with more surgery sanction in the group of patients previously operated of appendicectomy. Perhaps because this surgery involves the very distal part of the small bowel and decrease the efficiency of a proximal nasogastric aspiration. These results should not change the initial management of SBO by medical treatment in absence of severity signs. However, knowing this data, we have to consider that a history of appendicectomy is a risk factor of failure of medical treatment in this situation.

PR 334

Diaphragmatic injuries: 10 years experience

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Introduction: Diaphragmatic injuries are a rare consequence of closed thoraco-abdominal trauma that could be difficult to detect due to paucity of clinical signs and frequent erroneous interpretation of radiological images. The overall incidence of diaphragmatic injury is 0,8–5,8% in blunt trauma. If the injury is not recognized it could lead to considerable risk of late morbidity and mortality. This study reviews our 10 years experience in the management of this patients.

Material and methods: A retrospective review of trauma registry of our tertiary referral centre was performed. Preoperative, intraoperative and postoperative data were analysed to assess determinants of mortality, morbidity and effect of therapeutic delay by univariate analysis models. Penetrating injuries were excluded from the study.

Results: Over 10 years 31 patients with diaphragmatic injury due to blunt trauma were identified: 4 had a simple laceration of the diaphragm without hernia, 21 had acute and 6 chronic diaphragmatic hernia. The mean patient age was 40 years (range 17—78 years). Overall mortality was 15%. The site of injury was the left diaphragm in 18 cases, the right diaphragm in 8 cases and bilateral in 1 case.The hernia content was stomach (9), colon (4), spleen (3), liver (3), omentum (2) and multiorgan (6). All acute patients were managed with primary suture repair via laparotomy except for two patients that required additional thoracotomy; chronic patients were treated laparoscopically in 4 cases (66,6%), in which a synthetic or a biosynthetic mesh was used to reinforce the suture. Higher morbidity and mortality was seen in multiple associated injuries, head injuries associated, right diaprhagm injury, age > 65 years and treatment delay > 24 h.

Conclusions: Delayed treatment of diaphragmatic injuries could be dramatic: it is importnat not to misinterpreter the radiological findings and to reassess the patient mantaining a high level of suspicion of these injuries.

PC 335

Trauma opposing vector forces resulting in distal avulsion of internal oblique muscle: a case report

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Case History: Abdominal muscle injuries after blunt trauma are rare but increasingly recognized. Here we report a case of blunt trauma resulting in a complete disinsertion of the distal part of the internal oblique muscle.

Case report: 46 y.o. Male, was involved in a roll over motor vehicle accident. Primary survey was carried out according to ATLS® approach with good response. He had a seatbelt sign. According to the dynamic of the trauma he underwent a CT.

Diagnosis: A ce-MDCT revealed complete disinsertion of the oblique muscles of the left abdomen from their iliac insertion, with herniation of adipose tissue and Hematoma of the soft tissues without active blushing. No other traumatic injuries were identified.

Therapy Progressions: A conservative treatment of the hematoma of the left abdominal wall was adopted. The patients was then ischarged from hospital after 4 days. No late complications were observed.

Comments: The overall incidence in all traumatic admission is 0.2–0.9%. A deep knowledge of vector force involved in trauma and their influence in the specific anatomical changes of the abdominal wall muscle can lead to suspicious of this rare injuries even if no other lesion are detected. In our opinion this trauma case is useful in reminding us to look for it because the radiologist or a no well experienced trauma surgeon may miss it

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PR 336

Trauma patients with open abdomen: do they differ from others? A single center experience

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Introduction: Treatment with open abdomen is demanding for patients, staff and hospital. A multidisciplinary approach is mandatory. The aim of this study was to compare trauma patients with open

abdomen (OA) and patients treated with OA for other reasons, regarding outcome and resources spent.

Material and methods: Retrospective study of patients treated with OA in a tertiary hospital in Norway. Ten were trauma patients, 108 had open abdomen due to other reasons.

Results: Nine out of ten were men in the trauma group, compared to 73 out of 108 in the other group. Median age for the trauma group was 30 years (Inter Quartile Range: 23–43) versus 65 years (57–74). Days with OA was eight for the trauma patient, twelve for the other group. Days in ICU did not differ significantly neither did the number of dressing changes before final abdominal closure. SAPS II score among trauma patients was significantly lower ($p = 0.005$). In-hospital survival was seen in nine of ten trauma patients and 68 of 108 in the comparison group ($p = 0.174$).

Conclusions: Despite younger age and lower SAPS 2 score, survival and used resources was quite similar between the two groups. OA is demanding for all groups of patients and hospital.

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PR 337

Open abdomen in trauma and sepsis: outcomes of a step by step mesh mediated fascia traction algorithm for definitive closure

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Introduction: the best and correct management of patients with open abdomen (OA) is nowadays still unclear. Our algorithm consists of using an intra abdominal negative pressure wound therapy device plus an early medial mesh mediated fascia traction ("step by step" procedure). The aim of this study was to asses outcomes of this algorithm technique based on patient conditions and open abdomen technique performed.

Materials and Methods: we performed a retrospective analysis of 50 patients treated with Open Abdomen technique from 01/06/2016 to the 01/06/2019. Variables taken into account were: initial diagnosis, open abdomen technique used, number of surgical interventions, abdominal wall closure technique, length of stay in the ICU, in-hospital morbidity and mortality rates. We collected also data on the post-operative development of incisional hernias and entero-atmospheric fistula.

Results: 4/50 of open abdomen were done after trauma. In the remaining cases Open Abdomen was done for non-traumatic disease. 36 patients have been treated following our algorithm (with negative pressure wound therapy Abthera device and step by step approach with medial mesh mediated fascia traction). In this group fascial retraction was significant lower and definitive direct abdominal wall closure rate was statistically higher.

Conclusion: An early fascia traction mediated with a mesh lead to an earlier fascia closure with a lower need of mesh positioning for definitive closure; the rate of post incisional hernia is similar among the two groups

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PC 338

Ileo-cecal intussusception in an adult lymphoma patient: A case report

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Case history: A 59 year old male presented in the ER with malaise, fatigue and loss of appetite. He was recently hospitalised due to a peritonsillar abscess and during investigations he was first-diagnosed with non-Hodgkin lymphoma. His medical and surgical history were otherwise unremarkable.

Clinical findings: On admission the patient was febrile and tachycardic (HR 120 bpm) but remained hemodynamically stable (BP:157/99 mmHg). Clinical examination revealed abdominal distention and rebound tenderness in the right abdomen.

Investigation/Results: Blood tests were significant for leukocytosis (WBC: 48.300/μl—Neut:75%), acute kidney injury (Urea: 240 mg/dl, Cr: 3.0 mg/dl), elevated CRP (313 mg/l) and LDH (520 IU/l), hyponatremia (Na:126 mmol/L) and hypoalbuminemia. Chest and abdominal X-rays were non-diagnostic, while abdominal ultrasound showed increased air presence along the medial line. Investigations concluded with an abdominal CT scan that revealed pneumoperitoneum, small bowel distention and multiple enlarged mesenteric lymph nodes.

Diagnosis: The patient was transferred to the OR for an explorative laparotomy. He was diagnosed with ileo-cecal intussusception causing bowel ischemia and perforation at the ileocecal valve. Enlarged lymph nodes were observed along the mesentery.

Therapy and Progressions: The affected ileus and colon were removed and a subtotal colectomy with end ileostomy was performed. The pathology report confirmed infiltration of the dissected bowel and lymph nodes by lymphoma cells. The patient continued treatment in the ICU. He was discharged on the 14th postoperative day.

Comments: Intussusception is rare in adults and, contrary to children, is highly associated with malignancies. Resection without reduction has been advocated—wherever possible—in order to ensure better oncological outcomes.

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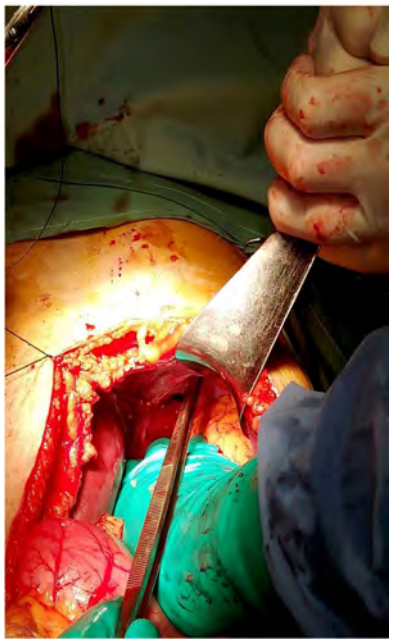
Fig. 1

Fig. 1

Fig. 2



PR 339

Thoracic-abdominal trauma with diaphragm lesions

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Introduction: Blunt or penetrant thoracic abdominal trauma may be associated with diaphragm lesions. These are potential lethal lesions by the intrapleural herniation of the abdominal viscera and by the severity of associated lesions. We have analyzed clinical aspects and management of our patients admitted with diaphragm tears associated with thoracic-abdominal trauma.

Material and methods: Retrospective 5 years study of the patients with acute diaphragm tears admitted in First Surgical Clinic, "St. Spiridon" Hospital Iasi. We have analyzed clinical data, trauma mechanism, pathology of the lesion, time trauma-diagnostic, associated lesions, treatment, and follow-up.

Results: There have been 18 patients (12 men, 6 women), mean age 42. Location of diaphragmatic tears has been on the left hemidiaphragm (12 cases), on the right hemidiaphragm (3 cases), or bilateral (3 cases). The trauma mechanism has been blunt (10 cases) or penetrant (8 cases). All patients had associated visceral lesions and had been operated, with direct suture of the diaphragm tear in 17 cases (94.4%). Postoperative mortality: 16.7%.

Conclusions: Most frequent causes of diaphragm lesions are traffic accidents, falling from height, and stab wounds. Left hemidiaphragm is much more frequent teared than the right hemidiaphragm. Early diagnose and treatment may have good results.

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PR 340

Emergency repair of incarcerated ventral hernias with polyvinylidene fluoride meshes. A cohort study

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Introduction: Emergency surgeries are oftenly related to contaminated/infected fields, where the implantation of non reabsorbable meshes for reconstruction of the abdominal wall may not be recomendable. We aim to evaluate the results of polyvinylidenfluoride (PVDF) meshes used for complicated ventral hernia in the acute setting

Material and methods: Retrospective analysis of patients with VH undergoing emergency surgery on which a PVDF mesh was required, in a third level hospital (November 2013–September 2019). We analyzed early and late postoperative complications and 1-year recurrence rates.

Association between grade of contamination, mesh placement and infectious complications and recurrences was investigated using binary and multiple regression.

Results: We collected 123 patients with a mean age of 62"3 years, mean BMI of 31"1 kg/m^2 and mean CeDAR index of 51"6. 96"4% of patients had a grade 2–3 ventral hernia according to Rosen"s index. Concomitant procedures included al least one organ resection in 48"7% of surgeries and previous contamined mesh explantation in 11"5%. A PVDF mesh was placed using an intraperitoneal onlay mesh (IPOM) technique in 56"3% of cases and an interposition location in 39"9%. Readmission rate was 15"7%, one-month recurrence 5"7% and recurrence after a year 19"1%. Overall mortality rate was 27.6%. Risk of recurrence was related with patients with a Rosen score over 2 ($p < 0.001$) and also with postoperative SSI ($p = 0.045$). Higher recurrence rates were not found regarding the PDVF meshes placement. Postoperative seroma and hematoma rates were 21"1% and 10"6%. Enteroatmospheric fistula rate was 7"8%.

Conclusions: PVDF prosthesis seems to be an useful material for complicated ventral hernia repair, specially in the acute setting, showing similar recurrence and infectious complication (fistula, chronic mesh infection, surgical site infection) rates with regard to different prosthesis used in the literature.

PR 341

Operative vs non-operative management in liver trauma patients in a UK Major Trauma Centre

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Background: Liver injury remains a major cause of death following abdominal trauma. The management of liver trauma has changed to non-operative management (NOM) being favoured in all haemodynamically stable patients. The aim is to evaluate which factors predict operative management (OM) in liver trauma at East Midlands Major Trauma Centre (EMMTC).

Method: This is a retrospective database review of all patients treated at EMMTC with traumatic liver injury between 2005 and 2018. Univariate and multiple logistic regression were performed using Stata v 15. P value of < 0.05 taken as significant.

Results: Of 393 patients with liver injury, 20.9% (82/393) were AAST grade 4 or 5. In the total group, median age was 32 years, 66.1% were male and 79.6% were blunt injuries. Median ISS in the NOM group was 22 and 25 in the OM group. Median ISS for those with grade 4 or 5 injury was 26. 64.6% (254/393) underwent NOM, compared to 59.8% (49/82) of those with AAST grade 4 or 5. For each 1 mmHg increase in systolic blood pressure, patients with Grade 4 or 5 injury were 3% less likely to have an operation (OR 0.97, $p = 0.003$) and for each 1 beat increase in heart rate, 3% more likely to have an operation (OR 1.03, $p = 0.001$). Age, sex, AAST liver injury grade and Injury Severity Score did not predict type of management in the whole cohort or those with Grade 4 or 5 injury. Those that underwent OM were more likely to have liver related complications (OR 4.21 $p < 0.001$). The overall mortality was 7.1% (28/393). Of the NOM patients 4.7% died, compared to 11.5% in the OM group ($p = 0.012$). For those with AAST grade 4 or 5 injury, 2.0% died in the NOM group, compared to 18.2% in the OM group ($p = 0.01$).

Conclusion: We found worsening patient physiology to be positively correlated with operative intervention. OM was associated with higher liver-related complications rates and mortality.

PR 342

Can appendicitis inflammatory response score predict the severity of acute appendicitis?

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Introduction: Appendicitis Inflammatory Response score (AIRS) is one of the recent scores developed to diagnose acute appendicitis (AA). The aim of this study was to evaluate the severity of the AA related to the AIRS

Methods: We retrospectively analyzed 115 patients with AA diagnosis that subjected to surgery, adimitted at Humanitas Research Hospital (Rozzano) from 1 January 2017 to 31 December 2018. The details of age, sex, intra operative findings (AAST score), drainage, post-operative stay, histological findings and readmission were evaluated according to AIRS.

Results: The study population consisted of 71 men (61,7%) and 44 women (38,3%), with a mean age of 38,5 years (range: 14–84 years). There were 28 (24,3%) patients with an AIRS 1–4, 69 (60%) patients with an AIRS of 5-8, and 18 (15,7%) patients with an AIRS of > 8. Drainage was used in 74 patients (64,3%), the conversion rate was 12% and the mean post-operative stay was 3 (range 1–16). Patients readmitted for complications were 5 (4,3%). Intra-operative Grade I was revealed in 57 patients (49,8%), Grade II in 24 (20,8%), Grade III in 8 (6,7%) Grade IV in 21 (18,2%) and Grade V in 5 (4,5%). Histologic finding of catarral appendicitis was found in 32 (27,8%) patients, 39 (34%) had phlegmonous appendicitis and 44 (38,2%) had gangrenous appendicitis. The AIRS difference was statistically significant with histological findings ($p < 0{,}01$), intra-operative grading ($p < 0{,}05$) and postoperative day ($p < 0{,}05$).

Conclusions: The AIRS can predict the histologic severity and the intra operative findings in patients with a high clinical suspicion of AA. AIRS could be useful to reduce negative appendectomy and predict the postoperative stay

SPINAL INJURIES

PR 433

To evaluate the deformity progression in spine injuries (dorsal, dorsolumbar, lumbar) managed by internal fixation.

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Introduction: There continues to be controversy surrounding the management of thoracolumbar burst fractures. Numerous methods of fixation have been described for this injury, but to our knowledge, spinal fusion has always been part of the stabilising procedure, whether this involves an anterior or a posterior approach.
Material and methods: 64 patients with spinal injury (dorsal, dorsolumbar, lumbar) were included. All patients had dorsal, dorsolumbar, lumbar spine injuries managed with posterior short segment pedicle screw fixation and were followed up for at least one year after surgery. Preoperative, post operative and follow up lateral radiographs were examined for Cobb"s angle, anterior wedge compression angle and upper and lower adjacent intervertebral disc heights anteriorly, middle and posteriorly.
Results: At final follow up, the mean improvement in Cobb"s angle post operatively was 10.8°. The mean loss of correction of Cobb"s angle was 7.1° with SD of 5.7° compared to post operative. The mean improvement in anterior wedge compression angle was 7.1° post operatively. The mean loss of reduction in anterior wedge compression angle was 2.05° with SD of 2.3°. The increase in Cobb"s angle was statically significant ($r = 0.684$, $p = 0.001$) with the loss of reduction of anterior wedge compression angle at follow up and loss in intervetebral disc height at upper intervetebral disc anteriorly only($r = 0.545$, $p = 0.013$). The mean period at which sitting and standing was initiated was 1.5 months and 3.12 months respectively and mean periods for which brace was used was 8.6 months.
Conclusions: Pedicle screw fixation is good but related to loss in reduction of anterior wedge compression angle and decrease in upper intervertebral disc height anteriorly.
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PR 434

New AOSpine Upper Cervical Classification System in comparison with the established classification systems

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Introduction: With the newly implemented AO Upper Cervical Spine Classification system a modern, pragmatic system has been established. To what extent the simplification is helpful or whether an adjustment of the new AO classification may be discussed, forms the question of this work.
Material and methods: Retrospective analysis of 60 upper cervical spine injuries with CT/MRI diagnostics presented to 4 trauma surgeons with several years' experience to do classification and suggest treatment.
Results: The classification according to the known systems showed a relatively good agreement in the exact classification and therapy. The classification according to the new AO Upper Cervical Spine was simple and consistent but revealed different treatment recommendations for two subtypes (III Type A and III Type B).
Conclusions: The new AO Upper Cervical Spine classification system leads to a simplification. Uncertainties remain with the most frequent fractures on the upper cervical spine, the C2 fractures. These will be managed under III Type A. However, just these injuries require completely different treatment concepts. Further adaptation is required for type III B because there uncertainties regarding the therapy also remain.

PC 435

Cement-embolic stroke after percutaneous kyphoplasty: a case report

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Case history: A 83-year-old woman, on treatment with acenocoumarol due to atrial fibrillation, and interatrial communication, suffered a compression fracture of the vertebrae L2 to L4 after a low-energy trauma. Due to poor pain control, she underwent a percutaneous transpedicular kyphoplasty, with no intraoperative complications.
Clinical findings: During the immediate postoperative period, she developed dysarthria and claudication of Barré in her right upper limb.
Investigation/Results: An Angio-CT scan was performed, showing endovascular material in the left middle cerebral artery (MCA) and within the lungs, compatible with cement emboli. MRI showed cortico-subcortical ischemic areas in MCA territory.
Diagnosis: Cement-Embolism Stroke After Percutaneous Kyphoplasty
Therapy and Progressions: Conservative treatment was chosen due to the high number of emboli and the favorable evolution of the patient, with resolution of the neurologic symptoms in 48 h without sequelae. 15 days later, she suffered a transient ischemic attack, with no changes in the CT-scan compared to the previous images, which also solved with no residual deficits. One month after this episode, the patient died due to a spontaneous cerebellar hemorrhage related to acenocoumarol overdose.
Comments: Kyphoplasty is a safe technique performed to treat vertebral compression fractures in elderly patients, with good clinical results and a low complication rate. Its main complications are related to the leakage of cement from the vertebral body, usually well tolerated. Other complications are exceptional, such as cerebral strokes, cardiac perforation, or death.
The present case, although infrequent, shows us the need to assess the risk-benefit balance when operating fragile patients, as life-threatening complications may happen in these procedures.
References:
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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 437

Survival rate and application number of total hip arthroplasty in patients with femoral neck fracture: an analysis of clinical studies and national arthroplasty registers

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Introduction: Total hip arthroplasty (THA) is an increasingly popular treatment option for fractured neck of femur (NOF) [1,2]. The aim of this study was to systematically review all literature on primary THA after fractured NOF to calculate an overall revision rate. Furthermore, we wanted to compare primary THA implantations after fractured NOF between different countries in terms of THA number per inhabitant.

Material and methods: All clinical studies on THA for femoral neck fractures between 1999 and 2019 were reviewed and evaluated with a special interest on revision rate. Revision rate was calculated as "revision per 100 component years" [3]. THA registers were compared between different countries with respect to the number of primary implantations per inhabitant.

Results: Twenty-two studies showed a mean revision rate of 11.8% after ten years. We identified eight arthroplasty registers that revealed an annual average incidence of THA for fractured NOF of 9.7 per 100,000 inhabitants (Table 1).

Conclusions: We found similar annual numbers of THAs for fractured NOF per inhabitant across countries. Revision rates in clinical studies are higher compared to registry data [1,2,4]. The results of this analysis can be used to rank present and future national THA numbers within an international context.

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[3] Quality of Publications regarding the Outcome of Revision Rate after Arthroplasty. http://www.ear.efort.org/downloads/E-Book_QoLA%20Project_Final%20Report_EFORT%20Copenhagen.;

[4] Swedish Hip Arthroplasty Register Annual Report 2017. https://shpr.registercentrum.se/shar-in-english/the-swedish-hip-arthroplasty-register/p/ryouZwaoe.; 2018

Fig. 1

Table 1
Arthroplasty registers including the proportion of total hip arthroplasty (THA) performed for an indication of fractured (#) neck of femur (NOF) and the annual number of primary THA implantations for fractured NOF per 100,000 inhabitants

Registry	Total THA (n)	Total THA due to # NOF (n)	Proportion (#NOF/Total) (%)	Time period	Inhabitants (n)	#of Prim.THA due to #NOF/100,000 inhabitants
Netherlands	29,031	1,435	4.9	2017	17,181,084	8.4
England/Wales/ Northern Ireland	84,418	5,443	5.3	2017	56,435,600	9.7
Norway	9,097	400	4.4	2017	5,345,599	7.5
Sweden	18,140	1,643	9.1	2017	10,281,189	16.0
Denmark	10,416	583	5.6	2017	5,814,461	10.0
New Zealand	9,150	507	5.5	2017	4,920,000	10.3
Australia	37,137	2,120	5.7	2017	25,458,017	8.3
Scotland	7,786	553	7.1	2017	5,438,100	10.2

PR 438

Management of vertebral injuries in peripheral centre: a general surgery domain

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Introduction: Vertebral compression fractures constitute a large percentage of traumatic injuries of spine. The initial management plays an important role in the final outcomes. The present study aims to study the profile of vertebral Injuries in rural & semi urban population & to analyse the role of level two hospitals in initial management of vertebral injuries.

Material and methods: This study was a retrospective analysis of progressively collected data of patients presenting with vertebral injuries in a level two hospital catering to semi urban & rural population in India. The Initial presentation along with the age & sex profile was noted. Etiological factors leading to compression fractures were noted. Any neurological deficit either at the time of admission or transfer to a tertiary care neurocentre was noted as per ASIA scale. Initial management was carried out in accordance with the ATLS guidelines.

Results: A total of 44 out 3000 patients admitted with complaints of back pain were diagnosed to have compression fractures of the spine. The mean age was 49.4 years. Male: female ratio was approx 5:1. The lumbo sacral spine region was the most comply affected region. Two patients were incidentally detected to have vertebral fractures as a result of metastatic malignancy. A due note was made regarding patients who had deteriorated during the transfer in terms of neurological deficit & evidence of spinal shock.

Conclusions: Road traffic accidents contribute a significant portion of vertebral trauma . Smaller hospitals & general surgeons have an important role to play in terms of initial stabilisation of such patients particularly the ones presenting with neurogenic shock. A good initial management has sigificant bearing on outcomes.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

PR 439

Analysis of risk factors for tracheostomy in cervical spinal cord injury without bone injury

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Introduction: There are many cases that require tracheostomy in the acute phase of cervical spinal cord injury, and various risk factors have been reported so far. However, there has been no report on cervical spinal cord injury without bone injury. The aim of this study is to evaluate risk factors for tracheostomy in patients with cervical spinal cord injury without bone injury.
Material and methods: We conducted a retrospective observational study. Patients who were treated for cervical spinal cord injury without bone injury in our hospital were divided into 2 groups: tracheostomy (TC) group and no tracheostomy (no TC) group. We compared variables, including age, sex, ASIA impairment scale (AIS), neurological level of injury (NLI), Injury Severity Score (ISS), vital signs, blood gas analysis, tracheal intubation, chest complication, smoking history between two groups.
Results: There were 8 patients in TC group, and 46 patients in no TC group. On univariate analysis, there were significant differences in age, AIS A, tracheal intubation, NLI $\geqq$ C4. On multivariate analysis, NLI $\geqq$ C4 was an independent predictor of tracheostomy.
Conclusions: In this study, we demonstrated that NLI $\geqq$ TC4 could be useful to predict tracheostomy in patients with cervical spinal cord injury without bone injury.

PC 440

Unilateral fracture of the superior articular process of C7. Minimally invasive transpedicular screw fixation at C6 and C7. Case report

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Case history: Many fractures of the articular processes of the cervical spine are associated with displacement and instability, approximately 5% of all traumatic cervical spine injuries involve isolated fracture of the articular processes non-displaced or minimally displaced. [1] This case demonstrates a isolated facet fracture of the cervical spine with C7 radiculapathy treated with minimally invasive spine surgery techniques
Clinical findings: A 47-year-old male was admitted to the Neurosurgery Department due to severe neck pain (VAS 9/10). The pain radiating to the right upper extermity along dermatome C7. Neck and trunk rotation worsened the pain.
Investigation/Results: Furthermore, physical examination revealed hyperaesthesia in the right index finger without muscle weakness. Ailments suddenly appeared 4 weeks earlier after getting up in the morning. Imaging demonstrated isolated, unilateral fracture of the right superior articular process of C7
Diagnosis: Imaging demonstrated isolated, unilateral fracture of the right superior articular process of C7
Therapy and Progressions: The patient was treated by microsurgical C7 decompression and fusion of C6-7 under navigation guidance. Intraoperative CT scans were performed to evaluate sufficient bone removal.After the surgery, the neck and upper extremity pain subsided. The patient had returned to his usual job and sport activities.
Comments: This case illustrates the value of the navigation and intraoperative CT in the evaluation of bony decompression, anatomy and location of implants. Navigation minimized iatrogenic injury resulting in reducing postoperative complications like chronic pain, kyphotic deformity and muscular atrophy.
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DePuy—Research Grants
Medtronic—Research Grants

Fig. 1

Fig. 3

Fig. 2

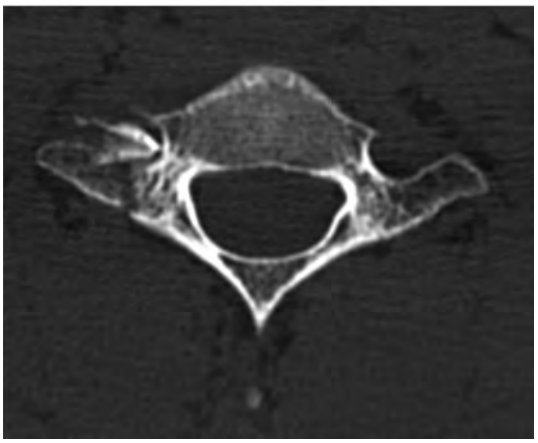

Fig. 4

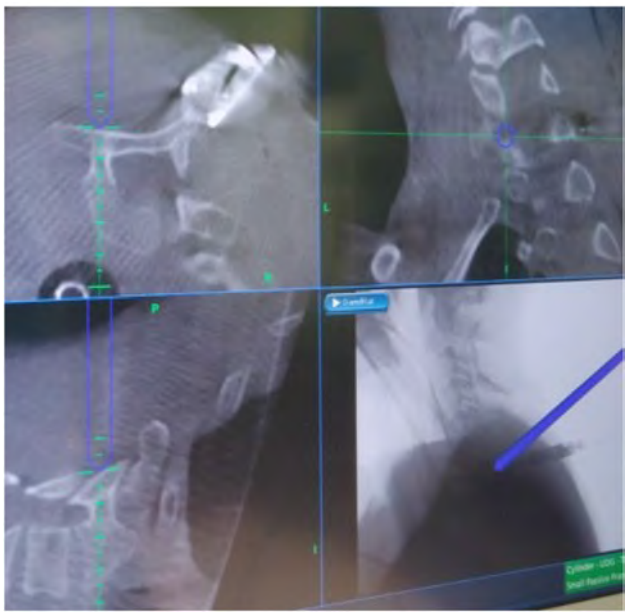

Fig. 5

PR 441

Early clinical predictors of pneumonia in patients with acute spinal cord injury without bone injury: a retrospective study

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Introduction: Pneumonia is still significant complication that associates with mortality and duration of hospitalization in patient with acute spinal cord injury without bone injury (SCIWOBI). The purpose of this retrospective study is to clarify early clinical predictors of pneumonia in patients with SCIWOBI.
Material and methods: We reviewed the medical records of patients with SCIWOBI who admitted between January 2012 and November 2019. Spearman's rank-correlation coefficient was used to test the relationship between each parameter. Multiple logistic regression analysis was performed to determine the factors that influenced pneumonic morbidity.
Results: A total of 44 patients with acute SCIWOBI, who were evaluated for neurological impairment within 24 h after injury, were reviewed. Pneumonia occurred in 11 patients (25%), seven patients injured at C4 and four at C5. According to Spearman's rank method, ASIA motor score, beginning period of nutrition, ventilator use, neurological level of injury (NLI) $\geqq$ C5, low prognostic nutritional index (PNI) were correlated with onset of pneumonia. Logistic regression found ventilator use to be most predictive of pneumonia (odds ratio [OR] = 12.7, 95% confidence interval [CI] 1.24–131), followed by NLI $\geqq$ C5 (OR 2.3, 95% CI 0.36–14.4), beginning period of nutrition (OR 2.1, 95% CI 0.95–4.8), PNI (OR 1.3, 95% CI 0.94–2.5).
Conclusions: In addition NLI, low PNI increases the risk of pneumonia. We consider that improving nutritional status, especially early initiation of enteral nutrition, decrease the incidence of pneumonia.

PR 442

Bicycle-related cervical spine fractures

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Introduction: The incidence of traumatic cervical spine fractures (CS-fx) in the Norwegian population is 15/100,000/year, and 12% of these injuries are bicycle-related (1, 2).
Materials and Methods: Prospective cohort study of all bicycle-related CS-fx in the South-East Norwegian population (3.0 million) in the time period 2015–2018. The data were retrieved from our quality control database for traumatic CS-fx in South-East Norway. In the database all CS-fx patients (C0 (occipital condyle) to C7/Th1) are prospectively registered.
Results: During the four-year study period 209 patients with bicycle-related CS-fx were registered, 175 (84%) were males, and mean age was 52 years (range 16-87). The CS-fx was located in the upper cervical segment (C0-C2) in 68 (33%) patients, lower cervical segment (C3-Th1) in 117 (56%), and at both segments in 24 (11%). The most common fx subtype was C0-fx. Spinal cord injury secondary to CS-fx was registered in 26 patients (12%). Fracture stabilization was achieved with open surgery in 41 (20%), external immobilization with a stiff collar alone in 147 (70%,) and without treatment in 21 (10%).
Conclusions: Severe bicycle-related cervical spine injuries are not uncommon. The increasing political desire to move commuting from motorized vehicles to bicycles warrants a heightened focus on road safety.
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PR 443

Efficacy and adhesion of two cervical spine clinical evaluation algorithms in trauma patients

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Introduction: The need for cervical immobilization is predicted by the ATLS, the standard of care in trauma since 1980, because cervical trauma is a important cause of disability. However, its discontinuation was linked to X-rays, a fact that has been changed thanks to the development of two algorithms that assess the severity of cervical trauma: the Canadian C-Spine Rule (CCR) and the National Emergency X-Radigraphy Utilization Study (NEXUS).
Material and methods: This study aims to compare the reduction values in the number of CT scans required after the application of both algorithms in a Level-1 Trauma Center and to verify the degree of adherence of residents in the use of each. Cohort study with randomized application by residents of the algorithms in all patients suffering from blunt trauma with cervical collars who were admitted

from August to October 2019. The conducts had their frequencies analyzed to obtain an inference about the efficacy of each method in the abstention of X-rays and case resolution, in addition to verifying if the indicated conduct was followed by the resident, inferring on the confidence in the algorithm.
Results: 158 cases were evaluated during this period, of which 76 were by the CCR algorithm and 82 by the NEXUS. The indication rate for CCR imaging was 39.4% and NEXUS was 42.6%, showing no statistical difference between them (p = 0,682; CI = 95%). In the evaluation of the effective conduct, which evaluated the reliability of the algorithm, there was no disagreement between them (p > 0,05; CI = 95%).
Conclusions: Neither method demonstrated superiority to the other in reducing the indication of imaging exams and its uses had equal adherence by resident physicians.
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PC 444

Hyper-extension injury resulting in fracture through a fused C6/7 anterior cervical discectomy and fusion

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Case history: A 65 year old lady presented with severe neck pain following a fall and cervical hyper-extension injury. She had previously undergone anterior cervical discectomy and fusion at C6/7 with placement of artificial interbody bone graft. Postoperatively, the patient reported an excellent clinical outcome and later imaging confirmed interbody fusion.
Clinical findings: On examination, the patient was neurologically intact but reported severe mid-cervical neck pain with reduced range of movement.
Investigation/Results: Imaging included CT and MRI of the whole spine
Diagnosis: Imaging revealed an unstable hyper-extension injury of the cervical spine. A fracture extended through the caudal end of the fused graft-vertebral interface at C6/7 with disruption of the posterior elements.
Therapy and Progressions: Given the severity of the injury surgery was recommended. The patient underwent uneventful C6-T1 posterior instrumentation and fusion with excellent outcome (follow up two years).
Comments: This is the first report of a cervical spine fracture through the site of an anterior cervical discectomy and fusion. It is hypothesised that the fused cervical segment resulted in increased stress at the fused caudal graft-vertebral interface during hyper-extension, this combined with reduced tensile strength at the graft-vertebral interface resulted in this unusual transverse fracture pattern. The clinician should be aware that patients presenting with cervical spine trauma in the context of previous cervical spine surgery are prone to greater mechanical forces. There should be a high index of suspicion for serious injury prompting thorough assessment and investigation.

PR 445

S1-Screw-fixation: computer aided study prevent unguided missile

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Introduction: Transiliosacral screw fixation of unstable dorsal pelvic ring fractures is not much present neither in literature nor in practice. In cause of the complex anatomy and the varying narrow safe bony corridors it´s a demanding procedure. Limited information is available on optimal placement and the geometry of safe zones for screw insertion in the pelvis.
Material and methods: 3D-reconstructions of 50 consecutive CT scans of polytraumatic injured patients (15 female, 35 male) were the basis to insert two virtual CAD bolts (representing screws) into the first two sacral segments as performing during screw fixation.
Results: In S1 the narrowest point was reached after a mean of 62.75 mm respectively 63.31 mm, depending on the selected way of measurement. For S2 the mean distance to the tricky constriction area amounted to 50.61 mm, respectively 51.54 mm. The average height in S1 measured 25.88 mm and the average width 25.49 mm. According, the average height for S2 was 17.54 mm and the average width 17.61 mm. The measurement results didn‘t show a significant difference between male and female pelvis bones for any distance of interest.
Conclusions: An optimal screw position is very important, because in the areas of bony narrowing are the exit points of the sacral nerves, which exit through the foramina anteriorly and posteriorly. Damage to this nerve structures can cause severe long-term consequences such as numbness or paralysis. Knowledge of predefined distances may aid in preoperative planning, decrease operative and radiation times and may prevent unguided missiles.
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PC 446

Traumatic chylothorax after blunt chest trauma

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Case history: 55-yr-old female was injured in a car accident suffering blunt thoracic trauma, with no apparent trauma. After 5 days she developed severe chest pain and dyspnea. She needed urgent ventilatory support. During intubation she sustained heart arrest and successful cardiopulmonary resuscitation was performed.

Clinical findings: There were absent breath sounds on the right side of the thorax, ultrasound showed an extensive pleural effusion. A chest tube was inserted and 2L of bloody-milky fluid was drained.
Investigation/Results: CT scan showed fractured C1-C2 and Th1-Th3 vertebral bodies, fractured lateral osteophytes of Th11-12 and probable injury of the thoracic duct at Th11-12 level. Pleural effusion analysis showed raised cholesterol and triglyceride levels.
Diagnosis: Traumatic chylothorax; Fractures Th11-Th12, Th1-Th3, C1-C2
Therapy and Progressions: Patient was kept on ventilatory support for 3 days. Primarily she was treated with total parenteral nutrition followed by no fat and hypolipidemic diet. The chest tube was removed after 8 days. She was discharged in stable condition the following day. At the 1 month check-up she was stable and eupnoic.
Comments: Traumatic chylothorax caused by blunt chest trauma is extremely rare. There are hypotheses that injuries to the thoracic duct are caused by hyperextension of the spine or by increased thoracic/abdominal pressure (seat-belt injuries). In our case, chylothorax probably resulted from fractured lateral osteophytes. Patients are usually successfully treated with pleural drainage and total parenteral nutrition. If there is no improvement after 2 weeks or if drainage exceeds 1.5L/day or 1L/day for more than 5 days, thoracic duct ligation should be considered.
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PR 447

Percutaneous pedicle screw fixation (PPSF) in the treatment of Thoracic and Lumbar spine fractures

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Introduction: Surgical treatment of Thoracic and Lumbar spine fractures depends on various factors. Pathological features of the vertebral lesion, neurological deficit, general condition of health and presence of polytrauma affects the treatment.
Conservative treatment resulting in T-L or Lumbar kyphosis can worsen the quality of life of the patient whereas traditional open surgery may be an overtreatment in some cases, considering blood loss, possible complications, hospital stay and delayed functional recovery. In this setting, a good option can be a percutaneous minimally invasive surgery.

The advantages of percutaneous pedicle screw fixation are: preservation of posterior musculature, less blood loss, shorter operative time, lower infection risk, less postoperative pain, shorter hospital stay and easier implant removal after bone union. Limitations such as inability to achieve direct spinal canal decompression can be dealed by combination with open techniques.

The objective of this study was to report the results of PPSF on these fractures and the technical problems we had to overcome.
Methods: 32 patients are included, treated with percutaneous transpedicular fixation and stabilization with minimally invasive technique from December 2015 to October 2019. 24 patients were males, 8 females; average age was 46,5 years (range from 18 to 82). In all cases, system Pathfinder—NXT (Zimmer) was used.
Results: Most of the patients presented an early post-operative mobilization with amelioration concerning pain and a low complication rate. Limitations in mobilization were mainly due to co-existent injuries, polytrauma or non-reversible neurological deficit.
Conclusion: PPSF is a reliable and safe procedure which does not replace the open technique but adds to treatment options by restoring a good sagittal alignment similar to those reported for open surgery. Removal of hard material is advocated after fracture healing to preserve the lumbar spinal mobility and avoid zygapophyseal joint osteoarthritis.

TRAUMA SYSTEMS & PREHOSPITAL CARE

PR 448

Critical surgery within the first hour of presentation: is it a feasible intervention for better trauma care outcomes in Low and Middle income countries?

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Introduction: In low and middle-income countries (LMIC) Golden Hour care concept is almost nonexistence due to resource constraints. In this study, we analyzed one novel concept of critical surgery within the first hour of admission as a possible intervention which could be applied in the existing scenario in these countries without much resource requirement.
Material and methods: A retrospective analysis of a prospectively maintained data registry under a project named TITCO (Towards Improved Trauma Care Outcome) was done. Registry data from a level -1 trauma Centre in India were analyzed from October 2013 to September 2015. All patients who admitted and underwent critical surgical interventions within the first hour of presentation were analyzed. These patients were divided into two groups depending upon primary presentation or referred from another facility. Statistical analysis was done between these two groups to compare the outcome.
Results: Sixty-one (57.6%) patients were directly admitted from the site of the incident whereas forty-five (42.4%) were transferred from other hospitals for surgical needs. The median time from injury to presentation for primary patients was 50 min with interquartile range (IQR) of 40. In the referred patient median time gap between the injury to our center (not referring center) was 230 min with IQR of 350. This difference was statistically significant. Major outcome indicators in the form of median ICU and total stay, as well as mortality, were not significantly different
Conclusions: Proposed concept might be a useful hospital-based intervention in existing trauma system in LMIC to improve the outcome of injured patients along with improving prehospital services.
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PR 450

Molecular mechanisms of exercise-induced health benefits

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Introduction: It is well-known that physical activity is good for us. Although the skeletal muscle is the main organ which is directly affected, exercise affects the whole body. The mechanisms responsible for these beneficial effects are gradually becoming known to us through extensive research. This might make it easier for physicians to prescribe exercise as a therapy equally and even more beneficial than drugs regarding effect and risk profile. The aim of this thesis was to review the current literature on the molecular mechanisms of exercise-induced health benefits.
Material and methods: A search in Medline and Embase resulted in 468 articles. They were sorted by title and abstract, then by reading the full text. Relevant articles from the reference-lists were included. 18 sources were found outside of the search.
Results: When we exercise, the skeletal muscle is subjected to several mechanical and chemical stimuli, which in turn activate a set of kinases and phosphatases. These are molecules that regulate transcription-factors and co-activators, and this leads to adaption of the muscle-cells. I addition, the muscle secretes a number of proteins called myokines, which conduct the effect of exercise to other organs and tissues. Some lead to increased cerebral neuroplasticity, hypertrophy and angiogenesis (BDNF, VEGF and IGF-1). Several interleukins have also been identified as myokines, and they mediate an anti-inflammatory effect which is favorable in the prevention and management of conditions like atherosclerosis and type 2 diabetes. Lastly, we found that exercise leads to epigenetic changes, altering the genetic expression in several types of tissues. Some studies suggest that the epigenome is affected by exercise even before we are born, giving babies born to physically active mothers a favorable epigenetic expression.
Conclusions: We should use this knowledge to support the implementation of physical activity in treatment and preventive health care.

PR 451

Impact on undertriage and mortality after changing from a two-tiered to one-tiered trauma team activation protocol

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Introduction: To reduce the risk of trauma team activation (TTA) fatigue, a two-tiered TTA protocol has been used since inception in 2009 in our hospital. However, after the revised national traumaplan recommended use of only one tiered TTA, this was implemented from 2017. The aim of this study was to compare the immediate period before-and-after TTA protocol change with focus on undertriage and mortality.
Material and methods: All data were extracted from the Stavanger University Trauma registry from 2017 and 2018. Descriptive analysis was performed with chi square and Kruskal Wallis tests were.
Results: In 2017, 722 patients were included in the trauma registry. Median ISS was 5 and 122 patients had an ISS > 15. Of these patients, 20/122 (16%) did not receive a trauma team activation (TTA) and were classified as undertriaged. Mortality for this group was 20% (4/20). Total mortality in 2017 was 2,6% (19/722).
In 2018, 501patients were included in the trauma registry. Median ISS was 9 and 103 patients had an ISS > 15. Of these patients 31/103 (30%) were undertriaged with a mortality of 5/31(16%). The total mortality in 2018 was 4,8% (24/501). I 2017, median age was 62 years for the patients with no TTA vs 36 years for those patients who did receive a TTA ($p < 0.001$). Median ISS in 2017 was 13 for patients with no TTA vs 5 for those with TTA ($p < 0.001$). Of the patients with fall as trauma mechanism, 12,5% (46/366) did not receive TTA, while 3,3% (12/353) of patients with another trauma mechanism than fall received a TTA ($p < 0.001$). I 2018 median age was 60 years for the patients with no TTA vs 38 years for those patients who did receive a TTA ($p < 0.001$). Median ISS in 2018 was 14 for patients with no TTA vs 5 for those with TTA ($p < 0.001$). . Of the patients with fall as trauma mechanism, 21,7% (46/212) did not receive TTA, while 8,8% (26/297) of patients with another trauma mechanism than fall received a TTA ($p < 0.001$).
Conclusions: After changing protocol from two tiered TTA to one tiered TTA, the undertriage almost doubled. Patients who do not receive a TTA are characterized by age > 60 years, higher ISS than patients who receive TTA and fall as trauma mechanism.

PR 453

Prognostic factors for medical and productivity costs, and return to work after trauma: a prospective cohort study

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Introduction: The aim of this study was to determine prognostic factors for medical and productivity costs, and return to work (RTW) during the first 2 years after trauma in a clinical trauma population.
Material and methods: This prospective multicentre observational study followed all adult trauma patients (≥ 18 years) admitted to a hospital in Noord-Brabant, the Netherlands from August 2015 through November 2016. Health care consumption, productivity loss and return to work were measured in questionnaires at 1 week, 1, 3, 6, 12 and 24 months after injury. Data was linked with hospital registries. Prognostic factors for medical costs and productivity costs were analysed with log-linked gamma generalized linear models. Prognostic factors for RTW were assessed with Cox proportional hazards model. The predictive ability of the models was assessed with McFadden R2 (explained variance) and c-statistics (discrimination).
Results: A total of 3785 trauma patients (39% of total study population) responded to at least one follow-up questionnaire. Mean medical costs per patient (€9,710) and mean productivity costs per patient (€9,000) varied widely. Prognostic factors for high medical costs were higher age, female gender, spine injury, lower extremity injury, severe head injury, high injury severity, comorbidities, and pre-injury health status. Productivity costs were highest in males, and in patients with spinal cord injury, high injury severity, longer length of stay at the hospital and patients admitted to the ICU. Prognostic factors for RTW were high educational level, male gender, low injury severity, shorter length of stay at the hospital.
Conclusions: Productivity costs and RTW should be considered when assessing the economic impact of injury in addition to medical

costs. Prognostic factors may assist in identifying high cost groups with potentially modifiable factors for targeted preventive interventions, hence reducing costs and increase RTW rates.

PR 454

Evaluation of long-term follow-up and consequences of gunshot and stab wounds in a French civilian population

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Introduction: The data concerning long-temr follow-up of patients and consequences of gunshot wound (GSW) and stab wound (SW) are almost inexistent in the literature. In Finland, a 2014 study showed that 12% of patients with trunk wounds died secondarily from alcohol-related or violent problems [1], highlighting the secondary importance of long-term care for these patients.
The main objective of our study was to analyze the hospital and post-hospital follow-up of patients with GSW or SW and to evaluate late complications and the consequences of these traumas.
Material and methods: From January 2007 to January 2017, 165 patients were hospitalized for GSW or SW management in Laveran Military Hospital. Hospital data were collected via informatic patient file and post-hospital data via a telephone questionnaire with the general physician (GP).
Results: Median hospital follow-up was 28 days [4–66]. Seventy-six patients had a follow-up visit with their GP (46%). Median follow-up was 47 mois [21–75]. Twenty-four patients were totally lost to follow-up (14.5%). Global follow-up identified 54 patients with long-term consequences (32.7%), 20 psychiatrics and 30 organics. Seventeen cases of recurrence were found (10.3%). High ISS, age, GSW and GP identified in patient medical file were significantly linked to long-term consequences occurrence.
Conclusion: This study showed a high number of long-term consequences occurrence among patients with GSW or SW. However, the extra-hospital follow-up seems insufficient. It is therefore imperative to strengthen the compliance and adherence to the care network of these patients. Awareness and involvement of medical, paramedical teams and GP role seems essential to screening and management of these consequences.
References:
1. Inkinen J, Kirjasuo K, Gunn J, Kuttila K. Penetrating trauma; experience from Southwest Finland between 1997 and 2011, a retrospective descriptive study. Eur J Trauma Emerg Surg. 2015. p. 429–433

Fig. 1

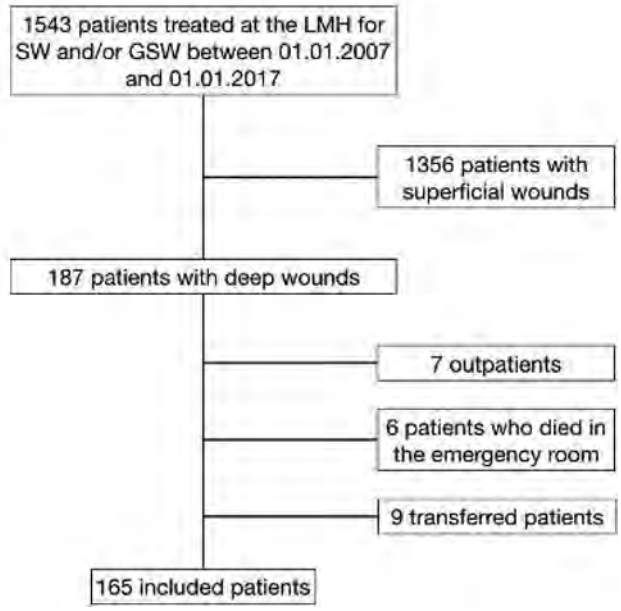

Fig. 2

Table 1 - Patient and trauma characteristics (expressed in n (%) or median[interquartile]).

TOTAL	**165 (100)**
PATIENT CHARACTERISTICS	
Male sex	151 (91.5)
Age (years)	26 [20-38]
ASA score	1 [1-1]
CHARACTERISTICS OF THE TRAUMA	
Type of trauma	
GSW	58 (35.2)
SW	107 (64.8)
Mode of occurrence	
Assault	142 (86.1)
Self-inflicted injury	15 (9.1)
Accident	8 (4.8)
Coming mode	
Own ressource	95 (57.6)
After pre-hospital care	70 (42.4)
Wounds location	
Thoracic	80 (48.5)
Abdomino-pelvic	82 (46.7)
Cervico-cephalic	33 (20)
Upper limbs	33 (20)
Lower limbs	43 (26.1)
ISS	20 [13-29]
< 10 (minor)	26 (15.8)
10-19 (moderate)	40 (24.2)
20-29 (sever)	69 (41.8)
> 29 (critical)	30 (18.2)

Score ASA: score of American Society of Anesthesiologists, ISS: Injury Severity Score ; GSW: gunshot wound ; SW: stab wound.

Fig. 3

Table 2 - Trauma management and follow-up (expressed as n (%) or median[interquartile]).

	Total	Patients with thoracic and/or abdominal injury	Patients without thoracic and/or abdominal injury	
	165	86 (52.1)	79 (47.9)	
TRAUMA CHARACTERISTICS				
ISS	20 [13-29]	23 [20-30]	13 [8-20]	**<0.001**
GSW	58 (35.1)	24 (27.9)	34 (43)	**0.05**
Patients managed in pre-hospital care	70 (42.4)	50 (58.1)	20 (25.3)	**<0.001**
IN-HOSPITAL FOLLOW-UP				
Surgical treatment	124 (75.1)	80 (93)	44 (55.6)	**<0.001**
Post-operative complications (% operated on)	13 (10.5)	12 (15)	1 (2.3)	**0.003**
Secondary complications	21 (12.7)	15 (17.4)	6 (7.6)	0.065
In-hospital lenght of stay (day)	5 [2-8]	13 [8-20]	7 [5-11]	0.5
Re-hospitalization	17 (10.3)	14 (16.3)	3 (3.8)	**0.01**
Re-intervention	16 (9.7)	9 (10.5)	7 (8.8)	0.8
1-month follow-up consultation	102 (61.8)	64 (74.4)	38 (48.1)	**<0.001**
Follow-up duration (days)	28 [4-66]	38.5 [15-144]	11[1.5-42]	0.95
IHC	40 (24.2)	26 (30.2)	14 (17.7)	0.07
EXTRA-HOSPITAL FOLLOW-UP				
Monitoring by the GP	68 (41.2)	39 (45.3)	29 (36.7)	0.3
Duration of monitoring by the GP	47 [22-75]	46 [23-75]	48 [20-75]	0.92
PHC	24 (14.5)	13 (15.1)	11 (13.9)	1

ISS: Injury Severity Score; GSW: gunshot wound ; IHC: Intra-Hospital Consequence; GP: General Physician ; PHC: Post-Hospital Consequence

Fig. 4

Table 3 - Trauma Consequences related to GSW and SW (expressed in n (%)).

	IHC	PHC	Total
TOTAL	**40 (24.2)**	**24 (14.5)**	**54 (32.7)**
Organics	**30 (18.2)**	**6 (3.6)**	**30 (18.2)**
Neurologic	22 (13.3)	2(1.2)	22 (12.3)
Central	2 (1.2)	0	2 (1.2)
Peripheral	20 (12.1)	2 (1.2)	20 (12.1)
Osteo-articular	3 (1.8)	2 (1.2)	3 (1.8)
Cardiologic	1 (0.6)	0	1 (0.6)
Urinary	2 (1.2)	1 (0.6)	2 (1.2)
Abdominal	1 (0.6)	1 (0.6)	1 (0.6)
Maxillo-facial	1 (0.6)	0	1 (0.6)
Psychiatric	**9 (5.4)**	**14 (8.5)**	**20 (12.1)**
AD	4 (2.4)	8 (4.9)	11 (6.6)
PTSD	5 (3.0)	6 (3.6)	9 (5.5)
Death	**1 (0.6)**	**4 (2.4)**	**4 (2.4)**
Recurrence	**12 (7.3)**	**6 (3.6)**	**17 (10.3)**

GSW: gunshot wound; SB: stab wound; IHC: Intra-Hospital Consequence; PHC: Post-Hospital Consequence ; AD: Anxiety Disorder ; PTSD: Post-Traumatic Stress Disorder.

Fig. 5

Table 4 - Univariate analysis of wound consequences according to different epidemiological factors

	Overall consequences of trauma by GSW / SW		Univariate		
	0	1	OR	95% CI for OR	P
Age (years)	24.7 (20.2-35.4)	29.9 (22.1-41.7)	1	(1.01, 1.06)	**0.01**
<20	26 (23.4)	10 (18.5)	-	-	-
20-40	66 (59.5)	29 (53.7)	1.1	(0.49, 2.67)	0.76
> 40	19 (17.1)	15 (27.8)	2.1	(0.76, 5.55)	0.16
ISS					
< 20	48 (43.2)	13 (24.1)	-	-	-
20-29	41 (36.9)	14 (25.9)	1.3	(0.53, 2.99)	0.6
> 30	22 (19.8)	27 (50.0)	4.5	(1.97, 10.41)	**<0.001**
GSW	28 (25.2)	30 (55.6)	3.7	(1.86, 7.36)	**<0.001**
Patients with GP reported	58 (52.3)	43 (79.6)	3.6	(1.67, 7.64)	**0.001**
Surgical patient	79 (71.2)	45 (83.3)	2	(0.89, 4.62)	0.09
Wound location					
Upper limb	22 (19.8)	11 (20.4)	1	(0.46, 2.33)	0.93
Lower limb	26 (23.4)	18 (33.3)	1.6	(0.80, 3.35)	0.18
Cephalic	10 (9.0)	6 (11.1)	1.3	(0.43, 3.68)	0.67
Cervical	11 (9.9)	6 (11.1)	1.1	(0.40, 3.26)	0.81
Abdomen	53 (47.7)	25 (46.3)	0.9	(0.49, 1.81)	0.86
Thorax	55 (49.5)	25 (46.3)	0.9	(0.46, 1.68)	0.69
Perineum	3 (2.7)	1 (1.9)	0.7	(0.07, 6.69)	0.74
Attendance at the consultation at 1 month	63 (56.8)	39 (72.2)	2	(0.98, 4.01)	0.06

ISS: Injury Severity Score ; GP : General Physician; GSW : gunshot wound ;
Note: p-values less than 0.3 are the variables used by the CART model

PR 457

Accuracy of trauma ultrasound in helicopter emergency medical service: how can we utilize it more effective?

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Introduction: Focused assessment with sonography for trauma(-FAST) is an effective tool for assessments of severely injured patients, especially in the settings of helicopter emergency medical service(HEMS) because of limited devices and time. The objective of this study is to investigate accuracy of trauma ultrasound in helicopter emergency service compared with enhanced CT scan.

Material and methods: We investigated the trauma patients in 3 years which was demonstrated FAST and delivered to the Advanced Critical Care Center in Gifu University by HEMS. Accuracy of the FAST was determined by comparison to the presence of injury, primarily determined by computed tomography, and to required interventions.

Results: 108 patients were included in this criteria. There were 57 and 13 patients in which we found fluids in thoracic or abdominal cavity by enhanced CT scans and ultrasounds in HEMS, respectively. Sensitivity and specificity, positive predictive value, negative predictive value, accuracy were 0.24, 0.963, 0.866, 0.559, 0.60. If we limited the data for abdominal fluids, each data were 0.409, 0.988, 0.9, 0.86, 0.87. In the patients of negative FAST with positive CT, no patient died due to hemorrhage in thoracic or abdominal cavity.

Conclusions: It has been reported that sensitivity of FAST in HEMS was lower compared with in ER. In the settings of prehospital trauma care, advantages of portable ultrasound could be limited because of peculiar environments. And also, the thoracic or abdominal fluids

could increase with time by organ injuries and it causes FAST negative in acute phases.In this series, we could not find cases which has possibility of death because of negative FAST and might influence the treatment. Repeated FAST or careful assessment of patients based on the other findings could be beneficial.

References: The sensitivity of FAST in HEMS was low and demonstrating FAST for several times could be effective to detect the thoracic or abdominal hemorrhage.

PR 458

Pre-hospital trauma care in Switzerland and Germany: Do they speak the same language?

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Introduction: Swiss and German (pre-)hospital systems, distribution and organisation of trauma centres differ from each other [1,2]. It is unclear if outcome in trauma patients differs as well. Therefore, this study aims to determine differences in characteristics, therapy and outcome of trauma patients between both German-speaking countries.

Material and methods: The TraumaRegister DGU® (TR-DGU) was used for this retrospective analysis. Patients with Injury Severity Score ≥ 9 admitted to a level 1 trauma centre between 01-2009 and 12-2017 were included if they required ICU care or died. Trauma pattern, prehospital procedures and outcome were compared between Swiss (CH, n = 4,768) and German (DE, n = 66,908) groups.

Results: Swiss patients were older than German patients (53 vs. 50 years). ISS did not differ between groups (CH 23.8 vs. DE 23.0 points). There were more low falls < 3 m (34% vs. 21%) at the expense of less traffic accidents (37% vs. 52%) in the Swiss population. In Switzerland 30% of allocations were done without physician involvement, whereas this occurred in only 4% of German cases. Despite a comparable amount of patients with a GCS ≤ 8 (CH 29.6%; DE 26.4%), differences in prehospital intubation rates were observed (CH 31% vs. DE 40%). Severe traumatic brain injuries were diagnosed most frequently in Switzerland (CH 62% vs. G 49%). Admission vital signs were similar, and standardized mortality ratios were close to one in both countries.

Conclusions: This study demonstrates that patients age, trauma patterns and prehospital care differ between both Germany and Switzerland. Furthermore, mortality slightly differs between both countries. Further benchmarking studies are indicated to optimize trauma care in both German-speaking countries.

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2. Allgoewer M. Trauma systems in Europe. *Am J Surg* 1991;161(2):226–9.

PR 459

Practical assessment of different saw types for field amputation: a Cadaver-based test study

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Introduction: Field amputation can be life-saving for entrapped patients requiring surgical extrication. Under these austere conditions, the procedure must be performed as rapidly as possible with limited equipment, often in a confined space, while minimizing provider risk. The aim of this study was to determine the optimal saw for a field amputation.

Material and methods: This was a prospective cadaver-based study. Four saws (Gigli, hand pruning, electric oscillating and reciprocating) were tested in human cadavers. Each saw was used to transect four separate long bones (humerus, ulna/radius, femur and tibia/fibula). The time required for each saw to cut through the bone, the number of attempts, slippage, quality of proximal bone cut and extent of body fluid splatter as well as the physical space required by each device during the amputation were recorded. Univariate analysis (Fisher's exact and Kruskal-Wallis or Mann-Whitney U-test) was used to compare the outcomes between the different saws.

Results: The fastest saw was the reciprocating followed by oscillating (2.1 [1.4–3.7] sec vs 3.0 [1.6–4.9] sec, p = 0.007). The number of attempts required to amputate (5.8 [3.0–8.3], p = 0.02) and the amount of slippage (3.0 [1.5–3.8], p = 0.03) were highest with the pruning saw. The reciprocating saw had the worst proximal bone cut quality (75% poor, p = 0.04) and the largest blood splatter (47.5 [41–63], p = 0.044). The physical space required to perform an amputation ranged from 3500 cm^3 with the oscillating to 12000 cm^3 with the reciprocating saw. Overall, the oscillating saw outperformed the others in number of attempts, slippage and quality of bone cut and physical space requirements, and was the second fastest (**Table 1**).

Conclusions: The speed, precision, safety, space required, as well as the highly adjustable blade in the oscillating saw make it ideal for a field amputation. A Gigli saw is an excellent backup for when electrical tools cannot be used or fail.

Fig. 1

Table 1 Saw characteristics and amputation results according to the saw used

	Gigli	Pruning	Oscillating	Reciprocating	*p value*
Characteristics					
Weight (g)	32	327	1026	2369	
Space needed, circa (cm3)*	4500	8000	3500	12000	
Time (sec)					
Humerus	4.75	52.69	1.75	1.35	**0.007**
Ulna/radius	4.2	65.0	1.6	1.4	
Femur	9.3	15.8	4.2	4.0	
Tibia/fibula	6.5	140.0	5.1	2.9	
Overall	*5.6 (4.3-8.6)*	*58.8 (25-121)*	*3.0 (1.6-4.9)*	*2.1 (1.4-3.7)*	

**Amputation was performed on a 4cm diameter bone. Physical space was defined as the space occupied by each device during the amputation*

PR 460

Impact of air medical transport on the survival of major trauma patients in Thailand

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Introduction: Air medical transport is an alternative mode of inter-facility transfer for injured patients who required a higher level of trauma care in Thailand. This study assessed the impact of air medical transport on the survival of major trauma patients transferred from local hospitals to a tertiary care hospital.
Material and methods: Trauma registry of 2014–2018 was reviewed. Major trauma patients transferred by air ambulance were identified. Injury Severity Score (ISS), predicted mortality and actual survival to hospital discharge were studied and compared between two subgroups, the seriously injured patients (ISS 15–24) and the severely injured patients (ISS > 24). The predicted mortality was calculated from the probability of survival (Ps) of Trauma and Injury Severity Score (TRISS).
Results: There were 99 major trauma patients (ISS > 15) transferred by air ambulance in five years period. 62 patients were severely injured (median ISS = 33), and 37 patients were seriously injured (median ISS = 17). The range of flight time was 20–200 min. The overall survival rate was 88.88%. The predicted mortality in the severely injured group was 21 cases (33.87%), but the actual mortality was nine (14.51%), 19.36% lower than predicted mortality. The predicted mortality in the seriously injured group was one case (2.7%), while the actual number was two (5.4%). The eleven deaths in this study were eight cases of severe traumatic brain injury(TBI) patients, two cases of massive bleeding with subsequent multi-organ failure and one drowning.
Conclusions: Air medical transport significantly improved the survival of severely injured patients who need higher level of trauma care. Severe TBI and the presence of multi-organ failure associated with unfavorable outcomes.
References:
1. David Michaels et al. Helicopter versus ground ambulance: review of national database for outcomes in survival in transferred trauma patients in the USA. Trauma Surg Acute Care Open. 2019; 1–3.

PR 461

A decade of road deaths and injuries in the under 5 population of Qatar: pre-hospital deaths must be addressed

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Introduction: The epidemiology of road traffic injuries [RTIs] affecting children, under 18 years, in of Qatar has been reported. However, a detailed analysis of the trends and epidemiology of RTIs affecting the most vulnerable children in Qatar, under 5 years of age, has not been conducted. This study's primary objective of is to describe the epidemiology of RTIs and deaths in young pediatric patients in Qatar.
Material and methods: Data, for all young pediatric [under 5 years] victims of RTI"s and RTI deaths from January 1, 2008, through December 31, 2017, from the trauma registry of the Hamad Trauma Center [HTC], the national Level 1 trauma referral center of Qatar, was analyzed. This data was correlated and compared with data from the Hamad General Hospital Mortuary and vital statistics data from the Qatar Ministry of Development Planning and Statistics, the Vital Statistics Annual Bulletin, for the years 2008–2017.
Results: The HTC attended to 271 patients, under 5 years, with severe RTIs and 15 in-hospital RTI deaths were reported during the study period. Males made up 83.7% of the injured and 60% of fatalities.The average age of the injured was 3 years and for fatalities was it was 2.8 years. The RTI incidence rate per 100,000 for both sexes, under 5 years, has been unchanged (246 in 2007 and 225 in 2017). The road mortality rate, per 100,000, has decreased significantly, from 46.3 in 2008 to 7.2 in 2017. Since 2014, the proportion of pre-hospital deaths has been increasing, 25-100%, and the in-hospital death rates has been reduced to 0%.
Conclusions: Rapid improvements in pre and in-hospital post-crash care in Qatar have resulted in marked reductions in in-hospital deaths for young children with RTIs. The emergence of pre-hospital road deaths of under 5"s must be made a priority for road safety in Qatar. The implementation of proven prevention programsshould be fast tracked in order to directly address this issue.

PR 462

Decision making in prehospital traumatic cardiac arrest; a qualitative study

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Introduction: Despite improving survival of patients in prehospital traumatic cardiac arrest (TCA), initiation and/or discontinuation of resuscitation of TCA patients remains a subject of debate among prehospital emergency medical service providers. The aim of this study was to identify factors that influence decision making by pre-hospital emergency medical service providers during resuscitation of patients with TCA.
Methods: Twenty-five semi-structured interviews were conducted with experienced ambulance nurses, HEMS nurses and HEMS physicians individually, followed by a focus group discussion. Participants had to be currently active in prehospital medicine in the Netherlands. Interviews were encoded for analysis using ATLAS.ti. Using qualitative analysis, different themes around decision making in TCA were identified.

Results: Eight themes were identified as being important factors for decision making. These themes were: factual information (*e.g.*, electrocardiography rhythm);fear of providing futile care or major impairment if return of spontaneous circulation was obtained;potential organ donation; patient age; suspicion of attempted suicide;presence of bystanders or family; opinions of other team members; and training and education. Several ambulance nurses reported they do not feel adequately supported by the current official national ambulance guidelines on TCA, nor did they feel sufficiently trained to perform pre-hospital interventions such as endotracheal intubation or needle thoracocentesis on these patients.
Conclusions: Eight themes were identified as being important for decision making during prehospital TCA. While guidelines based on prognostic factors are important, it should be recognized that decision making in TCA is impacted by more than factual information alone. This should be reflected in educational programs and future guidelines.
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VASCULAR AND ENDOVASCULAR INTERVENTIONS

PR 463

Role of resuscitative endovascular balloon occlusion of the aorta in penetrative and blunt trauma resuscitation

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Introduction: Resuscitative Endovascular Balloon Occlusion of Aorta (REBOA) is a technique initially developed in the military for trauma patients injured in combat[1]. Recently, there has been much debate on its role in civilian trauma cases in controlling Non-compressible torso haemorrhage (NCTH)[2]. This review aims to provide an update on current literature on the outcomes and concerns of this procedure.
Material and methods: A systematic literature search according to PRISMA Guidelines was performed over the period of January 2005 to August 2019 across EMBASE, MEDLINE and COCHRANE databases. Patient characteristics, mechanism and severity of injury, survival rates and post-REBOA complications between survivors and non-survivors were compared.
Results: A total of 32 studies were included in this review. 8% and 92% of the 4042 REBOA cases were penetrative and blunt cases respectively. The survival rates ranged from 6 to 100% across the studies. Systolic Blood Pressure (SBP) was significantly elevated post-procedure, from 75.6 to 119.0 mmHg in the survivor group ($p < 0.001$) and 61.4 to 96.8 mmHg in the non-survivor group ($p = 0.001$). The Injury Severity Score (ISS) was lower in the survivor group (31.9 vs 41.7; $p < 0.001$) whereas their Glasgow Coma Scale (GCS) was higher (12.3 vs 5.6; $p = 0.008$). The survivors also had a shorter duration of aortic occlusion (48.2 vs 93.3 min; $p = 0.001$). Common complications noted following the procedure include renal injury, lower limb ischaemia and thrombosis.
Conclusions: Pre-REBOA SBP, ISS, GCS and duration of aortic occlusion were found to be associated with survival. Complications directly due to the procedure were difficult to ascertain. A prospective study in a multiple trauma centre is needed for further evaluation of the indications, feasibility and complications involved in REBOA.
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PR 464

Traumatic vertebral artery injury due to cervical spine injury. Stroke prevention with endovascular occlusion of the affected vertebral artery

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Introduction: Traumatic vertebral artery injury (VAI) is a well-known complication of cervical spine injury and often causes posterior circulation stroke. We report preventive effect of acute phase endovascular intervention for traumatic VAI.
Material and methods: All patients with cervical spine injury were surveyed with post-contrast computed tomography for VAI. When VAI was diagnosed, the affected vertebral artery (VA) was occluded with endovascular intervention before spine reduction and fixation. Brain ischemic lesion was evaluated before and after the treatment.
Results: Forty-one patients with VAI associated with cervical spine injury underwent endovascular intervention. The affected VA was occluded with endovascular coils before cervical spine reduction and fixation in 38 patients, and after treatment in one patient. VA stenting was done for another two. Six presented new brain infarctions after spine surgery. Of these, two had endovascular intervention after spine reduction. Out of 38 patients who had endovascular embolization before spine reduction, four had newly developed infarctions after spine surgery, of which two were symptomatic. There were no complications related to the endovascular procedure.
Conclusions: In conclusion, endovascular embolization for traumatic VAI before spine reduction and fixation was found to be effective to prevent symptomatic brain infarction.
References:
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PC 465

Effectiveness of Angioembolization in lower gastrointestinal bleeding

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Introduction: Acute lower gastrointestinal (LGI) bleeding refers to blood loss of recent onset originating from a site distal to the ligament of Treitz.This bleeding majority resolves spontaneously.However,-some patients have persistent bleeding and needs other therapies.
Clinical findings: Between 2009 and 2019, twenty-five patients in Gregorio Marañón Hospital suffered a LGI bleeding.Confirmed by angiography and treated with angioembolization.
Results: The causes of bleeding were grouped into several categories.The most frequent cause with 7 cases in a row is attributed to diverticular bleeding,other causes of bleeding were angiodysplasia,-post polypectomy bleeding,GIST tumor,rectal ulcers and inflammatory disease.No case presented mortal or serious complications,secondary to the procedure. Only 2 cases presented a mild complication: focal mucosal ischemia of the embolized intestinal segment that was resolved with conservative treatment.Lesions in charge of bleeding in those 5 cases in which the angiographic treatment failed,were:ulcer in 2 cases,a case of bleeding after endoscopic polypectomy, a case of diverticular bleeding and bleeding secondary to a coagulation disorder.Among these patients, the definitive treatment was the following: -A second angiographic treatment was effective in the case of bleeding due to coagulation disorder. -A case of self-limited bleeding. -Surgical treatment was the definitive treatment in both cases of bleeding in the context of and patient with bleeding after polypectomy. We have not observed a significant relationship neither the type of lesion or its location with the probability of failure of the angiographic treatment. Nor do we observe a significant relationship between the type of material used for embolization and the risk of treatment failure.
Comments: Our data show that angioembolization is an effective and safe technique to treatment LGI bleeding.
References: Clin Endosc 2019. Endoscopic Therapy for Acute Diverticular Bleeding

Fig. 1

Pruebas de chi-cuadrado

	Valor	gl	Significación asintótica (bilateral)
Chi-cuadrado de Pearson	1,207[a]	3	,751
Razón de verosimilitud	1,602	3	,659
N de casos válidos	25		

Fig. 2

Tabla cruzada Lesion*Emboliz efectiva

Recuento

		Emboliz efectiva		Total
		no	si	
Lesion	angiodisplasia	0	2	2
	diverticulosis	1	7	8
	endoscopia	1	3	4
	otros	3	8	11
Total		5	20	25

PR 466

An assessment of aortic occlusion balloons for REBOA with recommendations for current practice

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Introduction: The use of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) as adjunct for temporary hemorrhage control in patients with major torso hemorrhage is increasing. Specifications and characteristics of available aortic occlusion balloons (AOB) are diverse. In order to minimize the risk of failure and complications it is important to choose a device that fits the requirements per medical situation. The aim of this study is to provide guidance in the choice of an AOB in a specific situation.
Material and methods: 29 AOB were assessed for characteristics and different properties of each are outlined. The bending stiffness was measured with a three-point bending device.
Results: Although all AOB tested are small caliber devices ranging from 6 (ER-REBOA™) to 10 French (Coda® 46), some need large bore access sheaths up to 22 French (Fogarty® 45 and LeMaitre™ 45) or even insertion via surgical cut-down (Equalizer™ 40). The bending stiffness of the AOB varied from 0.08 N/mm (± 0.008 SD) with the Coda® 32 to 0.72 N/mm (± 0.024 SD) with the Russian prototype. Guidewire-free devices are generally stiffer than over-the-wire catheters. The Tokai Rescue Balloon™ showed kinking of the shaft at low bending pressures. The ER-REBOA™, Fogarty®, LeMaitre™, REBOA Balloon®, and Rescue Balloon™ are the only catheters with external length marks to assist blind positioning. The only AOB using a non-compliant balloon is the REBOA Balloon®.
Conclusions: Specifications of available AOB are diverse. In resource-limited settings, REBOA should be performed with a rather stiff device that can be placed without wire and fluoroscopy, such as the ER-REBOA™, Fogarty®, and LeMaitre™. Of these AOB, the ER-REBOA™ is the only catheter compatible with a small 7 French sheath. Use of non-compliant balloons without real-time fluoroscopy is not advised given the potential risk of aortic rupture. When fluoroscopy is available, a guidewire can be considered.

Cook Medical, Bloomington, Indiana, USA; Boston Scientific, Marlborough, Massachusetts, USA; Prytime Medical Devices, Boerne, Texas, USA; Edwards Lifesciences, Irvine, California, USA; LeMaitre Vascular, Burlington, Massachusetts, USA; Merit Medical, South Jordan, Utah, USA; REBOA Medical, Norway; Medtronic, Minneapolis, Minnesota, USA; Tokai Medical Products, Aichi, Japan; Minimally Invasive Technologies, Moscow, Russia, provided the catheters used for this study. No other support was provided. S.M. Vrancken, B.L.S. Borger van der Burg, P.J.E.M. Vrancken, G.A. Kock, and R. Hoencamp report no proprietary or commercial interest in any product mentioned or concept discussed in this article. Dr. Rasmussen is an inventor of REBOA and REBOA-like technology and is part of patents that have been declared and approved in several countries in this topic area. He has no relevant financial relationships to medical device industry in this topic area to disclose.

The authors declare that there are no conflicts of interest that could inappropriately influence (bias) their work.

PR 467

Use of drug coating balloons for acute ischemia due to sfa lessions

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Introduction: The use of Drug Coating Balloons (DCB) in primary or secondary angioplasty for peripheral vascular disease is a new tendency. The use of paclitaxel decelerates the growth and hyperplasia of neo-intima tissue which can cause re-stenosis and total occlusion in the spot of PTA is a very promising technique in long lasting results of balloon PTAs.

Purpose: To demonstrate our experience and results of the technique of DCB PTA with the use of drag coating balloons.

Material and Method: In the period between March 2013 and September 2019, 65 patients with SFA lessions were treated with PTA with DCB for acute limb ischemia. 41 were males and 24 females. Mean age was 69,2 y.o (± 6.39). Patients were examined pro operationally and immediate post operationally in ABI difference and their post operational follow up included measurement of ABI and U/S triplex scan on the 1st, 3rd, 6th and 12th month(where chronically available) after PTA.

Results: The mean immediate post operative increase of ABI was 0,32 (± 0,13). Were chronically available the increase of ABI remained to 0,26 in the 3 months follow up, 0,23 in the 6 months and 0,21 in the 12th month follow up while patency of the artery treated remained in all patients. 2 of the patients suffered from acute complications during or short after the PTA (1 with peripheral embolization and 1 with retroperitoneal hematoma) which were treated immediately and left no consequences.

Conclusions: The use of DCB for PTA in acute ischemia is a quite new, promising technique for maintaining patency of treated arteries for long time post operative period. The medium time results from its use in our clinic seem to be satisfactory.

Refereneces: Laird JR, Katzen BT, Scheinert D, et al. Nitinol stent implantation vs. balloon angioplasty for lesions in the superficial femoral and proximal popliteal arteries of patients with claudication: three-year follow-up from the RESILIENT randomized trial. J Endovasc Ther 2012;19:1–9

PC 468

A case study on thyroid rupture consequent upon blunt trauma injury treated with angioembolization

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Case history: A 38-year-old male hit his neck hard against the fence. Thereafter, he experienced difficulty in breathing and severe neck pain. He was brought to the emergency center by ambulance.

Clinical findings: His vital signs on arrival were GCS: E4V5M6, HR: 70, BP: 157/101, RR: 20, SpO_2: 100 ($3LO_2$). Significant neck edema and tracheal deviation were noted. Inspiratory stridor was not heard with no signs of retracted breathing or subcutaneous emphysema.

Investigation/Results: An enhanced CT scan of the neck revealed tracheal deviation and compression with ruptures of the left thyroid lobe. A large hematoma and arterial extravasation from a branch of the inferior thyroid artery were noted.

Diagnosis: Rupture of the left thyroid lobe and injury around the distal portion of the left inferior thyroid artery.

Therapy and Progressions: After securing the airway by intubation, angiography of the neck was performed; extravasation from a branch of the left inferior thyroid artery was suspected. Angioembolization was continued for hemostasis using gelatin sponge. Neck edema improved in the intensive care unit. Following extubation on the hospital Day 6, the patient was discharged on the 8th day with no complication.

Comments: Thyroid injury due to blunt neck trauma is rare and surgical intervention such as hemithyroidectomy is generally prescribed. The patient"s condition, in this case, improved by angioembolization without any invasive surgical procedures. Catheter procedure may, thus, be effective for hemostasis on thyroid injury after the confirmation of airway placement.

References:

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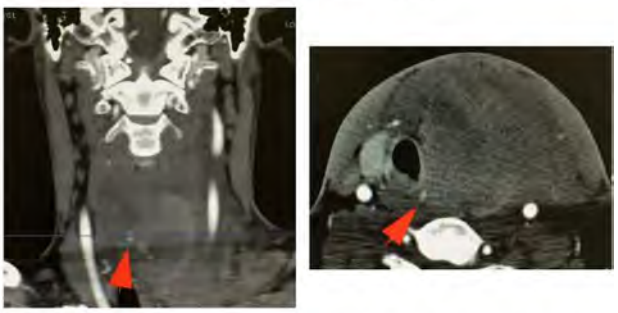
Arana-Garza S, et al. Thyroid gland rupture after blunt neck trauma: A case report and review of the literature. Int J Surg Case Rep. 2015;12:44-7.

Fig. 1

Enhanced CT scan of the neck



Left: coronal section Right: axial section

Arrows: extravasation from a branch of the left inferior thyroid artery

PR 469

Indications and contraindications for use of resuscitative endovascular occlusion of the aorta (REBOA) are associated with mortality?

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Introduction: The indication for resuscitative endovascular balloon occlusion of the aorta (REBOA) is hemodynamically unstable patients in life-threatening hemorrhage below diaphragm. It was unclear that the difference of indications for REBOA affects mortality in trauma.
Material and methods: This study used data from the Japan Trauma Data Bank (JTDB) (2004–2019), a nationwide trauma registry, to describe the epidemiology of REBOA. Adult trauma patients used REBOA were included. Patients were excluded if they had cardiac arrest at the scene or dead on arrival, or had an unsurvivable injury of any region of the body as defined by the Abbreviated Injury Scale. Patients were classified by whether patients had indications for REBOA. The indications for REBOA were defined by indications for hemostasis to intraabdominal, retroperitoneal, pelvic or extremity hemorrhage. The indications were decided by the Delphi method with the cooperation of experts in trauma for this study. The contraindications were defined by brain injury needed intervention and hemorrhage above diaphragm. The logistic regression was used to assess the mortality after adjustment for Injury Severity Score. As a sensitivity analysis, a generalized linear mixed model with random effects of a facility was performed.
Results: Of 361,706 patients registered in the JTDB, 993 patients underwent REBOA. 669 had indications for REBOA and 294 underwent REBOA without indications. The physiological variables were similar, but the consciousness was worse in the no-indications group. Injury severity of brain and chest were higher in the no-indications group. The indications group had 6.7% and the no-indications group had 13.6% contraindications for REBOA. The mortality was similar (43.6% versus 46.5%, OR 0.80, 95%CI 0.58–1.10). A sensitivity analysis showed the same result as the primary analysis (OR 0.82, 95%CI 0.60–1.12).
Conclusions: The indications for REBOA was not associated with hospital mortality.

PR 470

Vascular access and REBOA placement by Quick Response Team Fire Fighters; a feasibility study

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Introduction: Most incident first responders have a primary non-medical role, but are frequently the only professionals initially at the scene. Early hemorrhage control via advanced techniques such as Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) can save lives. Training first responders these techniques has therefore the potential to improve outcomes. This study evaluates the ability to train Quick Response Team Fire Fighters (QRT-FF) to gain percutaneous femoral artery access and place a REBOA catheter, using a comprehensive theoretical and practical training program.
Material and methods: Six QRT-FF participated in the training. SOF Medics from a previous training served as control group. A formalized training curriculum included basic anatomy and endovascular materials for percutaneous access and REBOA catheter placement. Key skills were: (1) preparation of an endovascular toolkit, (2) achieving vascular access in the model and (3) placement and positioning of the REBOA catheter.
Results: QRT-FF had significantly better baseline knowledge of surgical anatomy ($p = 0.048$) compared to Medics. They also scored significantly better on using endovascular materials ($p = 0.003$), performing the procedure without unnecessary attempts ($p = 0.032$) and overall technical skills ($p = 0.030$). The median time from start to REBOA inflation was 3:23 min for QRT-FF and 5:05 min for Medics. Procedure times improved in all QRT-FF and 4 of the 5 Medics in a second attempt of gaining vascular access and REBOA placement.
Conclusions: Our comprehensive theoretical and practical training program proves suitable for percutaneous femoral access and REBOA placement training of QRT-FF without prior ultrasound or endovascular experience. Repetition reduces procedure times. Training in the use of advanced hemorrhage control techniques such as REBOA, as a secondary occupational task, has the potential to improve outcomes for severely bleeding casualties in out-of-hospital settings.
Prytime Medical™ Devices, Inc. provided the REBOA Access Task Trainer (RATT) and the catheters used for this study. No other support was provided.

The authors declare that there are no conflicts of interest that could inappropriately influence (bias) their work.

PR 471

Angioembolization Practices and Outcomes in Severe Pelvic Fractures in Level 1 and 2 ACS Verified Trauma Centers

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Introduction: Angioembolization (AE) has become an important component in the management of bleeding from severe pelvic fractures. Timely availablity of AE is required for both, level 1 and 2 trauma centers. The aim of this study was to assess the utilization of this procedure in level 1 and 2 trauma centers and effect on oucomes.
Material and methods: Retrospective, 3-year (2013–2016) study using the the American College of Surgeons TQIP database, including adult patients with isolated severe pelvic facture (AIS 3–5). Patients who underwent laparotomy or preperitoneal packing within 4 h from admission were excluded, operative management for bleeding control between 4 and 24 h was considered as failure. Univariate analysis was used to compare patients in level 1 vs 2 centers, multivariate regression analysis was performed to determine factors predictive for mortality and overall complications.

Results: 10102 patients (6960 in level 1; 3142 in level 2 centers) met the criteria for inclusion. Overall, 610 (6.0%) underwent AE, with a trend toward higher AE rate in level 1 centers (6.3% vs 5.4%, p = 0.061). No significant differences were observed in timing and failure rate of AE between the 2 levels. Particulary in the AE subgroup there was a significantly lower blood product utilization in the first 24 h in level I centers (PRBC 5.6 vs 6.9 units, p = 0.015; plasma 3.8 vs 5.5 units, p = 0.003). Mortality and overall complication rates were similar. Table 1

The level of trauma center was not a predictive factor for mortality (OR 1.306, p = 0.284) and overall complications (OR 1.046, p = 0.591).

Conclusions: In isolated severe pelvic fractures, there was a trend toward higher AE rate and significantly lower utilization of blood products in level 1 centers. There were no significant differences in mortality or complications. The AE subgroup in level 2 centers had a higher blood products use without outcome benefit, suggesting more restrictive transfusion policy may be considered.

Fig. 1

Table 1 Differences between level 1 and 2 trauma centers in AE of severe, isolated pelvic fractures

	Total N = 10102	Level 1 N = 6960	Level 2 N =3142	*p-value*
ANGIO SUBGROUP	**610 (6.0%)**	**441 (6.3%)**	**169 (5.4%)**	0.061
Time to angio h(SD)		4.2 (3.2)	4.1 (3.5)	0.816
Failure rate	51 (8.4%)	40 (9.1%)	11 (6.5%)	0.306
PRBC 24 hrs(SD)*	6.0 (6.0)	5.6 (5.2)	6.9 (7.6)	**0.015**
Plasma 24 hrs(SD)*	4.2 (6.3)	3.8 (5.3)	5.5 (8.3)	**0.003**
Any complication	130 (29.5%)	47 (27.8%)	177 (29.0%)	0.692
In hospital mortality	35 (5.7%)	28 (6.3%)	7 (4.1%)	0.337
NO ANGIO SUBGROUP	**9492 (94.0%)**	**6519 (93.7%)**	**2973 (94.6 %)**	0.061
Failure rate	296 (3.1%)	207 (3.2%)	89 (3.0%)	0.637
Any complication	1010 (10.6%)	712 (10.9%)	298 (10.0%)	0.196
In hospital mortality	123 (1.3%)	81 (1.2%)	42 (1.4%)	0.497

*Average use of blood products, reported as standard units of 350cc packed red blood cell (PRBC) and 225cc for plasma.

PC 472

Portal vein thrombosis after distal splenopancreatectomy: successful recanalization using fogarty balloon catheter

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Case history: Intraoperative lesion of SMV during distal splenopancreatectomy is repaired using peritoneal patch harvested from anterior abdominal wall

Clinical findings: Postoperative increase in serum lactate and D-dimer without signs of peritonitis prompts bedside Doppler US showing no blood flood within portal vein (PV)

Investigation/Results: CT angiography is performed suspecting acute mesenteric ischemia, but no abnormal bowel enhancement/thickness is seen despite complete PV thrombosis. Anticoagulation with unfractioned heparin is started, but clinical conditions deteriorate

Diagnosis: At reintervention, bowel is viable, so the surgeon performs Fogarty balloon catheter thrombectomy successfully reestablishing blood flow within PV. No intestinal resection is required

Therapy and Progressions: PV patency is regularly evaluated with US. Anticoagulation with low molecular weight heparin is prosecuted for 3 months and then suspended since no recurrence is recorded meanwhile

Comments: PV thrombosis is uncommon but can follow injury to portal venous axis during surgery. Anticoagulation with heparin should be started as soon as the diagnosis is made and maintained for at least 3–6 months postoperatively to prevent recurrence. Patients with persisting/worsening symptoms 48–72 h after initiation of anticoagulation, or those with peritonitis who are poor surgical candidates may be considered for interventional radiological treatment. Otherwise, surgical intervention is required and may encompass resection of necrotic bowel. Thrombectomy and/or balloon dilation/vascular stent placement may be helpful in recently developed PV thrombosis since risk of recurrence seems to be decreased

References: *Acute mesenteric ischemia: guidelines of the World Society of Emergency Surgery* (World J Emerg Surg 2017); *Mesenteric venous thrombosis* (J Clin Exp Hepatol 2014); *Contemporary management of acute mesenteric ischemia in the endovascular era* (Vasc Endovascular Surg 2019)

Fig. 1

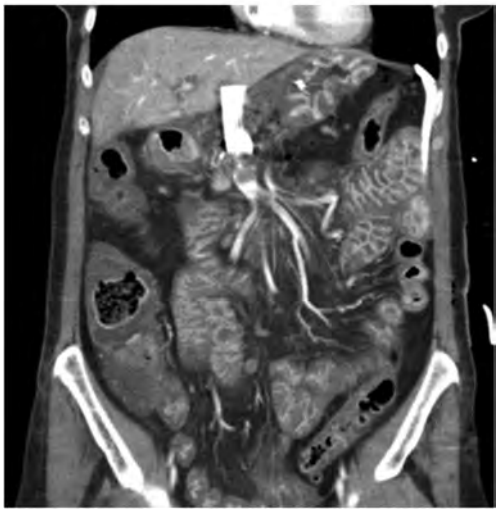


Fig. 2

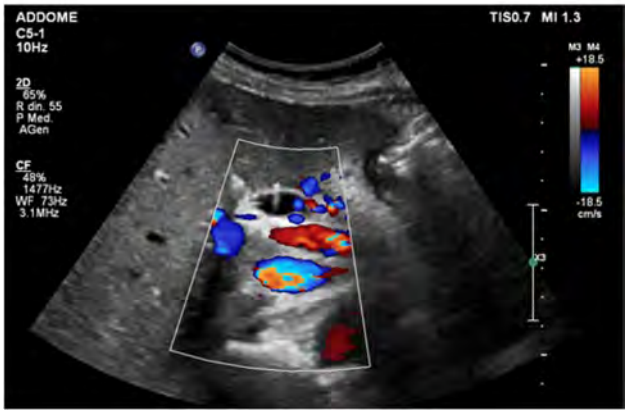


Fig. 3

Fig. 1

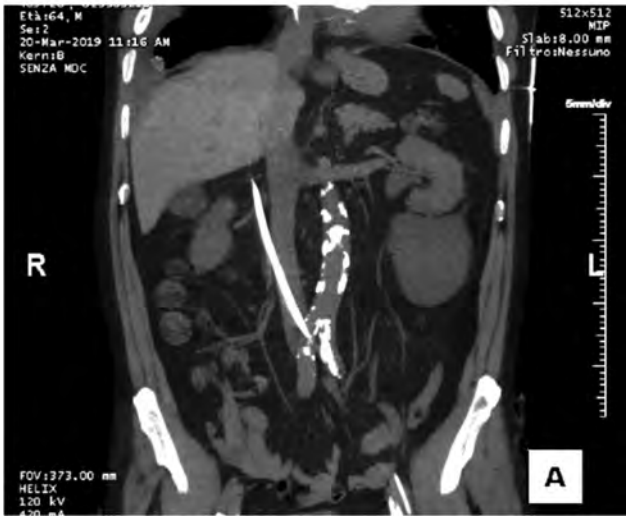
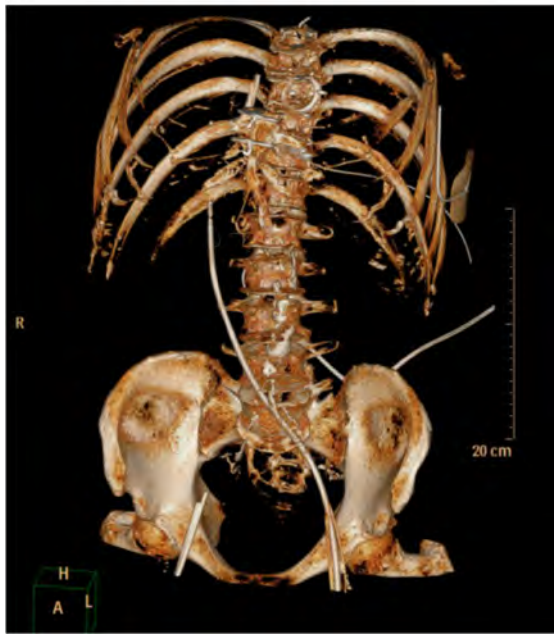


Fig. 2



PC 473

An uncommon case of inferior vena cava laceration during atrial fibrillation ablation

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Case history: A 64-year-old man underwent catheter ablation (CA) of atrial fibrillation with intracardiac echocardiography (ICE) assistance and an INR of 1,86.

Clinical findings: A 8Fr ICE probe was inserted into the left femoral vein and advanced to the IVC. Sudden abdominal pain was felt by the patient with hypotension and tachycardia requiring fluids and vasopressors for hemodynamic stabilization.

Investigation/Results: A FAST exam was negative for free abdominal or pericardial fluid. A CT scan showed the distal part of the probe outside the IVC and the tip free within the retroperitoneal space (Figs. 1, 2).

Diagnosis: The probe had perforated the IVC wall.

Therapy and Progressions: Open repair was performed through a xifopubic laparotomy and the Cattel-Braasch maneuver to expose the IVC (Fig. 3). A retroperitoneal hematoma was observed anteriorly to the infrarenal IVC, without active bleeding. The IVC was dissected out sufficiently to permit proximal and distal vascular control (Fig. 4), the probe was then removed and the laceration on the infrarenal IVC closed with a running suture. The postoperative course was uneventful.

Comments: To our knowledge this is the first reported case of symptomatic IVC laceration by an ICE probe during CA.

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Fig. 3

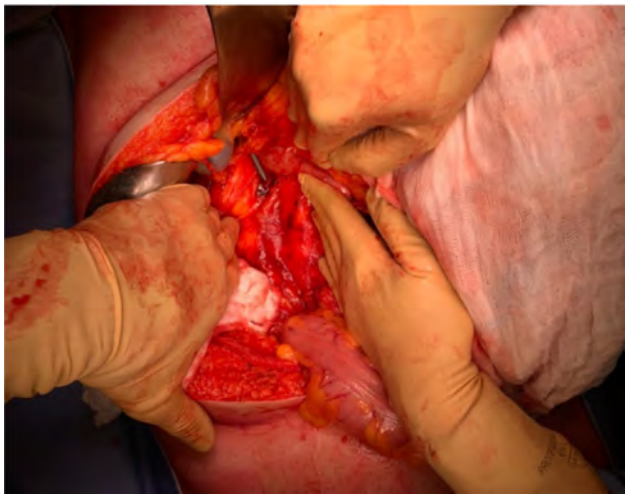
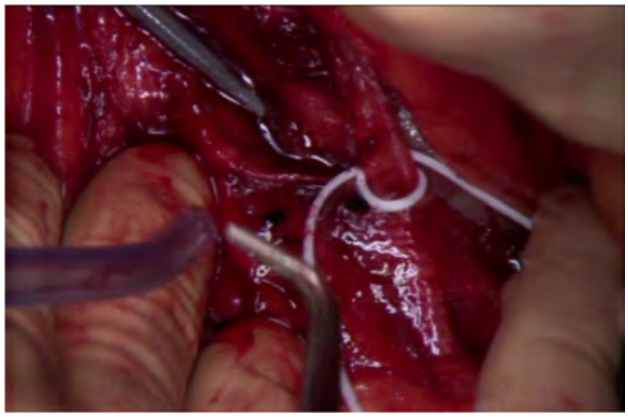


Fig. 4



PC 474

Pertrochanteric femoral fracture (AO 31-A2.3): A life-threatening bleeding caused by the lesser trochanter

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Case history: 89 year old male patient presenting with an initially uncomplicated pertrochanteric fracture, treated by an intramedullary nailing system (Figs. 1 and 2). Days after the operation and mobilization without any adverse events the patient was readmitted.
Clinical findings: Massive swelling, hematoma and pain.
Investigation/Results: Sudden fall of Hb values down to 4,4 g/dl, CT scans showed the lesser trochanter located directly to the deeper femoral artery after mobilization (Fig. 3).
Diagnosis: Perforation of the deep femoral artery and several veins by the dislocated lesser trochanter
Therapy and Progressions: Blood transfusion, intraoperative cardiopulmonary resuscitation, several revision surgeries to stop the bleeding by oversewing the deep femoral artery and ligation of the veins, removal of the lesser trochanter fragment (Fig. 4). Admission to intensive care unit. Subsequent plastic coverage.
Comments: According to literature, bleeding complications and injuries of the deep femoral artery can occur even several days after an initially uncomplicated pertrochanteric hip fracture. Besides acute life-threatening bleeding, false aneurysm can occur (1–3). Even if those late complications are very rare, the consequence for the patient can be devastating. These rare cases show the clear obligation to a thorough follow up treatment and regularly dressing changes.
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Fig. 1

Fig. 1: preoperative X-Ray of pertrochanteric hip fracture with lesser trochanter not beeing dislocated

Fig. 2

Fig. 2: postoperative X-Ray after osteosynthesis with Gamma3 nail

Fig. 3

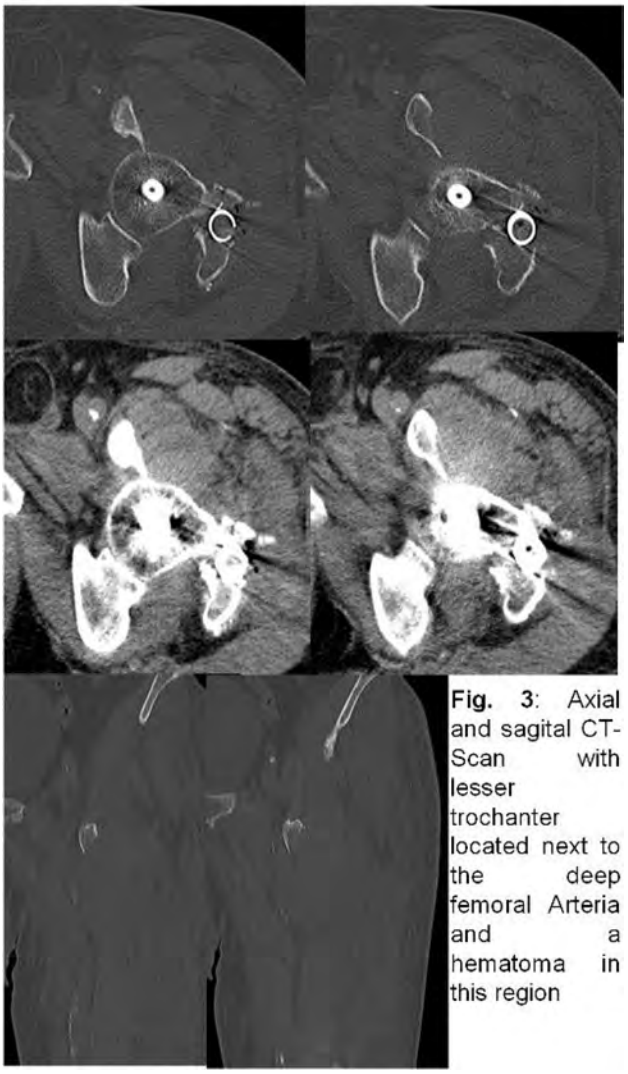

Fig. 3: Axial and sagital CT-Scan with lesser trochanter located next to the deep femoral Arteria and a hematoma in this region

Fig. 4

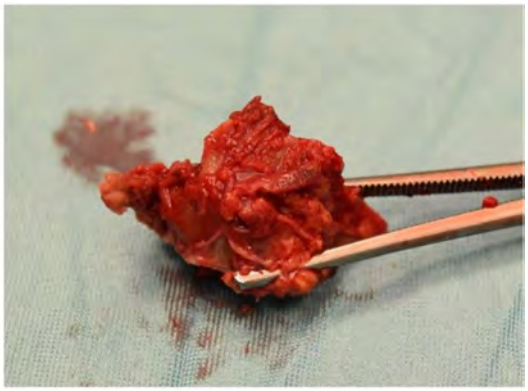

Fig. 4: Lesser trochanter after removal

PR 475

Survival analysis of major thoraco-abdominal vascular injuries in trauma patients

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Introduction: major vascular injuries in trauma patients are associated to a high mortality rate. Achieving an early vessel control is imperative to prevent exsanguination (1). The aim of our study was to assess whether there was an improvement in outcome during the last few years.

Material and methods: Retrospective cohort study. Inclusion criteria were: severe trauma patients (Injury Severity Score [ISS] $\geq$ 15) admitted to a Level I Trauma Centre from June 1993 to July 2019, with major thoraco-abdominal vascular injuries (aorta, inferior vena cava and main branches). Data on demographic, clinical status and imaging was recorded. Descriptive and Kaplan Meir survival analysis was performed.

Results: 87 patients were included. Median age was 33 years (IQR 45–25), 70 (80.5%) were male. Aorta was the most frequently damaged vessel (40,2%), followed by renal arteries (8%) and vena cava (6.9%). Blunt trauma (73.6%) was more frequent than penetrating (26.4%) (vehicle collisions 36.9%, stab wound 20.7%, gunshot wound 5.7%). The median ISS was 29 (IQR 38–25). 47.1% of the patients were in shock at arrival. Emergency surgery was performed in 73 patients (83.9%) and 21 (24.1%) required a vascular interventional procedure. Overall mortality was 46%, with 45% of deaths during the first hour, 37.5% in the first 24 h and 17.5% afterwards. Median survival was 54 days (IC19-88). We compared survival curves in periods: 1 (1993–2001), 2 (2002–2010) and 3 (2011–2019). We found that 24 h, 48 h and overall survival was better in group 2 and 3 versus group 1 ($p < 0.05$). No differences were found when comparing survival curves in blunt versus penetrating trauma.

Conclusions: Damaged-control surgery and the increasing use of vascular interventional procedures could explain the improvement in survival seen in our patients. More studies should be done to handle these life-threatening injuries.

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PC 476

Delayed repair in arterial injuries: benefits & challenges!!

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Case history: Popliteal artery injuries are frequently seen with fractures, dislocations, or penetrating injuries. A thirty one year old male wrestler suffered from posterior dislocation of left knee which was associated with severe pain and swelling at the left knee. X Ray done at a peripheral centre revealed no bony injury. Patient was brought to our hospital the next day

Clinical findings: On examination a large ecchymosis was present in the popliteal fossa extending upto the calf along with swelling. Movement at the knee was restricted and painful. Calf was tense. Peripheral pulsations were not felt. Patient was unable to dorsiflex the toes and there was loss of sensation over the left foot. The ankle brachial index (ABI) was 0.38 on the left side.

Investigation/Results: Arterial Colour doppler of the popliteal artery showed hypoechoeic contents and narrowed lumen. Biphasic flow was seen in both popliteal and posterior tibial arteries.
Diagnosis: Popliteal Artery Injury with Delayed Repair Therapy and Progressions: Two incision and four compartment fasciotomy was done under regional block the next day which revealed a non contractile posterior compartment. Superficial and deep muscles of the posterior compartment had doubtful viability. Left Distal SFA to infragenicular popliteal artery bypass graft was placed on day 4 post injury. Blood flow was established upto the ankle and foot, confirmed on check angio. However, foot drop of the patient persisted. After appearance of a healthy granulation tissue at the wound site (7 days), a split thickness skin graft was placed to give coverage with 100% uptake of the graft.
Comments: Blunt popliteal artery injury has been reported to result in amputation rates of nearly 30–60%.The importance of a detailed vascular examination of a blunt trauma patient is emphasized as a limb can be salvaged if timely intervention is done. In this case even with an unfavourable MESS score.
References:

Fig. 1

Fig. 2

Fig. 3

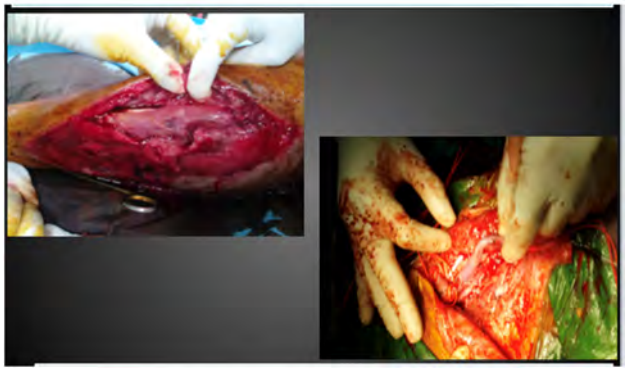

Fig. 4

PC 477

Importance of serial physical examination in the 21st century after knee dislocation. Case report

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Case history: A healthy 27-year-old male, with no history of interest, suffers a high-energy trauma as a water bottle rushes over his left knee.
Clinical findings: Go to the emergency room with pain and functional impotence in the left knee, with its anatomical deformity.
Knee X-ray PA and L are performed and the distal pulses that are present are taken. Ankle-brachial index > 0.9.

Closed reduction is performed in emergencies under sedation and control X-ray is requested, aiming at correct reduction.

It was decided to keep under observation for 24–48 h before discharge from hospital to schedule regulated ligament reconstruction surgery after studying with MRI.
Therapy and Progressions: At 12 h of evolution after the accident and after having reduced the dislocation, the patient who has the leg with a temperature equal to the contralateral is reassessed, however, there is no palpable dorsal pedis pulse or posterior tibial palpation in the affected leg.
It is decided to urgently request an AngioTC and it is objective Thrombosis of popliteal artery.

Vascular Surgeon is contacted and emergency surgery is decided. A By-Pass is performed with Vena Safena.
Diagnosis: Traumatic knee dislocation and popliteal artery injury
Comments: In the 21st century, complementary tests in diagnosis are becoming increasingly important. However, in this case we want to

emphasize the importance of "touching" the patient. It will always provide very important information for a correct diagnosis and management in this type of pathologies.

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

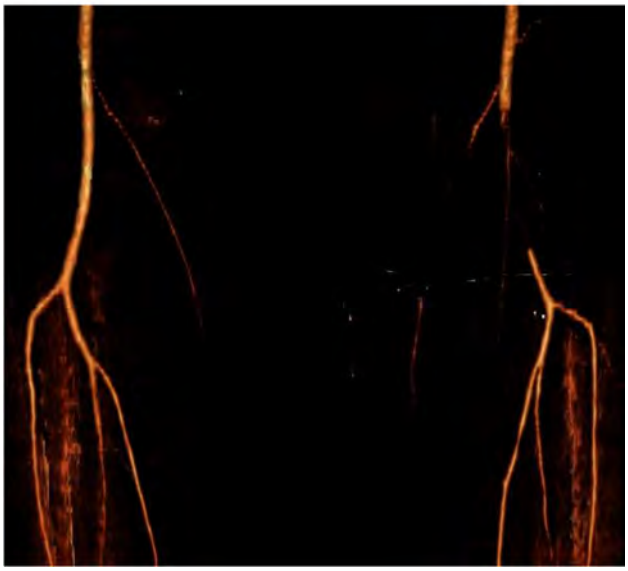

Fig. 5

Author Index

Aarhus, Mads O 71, PR 153, PR 159, PR 161, PR 162
Abarquero Diezhandino, Ana PR 97, PR 270, PC 435
Abbasi, Hamid Reza PC 357, PR 305
Abdelmabod, Areeg A. N. O 12, PC 346
Abdolrahimzadeh Fard, Hossein PC 357, PR 305
Abe, Takeru PR 33
Abeid, Aisha PR 461
Abeysekara, Abeywardana O 2
Abudayeh, Audai PR 257
Adami, Ennio PC 314, PR 36, PR 334
Adamski, Stanislaw O 58, PC 440
Adriana Martins, Rangel PR 245, PR 248
Agarwal, Amit PC 35
Aggarwal, Harshit PR 1, PR 221
Aggeli, Chrysanthi PC 174, PR 394
Agnes, Amedea PR 383
Agostinho, Francisco PC 125, PC 275
Agresti, Alessandra PR 298
Ai, Tomohiko O 18
Akhadov, Tolibdzhon PR 157, PR 158, PR 319, PR 321
Akhtar, Amina PR 144
Aksnes, Gunnar PR 399
Al-Thani, Hassan PR 301, PR 461
Alagoa João, Ana PC 374
Albuquerque, Ana PC 223, PC 306, PR 188
Aleksandrowicz, Katarzyna O 58, PC 440
Alemanno, Giovanni PR 296
Alexandrino, Henrique O 94, PR 39, PR 192
Alfredo Cavalcante Padilha, José PC 217
Älgå, Andreas PR 293
Alikhani, Mohammad O 16
Alizade, Elcin PR 24
Allemann, Florin O 28
Alnumay, Abdulaziz O 9
Alonso Tejero, Diego PC 115, PC 307, PC 370, PR 97, PR 117, PR 417
Altieri, Gaia PC 335, PR 385
Alvarez, Rubén PR 404
Álvarez de La Cruz, Javier PC 477
Amina, Youcef PR 398
Ampadiotaki, Margarita-Michaela O 88, PR 358, PR 432
Andelic, Nada PR 152, PR 159, PR 161
Andersen, Kurt PR 315
Andersen, Vegard O 59
Andrejevic, Predrag PR 13
Andreu-Magarolas, Marta PR 350
Andriopoulos, Panagiotis PR 242
Andronic, Dan PR 339
Angel, Ana PR 147
Annese, Gaetano PR 365
Antoinette, Lasseur O 27
Anwer, Md Majid PR 221
Aparício, David PC 374
Aparicio Sánchez, Daniel PR 187
Apukhovska, Larysa PR 94
Arakawa, Kazukiyo PC 290
Arand, Charlotte PR 203, PR 282
Aranda Narváez, Jose Manuel PR 72
Arimoto, HIdeki PR 160
Ariyoshi, Koichi PR 356
Arkadopoulos, Nikolaos PR 139
Arnaut, Oleg PR 116, PR 241
Aroca Peinado, Miguel PC 307, PR 270, PR 417
Arora, Aman PC 476, PR 149, PR 353, PR 438
Artiles Armas, Manuel PR 25
Arts, Elke PR 201
Asamoto, Masamune PR 418
Asamoto, Takamune PR 418
Ashkenazi, Itamar PR 46, PR 47, PR 195, PR 239
Askari, Amir PC 357
Assink, Nick PR 403
Auriemma, Stefano PC 31
Ausset, Sylvain PR 67
Azijli, Kaoutar PR 309
Babst, Reto O 45, O 76, O 86, O 89, PR 3
Bachmann, Robert PR 216
Badalov, Vadim PR 53
Bader, Bernd PR 434
Baer, Evyatar PR 322
Bagaria, Dinesh Kumar PR 1, PR 448
Bagga, Rahul PR 28
Bakir, Sinan O 90, PR 104, PR 359, PR 366
Bakke, Håkon Kvåle O 43, PR 143
Bakota, Bore PR 133, PR 134, PR 253
Baksaas-Aasen, Kjersti O 8
Baltaga, Ruslan PR 116, PR 241
Banierink, Hester O 63, PR 93
Baptista, Hamilton PR 192
Baptista, Sérgio O 94
Baqué, Patrick PR 172, PR 251
Baranowski, Andreas PR 98
Barberio, Giovanni PR 176, PR 378
Barbosa, Bruno PC 32, PR 188
Barbosa, Marcos O 56, PR 151
Barrera Gómez, Manuel Ángel PR 397
Barros, Inês PR 167
Barrutia, Jon PC 90
Bartley, Matthew O 7, O 46, O 49, PR 304
Bartzokas, Christos PR 139
Barzel, Oren PR 47, PR 195
Başar, Betül PR 258
Başar, Hakan PR 258
Bascuas Rodrigo, Beatriz PC 380
Basic, Sead PR 281
Bass, Gary A. O 13, PR 170, PR 373
Basu, Sanjoy PR 250
Batomen, Brice PR 456
Baudoin, Yoann PR 367
Bayraktar, Adem PR 24, PR 189, PR 190
Bechmann, Cornelius PR 34
Becirbegovic, Semin PR 428
Becker, Alexander PR 355
Beckett, Andrew N O 9
Beeres, Frank J-P. O 45, O 76, O 86, O 89, PR 3
Bek, Annemarije PR 20
Bekić, Marijo PR 133
Beks, Reinier O 76
Belcaid, Amina O 52, PR 318
Bellio, Gabriele O 13, PC 382
Bemelman, Mike PR 201
Ben-Hamida, Abduljali PC 14
Benbrika, Widad PR 67
Benčić, Ivan PR 133, PR 134, PR 253
Benjamin, Elizabeth O 72, PR 364, PR 459, PR 471
Berben, Sivera O 55
Bere, Tone PR 276, PR 450
Berende, Cornelis A.S. O 84, PR 238
Bergamini, Carlo PR 296

Berkeveld, Eva PR 168, PR 309
Berlin, Yuri PR 355
Bernardi, Laura PC 71, PC 382
Bertazzoni, Paola PR 163
Berube, Melanie PR 111, PR 196, PR 197
Berzins, Uldis PC 69
Bettencourt, Rui O 26
Beveridge, Majella PR 5
Bhagat, Neelakshi PR 320, PR 402
Bhatnagar, Rahul PR 152
Bianchi, Marco PR 298
Bianco, Elisabetta PC 473
Biert, Jan PR 109, PR 201, PR 412
Biloslavo, Alan O 13, PC 71, PC 382, PC 472, PC 473, PR 68
Birkner, Dorothea O 77
Birnie, Merel F.N. PR 128
Biscevic, Mirza PR 281, PR 426
Blaas, Leanne O 87, PR 204
Blackburn, Lauren PR 144
Blaesius, Felix PR 232
Blas Laína, Juan Luis PC 375, PR 48, PR 61, PR 62
Blažević, Dejan PR 133, PR 134, PR 253
Bleeker, Nils-Jan O 40, O 50
Bliksøen, Marte O 48
Bloemers, Frank W. PR 168, PR 309
Boddaert, Guillaume PR 361
Boele Van Hensbroek, P. PR 238
Boersma, Emily PR 416
Boffard, Kenneth PR 73
Bogoni, Selene PC 71
Bogstrand, Stig Tore PR 141
Bolandparvaz, Shahram PC 357, PR 305
Bolierakis, Eftychios PR 232
Boluda Mengod, Juan PC 271, PC 274
Bond-Smith, Giles O 11
Bonet, Idoia PR 226
Bongers, Suzanne O 3
Bonta, Marco PR 89
Boonen, Bert PR 198
Bordianu, Igor PR 339
Bordu, Silviu PR 177
Borger Van Der Burg, B.L.S. PR 466, PR 470
Borralho, Nuno PC 422
Borse, V.H. O 60
Bortul, Marina PC 472, PR 68
Bosco, Alessandro PR 176, PR 378
Boström, Lennart PR 80, PR 182, PR 293
Botou, Anna PC 165
Bottari, Andrea PR 296
Bouderba, Samy PR 318
Bougiouklis, Dimitrios O 24, PR 12, PR 106, PR 107
Bountouris, Ioannis PR 467
Boutonnet, Mathieu PR 67
Bouwens, Maneka PR 462
Bowley, Douglas PR 26
Bowyer, Mark PR 470
Braathen, Camilla Christin PR 141
Brants, Anne O 55
Bratschitsch, Gerhard PR 317
Brattebø, Guttorm PR 229
Bravo Salva, Alejandro PR 377
Breedt, Danyca Shadé PR 287
Breeman, Wim PR 462
Brescacin, Alessandra PC 332
Bressan, Livia PR 68
Bridge, Matthew O 44
Brito, Francisco PC 273
Britton, John PR 303
Bronchti, Gilles PR 65
Brooks, Adam J. PR 144, PR 297, PR 303, PR 341
Brouwers, Lars O 64, PR 201
Brune, Jan C. O 33
Bubuianu, Alexandru Leopold PR 194
Buckler, David O 100
Bulgaru, Flavius PR 230
Bunn, Jason PR 452
Burbano, Daniela PR 23, PR 29
Burlew, Clay O 7, O 46
Bustamante Recuenco, Daniel O 34, PC 99, PC 307, PC 414, PC 435, PR 404
Butcher, Lisa O 11
Butler, Jonathan PR 126
Butt, Edina PR 233
Caba Doussoux, Pedro O 34, PC 307, PR 270
Caballero Mestres, Ferran PR 16, PR 17, PR 226
Cafarelli, Angela PR 365
Calcerrada Alises, Enrique PC 77
Calero Castro, Francisco PR 199
Cambiaso-Daniel, Janos PR 212
Caminsky, Natasha G. O 9
Campagna, Saverio PR 176, PR 378
Campanale, Erasmo Roberto PR 365
Campion, Eric O 7, O 46
Campos Pereira, Eva PC 277
Campos-Serra, Andrea PC 40, PR 11, PR 350
Canamar, Catherine PR 364
Capitán Vallvey, José María PC 234
Carabali, Mabel PR 456
Caratão, Fátima PC 214
Carden, Richard O 41
Cardoso, Ruben PR 151
Carlström, Eric PR 49
Carlucci, Michele PR 30, PR 298, PR 365, PR 369
Carr, Brendan O 100
Cartu, Dan PR 177
Caruhel, Jean Baptiste PR 52
Carvajal, Sandra PR 23, PR 29, PR 147
Carvalho, André PC 114, PC 127
Casagranda, Biagio PC 71
Casas, Paula PR 404
Casimiro, Carlos PC 32, PC 306, PC 326
Casoni, Daniela O 79
Cassidy, Noelle PR 268
Casteels, Phyline PR 129
Castillón, Pablo O 34
Castoldi, Laura PR 55, PR 163, PR 289
Castro, Beatriz PR 150
Cataldi, Carlo PR 36
Catarino, Oliveira PC 214
Catarino, Sara PC 326
Cavallo, Simona PR 56
Cebolla, Laura PR 150
Cebrián García, Carmelo PC 375
Cecilia López, David PC 115, PR 117
Ceolin, M. PR 342
Cervero Suárez, Francisco Javier PC 386
Cesarovic, Nikola O 5, O 85, PR 22
Ceschiutti, Giulia PC 472
Champion, Howard PR 456
Chan, Anthony O 96, PR 44
Chango Sigüenza, Oscar PR 140

Chapman, James O 42
Charbonney, Emmanuel PR 65
Chastant, Robin PR 65
Chaushu, Hen PR 208
Chen, John PR 288
Chen, Szu-An PR 186
Chetboun, Mikael PR 398
Chica, Julián PR 23, PR 29, PR 147
Chinna, Shalini PR 303
Chip, Yevhen O 32
Cho, Hangjoo O 6
Cho, Ja Yoon PR 325
Cho, Jinbeom PC 179
Cho, Min Jae PC 313
Choi, Boyoon PC 179
Choi, Donghwan PR 135
Choi, James O 20, PR 126, PR 4
Choi, Kang Kook O 93, PR 325
Chornyi, Volodymyr PR 257
Choudhary, Narendra PR 1, PR 448
Chowdhury, Ashim PC 169, PR 250
Christou, Chrysanthos PR 145
Chupriaev, Viktor PR 53
Cibelli, Maria Teresa PR 365
Cinelli, Paolo O 85, PR 22, PR 247
Cingolani, Emiliano PR 334
Ciocca Vasino, Michele PC 332
Clément, Julien O 52, PR 318
Cléroux, Sarah PR 197
Cobos Cuesta, Raquel PC 234
Cohen, Mitchell O 7, O 46, O 49, PR 304
Cohnert, Tina PR 212
Coinsin, Benjamin PR 398
Coleman, Jamie O 7
Coleman, Julia O 49
Collaborators, Tela O 41
Colney, Lalchhandami O 25
Colombari, Renan Carlo PR 181, PR 475
Colsa Gutierrez, Pablo PC 78
Con, Jorge PR 19
Condurro, Salvatore PR 176, PR 378
Constantin, Georgiana Bianca PR 230
Constantin, Iulian PR 230
Consunji, Rafael PR 301, PR 461
Contenti, Julie PR 251
Corceiro Vaz, Maria Rita PC 415, PC 422
Coretti, Rosario PR 365
Corkill, Jamie PR 144
Cosci, Marco PC 31
Cosola, Davide PC 382, PC 472
Costa, Ana Sofia PC 114, PC 125, PC 275, PC 278, PC 410, PC 415
Costa, Joana PC 43, PR 100, PR 413
Costa, João PC 43, PR 100, PR 272, PR 413
Costache, Mircea PR 339
Côté, Caroline PR 111, PR 196, PR 197
Cozza, Valerio PC 335, PR 243, PR 337, PR 383
Cramer, Christopher PR 308
Cremonini, Camilla PR 364, PR 471
Crespo Lastras, Patricia PC 386
Croitor, Gheorghe PR 113
Croker, Nicholas PR 5
Cronenberg, Sonja PR 266
Cros Montalbán, Beatriz PC 375
Csonka, Ákos PR 259
Csonka, Endre PC 118, PR 233
Cuevas-Østrem, Mathias PR 237
Çümen, Hüseyin PR 258
Ćuti, Tomislav PR 133, PR 134, PR 253
D'Angelo, Armando PR 30
Daban, Jean Louis PR 361
Dahlberg, Martin PR 80, PR 182
Dall'Acqua, Jacopo PC 31
Danila, Nicolae PR 339
Dara, Kevin PR 276
Darwin, Genevieve PC 14, PC 392
Davenport, Ross O 41, PR 28
Davris, Dimitris PC 165, PC 185
De Almeida Maia, Luis PR 100, PR 413
De Barberis Mainini, Elisabetta PR 176, PR 378
De Bruin, Ivar PR 57
De Carbonnière, Anne PR 361
De Faber, J. Tjeerd H.N. PR 323
De Francisco, Mario PC 178
De Groot, H.G.W. PR 238
De Jaeghere, Anais O 81
De Jong, Louis O 62
De Jong, Mirjam PR 57
De Jongh, Mariska O 64, O 74, PR 453
De La Villéon, Bruno O 22, PR 454
De Leeuw, Marcel A. PR 168
De Loos, Erik PR 198
De Manzini, Nicolò PC 71, PC 382, PC 472, PC 473, PR 68
De Marchi, Francesco PC 31
De Munter, Leonie O 64, O 74, PR 453
De Pellegrin, Maurizio O 57, PR 369
De Planque, Annick PR 204
De Vincenti, Rosita PR 296
De Vries, Jean Paul M. PR 93, PR 403
De Vries, Jolanda O 92
Deckelbaum, Dan L O 9
DeCourcey, Cynthia PR 26
Decq, Philippe PR 156
Dedeyan, Michel PR 213
Degermetzoglou, Nikolaos PR 58, PR 467
Dehbozorgi, Mohammad PC 357
Dehli, Trond PR 143
Deininger, Christian PC 474, PR 202, PR 205, PR 354
Deininger, Susanne PR 354
Del Zotto, Giulio PC 382
Delitala, Alberto PC 314
Dell'Antonio, Andrea PC 473
Deltoff, Marshall PR 87
Demarest, Matthew PR 364
Demetriades, Demetrios O 72, PR 364, PR 459, PR 471
Den Oudsten, Brenda O 92
Dendoncker, Karen PR 405
der DGU, AG Becken III PR 216
Derenda, Marek O 58, PC 440
Derksen, Robert Jan O 87, PR 204
Dhebri, Alhad PC 379
Dhillan, Rishi PC 476, PR 149, PR 353, PR 438
Di Grezia, Marta PC 335, PR 243, PR 337, PR 383, PR 385
Dias, Wilma PC 374
Diaz Gómez, Daniel PR 340
Díaz Jiménez, Nélida PR 397
Dickson, Edward PR 303
Diepold, Julian PR 205
Dietrichs, Erik Sveberg O 43
Difino, Margherita PR 369
Digalakis, Michail O 24, PR 12
Dijkink, Suzan O 91
Dingemans, Siem A. PR 128

Diniz, Sara PC 277
Djozic, Harun PR 281
Do Val Roso, Ryana Elyzabeth PR 74
Doğan, Selim PR 27
Doi, Tomoaki PR 183
Dolgusevs, Mihails PR 224
Dolva, Merete Stephanie O 29
Domanskiy, Andriy PR 123
Donker, J.M.W. PR 238
Donmez, Turgut O 47, PR 384
Dorn, Tina PR 218
Dörsam, Edgar PR 200
Doughty, Heidi PR 26
Douissard, Jonathan PR 172
Driessen, Mitchell PR 142, PR 256, PR 412
Drys, Nikolaos PC 391
DuBose, J.J. PR 470
Duman, Salih PR 190
Dumbrava, Bogdan D. O 13
Dupuis, Sebastien PR 197
Duque, Patricia PC 220, PR 70, PR 211, PR 219, PR 291
Durán Muñoz-Cruzado, Virginia María PR 72, PR 187, PR 199, PR 292, PR 340
Dusseau, Brian PR 89
Dvorkin, Lee PR 288
Easthope, Amy O 53
Echenagusia, Miguel PR 219
Ecseri, Tamás PR 259
Eden, Lars PR 34
Eduardo Silva, Francisco PC 217
Edwards, Michael O 55, O 64, PR 109, PR 412, PR 416
Egozi, Dana PR 195
Eibinger, Nicolas PR 317
Eilertsen, Kenneth PR 310
Eira, Carla PC 223
Eitel, Andrew O 7, O 46, O 49, PR 304
Ekeh, Akpofure Peter O 23
Eken, Torsten PR 222, PR 300
Ekkernkamp, Axel O 90, O 99, PR 104, PR 206, PR 207, PR 359, PR 366
El Bendary, Yéhia PR 156
El Damaty, Ahmed O 75
El Moumni, Mostafa O 35
El-Menyar, Ayman PR 301, PR 461
El-Shabrawi, Jasmin Helena PR 317
Ellis, David PR 44
Elseed, Alaa PR 301
Eltantawy, Tarek PR 244, PR 255
Eltemur, Yagmur PR 24
Emaldi, Ane PC 178
Emmink, Benjamin L PR 269
Endo, Akira O 80
Eng, Svend Filip PR 442
English, William O 2, PC 86, PR 288
Entriken, Catherine O 23
Ercan, Leman Damla PR 24, PR 189, PR 190
Erichsen, Christoph PC 343
Eriksson, Anders PR 143
Eroz, Erhan PR 189
Ertekin, Cemalettin PR 189
Escartin Arias, Alfredo PC 401
Escocia Dorigatti, Alcir PR 74
Escrevente, Ricardo PC 214
Esposito, Andrea PR 289
Estraviz, Begoña PC 90, PC 178
Eustache, Jules H. O 9
Ezra, Sigal PR 47, PR 195
Fabbi, Manrica PR 163
Faccincani, Roberto PR 30, PR 55, PR 298, PR 365, PR 369
Fagertun, Henriette PR 336
Falidas, Evaggelos PC 165, PC 185
Faraj, Walid PC 164
Farazi-Chongouki, Christos PC 338
Farhat, Imen O 52
Fata, Paola O 9
Fauskevåg, Ole Martin O 43
Febrer, Guillaume PR 65
Feldinszka, Jana PR 265
Ferahman, Sina O 47
Ferguson-Lobo, Rosa O 2
Fernandez, Laura PC 90
Fernández de Córdova, Lenin PR 140
Fernández Martínez, María PR 21, PR 25, PR 181, PR 249, PR 475
Fernández Vázquez, María Luz PR 475
Fernando Trebolle, José PC 375
Ferreira Pinto, Luís Manuel O 94, PC 127, PC 283, PR 39, PR 192
Ferrer Vilela, Irene PR 397
Ferro, Alessandra PC 86
Fico, Valeria PR 243, PR 337
Filippatos, Georgios PR 242
Firescu, Dorel PR 230
Fischer, Henning PR 3
Fischer, Jessica PR 148
Fischerauer, Stefan PC 69
Fischinger, Aleš PC 120, PC 130
Fitzgerald, Mark PR 344
Florance, Charlotte PR 250
Flores Lazo, Nube PR 140
Flugsrud, Gunnar PR 276
Foco, Maurizio PR 385
Fogel-Grinvald, Haya PR 208
Fok, Matthew O 14
Fokkema, Anne O 54
Fontaínhas, Tiago PC 275, PC 278, PC 368, PC 410, PC 415, PC 422
Fontoura, Ugo PC 410, PC 415
Formenti Uljaki, George PR 30
Foster, Mark PR 26
Fouet, Mathilde PR 156
Fougner Skaansar, Ola PR 153
Fourie, Lana PR 3
Fournier, Julie PR 454
Fox, Charles O 46
Frade, Maria João PR 151
Frade, Sofia PR 167
Fraga, Gustavo Pereira PR 61, PR 62, PR 74
Fraga Ferreira, José PR 100, PR 272, PR 413
Fragoso, Marta PC 374
Fragoso, Miguel O 49
François, Pierre-Marc PR 156
Frank, Johannes PR 200, PR 406
Fransvea, Pietro PC 335, PR 36, PR 243, PR 337, PR 383, PR 385
Freitag, Philipp PR 34
Freude, Thomas PR 202, PR 205
Froghi, Saeid PR 463
Frosch, Karl-Heinz PR 308
Fu, Chihyuan PR 215
Fujita, Mamoru PC 263
Fujita, Masanori PR 54
Fujiwara, Gaku PR 316
Fujiwara, Yasuaki PC 45, PC 468, PR 75
Fujiya, Shoma PC 45, PR 75
Fuke, Akihiro PR 160

Fukushima, Hidetada PR 423
Fukuta, Tetsuya PR 183
Funabiki, Tomohiro PC 231
Furák, József PR 347
Furmanova, Ksenia O 31
Furugori, Shintaro PC 231
Furuhashi, Yuri PC 45, PR 75
Furukawa, Hiroyuki PC 15
Furuya, Shinsuke PR 160
Gaarder, Christine O 8, O 29, O 48, O 70, PR 38, PR 341, PR 393
Gaetani, Luca PR 385
Gago, Susana PC 220
Gallego, Leticia PR 404
Galteland, Pål PR 222
Galvão, Diogo O 26, PC 171
Gänsslen, Axel PR 209
Garcea, Alessandro PR 63
García, Alberto F. PR 23, PR 29, PR 147, PR 191
García, Eva O 34
García Bello, Miguel Ángel PR 397
García Domínguez, Antonio PC 375
García Dominguez, Melody PC 78, PC 375, PR 63
García Jarabo, Eva PC 99, PC 414, PR 270
García Lamas, Lorena PC 115, PR 117
García León, Anabel PR 187
García-Borobia, Francisco Javier PR 11
García-Schiever, Jesús Gabriel PC 76
Garciafilia Cabrera, Laura PC 166, PR 249
Garg, Pramod O 25
Gárgyán, István PR 259, PR 347
Garlito Díaz, Hugo PC 386
Garrigue, Delphine PR 398
Garritano, Tiziana PC 314, PR 334
Gaski, Iver Anders O 70, PR 393
Gavrankapetanovic, Faris PR 428
Gavrankapetanovic, Ismet PR 60, PR 281, PR 426, PR 428
Gefen, Amit PR 195
Geibijeva, Leila PR 224
Geisner, Thomas O 54
Gemici, Eyup PR 384
Georgiadou, Despina PC 185
Geraerds, Sandra PR 453
Germain, Jennifer O 95
Germani, Paola PC 472, PC 71
Germanova, Liuba PC 79
Ghahramani, Zahra O 16
Ghasabyan, Arsen O 49
Giannakópoulos, Georgios F. PR 168, PR 218, PR 309, PR 312
Gida, Sunil PR 297
Giil-Jensen, Vigdis PR 315
Gil, Javier PR 150
Gil-Olarte Márquez, María de los Ángeles PC 76, PC 77
Gillies, Kate PR 28
Giudici, Simone PR 342
Gjerde, Hallvard PR 141
Gkaravellas, Georgios PC 391
Gkoutos, Georgious PR 26
Glantz, Viktor PR 49
Glaser, Benjamin PR 84, PR 85
Glover, Thomas PR 303
Goessens, Marco PR 256
Goganau, Alexandru PR 177
Gogna, Shekhar O 20, PR 4, PR 126
Goin, Géraldine O 22, PR 454
Gok, Ali Fuat Kaan PR 24, PR 27, PR 189, PR 190
Goldenshluger, Michael PR 208
Golicov, Denis PR 180
Golovko, Konstantin PR 53
Gomes, Aline PR 188
Gomes, João PC 79, PC 400
Gomes, José António PC 125, PC 275, PC 278
Gómez, Alba O 34
Gomez, David PC 178
Gonçalves, Zico PC 125, PC 275, PC 422
Gonschorek, Oliver PR 434
Gonthier, Catherine O 52
Gonzalez, Andres PR 147
Gonzalez, Melania PC 90
González Abós, Sandra PR 17
Gonzalez Castillo, Ana Maria PR 377
González Conde, Ricardo PR 25
Gonzalez Leyte, Manuel PR 219
González Martín, David PC 271, PC 274, PC 477
Gonzalez Taranco, Jaime PC 90
Gonzalez Zarco, Luis María PC 220
González-Costa, Anna PC 40, PR 11, PR 350
Gorelic, Alexander PR 180
Gosens, Taco O 92
Goudard, Yvain O 22, PR 454
Gourtzelidis, Georgios O 88, PR 358
Goutagny, Stéphane PR 156
Gouveia, António PC 79, PC 400
Govaert, Geertje PR 57
Graafen, Marcus O 69
Grabovschi, Ion PR 116, PR 241
Gracia-Roman, Raquel PC 40, PR 11, PR 350
Grechenig, Peter PR 209
Greco, Massimiliano PR 55
Green, Connor PR 119
Greven, Johannes PR 232
Grier, Gareth O 53
Grosso, Elena PR 56
Grosu, Elena PR 116
Grün, Wolfram O 36
Grushka, Jeremy R. O 9
Gruszka, Dominik PR 282
Guarino, Dario PR 176, PR 378
Güemes, Antonio PR 48, PR 61, PR 62
Guerrero, Ruben PR 17
Guerrero Ortiz, Maria Alejandra PR 377
Guerrini, J. PR 342
Gui, Daniele PR 383
Gumaa, Duaa PR 395
Gümbel, Denis O 90, O 99, PR 104, PR 206, PR 207, PR 359
Gumm, Kellie O 21
Gunay, Kayihan PR 27, PR 190
Gunes, Mehmet Emin O 47
Gunjiganvi, Mallikarjun PC 35
Gupta, Amit O 25, PR 1, PR 221, PR 448
Gupta, Nandita O 25
Gurevich, Michael PR 47, PR 195
Gurigard, Vilde Ravnsborg O 59
Gustafson, Pelle PR 73
Gustafsson, Torfinn PR 143
Guzman, Monica PR 191
Haagsma, Juanita PR 453
Habel, Cleo PR 148
Hadley, Jamie O 7, O 46, O 49, PR 304
Haen, Pierre PR 52
Hagawa, Naohiro PR 302
Hagenaars, Tjebbe O 84
Hagiwara, Masahiro PC 15

Hajdu, Stefan PR 41, PR 213
Hakkenbrak, Nadia PR 218
Halat, Gabriel PR 41
Halikiopoulos, Spyridon - Augustinos PR 432
Hallal, Ali PC 164
Halldestam, Ingvar O 19
Halm, Jens A. PR 218, PR 312
Halvachizadeh, Sascha O 5, O 77, O 85, PR 22, PR 247
Halvorsen, Sigrun PR 152
Hampton, David PC 83
Hansen, Kirk O 49, PR 304
Hara, Yoshie PR 464
Haralambiev, Lyubomir O 90, O 99, PR 104, PR 206, PR 207, PR 359, PR 366
Harbiyeli, Emir PR 258
Hardcastle, Timothy PR 7
Hart-Pinto, Andrew PR 244
Hartmann, Petra PR 233
Hartpinto, Andrew PR 255
Hasara, Roman PC 328
Hashimoto, Masayuki PR 175
Hauck, Stefan PR 434
Hauer, Georg PR 437
Haverkamp, Frederike O 55, PR 360
Heineman, Erik O 63
Heinz, Simon Martin PR 372
Heinz, Thomas PR 41
Heinze, Dirk O 83
Helle, Torbjørn Kongsvik PR 315
Hellebrekers, Pien O 73
Hellund, Johan Castberg PR 276
Helseth, Eirik O 71, PR 152, PR 153, PR 159, PR 161, PR 222, PR 442
Helseth, Ragnhild PR 152
Hendrikx, Roel PR 198
Henning, Esther O 90, O 99, PR 104, PR 359, PR 366
Henrich, Dirk O 33, PR 200
Herath, Steven PR 216
Heri, Andreas PR 437
Hermans, Erik PR 109, PR 412
Herrera Pérez, Mario PC 271, PC 274
Hershko, Dan PR 355
Herteleer, Michiel O 39, O 81
Hesselink, Lillian O 3, O 73, PR 7, PR 324
Hestnes, Morten O 8, O 29, O 48, O 70, PR 38
Heuser, Julian PR 366
Hietbrink, Falco O 3, O 73, PR 7, PR 9, PR 57, PR 184, PR 324
Higaki, Ayuho PC 468
Hildebrand, Frank O 85, PR 232
Himmler, Amber PR 140
Hindocha, Sandip PR 244
Hinz, Peter PR 104
Hirase, Hitoshi PR 262
Hirose, Tomoya PR 311
Höch, Andreas PR 216
Hodel, Sandro O 86
Hoehn, Melanie O 7
Hoekstra, Harm O 39, O 81
Hoencamp, Rigo O 4, PC 389, PR 20, PR 88, PR 136, PR 138, PR 466, PR 470
Hoepelman, Ruben PR 324
Hoffmann, R. PR 372
Hofmann, Alexander O 69, PR 122
Hofmann, Valeska PC 474, PR 202, PR 205, PR 354
Hohenberger, Gloria PC 69, PR 209, PR 212, PR 445
Hom, Patrick O 49
Homsi, Mouafak PC 164
Hoogendoorn, Jochem PR 424
Hope, Carla PR 297, PR 341
Hopf, Johannes PR 282
Hörer, Tal O 10
Horesh, Nir PR 208
Hornez, Emmanuel PR 361
Horst, Klemens PR 232
Hosoya, Yoshinori PC 37
Houwert, Marijn O 78, O 89, PR 57, PR 155
Houwert, Roderick M. O 76, PR 184, PR 269
Hrovat, Eva PC 446
Hryhorovskyi, Volodymyr PR 94
Hsieh, ChiHsun PR 186, PR 215
Huh, JiYoung PR 356
Huisman, Albert O 73
Hussein, Basim O 2, PR 288
Huwer, Christina O 99
Huynh, Hai PR 65
Hval, Gyri PR 310
Hyun, Sung Youl PR 325
Iacopini, Veronica PR 296
Iacuzzo, Cristiana PR 68
Ichihashi, Masahiro PR 183, PR 457
IJpma, Frank F.A. O 63, PR 93, PR 403
Ikeuchi, Hisashi PR 54
Ilhan, Mehmet PR 24, PR 27, PR 189, PR 190
Imai, Kouji PC 15
Imamoto, Toshiro PR 175
Impagnatiello, Alessio PR 334
Imran, Rizwana PR 26
Inaba, Kenji O 72, PR 364, PR 459
Infantes Ormad, Marina PC 380
Inoue, Sanshiro PR 105
Inoue, Takahiro PR 105
Iordanou, Christos PC 338
Isand, Karl-Gunnar PR 137
Ishidoya, Shunta PC 15
Ishii, Keisuke PR 260
Ishikawa, Junichi PR 160
Ito, Kenjiro PR 408
Ito, Yasuo PR 464
Itzhak, Ziev-Ner PR 195
Izawa, Yoshimitsu PC 37, PC 45, PC 468, PR 75
Jac-Okereke, Chukwunonso O 37, PR 327
Jacko, Peter PR 265
Jackson, Rob O 97
Jakob, Dominik A. PR 459, PR 471
Jakob, Stephan M. O 79
Jang, Ji Young O 68
Jang, Myong Jin PR 325
Janko, Maren PR 406
Jankowski, Marcin O 30
Jansson, K. O 10
Javor, Peter PR 233
Jehan, Faisal PR 19
Jensen, Kai Oliver O 1, O 77, PR 330, PR 331, PR 458
Jeon, Jehyung PR 92, PR 96
Jeon, Yang Bin O 93, PR 325, PR 351
Jeong, Euisung PC 6
Jeppesen, Elisabeth PR 237, PR 310
Jiménez, Luis Miguel PR 181
Jiménez Díaz, Verónica PC 115, PR 117
Jo, Young Goun PC 6
Jochems, Denise PR 155
Joergenrud, Benedicte Marie PR 141

Johannesdottir, Bergros O 54
Johnsen, Lars Gunnar PR 229
Jones, David O 96
Jones, Elinor O 98, PR 252
Jung, Ik Jae PR 279, PR 280
Jung, Kyoungwon PR 135
Justin, Viktor PR 84, PR 85
Kabeil, Mahmood O 49
Kadoya, Takashi PC 290
Kaga, Shinichiro PR 302
Kalashnikov, Andriy O 32, PR 91, PR 94
Kalbas, Yannik O 1, O 5, O 85, PR 22
Kallias, Anastasios O 88
Kallifatidis, Dimitrios O 24, PR 12
Kambarhanov, B. PR 193
Kamer, Lukas PR 203
Kanda, Norihide PR 183, PR 457
Kanezaki, Shozo PR 260, PR 439, PR 441
Kang, Byung Hee PR 135
Kang, Chan PR 92, PR 96
Kang, Suk-Woong PR 421
Kantarcı, Tarık Recep PR 27
Karabulut, Mehmet PR 384
Karakus Bozkurt, Seyma PR 189
Karamanidi, Maria PC 338
Karaseva, Olga PR 180
Karlgren, Klas PR 73
Karlstrand, Emma O 38
Karnezis, I. PR 447
Kase, Kenichi PC 290
Kassab, Ahmad PC 164
Katayama, Yusuke PR 311
Kato, Makoto PR 33
Kattakayam, Arjun O 14
Kaur, Harjot O 82, PR 433
Kawai, Yoshiaki PC 231
Kawakami, Yukio PR 285
Kawamura, Kenji PR 423
Kawamura, Tadashi PR 427
Kayser Mata, Silvia PC 166, PR 21, PR 181
Keizer, Jort PR 269
Kellett, C. PC 444
Kellett, Suzanne PR 28
Keorochana, Kris PR 2
Kerner, Alexander PR 209
Khan, Al O 60
Khan, Mansoor PR 73
Khan, Muhammad PR 19
Kharchenko, Sergiy PR 66
Khazoom, Francois PR 65
Khorram-Manesh, Amir PR 49, PR 50, PR 51, PR 64
Khuri, Safi PR 376
Khwaja, Kosar O 9
Kihara, Peter PR 195
Kilian, Miroslav PR 265
Kim, Hong Rye PC 313
Kim, Hyungjung O 6
Kim, Ji Wan PR 279, PR 280, PR 425
Kim, Jungchul PC 6
Kim, Kihoon PR 371
Kim, Maru O 6
Kim, Myoung Jun O 68
Kim, Simon O 90, PR 359
Kim, Taeah PR 135
Kim, Young Kyu PC 313
Kip, Marijn PR 9
Kiritoshi, Ayako PR 302
Kiriu, Nobuaki PC 15, PR 54
Kisilak, Miha PC 120, PC 130, PR 122
Kistemaker, Rosanne M.G. PR 396
Kitada, Shimpei O 67, PC 431, PR 262
Kitamura, Tetsuhisa PR 311
Kiwanuka, Olivia PR 293
Klein, Angelina PR 366
Klein, Yoram PR 208
Klem, Taco O 62
Klim, Sebastian PR 437
Klingebiel, Felix PR 232
Kloc, Wojciech O 58, PC 440
Kluger, Yoram PR 376
Knobe, Matthias O 45, O 76, O 89
Ko, Ho Juen PR 463
Kobayashi, Naoya PR 246
Koch, S.M.P. PR 88
Kock, G.A.H. PR 466
Koenderman, Leo O 3, O 73, PR 324
Kohler, Andreas O 79
Koleda, Piotr PR 39
Kondo, Hiroya PR 108, PR 409
Konečný, Jan PC 328
Konishi, Hironobu PR 423
Konrads, Christian PR 112
Konstantiniuk, Peter PR 212
Konstas, Athanasios PR 106, PR 107
Koo, Hui Fen PR 463
Koshanova, A. PR 193
Kostic, Igor PR 254
Kostidou, Eleni PR 139
Kószó, Balázs PC 118
Kothe, Sarina PR 308
Koumpoura, Alkmini PR 139
Kourtzis, Dimitrios PR 447
Kovačič, Ladislav PC 446
Kraeima, Joep PR 93, PR 403
Krassnig, Renate PC 69, PR 209, PR 445
Kremo, Valérie O 45, O 76, PR 3
Krijnen, Pieta O 35, O 91
Kristiansen, Thomas PR 141
Kriwanek, Stephan PR 84, PR 85
Krouchev, Radoslav PR 318
Kuijper, Martijn O 62
Kujo, Masanori PR 146
Kumar, Abhinav PR 1, PR 448
Kumar, Atin O 25
Kumar, Subodh O 25, PR 1, PR 221, PR 448
Küper, Markus Alexander O 66, PR 112, PR 216
Kurata, Yoshiaki PR 429, PR 430
Kurihara, Hayato PR 342
Kurlandt, Patryk O 58, PC 440
Kurtoğlu, Mehmet Hamdi PR 24
Kuziv, Yevhen PR 94
Kwak, Ji Hoon PR 325
Kwon, Junsik PR 135
La Greca, Antonio PC 335, PR 243, PR 337, PR 383
Laas, Hanna Kadri PC 352, PR 137
Labmayr, Viktor O 65
Ladurner, Ruth PR 216
Lailheugue, Aurore PR 333
Laisaar, Tanel PC 352
Lam, Lydia O 72, PR 459
Lameijer, Charlotte O 87
Landaluce-Olavarria, Aitor PC 90, PC 178

Lang, Michael PC 343
Lange, Jörn PR 104
Lansink, Koen O 64, O 74
Lanz, Philipp PR 317
Laporte, Sébastien PR 156
Larsen, Johannes Wiik PR 10
Latifi, Rifat O 20, PR 4, PR 19, PR 126
Laurent, Gruner O 27
Lauzier, François O 52
Laversanne, Sophie PR 52
Lawless, Ryan O 7, O 46
Lazarev, Igor O 32
Le Guillan, Soazig PR 65
Leduc, Stéphane PR 197
Lee, Gil Jae PR 325
Lee, Gisoo PR 92, PR 96
Lee, Jae Gil O 68
Lee, John Cook-Jong PR 135
Lee, Jung Nam O 93, PR 325
Lee, Min A. O 93
Lee, Seung Hwan O 68
Leemeyer, Anna-Marie PR 462
Leenen, Loek PR 57
Leenen, Luke O 3, O 73, O 78, PR 7, PR 9, PR 142, PR 155, PR 184, PR 324
Lefering, Rolf O 1, PR 458
Lehnick, Dirk PR 3
Leijnen, Michiel PR 136
Leiser, Alfred O 76
Leite, Cláudia PC 32, PC 306, PC 326
Leite, Francisco PC 277
Leithner, Andreas PR 317, PR 437
Leitner, Lukas PR 317
Lemos, António PC 32
Lemos, Francisco PC 273
Leon, Manolo PC 90
Leonardo, Felipe PR 443
Lepp, Jaak PR 137
Leticia, Seisdedos Rodriguez PC 465
Lewis, Meghan O 72
Libionka, Witold O 58, PC 440
Liechti, Rémy PR 3
Lim, Patrick PR 5
Linares Yanes, Fernando PC 271, PC 274, PC 477
Link, Björn-Christian O 45, O 76, O 86, O 89, PR 3
Linnerud, Hege PR 442
Lipiski, Miriam O 5
Lipping, Edgar PR 137
Littlefair, Esme O 42
Litun, Iurii PR 91
Liu, Shengchen O 79
Lobato-Gil, Raquel PC 40, PR 11, PR 350
Lockie, Elizabeth O 21, PR 284
Lodder, Paul O 74
Londoño, Alejandra PR 29
Lopez, Maria PR 147
López López, Sara PC 370, PR 417
López Rubio, José Antonio PR 48
López Ruiz, Jose PR 25
Lopez Salas, David PR 270
Lora Tamayo, Jaime PC 414
Lorente, Teofilo PR 48, PR 62
Loskutov, Oleg O 31
Loskutov, Oleksandr PR 123
Loughenbury, Faye PR 132
Loughenbury, Peter O 60, PC 444
Lourenço, Liliana O 94
Louverdis, Dionysios PR 106, PR 107
Lucena López, Juan PC 234
Luengo Alonso, Gonzalo PC 115, PR 97
Lumenta, David PR 212
Luna-Aufroy, Alexis PC 40
Lundberg, Lars PR 73
Lunevicius, Raimundas O 51, PR 81, PR 82
Lupascu, Cristian PR 339
Lyon, Richard PR 28
Ma, Dae Sung PR 351
Macedo, Fernando PC 43, PR 100, PR 413
Mácsai, Attila PC 118
Madan, Vadim PR 113
Mader, Konrad PR 308
Maegawa, Naoki PR 423
Maes, Vincent PR 267
Maestre González, Yolanda PC 401
Maezawa, Toshinori PR 356
Magalini, Sabina PR 383
Mahamid, Alaa PR 46
Maheshwari, Kavish PR 244, PR 255
Mahindrakar, Santosh PR 448
Maia, Luís PC 43, PR 272
Majak, Peter PR 38
Majeed, Mustafa O 11
Maksic, Senad PR 428
Malagnino, Alessia PC 332
Malik, Nabeela PR 26
Mancuso, Rosaria PR 334
Mandler, Shay PR 208
Manfrin, Vinicio PC 31
Manfroni, Stefano PC 314
Manolidis, Georgios PC 391
Mansour, Subhi PR 376
Manzano-Nunez, Ramiro PR 23, PR 29
Manzhurtsev, Andrei PR 157, PR 158, PR 319, PR 321
Maragno, Margherita PR 365
Marasco, Silvana PR 344
Marenco de la Cuadra, Beatriz PC 380
Maria Dolores, Perez Diaz PC 465
Mariage, Daniela PR 172, PR 251
Marini, Aldo PR 163, PR 289
Marini, Pierluigi PC 314, PR 36, PR 334
Markovich, Ian PR 89
Marsden, Max O 41, O 53, PR 28
Marta, Ricardo PC 43, PR 100, PR 272, PR 413
Martiel Marcé, Manrique Zegarra PC 465
Martin, Katherine PR 344
Martín Fuentes, Ana María PC 435
Martín Román, Lorena PC 166, PR 21, PR 181, PR 249, PR 475
Martín-Fernández, Jesús PC 76
Martín-Vélez, Pablo PC 271, PC 274, PC 477
Martínez, Isabel PR 48
Martinez, Juan Jose PR 191
Martínez, Nicolás PR 226
Martinez, Rocio PC 220
Martínez Casas, Isidro PC 234, PR 72
Martinez De Paz, Fernando PC 77
Martínez Moreno, Clara PR 181
Martins, Carla PC 368, PC 415
Martins, Lisandra O 26
Martins, Ricardo PR 192
Martins, Rita PC 374
Martins Guimarães, João PC 374
Martins Rangel, Adriana PC 217

Maruo, Akihiro PR 131
Maruyama, Daisuke PR 316
Marzi, Federica PR 337
Marzi, Ingo O 33, PR 200, PR 232, PR 406
Mascaraque, Rocío PC 386
Mason, Lyndon PR 210
Massalou, Damien PR 59, PR 172, PR 251
Masuda, Keisuke PR 423
Masuda, Munetaka PR 33
Mateo Arranz, José PR 16
Mathew, Joseph PR 344
Mato, Takashi PC 37, PC 45, PC 468, PR 75
Matsuda, Masaki PR 175
Matsuhashi, Minami PR 108
Matsui, Hirotada PR 429
Matsumoto, Hisashi PR 345
Matsumoto, Shokei PC 231
Matsumura, Kazuki PC 231
Matsuno, Naoto PC 15
Matsushima, Kazuhide O 72, PR 459
Matsushima, Shinji PR 408
Matsuura, Terumasa PR 427
Mattyasovszky, Stefan G. PR 98
Matuhashi, Minami PR 409
Matzi, Veronika PR 212
Maubert, Alexandre PR 172, PR 251
Mauri, Gianmaria PC 332
Mazzoli Gutierrez, Diego PR 74
McCarrick, Cathleen PR 119, PR 170, PR 268, PR 373
McDonald, Ciaran PR 119, PR 268
McKendy, Katherine M. O 9
Meares, Charles PR 5
Medrano Caviedes, Rodrigo PR 16, PR 17, PR 226
Meesters, Anne M.L. PR 93, PR 403
Meesters, Berry PR 198
Meffert, Rainer PR 34
Mega, Manuel PC 79, PC 400
Mehler, Dorothea PR 282
Mehrnoush, Vahid PR 305
Meier, Maxine PR 452
Meizoso, Jonathan O 7
Mejlænder-Evjensvold, Magnus O 71, PR 442
Melberg, Mathias PR 152
Melderis, Alvils PR 224
Melé Olivé, Jordi PC 401
Melendez, Juan Jose PR 29, PR 191
Melling, David O 42
Melnikov, Ilia PR 157, PR 319, PR 321
Melo, Débora O 26
Membrilla Fernández, Estela PR 377
Menshchikov, Petr PR 157, PR 158
Mercier, Éric PR 318
Merichal Resina, Mireia PC 401
Merlo, Anna PC 31
Mesquita, Carlos O 94, PC 390, PR 62
Mesri, Mina O 51, PR 81
Metzger, Jürg PR 3
Mica, Ladislav O 5, PR 458
Michaud Maturana, Mailis PR 288
Micic, Ivan PR 294, PR 419
Mickan, Tim PR 98
Miguel, Cuende Diez PC 465
Mihailescu, Andrei PC 14, PC 392, PR 194
Mihailov, Raul PR 230
Milenkovic, Sasa PR 261, PR 294, PR 419
Miller, Liron PR 208
Millo, Paolo PR 176, PR 378
Mills, Sarah PR 97
Minarski, Christian PR 112, PR 216
Minehara, Hiroaki PR 427
Minneti, Michael PR 364, PR 459
Misailidis, Alexandros PR 358, PR 432
Mishra, Biplab PR 1, PR 448
Misra, Nikhil O 14, O 15, O 44, O 95, O 97, PR 8, PR 210, PR 225
Mitkovic, Milan Milorad PR 254, PR 261, PR 294, PR 419
Mitra, Sanchayita O 49
Miyaichi, Toshinori PR 160
Miyake, Takahito PR 183, PR 457
Mizobata, Yasumitsu PR 302
Mochizuki, Yusuke PR 108
Mogensen, Brynjólfur PR 143
Mohamad, Ash PC 14
Mohamed, Hesham PC 169, PR 250
Mohamedahmed, Ali Yasen Yasen O 12, PC 346
Mohseni, Shahin O 16
Mollavelioglu, Baran PR 27
Mollnes, Tom Eirik PR 300
Molund, Marius O 36
Monchal, Tristan PR 361
Monneuse, Olivier O 27
Monoczki, László PC 118
Montagna, Marco PR 337
Monteiro, Rita PC 79, PC 400
Montmany-Vioque, Sandra PC 40, PR 11, PR 350
Montón Condón, Soledad PR 72
Montuori, Mauro PC 332
Moon, Nam Hoon PR 299, PR 420, PR 421
Moore, Ernest E. O 7, O 46, O 49, PR 304
Moore, Hunter O 7, O 46, O 49, PR 304
Moore, Lynne O 52, PR 318, PR 456
Mora, António O 26
Morais, João PC 415
Moral, Antonio PR 17, PR 226
Moral Duarte, Antonio PR 16
Morales Bernaldo De Quirós, Javier Tomas PR 249
Morar, Alexandru PR 339
Moreira, António PC 43
Moreira Pinto, Eduardo PC 283
Mori, Shusuke O 18
Morks, A.N. PR 88
Moro, Mahir PR 426
Morooka, Takaya PR 160
Morote González, Melanie PR 21, PR 150
Motiei, Menachem PR 47, PR 195
Motomura, Tomokazu PR 345
Moulton, Steven PR 452
Moura, João PR 100, PR 272, PR 413
Mourikis, Euaggelos PR 235
Moustakalis, Ioannis PR 235
Moutsos, Ioannis PR 82
Mperdelis, Vasilis PC 338
Muharemovic, Tarik PR 426
Mühlhäuser, Julia O 45
Muhrbeck, Måns PR 360
Munoz, Beau PR 26
Murakami, Mamoru PR 316
Murakami, Nobukuni PR 316
Muralha, Nuno PR 63
Muraoka, Tatsuhiko PR 105
Mutheka, Koome PR 195
Muti-Schuenemann, Greta O 57
Naik, Anand V. PR 433

Najiuba, Obi O 41
Nakagawa, Yuko PR 311
Nakama, Rakuhei PC 290
Nakao, Atsunori PR 246
Nakayama, Shin-ichi PR 464
Nandakumar, Madura PR 288
Nandi, Arijit PR 456
Naqvi, Aina PR 162
Narvestad, J. K. PR 451
Naumenko, Artem O 31
Navarro, Alex PR 341
Navarro-Soto, Salvador PC 40, PR 11, PR 25, PR 350
Navas García, Carlos PC 99, PC 370, PR 417
Nawijn, Femke PR 184
Nee, Nadya PR 364
Negrin, Lukas PR 41, PR 213
Neijhoft, Jonas PR 200
Nelas, Joaquim Jorge PC 127, PC 283
Nemésio, Rodrigo PC 390
Netteland, Dag Ferner O 71
Neufang, Jörg PR 434
Neuffer, Ole PR 207
Neuhaus, Valentin O 1, O 5, O 28, PR 121, PR 330, PR 331
Ng, D. PC 444
Nicolaescu, Andrei PR 177
Nicolas, Dhome PR 333
Nielsen, Erik Waage O 43
Niemeyer, Menco O 78, PR 155
Nienhaus, Vinzenz PR 200
Niikura, Takahiro PR 262
Nijdam, Thomas PR 7, PR 9
Nijhuis - Van Der Sanden, Ria PR 416
Nijs, Stefaan O 81
Nijsink, Han PR 201
Nikakis, Christos PR 235, PR 447
Nikolaou, Stefania PR 358, PR 432
Nilsen, Fredrik O 36
Nilsson, K.F. O 10
Ninos, Anestis PC 338
Nishimoto, Tetsuya PR 345
Nishimura, Tetsuro PR 302
Nitsch, Andreas PR 104, PR 206, PR 207
Nixon, Alexander PC 165, PC 185
Noda, Tomohiro PR 302
Noda, Tomoyuki PR 108, PR 246, PR 409
Noorman, Femke O 4, PR 20
Nordberg, Martin PR 80, PR 182, PR 293
Noser, Hansrudi PR 203
Notani, Naoki PR 260, PR 439, PR 441
Novais Costa, Joana PR 272
Nowak, Tobias PR 282
Nowell, M. O 60
Ntikoudi, Anastasia PR 362, PR 387
Ntikoudi, Erifili PR 362
Nuechtern, Jakob Valentin PR 308
Nunes, Vítor PC 374
Nyström, Petter PR 80, PR 182
Nzamushe, Jean Robert PR 333, PR 398
Næss, Hanne Langseth PR 229
Næss, Ingar PR 222, PR 442
Næss, Pål Aksel O 8, O 29, O 48, O 70, PR 38, PR 341, PR 393, PR 399
O'Connor, Rory PR 144
Oe, Keisuke PR 262
Oehme, Florian O 45
Oerlemans, Anke O 55
Ogata, Miki PC 15
Ogura, Shinji PR 183, PR 457
Ogura, Takayuki PC 290
Ojeda Jiménez, Jorge PC 271, PC 274, PC 477
Okada, Hideshi PR 183, PR 457
Okamoto, Haruka PR 183
Okawara, Kento PR 175
Okuda, Akinori PR 423
Olaya González, Carlos PC 370
Oliva Mompeán, Fernando PC 380
Oliveira, Ana PC 32, PC 326
Oliveira, Teresa O 26
Olsina Kissler, Jorge Juan PC 401
Olthuis, Gert O 55
Omar, Al Hadeedi O 27
Onah, Ifeanyi PR 327
Ono, Yutaro PR 418
Oota, Makoto PC 468
Ordoñez, Carlos A. PR 23, PR 191
Orlas, Claudia P. PR 23, PR 29, PR 191
Ortega, Francisco Javier PC 435
Örtenwall, Per PR 73
Orti Rodríguez, Rafael José PR 397
Orue-Echebarría González, Maitane Igone PR 475
Osório, Tomás PC 273
Ota, Makoto PC 45, PR 75
Otomo, Yasuhiro O 18, O 80, PR 469
Ottestad, William PR 300
Ottolino, Pablo PR 61
Owattanapanich, Natthida O 72, PC 42, PR 2
Ozaki, Toshifumi PR 108, PR 246, PR 409
Özden, Erdem PR 258
Ozgur, Ilker PR 189
Ozkan, Berker PR 190
Pachi, Anna PC 338
Padilha, José Alfredo Cavalcanti PR 245, PR 248
Padillo Eguía, Andrés PR 199
Padillo Ruíz, Francisco Javier PR 187, PR 199, PR 292, PR 340
Paiano, Lucia PC 71
Palasinski, Marek O 97
Pallis, Dimitrios O 88, PR 358, PR 432
Palma Caucig, Nikolas Aldo PC 465, PR 21, PR 181, PR 475
Panchenko, Lesia PR 91
Paniagua Iglesias, Pilar PR 16
Panic, Stéphane PR 65, PR 197
Pankowski, Rafal O 58, PC 440
Papachristos, Alex O 17
Papachristou, Anastasia PR 362, PR 387
Papachristou, Maria PR 387
Papadakis, Stamatios A. O 88, PR 358, PR 432
Papadopoulos, Vasileios Nikolaos PR 145
Papagiannakos, Konstantinos PR 235, PR 447
Papaioannou, Georgios PC 338
Papanikolaou, Ioannis PR 235
Pape, Hans-Christoph O 1, O 5, O 28, O 77, O 85, PR 22, PR 121, PR 247, PR 330, PR 331, PR 458
Papoutsis, Grigorios PC 391
Pardo García, Juan María O 34, PC 414, PR 117
Pareja Ciuró, Felipe PR 72, PR 187, PR 199, PR 292, PR 340
Parianos, Christos PC 174, PR 394
Park, Jai Hyung PR 280
Park, Jin-Yeop PR 425
Park, Ki-Chul PR 280
Park, Young Eun PR 325
Park, Yun Chul PC 6
Parra, Michael W. PR 191

Páscoa Pinheiro, João O 56, PR 151
Pascua-Solé, Mireia PC 40
Pascual Espinosa, Pablo PR 181, PR 475
Pasquier, Pierre PR 67
Pastoricchio, Manuela PC 473
Patton, Marie-Pier O 52
Pauleau, Ghislain O 22, PR 454
Pavlova, Daria PR 101, PR 102
Pavotbawan, Kirusigan PR 407
Paydar, Shahram O 16, PC 357, PR 305
Paz García, Ignacio PR 48
Pedro, Vera PC 214
Pedro Gomes, António PC 374
Peek, Jesse O 76
Peliteiro, Joana PC 79, PC 400
Penders, Charlotte J.M. PR 323
Pepe, Gilda PC 335, PR 243, PR 337, PR 385
Peralta, Ruben PR 301, PR 461
Perea del Pozo, Eduardo PR 340
Pereira, Ana O 94
Pereira, David PC 368, PC 410
Pereira, Eva PC 273
Pereira, Filipa PC 273, PC 277
Pereira, Jorge O 13, O 94
Pereira, Luis PC 214
Pereira, Raquel PR 188
Pereira, Renata Pozzi PR 248
Pereira Rodriguez, Juan Antonio PR 377
Perez, Dolores PR 70, PR 211, PR 219, PR 291
Pérez Álvarez, Antonio Dámaso PR 397
Pérez Díaz, María Dolores PC 166, PR 25, PR 475
Pérez-Sánchez, Luis Eduardo PR 397
Perpetua Alvino, Eva PR 349
Petrov, Mikhail PR 101, PR 102
Pezy, Pierre PR 367
Pfeifer, Roman O 5, O 77, O 85, PR 22, PR 247, PR 458
Phattharapornjaroen, Phatthranit PR 64
Phillips, Ryan PR 452
Piccinini, Alice PR 364
Pichler, Wolfgang PR 445
Pielage, Marin PC 389
Pieracci, Frederic O 7, O 46
Pierrakakis, Stefanos PC 338
Pignatelli, Nuno PC 374
Pimenta, Joana PC 214
Pimentel, Fernando O 26
Pina, Gabriel PC 114, PC 125, PC 277, PC 368, PC 422
Pina, Sofia PR 167
Pinheiro, Luís Filipe O 26, O 94
Pinho, António PR 192
Pino Andrade, Raúl PR 140
Pinotti, Enrico PC 332
Pinto, Bruno PC 374
Pinto, Daniel PC 223
Pinto, Luís PC 368, PC 422
Pinto Marques, Hugo PR 167
Pirovano, Riccardo PC 332
Pischke, Søren Erik PR 300
Piscioneri, Francesco PR 388
Platnick, Barry O 7
Platnick, Kenneth O 46
Plaudis, Haralds PR 224
Plénier, Isabelle PR 333, PR 398
Plessas, Spyridon PR 106, PR 107
Plesser, Stefan PR 213
Poeze, Martijn O 64
Poillucci, Gaetano PR 36
Pokusevski, Goran PR 194
Polcari, Annie PC 83
Polinder, Suzanne PR 323, PR 453
Ponchietti, Luca PC 78, PC 375, PR 63
Popal, Zar PR 312
Popovtzer, Rachela PR 47, PR 195
Porcheron, Geoffrey PR 122
Porras Moreno, Miguel Ángel PC 115, PR 117
Pothmann, Carina Eva Maria O 28, PR 121, PR 330, PR 331
Pouggouras, Ioannis PC 338
Power, Fiachra PR 119, PR 268
Pozzi, Renata PC 217
Prabhakaran, Kartik PR 19
Preda, Daniel PR 177
Price, Alan PR 225
Prins, Jonne PR 349
Prionas, Apostolos PR 145
Priyadarshini, Pratyusha PR 1, PR 448
Prosch, Helmut PR 41
Prosperi, Paolo PR 296
Protsenko, Volodymyr PR 257
Psaila, Josephine PR 13
Puccioni, Caterina PR 385
Puchwein, Paul O 65, PR 317, PR 437
Pupelis, Guntars PR 224
Putzeys, Guy PR 267, PR 405
Puyana, Juan Carlos PR 23, PR 140
Qiao, Zhi O 85
Raatiniemi, Lasse PR 143
Raftopoulos, Antonis PC 338
Raggini, Filippo O 57
Rajput, Kunal O 44
Rajšter Koren, Alja PC 446
Ramalingam, Thanesan PR 250
Ramm-Pettersen, Jon PR 222, PR 442
Ramos, André PC 273
Ramos Pascua, Luís Rafael PC 414, PR 404
Ramos Ramos, Leandro Manuel PC 99
Rampini, Alessia PC 314, PR 36, PR 334
Rancic, Zoran O 5
Rangel, Diego PR 245, PR 248
Rappai, Tony Joseph PR 149, PR 438
Rasmussen, T.E. PR 466
Rauk, Mariliis PC 83
Raviolo, Mario PR 56
Rayner, Anthony O 2
Razek, Tarek S. O 9
Rebasa-Cladera, Pere PC 40, PR 11, PR 350
Rebelo, Tiago PC 114
Redeen, Stefan O 19
Régis-Marigny, Laure PR 454
Reguera Rosal, Julio PC 380
Reijnders, Udo PR 218
Reilly, John-Joe PR 341
Reininga, Inge O 54, O 63
Reinoso Naranjo, Jeovanni PR 140
Reis, Óscar O 26
Reisinger, Kostan PR 198
Relja, Borna PR 232
Renata Pozzi, Pereira PR 245
Resende, Ana Flávia PC 125, PC 275, PC 278, PC 410, PC 415
Reška, Michal PC 328
Retamar Gentil, Marina PC 380
Reul, Maike PR 129

Rey Valcárcel, Cristina PC 465, PR 21, PR 25, PR 70, PR 150, PR 181, PR 211, PR 249, PR 291, PR 475
Rhee, Peter PR 19
Ricchitelli, S. PR 342
Ricci, Gabriele PC 314, PR 334
Richards, Robert Geoff PR 203
Rico Villoras, Alberto PR 97
Riemann, Lennart O 75, PR 148
Rijnhout, Tim O 4, PR 20
Rikken, Quinten PR 218
Rimon, Uri PR 208
Ring, David PR 416
Rinka, Hiroshi PR 160
Rise, Sara Langlo PR 229
Ritz, Ulrike PR 98
Rizoli, Sandro PR 301
Rocha, Armando O 56, PR 151
Roclawski, Marek O 58, PC 440
Rodas, Edgar PR 140
Rodrigues, Cláudia PC 124
Rodrigues, Filipe PC 277
Rodrigues Araújo Calderan, Thiago PR 74
Rodriguez, Fernando PR 191
Roerdink, W. Herbert O 84
Rofin Serra, Silvia PR 16, PR 17, PR 226
Rognes, Ingrid Nygren PR 300
Rojnoveanu, Gheorghe PR 116, PR 241
Roks, Gerwin O 74
Roldón Golet, Marta PC 78, PR 63
Rollero, Luca PR 56
Romano, Manuela PC 79, PC 400
Romijn, Donald PR 109
Rommens, Pol Maria O 69, PR 98, PR 122, PR 203, PR 282
Ron, Guy PR 208
Rona, Katzengold PR 195
Rongieras, Frédéric PR 367
Roos, D. PR 88
Rosa, João PC 277
Rosseland, Leiv Arne PR 141
Rosu, Suzana PR 177
Roukema, Gert O 62
Rowinski, Sergio O 82
Roy, Isabel PR 197
Rozze, Davide PC 71
Rubinstein, Sidney O 35
Rubio López, Jose PC 234
Rudenko, Alexander PR 193
Rueda López, Ana Isabel PC 234
Ruiz Moreno, Cristina PC 465, PR 150
Ruiz-Yucuma, Juan PR 29
Rutka, Olga O 44
Røise, Olav PR 237, PR 276, PR 450
Røislien, Jo PR 300
Rønning, Pål PR 152
Saar, Sten PR 137
Sabalić, Srećko PR 133, PR 134, PR 253
Sabri, Shariq PC 14, PC 392
Sacoto Aguilar, Hernán PR 140
Sada, Angela PR 150
Sadeghi, Mitra O 10
Sadoghi, Patrick PR 437
Sagar, Sushma O 25, PR 1, PR 221, PR 448
Sagnak, Ercan O 83
Sahhaf, Mohammad O 16
Sainz, Mateo PC 178
Saito, Jota PR 429
Saito, Taichi PR 108, PR 409
Saito, Yoshinari PC 15
Saitoh, Daizoh PR 54
Saitoh, Jota PR 430
Sajid, Irum PC 14
Sakamoto, Teruo PR 260
Sakamoto, Tomonori PR 260, PR 439, PR 441
Sakuma, Yasunaru PC 37
Sakurai, Atsushi PR 262
Sala, Michiel PR 424
Salamea Molina, Juan Carlos PR 140
Salazar, Camilo PR 29
Salini, Vincenzo O 57
Salm, Liliane O 79
Salucki, Benjamin PR 172, PR 251
Sammut, Mark PR 13
Sammut, Matthew PR 8, PR 13
Samokhvalov, Igor PR 53
Sampaio, Clara PR 167
Sampaio Soares, António PC 374
Samson, David PR 126
Sánchez Arteaga, Alejandro PR 187, PR 292, PR 340
Sanchez Morata, Enrique Javier PR 97
Sancho Insenser, Juan PR 377
Sandblom, Gabriel PR 80, PR 182, PR 293
Sanders, Fay R.K. PR 128, PR 396
Sandoz, Baptiste PR 156
Sandru, Serghei PR 116, PR 241
Sandset, Else Charlotte O 71
Santangelo, Maria PC 314, PR 334
Santos, Carla PR 188
Santos, Eva PR 192
Santos Leite, Pedro PC 124
Santos Silva, Marta PC 277
Santos-Espi, Marta Susana PC 40
Sanz, Aitor PC 178
Saramet, Raluca PC 214
Sarana, Bruno PC 352
Sardinha, Sergio PC 217
Saridakis, Vasileios PR 362, PR 387
Sarmiento Altamirano, Doris PR 140
Sasaki, Takeharu PR 262
Sathian, Brijesh PR 301
Sato, Kohei PR 108, PR 409
Sato, Toru PR 110
Sato, Yoichi PR 418
Sauaia, Angela O 7, O 46, PR 304
Savoie Hontoria, María PR 397
Sawano, Makoto PR 175
Scantling, Dane O 30
Scarelli Amaral, Ana Flavia PR 74
Schaible, Alexander O 33
Scheerlinck, Thierry PR 129
Schellenberg, Morgan O 72, PR 459
Schepers, Marlene O 83
Schepers, Tim PR 128, PR 312, PR 396
Scherdin, Ylva O 19
Scherer, Julian O 1
Schipper, Inger B. O 35, O 91
Schistad, Magnus PR 399
Schistad, Ole PR 399
Schmelz, Michael PR 266
Schmitt, Lauren O 49
Schnüriger, Beat O 79
Schober, Patrick PR 168
Schormans, P.M.J. PR 238

Schrading, Simone PR 3
Schramm, David PR 406
Schulz-Drost, Stefan O 90, PR 359
Schwaller, Christoph Andreas PR 266
Schwarte, Lothar A. PR 168
Schwarz, Angelika PC 69, PR 209, PR 212, PR 445
Schweigkofler, U. PR 372
Scott, Sharon O 42
Scott, Simon O 42
Scotton, Giovanni PC 382
Secchi, Antonio PR 30
Seisdedos, Leticia PR 150
Sejka, Magdalena O 17
Sekayan, Tsoler PR 461
Sekine, Masayasu PR 54
Selim, Yaser PR 173
Selvanathan, S. PC 444
Semenova, Natalia PR 157, PR 158, PR 319, PR 321
Senent Boza, Ana PR 292
Senoo, Satomi PC 231
Senra, Mathieu O 22
Serban, Cristina PR 230
Serna, Jose J. PR 191
Serôdio, Marco PR 192
Serrano Alonso, Juan David PC 99, PC 307, PC 414
Serrano Serrano, Raquel PC 386
Seternes, Arne PR 336
Seufert, Lisa PR 406
Sevilla Fernández, Julián PC 99
Sganga, Gabriele PC 335, PR 243, PR 337, PR 383, PR 385
Shahi, Niti PR 452
Shahzad, Khalid O 51
Shakerian, Rezvaneh O 21, PR 284
Shakerian, Rose O 17
Sharkov, Sergey PR 101
Shayan, Leyla O 16, PR 305
Shellien, Rachel O 95
Shigemitsu, Kazuaki PR 160
Shimamura, Yasunori PR 108, PR 409
Shimazu, Takeshi PR 311
Shimizu, Masayuki PC 231
Shin, Won Chul PR 299, PR 420, PR 421
Shinjo, Takafumi PC 37, PC 45, PR 75
Shinjo, Takahumi PC 468
Shiota, Naofumi PR 110
Shiraishi, Atsushi O 80, PR 469
Shoda, Etsuo O 67, PC 431, PR 262
Shoji, Shintaro PR 427
Shrestha, Ashish PC 169, PR 250
Sibi, Eranki PR 149, PR 438
Sidhu, Gur Aziz Singh O 82, PR 433
Sidhu, Har Sumeet PR 433
Sidiropoulos, Theodoros PR 139
Sierkstra, Thomas C.N. PR 168
Silliman, Christopher O 49, PR 304
Silva, Anaísa O 26, PC 171
Silva, Francisco Eduardo PR 245, PR 248
Silva, Marcos PC 277
Silva, Vitor O 56
Silva Rodrigues, Jose Mauro PR 443
Simko, Peter PR 265
Simmen, Hans-Peter O 28, PR 121, PR 330, PR 331, PR 458
Simmermacher, Rogier PR 57
Simões, Nuno PC 125, PC 275
Simon, Violette O 49
Singer, Adam PR 322
Singh, Chandeep PR 433
Singh Selhi, Harpal O 82
Siriwanitchaphan, Wassana PR 460
Sjo, Ole Helmer PR 393
Skaansar, Ola Fougner PR 152, PR 159, PR 161
Skadberg, Eline PR 141
Skaga, Nils-Oddvar O 8, O 29, O 70, O 71, PR 222
Skaife, Paul PR 8
Skandarajah, Anita O 17
Skandsen, Toril PR 229
Skari, Hans PR 399
Skogen, Karoline PR 162
Skoog, P. O 10
Skopljak, Edna PR 60, PR 281, PR 426, PR 428
Slotina, Ekaterina PR 98
Smeeing, Diederik P.J. PR 184, PR 269
Smiley, Abbas PR 4
Smit, De Villiers PR 344
Smit, Xander PR 323
Smith, Stella O 96, PR 44
Smithuis, R.H.M. PR 88
Smyrnis, Panagiotis PR 145
Snartland, Vilde PR 38
Soares, Ana O 26, PC 171
Soares, Duarte O 26
Sockeel, Philippe O 22
Sofos, George PC 165, PC 185
Söhling, Nicolas O 33, PR 200
Sola, Harald PR 295
Solonitsyn, Yevhen PR 257
Soltana, Kahina PR 318
Somigli, Riccardo PC 236
Somme, Stig PR 452
Sommer, Christoph PR 407
Son, Seung Min PR 299, PR 420, PR 421
Sonesson, Linda PR 73
Soonawalla, Zahir O 11
Sormaz, Ismail Cem PR 189
Sousa, José O 26
Sousa, Manuel PC 114, PC 127, PC 278, PC 283, PC 368, PC 410
Sousa, Marta PC 374
Sousa, Rui PC 114, PC 127, PC 223, PC 275, PC 278, PC 368, PC 415
Spada, Pierluigi PC 335
Spencer, Jonah PR 303
Spiers, Harry O 96, PR 44
Spijkerman, Roy O 3, O 73, PR 7, PR 9, PR 324
Spiteri, Neville PR 13
Sprengel, Kai O 1, O 77, PR 247, PR 330, PR 331, PR 458
Stan, Dorina PR 230
Stangebye, Marie PR 450
Staquet, Hélène PR 156
Stassen, Robert PR 198
Stathakarou, Natalia PR 73
Stavinskyi, Iurii O 32, PR 91
Stefanescu, Bogdan PR 230
Steinvik, Tine PR 143
Stell, Kamar PR 225
Stem, Arthur O 49
Stene Hurtsén, A. O 10
Steyerberg, Ewout PR 453
Steyn, Elmin PR 287
Stickel, Michael PR 3
Stillhard, Phillipp PR 407
Stirler, V.M.A. PR 93
Stöckle, Ulrich O 66, PR 112, PR 216

Stoner, Rebecca PR 210
Stope, Matthias B. PR 206, PR 207
Störmann, Philipp PR 232
Strakeljahn, Silas PR 207
Streanga, Iuliana PR 339
Stuby, Fabian Maria O 66, PC 343, PR 112, PR 216
Stucchi, Riccardo PR 369
Sturms, Leontien PR 142
Stødle, Are O 36
Suárez Sánchez, Paula PC 386
Sumi, Yasuo PC 15
Sun, Kristi PC 86
Suprun, Tatiana PR 53
Surakarn, Ekkit PR 460
Surek, Ahmet O 47, PR 384
Surlin, Valeriu PR 177
Süslü, Ayse PR 153
Suzuki, Mototsugu PR 345
Suzuki, Toshinao PR 469
Svege, Ida PR 450
Szabó, Zsolt PR 347
Søreide, Jon Arne PR 10
Søreide, Kjetil PR 10, PR 451
Tachibana, Shotaro PR 131
Tai, Nigel O 41, PR 28
Takahashi, Hiroyuki PC 15
Takahashi, Ko PR 33
Takanosu, Tomotaka PC 45, PC 468, PR 75
Takaso, Masashi PR 427
Takeuchi, Ichiro PR 33
Talal El-Abur, Issa PC 375
Tallón Aguilar, Luis PR 25, PR 72, PR 187, PR 199, PR 292, PR 340
Talving, Peep PR 63, PR 137
Tan, Edward C.T.H. O 55, PR 360
Tan, Gim PR 344
Tanaka, Haruka PR 175
Tanaka, Yasuhito PR 423
Tanaka, Yasutaka PC 37, PC 45, PC 468, PR 75
Tanaka, Yoshihiro PR 54
Tandon, Nikhil O 25
Tanovic, Hasan PR 281, PR 426, PR 428
Taranu, Viorel O 26, PC 171
Tardif, Pier-Alexandre O 52, PR 318
Tas, David B. PR 269
Tazawa, Ryo PR 427
Tegenfalk, J. O 10
Teixeira, Artur PC 283
Teixeira Rangel, Diego PC 217
Ten Duis, Kaj O 63, PR 93, PR 403
Teodonno, Francesca PC 386
Termaat, Marco O 35
Terra, Maartje PR 168
Terradillos, Estrella PR 70, PR 211, PR 291
Terranova, Susanna PC 382
Tervala, Tomi PR 195
Terzulli, Giovanni PR 383
Teuben, Michel Paul Johan O 1, O 77, O 85, PR 9, PR 22, PR 458
Teunis, Teun PR 416
Theofanidou, Sofia PR 58, PR 467
Thode, Henry PR 322
Thompson, Amari PR 297
Thomson, Benjamin O 17, PR 284
Thorsen, Kenneth PR 10, PR 451
Timofeeva, Anna PR 180
Tinoco González, José PR 187, PR 199, PR 292, PR 340
Tjosevik, Kjell PR 10, PR 451
Todorovic, Momcilo PR 419
Tokoto, Pierre-Alain PR 172
Tomaževič, Matevž PC 120, PC 130
Tominaga, Keiichiro PC 45, PC 468
Tominaga, Keitiro PR 75
Tooulias, Andreas PR 145
Topaz, Guy PR 47, PR 195
Topaz, Moris PR 47, PR 195
Tothne Karip, Eszter PC 379
Toyoda, Hiroshi PR 33
Tralhão, José PR 192
Trauma Register DGU, The PR 458
TREAT Research Group, The O 85
Tristan, Cristina PR 150
Troian, Marina PC 472, PR 68
Tropeano, Giuseppe PR 385
Truffel, Sebastian PR 98
Trulson, Alexander O 66, PR 112, PR 216
Trulson, Inga M. PR 216
Trunfio, Antonio PR 176, PR 378
Trygonis, Nikolaos O 88, PR 358
Tsivelekas, Konstantinos O 88, PR 358, PR 432
Tsolakidis, Alexandros PR 145
Tsompanellis, Alexandros PR 139
Tsoulfas, Georgios PR 145
Tsuji, Hideki PR 429, PR 430
Tsumura, Hiroshi PR 260, PR 439
Tsuruoka, Ayumu PR 160
Tuleubayev, Berik PR 193
Tulwa, N. PR 132
Tur Martínez, Jaume PC 401
Turcotte, Valérie PR 197
Turégano Fuentes, Fernando Javier PC 166, PC 465, PR 21, PR 25, PR 61, PR 62, PR 70, PR 72, PR 150, PR 181, PR 211, PR 219, PR 249, PR 291, PR 475
Turgeon, Alexis O 52, PR 318
Tverdal, Cathrine PR 152, PR 153, PR 159, PR 161
Tyrrell-Marsh, Ian O 96, PR 44
Tzurbakis, M. PR 447
Ublinskiy, Maxim PR 157, PR 158, PR 319, PR 321
Uchida, Kenichiro PR 302
Uchino, Masataka PR 264
Ueda, Yasuhisa PR 429, PR 430
Uehara, Takenori PR 108, PR 246, PR 409
Ujihashi, Sadayuki PR 345
Um, Ju PR 303, PR 341
Unterberg, Andreas O 75, PR 148
Uppuluri, Aditya PR 320, PR 402
Uppuluri, Siri PR 402
Uribe, Francisco PR 147
Uriguen, Ana PC 90
Usurelu, Sergiu PC 79, PC 400
Utkina, Ksenia PR 180
Utrilla Fornals, Alejandra PC 78, PR 63
Vahidi, Abtin PC 357
Vale, Luís O 94
Valente, Sofia O 26
Valenti, David A. O 9
Van 't Hul, Mirjam PR 396
Van Aert, G.J.J. PR 238
Van Baal, Mark PR 57
Van Brandt, Celien O 39
Van Breugel, Marjolein O 78
Van De Krol, Erik PR 416
Van De Wall, Bryan O 86, O 89
Van Den Bremer, Jephta PC 389, PR 88, PR 136

Van Der Vlegel, Marjolein PR 453
Van Der Vlies, Cornelis H. PR 323
Van Der Wee, Mats PR 138
Van Der Wilden, Gwendolyn PR 88, PR 136, PR 138
Van Dongen, J.C. PR 238
Van Dongen, T.T.C.F. PR 470
Van Es, Michael PR 155
Van Gennip, Lisanne PR 360
Van Gerven, Pieter O 35
Van Leeuwen, Claar PR 424
Van Leeuwen, Robbert O 86, PR 3
Van Lieshout, Esther M.M. O 84, PR 323, PR 349, PR 462
Van Oijen, Guido W. O 84
Van Rijckevorsel, Veronique O 62
Van Schie, Peter PR 312
Van Schoten, Steffie M. PR 309
Van Sterkenburg, Maayke PR 204
Van Tulder, Maurits O 35
Van Veelen, Nicole O 76
Van Vledder, Mark PR 462
Van Vugt, Raoul PR 198
Van Wageningen, Bas PR 201
Van Wessem, Karlijn O 3, O 78, PR 57, PR 155
Van Wyk, Pieter PR 73
Van Yperen, Daan T. PR 323
Varela Cabo, Jesus Alberto PC 220, PR 70, PR 211, PR 219, PR 291
Varga, Endre PC 118, PR 233, PR 347
Vargas, Marília O 26
Varley, Rebecca O 96, PR 44
Vasques, André PC 273
Vassiliu, Pantelis PR 139
Vaz, Maria Rita PC 114, PC 278, PC 410
Veen, Harald PR 360
Vegt, Paul A. O 84
Vela Polanco, Fulthon Frank PR 377
Velez, Ana PR 192
Verboket, René O 33, PR 200
Vereb, Greg PR 89
Verhamme, Luc PR 201
Verhofstad, Michael H.J. O 84, PR 323, PR 462
Veverková, Lenka PC 328
Vidal Bujanda, Carlos PC 99
Vidali, Maria PC 338
Vidmar, Bogdan PC 446
Vidović, Dinko PR 133, PR 134, PR 253
Viegas, Helder PR 167
Vieira, Ana O 26
Vieira, Bárbara O 26, PC 171
Viertler, Elisabeth PR 445
Vigneshwar, Navin O 7, O 46, O 49, PR 304
Vikane, Eirik PR 229
Viks, Dagny PC 352
Vila y Rico, Jesus PR 97
Vilela, Carlos PC 43
Villalba, Jaume PR 17
Visser, Eva O 92
Vitón-Herrero, Rebeca PC 76, PC 77
Vlad, Nutu PR 339
Vlček, Petr PC 328
Vloet, Lilian O 55
Vogels, Sanne PC 389, PR 88
Voicu, Dragos PR 230
Vollrath, Jan Tilmann PR 232
Volmer, Raul PR 137
Von Stein, Thomas PC 343
Voormolen, Daphne O 75
Vos, D.I. PR 238
Vospert, Henrik PR 137
Vrachni, Vasiliki PC 391
Vrancken, P.J.E.M. PR 466
Vrancken, Suzanne M. PR 466, PR 470
Vrisekoop, Nienke O 3
Vulliamy, Paul O 41
Wabwire, Benjamin PR 195
Wade, Cian O 11
Wagner, Daniel O 69, PR 122, PR 203
Wahlgren, Carl-Magnus O 38
Waki, Takahiro PR 408
Wali, Umar PR 297
Walles, Thorsten PR 34
Walsh, Thomas N. O 13
Wang, Zhirui PR 304
Ward, Harry O 11
Wasser, Tom O 30
Watanabe, Nobutaka PC 37, PC 45, PC 468, PR 75
Węclewicz, Mateusz O 58
Weed, Zachary O 23
Wehling, Eike Ines PR 229
Weiß, Thomas PR 434
Welte, Patrick Karl PC 31
Wendt, Klaus O 54, O 63, PR 93
Wenig, Götz F. PR 216
Whitfield, Mark O 95
Wichlas, Florian PC 474, PR 202, PR 205, PR 354
Wiebe, Douglas O 100
Wien, Lasse PR 206, PR 207
Wiik-Larsen, J. PR 451
Wijffels, Mathieu PR 349
Wildburger, Renate PC 69, PR 445
Wileman, Fiona O 14
Wilson, Kenneth L. PC 83
Winberg, Morten PR 310
Winchell, Robert O 91
Winckelmans, Thomas O 81
Wisborg, Torben O 59, PR 143, PR 237, PR 310
Wisniewski, Jakub O 58, PC 440
Witjes, Max J.H. PR 93, PR 403
Wladis, Andreas PR 360
Won, Yougun PR 92, PR 96
Wong, Jason O 17
Woo, Kim PR 463
Wouters, P.C.R. PR 93
Wu, YuTung PR 186, PR 215
Wutzler, Sebastian PR 232
Yahya Gumusoglu, Alpen O 47
Yakovlev, Alexey PR 157, PR 158
Yamaguchi, Keishi PR 33
Yamaguchi, Masaya PC 103
Yamaguro, Tomotaka PC 45, PR 75
Yamamoto, Hiromasa PR 302
Yamamoto, Masahiro PR 429, PR 430
Yamashita, Haruo PR 464
Yamashita, Tomoya PR 160
Yamin, Mohd O 82
Yanai, Machi PR 356
Yanar, Hakan PR 24
Yánez Benítez, Carlos José PC 375, PR 48, PR 61, PR 62
Yano, Tomonori PR 408
Yanovsky, Max PR 66
Ye Zhou, Jinghuang PR 16
Yeung, Meei PR 344
Yilmaz, Serhan PR 384

Yokoo, Hideki PC 15
Yokota, Hiroyuki PR 345
Yonekawa, Chikara PC 37, PC 45, PC 468, PR 75
York, T. O 60
Yoshida, Atsushi PC 37
Yoshida, Masahiro O 61
Yoshida, Shozo PR 183
Yoshida, Takahiro PR 457
Yoshimura, Yuya PR 54
Yoshioka, Yuki PR 286
Young, Matthew PR 344
Young, Robert O 15, PR 225
Younsi, Alexander O 75, PR 148
Yousif, Ali PR 244, PR 255
Yu, Byung Chul O 93
Yumoto, Tetsuya PR 246
Yuste García, Pedro PR 25
Zago, Mauro O 13, PC 332
Žák, Jan PC 328
Zakaria, Reza Md O 12, PC 346
Zaman, M. PR 132
Zamani, Sara O 16, PR 305
Zambon, Katia Anna PR 298
Zarbin, Marco PR 320, PR 402
Zeb, Ehtishaam PC 392
Zeballos, Julio PC 178
Zebrowski, Alexis O 100
Zecchin, Massimo PC 473
Zerpa-Martin, Carla PR 11
Ziegenhain, Franziska O 1
Ziegler, Patrick PR 216
Ziev-Ner, Itzhak PR 47
Zijta, Frank PR 424
Zimmet, Adam PR 344
Zografos, Georgios PC 174, PR 394
Zoodsma, Margreet O 4, PR 20
Zucca, Annalisa PC 473
Zuidema, Wietse P. O 35, PR 218
Zwaving, Harmen H. O 84
Zweckberger, Klaus O 75, PR 148