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Angiotensin 1-7 blunts in vitro induced acute heart failure.

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Background: Angiotensin 1-7 (Ang 1-7) comprises consistent evidences regarding cardiovascular regulatory benefits due to Ang II receptor AT1 modulation via mass receptor.

Aim: Evaluation of the Ang 1-7 cardiac effects in the in vitro induced acute heart failure.

Material and methods: Acute heart failure (AHF) was induced using the model of isolated rat pumping heart perfused by Krebs solution without glucose during 20 min according to Neely-Rovetto model (glucose is a single energetic substrate in this model) – control series. In another series heart has been perfused without glucose, but Ang 1-7 was added till final concentration of 10-7 M – medicated series. Left ventricle (LV) functional parameters were assayed during inotropic stimulation by norepinephrine (NE) and endothelin 1 (ET-1) in concentration of 10-6 M, or ischemia-reperfusion impact (15 min of total ischemia followed by 20 min of reperfusion) reproduced in Langendorff isovolumic isolated heart.

Results: Cardiac output (CO) significantly decreased after 20 min perfusion of isolate heart without glucose by 25,9% ($29,4 \pm 1,3$ vs $39,7 \pm 2,1$ ml/min). Action of Ang 1-7 led to a less decline of CO compared to control ($34,8 \pm 1,6$ vs $29,4 \pm 1,3$ ml/min, $p < 0,05$). NE stimulation induced an increase of control CO by 10,7% associated by LV end-diastolic pressure (LVEDP) elevation of 30,3% while in medicated series response was better: CO increased by 14,4% and LVEDP boosted only by 17,6% (($19,3 \pm 1,6$ (Ang 1-7) vs $27,4 \pm 1,7$ (control) mm Hg, $p < 0,05$). Stimulated by ET-1 control isolated heart responded by a negative inotropic effect, and both systolic LV pressure and CO fallen respectively by 13,2% and 9,6%. Ang 1-7 insured a positive inotropic response during ET-1 action leading to CO and LV systolic pressure increase respectively by 10,5% and 11,7%. Ang 1-7 also improved the dynamics of LVEDP during ischemia-reperfusion. Thus, LVEDP was in medicated series significantly less than control index at finish of both ischemia ($41,3 \pm 3,2$ vs $55,4 \pm 4,4$ mm Hg) and reperfusion ($17,2 \pm 1,4$ vs $28,7 \pm 2,2$ mm Hg) periods.

Conclusion: Angiotensin 1-7 is a component of renin-angiotensin-aldosterone system which has a benefic action on acutely developing heart failure due to energy privation, manifested by improvement of inotropic response of NE and reinstated positive inotropic of ET-1 action as well as significant diminution of LVEDP during ischemia-reperfusion syndrome.