Evaluation of CSF flow dynamics by phase-contrast ultra-high field MRI in different types of hydrocephalus

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Background: The widespread use of mini-invasive neurosurgical methods for correcting cerebrospinal fluid (CSF) dynamics, dictates the need for its accurate evaluation. The study aimed to evaluate the possibilities of ultra-high field phase-contrast MRI for qualitative and quantitative assessment of CSF dynamics in different types of hydrocephalus.
Material and methods: 62 patients were included in the study presenting with either open-type post-traumatic hydrocephalus, normotensive hydrocephalus or occlusion hydrocephalus. A cohort of 20 healthy volunteers served as controls. All patients underwent a brain MRI on a Siemens 3T Magnetom Skyra scanner, using conventional sequences in three projections, phase-contrast MRI protocol and acquiring quantitative and qualitative data: amplitude of the linear velocity (Av) of the CSF flux, ejection volume (VE) and surface of the cerebral aqueduct (A).
Results: CSF flow parameters were within normal values in the control group. In occlusive hydrocephalus forms, CSF flow at the aqueduct level was reduced to a minimum or not detectable at all. Considerable increases in the values of the parameters were determined in patients with open-type post-traumatic hydrocephalus (VE-0.27 ± 0.075 ml, Av-11.95 ± 1.1 cm / s) and normotensive hydrocephalus (VE-0.21 ± 0.0764 ml, Av-13.3 ± 0.8cm / s), as compared to the control group. The recorded CSF flow parameters improved postoperatively, reaching the upper limit of the normal values. This was associated with a decrease in volume of the ventricular system and reduction of periventricular edema.
Conclusions: Phase-contrast MRI is a relevant method for assessing CSF flow dynamics, guiding the treatment strategy, and postoperative follow-up in patients with hydrocephalus.
Key words: Phase-contrast MRI, hydrocephalus, CSF flow parameters.