

JOINT EVENT

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CSF flows: From origins to alterations

The rapid amplitude change of the cerebral systolic arterial input flow increases the brain volume. Then cerebrospinal fluid (CSF) is quickly displaced out of the cranium toward the spinal canal; intracranial pressure (ICP) increase is therefore limited. Nevertheless, this first CSF response is also limited and has to be supplemented with the cerebral blood venous outflow. The venous contribution is slower than the CSF but at the end drains from the cranium all the blood input volume. Finally, due to the narrow aqueduct of Sylvius, a small CSF ventricular flows out of the fourth ventricle. Cerebral hydrodynamics knowledge has benefited considerably from the introduction of phase-contrast magnetic resonance imaging (PCMRI), the unique technique to investigate the small but rapid CSF oscillations. Using post-processing software, key parameters of flow can be easily calculated. In ten minutes CSF flow is quantified in the spinal subarachnoid spaces, the pontine cistern, the foramina of Magendie and the aqueduct of Sylvius. Blood flow is quantified in the internal carotid and the vertebral arteries, straight and sagittal sinus, jugular and epidural veins. These flows data can be functional information's complementary to the morphological imaging to better investigate the cranio-spinal system in case of patients presented hydrocephalus, Chiari malformation, syringomyelia, cerebral hemorrhage, intracranial hyper or hypo tension. The objective of this presentation is to describe the power and the limit of such clinical 2D PCMRI protocol concerning CSF and blood flow investigations and present what we have found in different healthy and pathological populations.

Recent Publications

1. Baledent M Czosnyka and Z H Czosnyka (2018) Brain pulsations enlightened. *Acta Neurochirurgica*. 160(2):225-227.
2. J Daouk, R Bouzerar and O Baledent (2017) Heart rate and respiration influence on macroscopic blood and CSF flows. *Acta radiologica* 58(8):977-982.
3. J Attier-Zmudka, B Chaarani, F Couvillers and O Baledent (2017) The role of pc-MRI in neurodegenerative diseases. *Geriatr. Gerontol. Aging (Impr.)* 11(2):68-75.
4. V Puy, J Zmudka-Attier, C Capel, O Baledent et al (2016) Interactions between flow oscillations and biochemical parameters in the cerebrospinal fluid. *Frontiers in Aging Neuroscience* 8:154.
5. C Capel, M Makki, C Gondry-Jouet, O Baledent et al (2014) Insights into cerebrospinal fluid and cerebral blood flows in infants and young children. *Journal of Child Neurology* 29(12):1608-1615.

Biography

Olivier Baledent has completed his PhD in Biophysics and Radiology at Jules Verne University. He is currently working as an Assistant Professor at Amiens University Hospital in France. He is heading the Department of Medical Image Processing and Bio Flow Image research team. After Master's degree in Informatics in Amiens, he completed a Postgraduate Diploma in the field of Image Processing in Lyon. The thesis subject was CSF flow imaging using MRI technique. Now, at Amiens University Hospital, with clinicians, he continues to develop CSF research and applies non-invasive hydrodynamic approach in clinical practice. He is also a Biophysics Teacher at Medical School of University of Picardie Jules Verne.

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