Cerebrospinal fluid dynamics

- Kininogen enhances seizure susceptibility in mice possibly through bradykinin-induced modulation of calcium transients in glutamatergic and GABAergic neurons
- Fluid dynamics model of the cerebral ventricular system
- Atrial fibrillation reduces CSF flow dynamics. A multimodal MRI study
- Cholinergic basal forebrain neurons regulate vascular dynamics and cerebrospinal fluid flux
- Modelling and analysis of cerebrospinal fluid flow in the human brain - is cerebrospinal fluid an effective protective mechanism during high-impact loading?
- Direct SERS profiling of small extracellular vesicles in cerebrospinal fluid for pediatric medulloblastoma detection and treatment monitoring
- Genomic profiling and prognostic factors of leptomeningeal metastasis in EGFR-mutant NSCLC after resistant to third-generation EGFR-tyrosine kinase inhibitors
- Postoperative changes in ventricular cerebrospinal fluid biomarkers with correlation to clinical outcome in idiopathic normal pressure hydrocephalus

Cerebrospinal fluid motion

see Cerebrospinal fluid motion.

Cerebrospinal fluid flow

Although CSF dynamics has been studied for an entire century, many of its aspects are still insufficiently understood. Today there are two hypotheses on cerebrospinal fluid physiology [1) 2)] : a) traditional hypothesis and b) microcirculatory/microvessel hypothesis.

Cerebrospinal fluid Secretion

Cerebrospinal fluid Circulation

Cerebrospinal fluid Absorption

Studies

Cerebrospinal fluid flow studies.

Foramen Magnum flow

Both fast cine-PC and pencil beam imaging demonstrated expected changes in CSF flow with Valsalva maneuver in healthy participants. The real-time capability of pencil-beam imaging may be necessary to detect Valsalva-related transient CSF flow obstruction in patients with pathologic conditions such as Chiari I malformation [3)].

Real-time MR imaging noninvasively showed a transient decrease in CSF flow across the foramen magnum after coughing in symptomatic patients with Chiari I malformation, a phenomenon not seen in healthy participants. The results provide preliminary evidence that the physiology-based imaging method used here has the potential to be an objective clinical test to differentiate symptomatic from asymptomatic patients with Chiari I malformation [4].

Disturbed cerebrospinal fluid (CSF) dynamics are part of the pathophysiology of normal pressure hydrocephalus (NPH) and can be modified and treated with shunt surgery.

Intracranial pressure (ICP) pulsations are generally considered a passive result of the pulsatility of blood flow. Active experimental modification of ICP pulsations would allow investigation of potential active effects on blood flow and cerebrospinal fluid flow and potentially create a new platform for the treatment of acute and chronic low blood flow states as well as a method of CSF substance clearance and delivery.

The motion of cerebrospinal fluid (CSF) within the subarachnoid space and ventricles is greatly modulated when propagating synchronously with the cardiac pulse and respiratory cycle and path through the nerves, blood vessels, and arachnoid trabeculae. Water molecule movement that propagates between two spaces via a stoma, foramen, or duct presents increased acceleration when passing through a narrow area and can exhibit “turbulence.” Recently, neurosurgeons have started to perform fenestration procedures using neuroendoscopy to treat hydrocephalus and cystic lesions. As part of the postoperative evaluation, a noninvasive diagnostic technique to visualize the water molecules at the fenestrated site is necessary. Because turbulence is observed at this fenestrated site, an imaging technique appropriate for observing this turbulence is essential. We therefore investigated the usefulness of a dynamic improved motion-sensitized driven-equilibrium steady-state free precession (Dynamic iMSDE SSFP) sequence of magnetic resonance imaging that is superior for ascertaining turbulent motions in healthy volunteers and patients. Images of Dynamic iMSDE SSFP from volunteers revealed that CSF motion at the ventral surface of the brainstem and the third ventricle is augmented and turbulent. Moreover, our findings confirmed that this technique is useful for evaluating treatments that utilize neuroendoscopy. As a result, Dynamic iMSDE SSFP, a simple sequence for visualizing CSF motion, entails a short imaging time, can extensively visualize CSF motion, does not require additional processes such as labeling or trigger setting, and is anticipated to have wide-ranging clinical applications in the future [5].

1)
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