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Commentary

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J. Gordon McComb[1]

Being able to measure local cerebrospinal fluid (CSF) within the central nervous system by phase-contrast magnetic resonance (MR) has significant relevance as a research tool as well as direct clinical application.

The study by Enzmann and Pelc in this issue (1) resolves any uncertainly that the primary force generator of CSF movement within the ventricular system is the whole arterial tree, confirming the previous work of DuBoulay (2, 3) and refuting the idea that the choroid plexus alone is the source (4).

This study found the flow of CSF through the aqueduct of Sylvius to be 0.4 ± 0.12 ml/min or 576 ± 173 ml/24 hours, which is consistent with previous studies that used different techniques.

The only route of CSF drainage has been thought for years to be directly from the subarachnoid space to the major intracranial venous sinuses via the arachnoid granulations. More recent laboratory studies have indicated that a significant fraction of CSF drains not into the venous sinuses but into lymphatics (5). Although some children with CSF-diverting shunts may experience nasal congestion or periorbital fullness if their shunts obstruct, to our knowledge there is no direct documentation of the CSF lymphatic drainage pathways in humans. Phase-contrast cine MR may make it possible to assess the extent and role of the nonarachnoidal CSF drainage routes in humans.

Eisenberg et al (6) have shown, in an experimental hydrocephalus setting, that the central canal of the spinal cord will dilate and serve as an alternative pathway for CSF drainage. This has been noted especially in patients with repaired myelomeningoceles. Phase-contrast cine MR could be used to determine whether this pathway is being used; its obstruction during orthopedic reconstructive procedures on the spine can lead to acute raised intracranial pressure with possible disastrous consequences (7).

Phase-contrast cine MR may be helpful in determining the location of obstruction in the ventricular system without having to introduce contrast agents into the subarachnoid space and may better define the nature of the obstruction. For instance, one could establish with phase-contrast cine MR that the blockage within the aqueduct of Sylvius is by a thin web of tissue rather than complete stenosis along the entire aqueduct. Using endoscopic means the web could be fenestrated, thus avoiding the necessity of placing an extracranial CSF-diverting shunt.

Another area in which phase-contrast cine MR may prove of use is in determining why arachnoid cysts enlarge and act as mass lesions. Although Go et al (8) have postulated that secretion by the lining of an arachnoid cyst accounts for its enlargement, the secretory function of arachnoid cells still remains in doubt, as does the reason such fluid should develop a pressure gradient rather than move freely across the arachnoid membrane of the cyst.

Another clinical problem is determining preoperatively which group of patients with so-called normal pressure hydrocephalus will benefit from an extracranial CSF-diverting procedure. At present, the clinical symptoms of dementia, ataxia, and incontinence are the most reliable; no objective diagnostic studies enable accurate prediction of which patients would benefit from the insertion of a shunt. Phase-contrast cine MR may prove useful in this clinical setting.

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