Key Points

1. Recently, many surgeons have begun to use intraoperative ultrasound to guide whether the dura should be opened as part of surgery
2. No real data has been published on how this affects outcomes
3. Study from Johns Hopkins looked at symptom persistence/recurrence in 256 pediatric Chiari cases where ultrasound was used to decide whether to open the dura
4. In all, the dura was opened 55% of the time and a bone only decompression was performed 45% of the time
5. Although overall results were good, for herniations below the level of C1, a bone only decompression was twice as likely to result in symptom recurrence
6. Authors believe that larger herniations can not be judged using ultrasound unless more objective measures are developed
7. An accompanying editorial called for the development of a validated Chiari assessment instrument and the adoption of stricter standards in Chiari research

Definitions

dura - thick, outer covering of the brain and spinal cord

duraplasty - surgical technique where the dura is expanded by sewing a patch into it

foramen magnum - opening at the base of the skull through which the brain connects with the spinal cord

intraoperative - during a surgical procedure

posterior fossa decompression (PFD) - in this study, refers to Chiari surgery in which the dura was not opened

posterior fossa decompression

Intraoperative Ultrasound May Not Be Effective

July 31, 2008 -- For several years now many surgeons have been using a type of imaging known as intraoperative ultrasound to determine whether it is necessary to open the dura during surgery. However, a recent study from Johns Hopkins (McGirt et al.) and published in the July, 2008 issue of the Journal of Neurosurgery: Pediatrics shows that ultrasound may not be reliable in determining whether a duraplasty is required.

As reported numerous times in this publication (including in this issue), there is an ongoing debate in the surgical community about whether and when to open the dura as part of Chiari surgery. Some surgeons, especially pediatric ones, have recently begun performing what are called bone only decompressions on selected patients. The major advantage of removing only bone and not opening the dura is that it dramatically reduces CSF related complications and in general is a less traumatic procedure. The drawback is that in some cases it may not be sufficient and a full duraplasty may be required in a follow-up procedure. Even the advocates of bone only decompression admit that patient selection is the key to success with the less invasive procedure, however objective guidelines for finding good candidates have failed to materialize.

That is why some surgeons have turned to using ultrasound, which can provide images using sound waves, during surgery to make the decision on whether to open the dura. Now the study from Hopkins calls into question the effectiveness of this practice. Specifically, the researchers looked at the rate of symptom persistence and recurrence in 256 pediatric Chiari cases treated surgically over a ten year period. The average age of the patients was 10 years and 47% were boys. Twenty-seven percent had syringomyelia and 11% had scoliosis. The extent of each patient's tonsillar herniation was classified as follows (note this has nothing to do with their symptom severity):

- Mild = Below the foramen magnum but above C1
- Moderate = Between C1 -C2
- Severe = C2 and below

Using this criteria, the vast majority of the cases had moderate herniation (76%, Figure 1).

The decision on whether to recommend surgery was based on the imaging and whether patients had symptoms commonly associated with Chiari, such as headaches and brainstem related problems. In general, cases with very mild herniations and symptoms which were vague were discouraged from having surgery.

Three surgeons performed similar procedures on all the patients. Ultrasound was used to visualize the space around the tonsils and it was left to each surgeon's discretion whether to open the dura as part of the procedure. Overall, duraplasty was performed 55% of the time (140 patients). The group was followed for an average of 29 months and tracked for symptom persistence and/or recurrence.

As a group, symptoms resolved 78% of the time and persisted or recurred 22% of the time. In nineteen children (7%), the symptoms were severe enough to require additional surgery. When the researchers compared the duraplasty patients to the bone only patients, they found that for moderate and severe herniations, patients who had a bone only decompression were twice as likely to experience symptom recurrence. In other words, for herniations at the C1 level and beyond, the intraoperative ultrasound did not seem to do a good job in indicating whether the dura should be opened. However for mild herniations, the ultrasound appeared to be adequate.

An accompanying Editorial points out several limitations of this study which the authors readily acknowledge. Specifically, that the selection of patients for surgery in the beginning was subjective, that the interpretation of the ultrasound results during surgery was subjective, and that the outcome assessments are based on patient self-reports. Interestingly, the Editor calls for something that Conquer Chiari has begun pushing for in the research community, namely a validated assessment measure of the severity of Chiari symptoms and/or a quantitative MRI measurement which correlates with symptom severity. In addition, the Editor makes a general call, which Conquer Chiari wholeheartedly supports, for greater scientific rigor in the structure and methods of Chiari research.

On the positive side, McGirt and his colleagues have begun using what can be called actuarial reporting of their outcome data (which the journal Editor applauded). This style of data report shows the patient outcomes over the entire time period of follow-up rather than just at one or two points in time. What it also shows is something many Chiari patients know first-hand, that while they may feel better right after surgery, in a significant number of cases, symptoms start to come back over time.

with duraplasty (PFDD) - in this study, refers to Chiari surgery which included duraplasty,

prospective - type of research study which follows patients forward from a point in time

retrospective - type of research study which uses medical records to look back in time

ultrasound - imaging technique which is sometimes used during Chiari surgery to determine if the dura needs to be opened

cerebellar tonsils - portion of the cerebellum located at the bottom, so named because of their shape

cerebrospinal fluid (CSF) - clear liquid in the brain and spinal cord, acts as a shock absorber

Chiari malformation I - condition where the cerebellar tonsils are displaced out of the skull area into the spinal area, causing compression of brain tissue and disruption of CSF flow

syringomyelia - condition where a fluid filled cyst forms in the spinal cord

Source

McGirt MJ, Attenello FJ, Datoo G, Gathinji M, Atiba A, Weingart JD, Carson B, Jallo GI. Intraoperative ultrasonography as a guide to patient selection for duraplasty after suboccipital decompression in children with Chiari malformation Type I. J Neurosurg Pediatrics. 2008 Jul;2(1):52-7

Figure 1: Extent of Tonsillar Herniation (256 Patients)

Extent of Herniation	Number of Patients	Percent
FM - C1	38	15%
C1-C2	195	76%
Below C2	23	9%

Notes: FM = foramen magnum; C1 = first cervical vertebra, C2 = second cervical vertebra

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