Key Points

1. Goal of study was to identify characteristics of patients who required a second surgery for CM
2. Of 133 surgeries - over the past 14 years - 17% (22) were second, or reoperations
3. Reasons for reoperation included: persistent syrinx, continued neurological symptoms, and misplaced shunts
4. Factors influencing need for reoperation include: misshaped skull (craniosynostosis), young age at first surgery, and problems with initial surgical technique - specifically, failure to ensure proper CSF flow out of 4th ventricle
5. Second surgeries did not always help; 3 out of 10 reoperations for persistent syrinx didn't work and 2 out of 5 reoperations for neurological symptoms were not successful

Definitions

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 - 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

Chiari II - more severe form of malformation which involves descent of parts of the brainstem and is usually associated with Spina Bifida

cisterna magna- CSF filled space below the cerebellum

craniosynostosis - premature fusion of the sutures of the skull in an infant; results in an abnormally shaped head

Trying To Identify Why Surgeries Fail

A Harvard pediatric neurosurgeon has weighed in on the important question of why decompression surgeries fail. Dr. R Michael Scott, Director of Clinical Pediatric Neurosurgery at Children's Hospital Boston, along with his colleague Dr. David Sacco, reviewed the hospital records, medical imaging, operative reports, and follow-up data of patients who were undergoing a reoperation for Chiari malformation during the past 14 years and compared the data to patients who were undergoing their first operation. The researchers specifically were trying to determine if age at time of first surgery, type of Chiari malformation (I vs. II), bony abnormalities, and/or initial operative technique contribute to the need for reoperation. They published their results in the October issue of the journal Pediatric Neurosurgery.

Of 133 operations for Chiari I or II that were performed, 22 (17%) represented reoperations. This failure rate is in-line with other reported failure rates (which go as high as 30%). Interestingly, the reoperation rates for Chiari I and Chiari II were almost identical, with 16 out of 100 Chiari I surgeries being reoperations and 6 out of 33 Chiari II surgeries being reoperations. Also of note is the fact that exactly half of the reoperations (11) were required within 1 year of the initial surgery and half (11) were not performed until more than a year from the time of the initial surgery. Reasons for reoperation included a persistent syrinx in 11 patients, continued neurological symptoms in 9 patients, and problems with stent placement in 2 patients. Although not stated explicitly in the research paper, the reporting surgeon's failure rate (for initial surgeries) can be deduced as 12.6% - this assumes patients for whom the surgery failed returned to see him.

The surgical procedure used was similar for most patients and for Chiari I patients included a suboccipital craniectomy, C1 laminectomy, duraplasty, and reduction of the cerebellar tonsils. In patients who also had syringomyelia, the outlet of the 4th ventricle was carefully examined and any scarring or blockage was removed. In addition, in most syringomyelia patients, a stent was placed in the 4th ventricle to allow for adequate drainage of CSF. In the first several years of the series, the top of the central canal - the obex - was also plugged. Chiari II patients underwent a similar procedure although with a more limited craniectomy and a more expansive laminectomy.

In looking at patient age at time of initial surgery, the researchers found that of the 43 patients whose initial surgery occurred when they were younger than 5 years old, 11 required reoperation (26%). In contrast, of the 90 patients who were older than 5, only 10 required additional surgery (11%). True statistical analysis was not possible given the nature of the study, however these results do indicate that a young age at time of initial surgery may play a role in the need for further operations. The authors point out that patients at a very young age are able to regrow bone which can cause compression again. They also point out that some surgeons try to remove a minimal amount of bone when decompressing a young child, and while this may seem like a good idea, it may also lead to the need for further operations.

The researchers also found an apparent association between skull anomalies - craniosynostosis - and the need for reoperation. There is an established link between abnormal skull shape and Chiari malformation, but this study also found that out of 9 patients with craniosynostosis, 5 were undergoing a reoperation. The authors speculate that a complicated - and confusing - bone structure around the foramen magnum can lead to an inadequate decompression unless it is carefully studied and understood by the neurosurgeon. In addition, craniosynostosis likely leads to abnormal CSF dynamics and may cause persistent problems that are difficult to resolve with decompression surgery.

The final factor the researchers examined as a cause of surgical failure was operative technique. Five of the reoperations that were performed were necessitated by problems with a fourth ventricle catheter - or stent. While the authors believe in using a catheter in patients with syringomyelia, they acknowledge that problems can develop if the tubing is too long or is not placed properly.

Although somewhat downplayed by the authors, it is disheartening to note that 6 patients failed to improve even after reoperation. This means the failure rate among the reoperations was 28%. 3 patients with a persistent syrinx did not improve, 2 patients continued to experience their main neurological problem, and one Chiari II patient developed new neurological problems 4 years later - although the authors do not believe the new problems were due to Chiari.

So why do surgeries fail? While this study is far from conclusive, it does appear that for pediatric patients young age at time of initial surgery, bony abnormalities, and stent failure may contribute to surgical failure. It also provides more evidence that absolute failure - meaning an explicit need for additional surgery - occurs between 10%-20% of the time.

Meet The Surgeon

dura - thick outer layer covering the brain and spinal cord

duraplasty - surgical procedure where a patch is sewn into the dura

foramen magnum - opening at the base of the skull, through which the spinal cord passes

laminectomy - surgical removal of part (the bony arch) of one or more vertebrae

stent - tube used to support an opening in the body

suboccipital craniectomy - surgical removal of part of the skull, or cranium, in the back of the head, near the base

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

ventricle - CSF filled space in the brain, 4th ventricle drains into the spinal system

Source

Children's Hospital Boston web site

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