Key Points

1. There is a growing focus on trying to minimize the trauma of Chiari surgery, especially for children
2. Some surgeons are looking at techniques which don't actually open the dura
3. This study looked at the outcomes of 30 children who underwent surgery without fully opening the dura
4. Report good results with nearly half becoming symptom free shortly after surgery
5. Long-term, over 90% experienced "significant improvement" and only two required re-operations
6. Because the dura wasn't opened, there were no complications and hospital stays were short
7. Critics argue that the risks associated with opening the dura are still low and in some cases required
8. Authors counter that what is needed is a way to identify which patients can benefit from a minimal procedure and which require a more invasive approach

Definitions

ataxia - loss of coordinated muscle movement; inability to walk properly

cervical - the upper part of the spine; the neck area

craniectomy - surgical technique where a piece of the skull is removed

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

duraplasty - surgical technique where a patch is sewn into the dura, thus making it bigger

laminectomy - surgical technique where part of one or more bony vertebra are removed

Limited Surgery Shown To Be Effective In Children

March 31, 2007 -- Among pediatric neurosurgeons, there is a an increased focus on developing minimally invasive surgical techniques which reduce the trauma for their young patients. While this is certainly a noble and worthwhile goal, it is not without controversy, and in fact has generated quite a bit of debate in the surgical community.

As has been discussed at length in this publication, one of the main focus areas in this debate is whether to open the dura, which is the outer covering of the brain and spinal cord. Those who advocate leaving the dura untouched - or not completely opening it - point out that cutting open the protective covering of the brain greatly increases the risk of complications, including CSF leaks, infections, and additional scarring of the dura itself, and results in more pain and longer hospital stays. They believe that most of the benefits of decompression surgery come from removing the bone - both skull and vertebra - and that opening the dura completely is not worth the added risk. In fact, one study seemed to show just that; electrical tests during surgery showed that most of the decompressive effect on the brainstem occurred after the bone removal.

On the other hand, those who advocate opening the dura point out that one of the main goals of decompression surgery is to restore normal CSF flow and that there are often obstructions to this flow - from scarring and adhesions - underneath the dura. Their position is supported by several reviews which have showed that many failed surgeries are due to just such issues.

To date, there have been no randomized clinical studies directly comparing opening the dura to not opening the dura, and barring this type of definitive study the debate among surgeons is likely to continue for some time. This is in fact the case in the March, 2007 issue of the Journal of Neurosurgery: Pediatrics, where a team of doctors report their results in using a minimal surgical approach in treating 30 pediatric Chiari patients. The journal issue also contains an editorial by Dr. Oakes of the University of Alabama-Birmingham (who has published extensively on Chiari) questioning the approach of the Italian doctors, and in turn their response to Dr. Oakes.

The study involved 30 children who underwent surgery between 1993-2001 and ranged in age from 2 months to 16 years. Their most common symptoms were (see Table 1) head/neck pain, vertigo, and upper extremity weakness, and 40% also had a syrinx clearly visible on MRI.

As an interesting side note, the doctors also evaluated 41 non-surgical patients during that time who showed tonsillar herniation on MRI. Many of these cases were found incidentally when imaging was done for a different reason, and none of the children had symptoms which were felt to be related to Chiari. However, the doctors were able to monitor and follow most of this group and not a single child who was diagnosed incidentally developed any symptoms consistent with Chiari or required decompression surgery.

Each of the thirty children underwent a suboccipital craniectomy and 21 underwent an additional laminectomy. While the dura was not opened in any case, the surgeons thought the dura was thickened in 11 cases and made a series of incisions in the outer layer of the dura to make more space. The surgeons also noted, as have most other Chiari surgeons, that all the patients had a thickened, fibrous band of tissue (sometimes referred to as the atlanto-occipital membrane) which was compressing the dura at the level of the foramen magnum and which they subsequently cut. Ultrasound was used during the surgeries to assess whether the decompressions were sufficient.

Although the authors don't detail specifically how they defined outcomes, it appears they achieved good results with this approach (see Table 2). Thirteen patients became symptom free almost immediately after surgery, by the final follow-up more than 90% of the children had experienced a significant improvement in their symptoms, and only 2 children required a re-operation due to continued symptoms. In addition, there were no complications from the surgeries, such as CSF leaks, and the authors believe their hospital stays were shorter than if they had opened the dura.

The results of this study go to the heart of the dural debate, namely that proponents of the minimal approach believe that adequate results can be achieved along with lower complication rates and quicker recoveries by not opening the dura. In an editorial, Dr. Oakes questions this logic by pointing out that the complication rate even with opening the dura is only 3% and that the complications are usually manageable. He believes there is clear evidence that some re-operations are necessary because the dura wasn't opened and CSF obstructions removed and asks why not always open the dura to be sure.

The authors of the study make an interesting point in their reply by saying maybe the debate should not be about which technique is better, but that the surgical community should focus on finding a way to identify which patients can benefit from a minimal surgery and which require the dura to be opened.

lumbar - the lower back area

posterior fossa - area in the lower part of the back of the skull where the cerebellum is situated

thoracic - the middle part of the spine; the chest area

vertebra - the individual bony segments of the spine; often referred to by region and number, such as C3 for the third cervical vertebra

vertigo - dizziness, spinning sensation

Common Chiari Terms

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

cerebellum - part of the brain located at the bottom of the skull, near the opening to the spinal area; important for muscle control, movement, and balance

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

decompression surgery - general term used for any of several surgical techniques employed to create more space around a Chiari malformation and to relieve compression

Source

Source: Caldarelli M, Novegno F, Massimi L, Romani R, Tamburrini G, Di Rocco C. The role of limited posterior fossa craniectomy in the surgical treatment of Chiari malformation Type 1: experience with a pediatric seriess. J Neurosurg Ped. 2007 Mar;106: 187-195

It is hard to argue that being able to definitely identify which surgeries should be used on which patients would indeed be a positive step forward in the battle against Chiari. Now the surgical and scientific community needs to develop a way to do just that.

Table 1
Most Common Presenting Symptoms (30 Patients Total)

Symptom	% With
Head/neck pain	57%
Vertigo	27%
UE Weakness	20%
Ataxia	20%
LE Weakness	20%
Sleep Apnea	20%
Abnormal Sensations	13%

Note: UE=Upper Extremity, LE=Lower Extremity

Table 2
Surgical Outcomes (30 Total Patients)

Asymptomatic	13
Significant Improvement	15
Re-operation Required	2

Note: Significant improvement number deduced from article; follow-up time ranged from 1-12 years

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