Key Points

1. Whether to open the dura during decompression surgery remains controversial
2. Recently there has been a trend toward less invasive procedures, especially for Chiari only
3. Study compared a number of measures between 12 Chiari children who underwent a dura splitting technique and 12 Chiari/syringomyelia children who underwent duraplasty
4. Short-term outcomes were equivalent, but the dura splitting group had shorter times in the OR and hospital and incurred less costs

Definitions

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 - 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

craniectomy - surgical technique where part of the skull is removed

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

diplopia - double vision

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

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

Surgical Technique Reduces Hospital Time And Costs

Despite the fact that thousands of Chiari decompressions are performed in the US each year, there continues to be controversy surrounding the specific techniques involved in the procedure. For example, the question of whether to open the dura - the tough outer covering of the brain - remains a subject of intense debate. Those in favor suggest that opening the dura is necessary to achieve an adequate decompression and that scars and adhesions that exist under the dura must be removed. Those against point out that opening the dura is the primary cause of surgical complications and that removing bone is often sufficient, especially for cases with Chiari only.

While each camp is likely to have it's strong advocates for years to come, evidence is growing that a group of modified procedures - lying somewhere in the middle - may provide adequate decompression in some cases. In an effort to reduce the invasiveness of the surgery - especially for children - some surgeons have begun to manipulate the dura without completely opening it and sewing a patch in. One such technique involves scoring the dura with a number of shallow incisions. Another technique which has had preliminary success involves opening only the outer layer of the dura, but not cutting all the way through.

To examine whether this type of dura splitting technique is beneficial, Dr.'s Selden and Limonadi, at Doernbecher Children's Hospital in Oregon, designed a study which compared clinical outcomes, time in surgery, time in hospital, and costs incurred between a group of children with Chiari who underwent dura splitting as part of their surgery and a group of children with Chiari and syringomyelia who had a full duraplasty as part of their surgery. They published their findings in a November, 2004 supplement to the Journal of Neurosurgery.

Over a period of approximately two years, the doctors operated on 24 children, 12 with Chiari only and 12 Chiari and syringomyelia. The initial decompression was the same for both groups and involved removing a piece of the skull and part of the top vertebra. The group with syringomyelia also underwent a duraplasty, whereas the group with Chiari only did not. In this group, the top layer of the dura was split and the two sides were peeled back and sutured into place. This exposed the softer, underlayer of the dura, which was not punctured or opened in any way. Ultrasound was used during the procedure to ensure adequate decompression of the tonsils.

In order to track the clinical outcome of each group, the researchers carefully documented each child's neurological signs and symptoms before and after surgery. A score was assigned for each of the three primary signs and/or symptoms of each child: 2 = resolved; 1 = improved; 0 = unchanged; -1 = worse. The three numbers were then averaged to produce single outcome score ranging from 2 (meaning all symptoms resolved) to -1 (meaning very poor outcome with every symptom worse).

Overall, the symptoms experienced by each group were similar (see Table1), however the Chiari only group did suffer more from headaches. Similarly, the syringomyelia group had instances of scoliosis and incontinence which did not occur in the Chiari only group.

After computing the outcome scores for each group, the scientists found virtually no difference between them (see Table 2). The syringomyelia/duraplasty group had an average outcome score of 1.53, while the Chiari/dura splitting group averaged 1.67. This difference is not statistically significant. It should be noted, however, that the average follow-up time was only 15 months after surgery, so this represents a short-term outcome measure.

The doctors did find, however, a significant difference between the groups in every other measure. The dura splitting group spent less time in surgery, in the operating room, and in the hospital overall. The costs incurred for the dura splitting group were also lower. On average, the duraplasty group spent a total of 249 minutes in the operating room and stayed in the hospital for 3.75 days. These numbers dropped to only 166 minutes in the OR and 3 days in the hospital for the dura splitting group. Similarly, total hospital charges for the duraplasty group were over $9,700 on average, but only $7700 for the dura splitting group.

Based on the good clinical results and the reduced time and costs associated with the dura splitting, the authors believe there is enough evidence to warrant a large, multi-center, randomized trial (meaning patients would be randomly assigned to receive either dura splitting or duraplasty) using children with Chiari only.

Despite it's strong results, this study does suffer from several limitations which the authors readily acknowledge. First, the two groups used for comparison were dissimilar. One group had syringomyelia and one didn't. Ideally, each group would be the same. Second, given the tendency for Chiari symptoms to come back, much longer term follow-up would be requirde to conclusively say whether dura splitting provides enough decompression.

dysphagia - trouble swallowing

dysarthria - slurred speech

incontinence - loss of bladder and/or bowel control

intradural exploration - general term referring to a surgeon finding and removing any scarring or obstructions to CSF flow that exist underneath the dura

laminectomy - surgical technique where part of a vertebra is removed

magnetic resonance imaging (MRI) - diagnostic device which uses a strong magnetic field to create images of the body's internal parts

posterior fossa - depression on the inside of the back of the skull, near the base, where the cerebellum is normally situated

scoliosis - abnormal curvature of the spine

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

syrinx - fluid filled cyst in the spinal cord

tonsillar herniation - descent of the cerebellar tonsils into the spinal area; often measure in mm

Source

Limonadi FM, Selden NR. Dura-splitting decompression of the craniocervical junction: reduced operative time, hospital stay, and cost with equivalent early outcome. J Neurosurg. 2004 Nov;101(2 Suppl):184-8.

The authors also stress that these results can not be extended to adults or to people with syringomyelia (even children). Despite it's limitations, the promise of a less invasive surgery for children is good news for Chiari families everywhere.

Table 1
Summary of Selected Signs and Symptoms

	Group (%)	
Symptom	**Duraplasty**	**Dura Splitting**
Headache	50	92
Extremity Weakness	33	33
Numbness	33	25
Dysphagia	25	17
Disarthria	17	8
Diplopia	8	8
Pain	17	17
Incontinence	17	0
Scoliosis Only	8	0

Table 2
Summary of Outcome Measures

	Dura- plasty	Dura Splitting	Sig?
Clinical	1.53	1.67	N
Op. Time (min)	169	99	Y
Total OR Time (min)	249	166	Y
LOS (days)	3.75	3.00	Y
OR Charges ($)	5538	3615	Y
Total Hosp Charges ($)	9759	7705	Y

Note: Sig? refers to whether the difference between the two groups is statistically significant and not likely due to chance.

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