Key Points

1. Chiari surgery usually involves a craniectomy, where a piece of the skull is removed, in order to create more space
2. However, after surgery the muscle can attach directly to the dura and cause headaches in patients
3. Experience with other surgeries has shown that craniotomies, where the bone flap is replaced, reduce headaches after surgery
4. Surgeons used a craniotomy on 6 pediatric Chiari patients
5. They elevated the bone flap by attaching a plate underneath it
6. Symptoms improved for all six patients, and in two patients with syrinxes, the syrinxes resolved completely
7. Researchers also used MRIs to show that even though the bone was replaced, because they added the plate, they were able to increase the volume of the posterior fossa

Definitions

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

craniotomy - surgical procedure where a piece of the skull is removed to provide access to the brain, but then the skull flap is replaced

cranium - the skull

dura - thick, outer covering of the brain and spine

posterior fossa -region in the back of the skull where the cerebellum is situated

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

Craniotomy vs Craniectomy

July 31st, 2009 -- While the goals of Chiari surgery are straightforward - to create more space around the cerebellar tonsils and restore the natural flow of cerebrospinal fluid - the devil is in the details. Currently, there are a number of open issues when it comes to the specific techniques involved, such as how much bone to remove, whether to open the dura, whether to remove any brain tissue, and what type of dural patch to use. With all these options, for patients it can seem like no two surgeons perform the surgery the same way.

The reality is that the procedure for Chiari surgery is still evolving, with surgeons exploring new variations ranging from minor tweaks like how to open the dura, to fundamental changes like bone only decompressions. The existence of these variations is not necessarily a bad thing, since the failure rate for Chiari surgery is still relatively high at around 20%. However, there is a real problem in the lack of methodologically sound clinical trials to compare the effectiveness of different techniques and approaches.

Right now, when a surgeon develops a new Chiari technique they will publish their results on a series of patients. Other surgeons may then comment on the technique and point out what they like or don't like about the approach. For minor issues this is not a big deal, but for large controversies, the lack of sound data leaves patients without recourse in evaluating what is best for them.

Highlighting the evolving nature of Chiari surgery, a group of surgeons from UCLA recently published a technical note in the journal, Child's Nervous System, where they describe using craiotomies instead of craniectomies for Chiari surgery. A craniectomy is where a piece of the skull is removed to gain access to the brain. With a craniotomy, a piece of the skull is also removed to gain access, but it is then put back into place at the end of the procedure.

While most surgeries at the back of the skull utilize a craniotomy, because the goal of Chiari surgery is to create more space, traditionally surgeons do not replace the piece of bone. However, research not specific to Chiari has shown that craniectomies in general can lead to post-operative headaches because the muscles in the neck attach directly to the dura. When these muscles tighten, it can pull on the dura.

Although some surgeons now use a metal plate to take the place of the bone flap that was removed, the UCLA surgeons believed that replacing the bone itself would be preferable. In order to ensure that there was enough space around the cerebellar tonsils, the surgeons used a plate to elevate the bone flap above where it used to be (Figure 1).

Figure 1: Surgical Picture Showing Bone Flap with Plate Attached

The doctors reported their results with this technique on six pediatric patients (Table 1). In all six cases, there was a significant improvement in the quality of life and in the two children who had syrinxes, both resolved completely. The doctors also showed, using MRIs, that putting the bone back still increased the size of the posterior fossa.

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

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

Source

Suboccipital craniotomy in the surgical treatment of Chiari I malformation. Chou YC, Sarkar R, Osuagwu FC, Lazareff JA. Childs Nerv Syst. 2009 Sep;25(9):1111-4

This provides another interesting alternative for Chiari surgeons to consider. In order to make informed decisions, one would hope that randomized, controlled trials comparing craniectomy to craniotomy for Chiari surgery will be undertaken soon.

Table 1: Pre and Post-Op Posterior Fossa Volume (cc) of Six Chiari Patients Who Underwent Craniotomy

Age	Sex	Pre-Op PFV	Post-Op PFV
17	F	170	180
18	M	187	198
13	F	172	203
4	M	144	183
14	M	155	177
6	F	181	197

Note: Volumes are measured in cubic centimeters (cc)

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