

Minimally Invasive Surgery for CMI (Chiari I Malformation)

This article concerns a relatively recent variation to CMI surgery, which involves the opening of skull and C1, without Duraplasty. A number of pediatric neurosurgeons are the current main advocates for this procedure. Their case series is small, since they just started; so long term results are unknown. This procedure is intended for young children. Their point is that when the dura (and the arachnoid) is opened, there is an increased risk of CSF leaks, wound infection, and meningitis. The risk of CSF leak is about 8% nationwide (while it is just 0.2% at The Chiari Institute).

There is no national standard of care about CMI surgery. A standard of care is a surgery which has been scientifically demonstrated as the best therapy, in contrast to others. Special kinds of biostatistical studies are designed to define standards of care. So far, the data about CMI surgery are not conclusive.

Some surgeons are more aggressive than others, other surgeons are minimalist. Opening the bone without opening the dura is the most conservative of the options. Aggressive forms of the decompression have a small incidence of damage for brain and cranial nerves. These complications are almost zero in the hands of the top national experts. The minimalist version of the surgery does not cover from the risk of craniocervical instability, in subjects predisposed to this condition (EDS, retroflexed odontoid, etc), since it affects ligaments and the craniocervical junction. Pegged tonsils are often incarcerated in a low position by arachnoid adhesions to the cervical spinal cord, and to the dura. Bone decompression, and duraplasties cannot promote the ascension of the tonsils in these cases. Lateral extensions of the tonsillar herniation along the sides of the brainstem, and some anatomical configurations of the foramen magnum tend to "choke" the tonsils into place, maintaining the herniation even after bone decompression.

In cases with SM, the restoration of the CSF flow is the key to success. If the CSF outlets are obstructed, the CSF flow will be abortive, despite an expansile duraplasty; such outlets are: the foramina of Luscka (plus their communication to the cisterna magna) and the foramen of Magendie. The first ones tend to be obliterated by lateral extensions of the tonsillar herniation along the side of the brainstem; the latter is obstructed by the posterior extension of the herniation. "Kissing" tonsils and grossly asymmetric tonsils tend to have a more severe effect on Magendie. If these outlets are not viable, the CSF will fill the new improved space providing by the duraplasty, but it will stagnate there, like in a "cul de sac".

The reality is that these surgeries work well only when the following criteria are met:

- The posterior fossa is small, but not very small;
- The tonsillar herniation is minimal;
- The tonsils are not compressing the brainstem, as mass occupying lesions;
- The tonsils are not laterally herniated;
- A large syrinx is not present;
- Brainstem symptoms are minimal or absent.

Bottom line: minimally invasive decompressions work well only with minimal forms of Chiari I. With other forms of Chiari, they tend to provide incomplete and often short-lived clinical improvements.

How do we know that? Because 49% of the patients operated on at TCI had former surgeries done elsewhere, with suboptimal results, a big chunk of these patients had different versions of minimally invasive decompressions done in the past.

Conclusions:

If a large SM is the target, a more aggressive surgery will have more chances to success; more aggressive variants of the surgery should be performed by experts in the field, to minimize complications. If a

minimalist version of the surgery does not work, the next step should be more aggressive. There is nothing wrong to do a minimalist surgery as a first step, since you can do more another day (but often you cannot undo what has been already done, if it went wrong). You cannot expect from a minimalist approach the same chances of success when compared to a more aggressive surgery. In every aspect of life, you win bigger when you risk bigger. Why CMI surgery should be different? More important: not all the Chiarians are created equal. The anatomical variations are many. We know it well, since we perform a CMI surgery on any working day of the week. Brainstem humps, vascular anomalies, hectatic PICA's, grossly asymmetric tonsils, arachnoid "blebs", are just some of the examples. The surgical planning should keep differences in anatomy in consideration.

"One size fits all" usually makes for unhappy customers.