Key Points

1. Tethered Cord Syndrome (TCS) is when the tissue of the spinal cord is put under tension due to an abnormal attachment or a tight filum
2. The relationship between TCS and Chiari is controversial
3. However, some patients have well documented TCS and also Chiari
4. Study reviewed 100 pediatric TCS surgeries to compare duraplasty to no duraplasty
5. Found no difference in hospital stay or surgical complications
6. Over time, 29 patients had their cords retether and required additional intervention
7. Among that group, complex TCS cases were much more likely to retether than simple ones
8. However, among the complex TCS group, those who had received duraplasty did NOT have a higher retether rate
9. Appears that duraplasty can help prevent retethering for complex TCS cases

Definitions

dura - thick, outer covering of the brain and spine; outermost layer of the meninges

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

filum terminale - small thread of tissue at the bottom of the spinal cord; if abnormal can result in TCS

gait - the act of walking

lipoma - a non-cancerous tumor of fatty tissue

lipomyelomeningocele - birth defect where a lump of fatty tissue protrudes from the spinal canal through the spinal column

myelomeningocele - spina bifida; birth defect where the spinal cord

Duraplasty Prevents Retethering In Complex TCS Cases

May 31st, 2009 -- Researchers at Johns Hopkins (Samuels et al.) have found that using duraplasty as part of surgical detethering is effective in preventing retethering in complex cases. They recently published this result on-line in the journal, Child's Nervous System.

Like many studies, the research was done retrospectively, meaning that the scientists reviewed medical records and performed statistical analysis to achieve their results. While considered weaker from a scientific stand-point than prospective studies, which define their hypothesis before any medical intervention and follow a group of patients over a period time, retrospective studies remain a stalwart in Chiari related research.

Tethered Cord Syndrome, where the tissue of the spinal cord is put under abnormal tension due to attaching, or tethering, to something else, is of growing interest to the Chiari community for a couple of reasons. Probably first and foremost is the controversial subject of occult tethered cord and its relationship, if any, to Chiari. Occult tethered cord refers to a condition where the thread-like bottom of the spinal cord, the filum terminale, is less flexible than it should be. This, in turn, pulls down on the cord, and essentially puts it in traction causing lower body problems such as pain, loss of sensation, and loss of bowel and bladder function.

There are two controversial.htmlects to this type of tethered cord as related to Chiari. First is the fact that this type of tethered cord is not always apparent on MRI; thus the word occult. While a fatty or tight filum sometimes can be seen on MRI, surgeons who treat occult tethered cord tend to rely more on patient symptoms in making a diagnosis and recommending a surgical release. [**Ed. Note**: *Most people are aware of the controversy surrounding The Chiari Institute as detailed in the mainstream media and discussed at length on the Chiari message boards. The use of tethered cord surgery at TCI is part of that controversy. Conquer Chiari, as a matter of policy does not endorse, or align with, any doctors or hospitals. This has been our stated position from the beginning and will remain our position. As such, we will take no position in this situation except for reporting on (and funding) any related, scientific research which may help shed light on the potential link between TCS and Chiari.*

The second controversial.htmlect is whether TCS can cause a Chiari malformation, meaning that the downward pull on the spine can lead the cerebellar tonsils to herniate. This has been proposed, most notably, by Royo-Salvador, but is not widely accepted. Indeed, there is evidence to support both sides of the argument. Ellenbogen documented, via MRI, a child with a clearly fatty and tight filum, who then developed Chiari over time. Although this is compelling, an MRI alone does not mean that the tight filum actually caused the tonsils to herniate. On the flip side, Tubbs found, through a cadaver study, that tension applied to the bottom of the spinal cord dissipates very quickly as you move up the spine, and thus is unlikely to affect the brain. However, Tubbs also found, in a different study, that an unusually high percentage of people with lipomyelomeningocele also have Chiari.

Regardless of the controversies, there are well established reasons for the Chiari community to be interested in TCS. Namely, that many of the leading causes of TCS have a high co-incident rate with Chiari. Recall that up to a third of spina bifida patients also suffer from Chiari II. It turns out that surgical repair of spina bifida can lead to tethering of the cord after surgery due to scar tissue and adhesions. Similarly, lipomyelomeningocele can lead to spinal cord tethering, and as mentioned above is somehow linked to Chiari. Finally, there is no question that some TCS cases are due to a fatty, tight filum, which as discussed above, may or may not be linked to Chiari.

The Hopkins study reviewed their medical records over a ten year period and identified 110 children who had been operated on for first time untethering of the cord. TCS surgery, like Chiari surgery, varies in the details, and the researchers wanted to know if there were any differences in the outcomes based on whether the patient had received a duraplasty (meaning the dura was expanded with a patch) versus just having the dura sewn shut after the detethering.

The average age of the children was 5.7 years and they were monitored for an average of 42 months after surgery. Monitoring occurred for 30 days post-op to look for signs of surgical complications, plus follow-up visits one month, three months, and then every six months after surgery. The children's clinical status was determined to be improved, unchanged, or worse. Patients who had worsening symptoms and MRI evidence of retethering of the cord, were classified as retethered. In addition, based on established criteria, the researchers grouped the cases as complex TCS or simple TCS.

On average, the children had shown symptoms for 3 months prior to surgery, with the most common being leg weakness and urinary problems (Fig 1). The most common causes of the TCS were post-surgical scarring from spina bifida repair and a fatty filum terminale (Fig 2). In all, the majority of the patients (75) did not receive a duraplasty while 35 did.

nerves and membranes protrude through the bony spine

occult - a disease or condition that is not readily apparent

scoliosis - abnormal curvature of the spine

TCS - Tethered Cord Syndrome; loose name for a spectrum of problems that all result in abnormal traction, or tension on the spinal cord

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

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

Source

Incidence of symptomatic retethering after surgical management of pediatric tethered cord syndrome with or without duraplasty. Samuels R, McGirt MJ, Attenello FJ, Garcés Ambrossi GL, Singh N, Solakoglu C, Weingart JD, Carson BS, Jallo GI.Childs Nerv Syst. 2009 May 6. [Epub ahead of print

In terms of complications and outcomes, the researchers could not find any differences between the duraplasty and no-duraplasty groups in terms of length of hospital stay and post-op complications. Similarly, there were 29 total cases of retethering during the follow-up period, but there was no statistical difference between the duraplasty and no-duraplasty group in this regard (Fig 3).

However, of the 29 retethered cases, 25 of them had what were categorized as complex TCS, which was statistically more significant than the retethering rate for simple TCS cases. Further, however, the researchers found that within the retethered, complex TCS group, those who had undergone duraplasty did not have a higher rate of retethering. In other words, the only sub-group with a comparatively high rate of retethering was the complex TCS patients who had not had duraplasty. Despite the structural limitations of the research, the authors feel this a good indication that duraplasty should be considered when detethering complex cases, although further research is needed to confirm this.

The relationship between TCS and Chiari is likely to remain controversial for quite some time, however, for patients with widely recognized TCS, it appears that duraplasty should be considered as part of the surgical procedure to release the cord.

Figure 1: Common Presenting Symptoms (110 Patients)

Symptom	# (%)
Lower limb weakness	58 (53%)
Urinary problems	48 (44%)
Pain	40 (36%)
Trouble walking (Gait)	42 (38%)
Avg. Duration of Symptoms	3 months

Figure 2: Cause of Tethered Cord (110 Patients)

Cause	# (%)
Post Myelomen. Repair	35 (32%)
Fatty Filum Terminale	26 (24%)
Lipomyelomeningocele	20 (18%)
Lipoma	18 (16%)
Intra-dural neoplasm	4 (4%)
Post Lipomyelo. Repair	2 (2%)

Figure 3: Cord Retethering (110 Patients)

Duraplasty (35 patients)	12 (41%)
No-Duraplasty (75 patients)	17 (59%)
Total	29 (26%)

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Chiari Linked To Lipomyelomeningocele

New Study Casts Doubt On Tethered Cord Causing Chiari

MRI Documents Acquired Chiari Due To Fatty Filum

Minimal Tethered Cord Shows Abnormal Anatomy