## Key Points

1. Dura splitting, where the top layer of the dura is removed, has been proposed as an alternative to full duraplasty
2. Study used cadaver specimens to study the histological and biomechanical properties of posterior fossa dura
3. Electron microscope revealed that the dura did not appear to be two distinct layers as thought, but rather was multilayered networks of collagen and elastic fibers
4. Strain testing of full and split dura samples showed that a split dura can provide significant expansion capabilities
5. This provides a theoretical basis for the effectiveness of the dura splitting technique
6. Study is limited because the dura of Chiari patients is thought to be abnormal and researchers only looked at samples from people over 70

## Definitions

**biomechanical -** study of the mechanics of the human body

**cadaver -** a dead body

**collagen -** substance found in connective tissue in the human body

**dura -** outer layer of the covering of the brain and spinal cord

**elastin -** substance found in connective tissue that has elastic properties

**histological -** study of the microscopic anatomy of cells and tissues

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

**cerebrospinal fluid (CSF) -** clear liquid in the brain and spinal cord, acts as a shock absorber

# Mechanical Study Supports Dura Splitting Technique

August 31st, 2010 -- The dura, the outer covering of the brain and spinal cord, has been a major focus of Chiari research for some time now. Specifically, there are numerous publications comparing outcomes and complication rates for decompression surgeries that involve opening the dura versus leaving it closed. In general terms, the research has shown that opening the dura results in a lower reoperation rate, but a higher complication rate. Conversely, not opening the dura virtually eliminates serious complications, but does not always provide for an adequate decompression, resulting in a higher rate of reoperation.

Some surgeons have proposed techniques which attempt to split the difference, literally, between the two approaches. The dura is composed of collagen and elastic fibers generally composed in two layers. Dural splitting is a surgical technique where the top layer of the dura is peeled back, but the bottom layer is kept intact. The thinking is that the remaining layer of dura is flexible enough to expand and allow for the free flow of spinal fluid. Recently, a research group from France (Chauvet et al) performed a histological and biomechanical study of the dura and published results which appear to support the dura splitting approach.

The scientists collected dura samples from 3 cadavers. Each of the samples came from someone who was more than 70 years old when they died and had no history of Chiari or any disease involving the covering of the brain. The team collected a number of samples (Figure 1) from the region around the craniovertebral junction.

To examine the structure of the dura, the team used an electron microscope (Figure 2). An electron microscope uses a beam of electrons to create an image of structures that are too small to be seen using regular magnification. As suspected, they found the dura was comprised of networks of collagen and elastin, with collagen being the primary component. However, they also found that in most samples, it was not possible to distinguish two distinct layers. Rather, the dura was comprised of many thin, leaf-like layers stacked on top of each other. In discussing this finding, the authors point out that previous publications, which have described two distinct layers, have focused on the dura covering the spine and not the craniovertebral area.

To assess the potential utility of the dura splitting technique, researchers set up an experiment to see how much their dura samples could expand without becoming damaged. For some samples, they peeled off the top layer(s) as would be done during surgery and compared it to intact dura samples. Without diving into the numbers, which are beyond the scope of this article, they found that indeed the split dura samples were able to expand significantly, implying that in a Chiari patient, a split dura could provide decompression of the area.

It is important to keep in mind that Chiari patients are often found to have abnormally thick and scarred duras, so while this study does provide a theoretical underpinning for the split dura technique, it is not clear that Chiari duras would respond in the same fashion. Still, it is encouraging to see research on Chiari that is from the laboratory, and not the operating room.

**Figure 1: Diagram of Where Dura Specimens Were Taken From Cadavers**

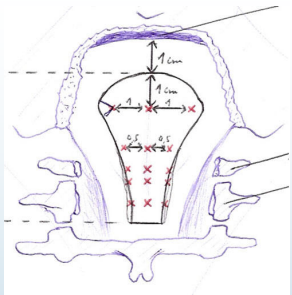


**Figure 2: Electron Microscope Study of the Collagen and Elastin Fibers of the Posterior Fossa Dura**

**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

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

## Source

**Source:** Histological and biomechanical study of dura mater applied to the technique of dura splitting decompression in Chiari type I malformation. Chauvet D, Carpentier A, Allain JM, Polivka M, Crépin J, George B. Neurosurg Rev. 2010 Jul;33(3):287-94

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