

## Key Points

1. Research has shown that surgery at a young age and extensive laminectomies can lead to cervical instability
2. This would seem to put Chiari II patients at high risk for problems
3. Study looked at children with multi-segment laminectomies
4. Reviewed flexion and extension x-rays to identify signs of instability
5. Found that 5 of 9 children with extensive laminectomies did show instability on x-rays
6. However, none of the children had symptoms associated with instability or required surgical correction for instability
7. Supports previous work which found high rates of radiographic instability, but not clinical
8. Authors questions the value of the radiographic definition of instability

## Definitions

**cervical** - refers to the upper part of the spine, neck region

**Chiari II** - type of Chiari malformation associated with Spina Bifida

**extension** - bending the neck backward

**flexion** - bending the neck forward

**laminectomy** - surgical procedure where part of one or more bony vertebrae are removed

**myelomeningocele** - another term for spina bifida

**Spina Bifida** - neural tube birth defect where the spinal cord does not close properly

**vertebra** - one of the bony segments of the spine

**x-ray** - imaging technology which uses radiation; used to look at

## Cervical Instability w/ Chiari II Surgery Doesn't Cause Problems

**January 31st, 2009** -- As part of most decompression surgeries for Chiari, surgeons will remove part of one or more bony vertebral segments of the spine; the procedure is called a laminectomy. In general, a surgeon will remove bone from the segments which are pressing on the herniated brain tissue. Therefore, while many laminectomies only involve the first segment (C1), a large herniation may require a more extensive laminectomy.

Unfortunately, as bone is removed from more segments, there is a downside. Specifically, surgeons begin to worry about creating instability in the spine, which would need to be corrected through fusion. In a large review of syringomyelia patients, Batzdorf showed that laminectomies beyond C1 can lead to spinal problems. Other research has shown that children may be at risk for developing instability associated with laminectomies. (Note that this is different than the work out of the Chiari Institute, which has shown that a subset of Chiari patients may fail with decompression surgery alone, due to connective tissue issues, and require cervical fusion for stability.)

Given these findings, it would seem logical that children with Chiari II would be at a high risk for cervical instability following Chiari decompression. This is because many patients with Chiari II (which is associated with spina bifida and can involve extensive herniations), undergo surgery as children and require laminectomies well beyond C1 (Figure 1).

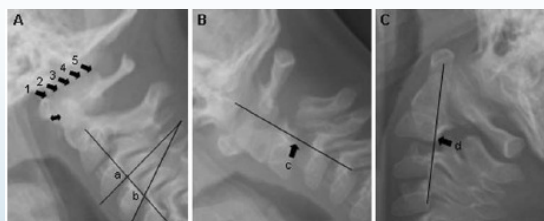
**Figure 1: MRI of Child With Chiari II to C4 Level**



However, in a study published in the January, 2009 issue of the journal, *Child's Nervous System*, a group of Canadian researchers show that the risk to Chiari II patients may actually depend on how you define instability. Specifically, the authors reviewed the medical records of children seen at their Spina Bifida clinic, who had undergone multi-segment laminectomies to treat Chiari II.

They identified nine such children, five boys and four girls. Their average age at the time of surgery was 2 years, and the laminectomies averaged an extensive 4.6 vertebral segments. The post surgical x-rays were examined for signs of instability with the neck bent forward (flexion) and backwards (extension).

**Figure 2: Radiographic Measurements of Instability**



The researches used generally accepted numerical measurements of distances and angles to determine if there was cervical instability (Figure 2). Using this criteria, they found that 5 out of 9 of the children showed cervical instability on the x-rays (Figure 3).

**Figure 3: X-ray of Child With Post-Op Cervical Instability**

bone structure

### Common Chiari Terms

**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

[Cervical spine instability following cervical laminectomies for Chiari II malformation: a retrospective cohort study.](#) Lam FC, Irwin BJ, Poskitt KJ, Steinbok P. Childs Nerv Syst. 2009 Jan;25(1):71-6



However, none of the children - even with instability on x-rays - showed any clinical signs or symptoms of instability. None of the children suffered from neck pain or neurological deficits commonly associated with spinal instability, and perhaps most important, none required surgical fusion to correct the instability (Figure 4).

Although in one sense this result is surprising, it does support earlier research. Specifically, one study found that 19 out of 20 children with extensive laminectomies showed radiographic signs of instability, but none required surgical correction. Given these findings, the authors speculate as to whether the radiographic definition of instability is even meaningful. When reading this, one can not help but think of the similarities to the radiographic definition of Chiari (at least 3mm-5mm) and how it too has been shown to be of limited value.

While this research is good news for Chiari II patients and their families, it is difficult to extend these findings to the general Chiari population. Beyond the very small number of patients involved, it is important to note that many of these children are limited in their activities due to spina bifida and their reduced activity level may be one reason that signs and symptoms of cervical instability have not emerged.

**Figure 4: Characteristics of Chiari II Patients (9 Total)**

Patient	Level of Laminect.	X-ray Instability	Clinical Instab.
1	C1-3	Y	N
2	C1-3	Y	N
3	C1-4	N	N
4	C1-7	N	N
5	C1-6	Y	N
6	C1-4	N	N
7	C1-3	Y	N
8	C1-6	N	N
9	C1-5	Y	N

**Notes:** Level of laminectomy refers to the vertebral segments in the cervical region

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