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## Chiari formation and atlantoaxial instability. Commentary on Minimally Invasive Non-Expansile Tubular Extradural Posterior Fossa Decompression (MINTED Technique) for the management of Chiari I.5 Malformation: Historical Overview of Surgical Techniques, Technical Note, Proof of Concept, Illustrative Case and Case Series. Lesser is Better

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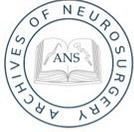
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## **Chiari formation and atlantoaxial instability. Commentary on Minimally Invasive Non-Expansile Tubular Extradural Posterior Fossa Decompression (MINTED Technique) for the management of Chiari I.5 Malformation: Historical Overview of Surgical Techniques, Technical Note, Proof of Concept, Illustrative Case and Case Series. Lesser is Better**

### **Abstract**

The authors have reviewed Chiari formation treatment and have put-forth their personal experience with minimally invasive techniques to perform foramen magnum decompression surgery. Based on the historical review of the subject, the authors have discussed the historical validity of only bone decompression, extra-arachnoidal decompression, and tonsillectomy. The article falls in line with the current minimally invasive surgery wave, a slightly larger cousin of the buttonhole surgery trend. It may be pertinent that I review my understanding of the subject based on the ongoing experience of nearly four decades. In the year 1998, we identified that the posterior fossa volume in cases with basilar invagination associated with Chiari formation is reduced. Accordingly, we suggested that foramen magnum decompression was the treatment. For the first time in literature, we suggested that only bone decompression is necessary and dural opening or decompression is unnecessary. As our understanding of the subject progressed, it was realized that the atlantoaxial joint, which is the most mobile joint of the body, is also most susceptible to developing instability. Chronic atlantoaxial instability is associated with a range of natural protective secondary maneuvers. Musculoskeletal alterations include short neck, torticollis, Klippel-Feil bone fusions, assimilation of atlas and platybasia, and neural alterations include Chiari formation and syringomyelia. Consequently, we preferred to label Chiari 'malformation' as Chiari 'formation.' More importantly, it was identified that all musculoskeletal and neural alterations could return to normalcy after the surgery, which involves only atlantoaxial fixation. We recently reported gratifying surgical results of 388 consecutively treated cases of Chiari formation by atlantoaxial stabilization. The successful conduct of surgery can lead to a cure from the disease. The validity of foramen magnum decompression as a format of treatment will have to be re-evaluated.

## Visual Abstract



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## VISUAL ABSTRACT

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### Chiari formation and atlantoaxial instability

The authors have reviewed Chiari formation treatment and have put forth their personal experience with minimally invasive techniques to perform foramen magnum decompression surgery.

In 1998, for the first time in literature, we suggested that only bone decompression was necessary and dural opening or decompression was unnecessary. As our understanding of the subject progressed, we realized that the atlantoaxial joint is most susceptible to developing instability. More importantly, it was identified that all musculoskeletal and neural alterations could return to normalcy after the surgery, which involves only atlantoaxial fixation.

We recently reported gratifying surgical results of 388 consecutively treated cases of Chiari formation by atlantoaxial stabilization. The successful conduct of surgery can lead to a cure from the disease. The validity of foramen magnum decompression as a format of treatment will have to be re-evaluated.

*Prof. Atul Goel*

### Keywords

Chiari formation, atlantoaxial instability, fixation.

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# Chiari Formation and Atlantoaxial Instability. Commentary on Minimally Invasive Non-expansile Tubular Extradural Posterior Fossa Decompression (MINTED technique) for the Management of Chiari I.5 Malformation: Historical Overview of Surgical Techniques, Technical Note, Proof of Concept, Illustrative Case and Case Series. Lesser is Better

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## Abstract

The authors have reviewed Chiari formation treatment and have put-forth their personal experience with minimally invasive techniques to perform foramen magnum decompression surgery. Based on the historical review of the subject, the authors have discussed the historical validity of only bone decompression, extra-arachnoidal decompression, and tonsillectomy. The article falls in line with the current minimally invasive surgery wave, a slightly larger cousin of the buttonhole surgery trend. It may be pertinent that I review my understanding of the subject based on the ongoing experience of nearly four decades. In the year 1998, we identified that the posterior fossa volume in cases with basilar invagination associated with Chiari formation was reduced. Accordingly, we suggested that foramen magnum decompression was the treatment. For the first time in literature, we suggested that only bone decompression was necessary and dural opening or decompression was unnecessary. As our understanding of the subject progressed, it was realized that the atlantoaxial joint, which is the most mobile joint of the body, is also most susceptible to developing instability. Chronic atlantoaxial instability is associated with a range of natural protective secondary maneuvers. Musculoskeletal alterations include short neck, torticollis, Klippel-Feil bone fusions, assimilation of atlas and platybasia, and neural alterations include Chiari formation and syringomyelia. Consequently, we preferred to label Chiari 'malformation' as Chiari 'formation.' More importantly, it was identified that all musculoskeletal and neural alterations could return to normalcy after the surgery, which involves only atlantoaxial fixation. We recently reported gratifying surgical results of 388 consecutively treated cases of Chiari formation by atlantoaxial stabilization. The successful conduct of surgery can lead to a cure from the disease. The validity of foramen magnum decompression as a format of treatment will have to be re-evaluated.

*Keywords:* Chiari formation, Atlantoaxial instability, Fixation

## 1. Chiari formation and atlantoaxial instability

The authors have reviewed Chiari formation treatment and have put-forth their personal experience with minimally invasive techniques to

perform foramen magnum decompression surgery. Based on a historical review of the subject, the authors have discussed the historical validity of only bone decompression, extra-arachnoidal decompression, and tonsillectomy [1]. The article

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It may be pertinent that I review my personal understanding of the subject based on the ongoing experience of nearly four decades. In the year 1998, we identified that the posterior fossa volume in cases with basilar invagination associated with Chiari formation is reduced. Accordingly, we suggested that foramen magnum decompression was the treatment [2]. For the first time in literature, we suggested that only bone decompression was necessary and dural opening or decompression was unnecessary. As the anomaly was identified as 'fixed' or there was no craniovertebral or atlantoaxial instability, decompression was considered the treatment. In the year 1995, instability was considered in selected cases of Chiari formation, and craniovertebral or atlantoaxial stabilization was included in the treatment [3]. To accomplish the twin tasks of foramen magnum decompression and to facilitate craniovertebral junction fusion, a technique of reverse foramen magnetomy was described [3].

As our understanding of the subject progressed, it was realized that the atlantoaxial joint, which is the most mobile joint of the body, is also most susceptible to developing instability. On the other hand, the occipitoatlantal joint that is the most stable joint of the body is least susceptible to develop instability. The traditional parameter of diagnosing atlantoaxial instability is based on the alteration of atlantodental interval on dynamic imaging and compression of neural structures by the odontoid process. We identified additional parameters to diagnose atlantoaxial instability based on the alignment of facets of atlas and axis on lateral profile imaging and the identification of instability on direct manipulation of bone during surgery [4]. It was observed that atlantoaxial instability occurs even when the atlantodental interval is not abnormally altered and even when there is no compression of the dural tube or neural structures at the craniovertebral junction. We labeled such atlantoaxial instability as axial or central [4,5]. Such instability was seen as a 'common' event associated with chronic or longstanding atlantoaxial instability and presentation by subtle, relentlessly progressive, and eventually disabling clinical symptoms. Chiari formation and basilar invagination are more frequently associated with central or axial atlantoaxial instability [6,7].

Chronic atlantoaxial instability is associated with a range of natural protective secondary maneuvers. Musculoskeletal alterations include short neck,

torticollis, Klippel-Feil bone fusions, assimilation of atlas and platybasia, and neural alterations include Chiari formation and syringomyelia. Our several articles on the subject identify that all these musculoskeletal and neural alterations are secondary and protective and an attempt of the Nature to prevent or minimize the effect of potential or manifest compression of neural structures between bones [6–9]. Consequently, we preferred to label Chiari 'malformation' as Chiari 'formation' and craniovertebral junction 'anomalies' as craniovertebral junction 'alterations' [10]. More importantly, it was identified that all musculoskeletal and neural alterations could return towards normalcy after the surgery that involves only atlantoaxial fixation.

In the year 2013, we identified that atlantoaxial instability is the nodal point of the pathogenesis of Chiari formation, and syringomyelia and atlantoaxial stabilization is the treatment [6]. We recently reported gratifying surgical results of 388 consecutively treated cases of Chiari formation by atlantoaxial stabilization [11].

Atlantoaxial stabilization is a relatively complex technical issue, particularly when it is associated with Chiari formation and syringomyelia. However, the successful conduct of surgery can lead to a cure from the disease. The validity of foramen magnum decompression as a format of treatment will have to be re-evaluated.

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## Declaration of Competing Interest

The author declares no conflict of interests.

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