Letters to the Editor

NEUROSURGICAL FORUM

Durotomy and foramen magnum decompression

TO THE EDITOR: We read with interest the article by Kennedy et al.⁸ (Kennedy BC, Kelly KM, Phan MQ, et al: Outcomes after suboccipital decompression without dural opening in children with Chiari malformation Type I. *J Neurosurg Pediatr* 16:150–158, August 2015). The authors discuss a relatively large series of patients with Chiari malformation Type I (CM-I) who were treated by foramen magnum decompression without resorting to opening of the dura mater. The authors report a positive outcome of symptoms following such a strategy of treatment. They discuss the potential negative issues related to opening the dura and intradural manipulations.

In 1998 we presented a series of 190 patients with basilar invagination.⁶ Of these, 102 patients had CM-I. Twenty-three patients with CM-I were below the age of 21 years. This article was among the first few that related small posterior cranial fossa volume to CM-I. According to my information, this article was among the first in the literature that discussed treatment of CM-I by foramen magnum decompression without opening of the dura. In the series, the dura was not opened even when CM-I was associated with syringomyelia. We also discussed in our subsequent articles that the issue of CM-I and small posterior cranial fossa volume was relevant only in cases with basilar invagination.^{1,5,7,9} Considering the direct relevance to the issue under discussion, the authors should have referenced our work.

In our more recent article, we identified the relationship of CM-I with atlantoaxial instability.³ We hypothesized that a herniated cerebellar tonsil is like “Nature’s air bag” and functions to cushion the craniocervical cord against manifest or potential atlantoaxial instability.⁴ Our analysis identified that the posterior fossa volume is not small in these cases. Moreover, the superior vermis and superior part of the cerebellum are atrophic in these cases, and the concept that the CM-I is a result of the presence of a smaller volume of posterior cranial fossa does not seem to be relevant in these cases. It would have been interesting if the authors had evaluated the posterior fossa volume

and the status of the cerebellum in the cases discussed. After our experience with several patients with CM-I over more than 30 years, we conclude that foramen magnum decompression is necessary only rarely.²

Atul Goel, MCh

King Edward VII Memorial Hospital and Seth G. S. Medical College, Parel, Mumbai, India

DISCLOSURE

The author reports no conflict of interest.

References

1. Goel A: Basilar invagination, Chiari malformation, syringomyelia: a review. *Neurol India* 57:235–246, 2009
2. Goel A: Can foramen magnum decompression surgery become historical? *J Craniovertebr Junction Spine* 6:49–50, 2015
3. Goel A: Is atlantoaxial instability the cause of Chiari malformation? Outcome analysis of 65 patients treated by atlantoaxial fixation. *J Neurosurg Spine* 22:116–127, 2015
4. Goel A: Is Chiari malformation nature’s protective “air-bag”? Is its presence diagnostic of atlantoaxial instability? *J Craniovertebr Junction Spine* 5:107–109, 2014
5. Goel A, Achawal S: The surgical treatment for Chiari malformation associated with atlantoaxial dislocation. *Br J Neurosurg* 9:67–72, 1995
6. Goel A, Bhatjiwale M, Desai K: Basilar invagination: a study based on 190 surgically treated cases. *J Neurosurg* 88:962–968, 1998
7. Goel A, Desai KI: Surgery for syringomyelia: An analysis based on 163 surgical cases. *Acta Neurochir (Wien)* 142:293–302, 2000
8. Kennedy BC, Kelly KM, Phan MQ, Bruce SS, McDowell MM, Anderson RCE, et al: Outcomes after suboccipital decompression without dural opening in children with Chiari malformation Type I. *J Neurosurg Pediatr* 16:150–158, 2015
9. Kothari M, Goel A: Maternalizing the meninges: A pregnant Arabic legacy. *Neurol India* 54:345–346, 2006

Response

We thank Dr. Goel for his interest and comments regarding our recent article. We are very familiar with Dr. Goel’s publications, but did not reference them because

they primarily include adult patients and are neither the first²⁷ nor the largest¹⁴ reports of children undergoing suboccipital decompression without dural opening for CM-I. Furthermore, perhaps in part due to his geographic location, we believe that Dr. Goel has a unique practice, and it is unlikely that the outcomes of his patients would reflect the majority of other patients with CM-I around the world. This notion is supported by the very high percentage of patients in his series presenting with basilar invagination, occipitalization of the atlas, and advanced neurological deficits.¹⁰

Dr. Goel discusses several times in his letter his work investigating the relationship between CM-I and posterior fossa volume, and mentions that it would have been interesting for us to have evaluated the posterior fossa volume in our cases. We chose instead to focus primarily on clinical rather than radiographic outcomes, because the relationship between posterior fossa volume and CM-I has already been extensively investigated and reviewed.^{3,7,8,15,17,21,22,24,25}

Dr. Goel also mentions his recent article in which he states that the “pathogenesis of CM . . . is primarily related to atlantoaxial instability,” that “surgical treatment in these cases should be directed toward atlantoaxial stabilization and segmental arthrodesis,” and that “foramen magnum decompression is not necessary and may be counter-effective in the long run.”¹⁰ Contrary to Dr. Goel’s conclusions, we believe that: 1) there is overwhelming medical evidence supporting suboccipital decompression for children with CM-I, regardless of whether the dura is opened;^{1,2,4–6,9,12–14,16,18,23,26} 2) decompression is accepted by the vast majority of pediatric neurosurgeons across the world;^{11,19,20} and 3) the incidence of immediate or delayed symptomatic atlantoaxial instability in the general pediatric population with CM-I is extremely rare.^{14,16,18,23} Our thoughts are echoed by the experience of many members of the Pediatric Craniocervical Society, which led the Society to write a statement in response to Dr. Goel’s paper that has been published in the *Journal of Neurosurgery: Spine*.²⁸

Last, Dr. Goel hypothesizes that in patients with CM-I, the cerebellar tonsils act as “Nature’s air bag” to “cushion the craniocervical cord.” We did not design our study to support or refute Dr. Goel’s hypothesis. Rather, the primary aim of our study was to report the clinical outcomes after suboccipital decompression without dural opening in children with CM-I, in what is, to our knowledge, the largest reported series in the literature.

Benjamin C. Kennedy, MD¹
Richard C. E. Anderson, MD^{1,2}
Neil A. Feldstein, MD^{1,2}

¹Columbia University, New York, NY

²Children’s Hospital of New York, Columbia University, New York, NY

References

- Alzate JC, Kothbauer KF, Jallo GI, Epstein FJ: Treatment of Chiari I malformation in patients with and without syringomyelia: a consecutive series of 66 cases. **Neurosurg Focus** 11(1):E3, 2001

- Attenello FJ, McGirt MJ, Gathinji M, Datto G, Atiba A, Weingart J, et al: Outcome of Chiari-associated syringomyelia after hindbrain decompression in children: analysis of 49 consecutive cases. **Neurosurgery** 62:1307–1313, 2008
- Badie B, Mendoza D, Batzdorf U: Posterior fossa volume and response to suboccipital decompression in patients with Chiari I malformation. **Neurosurgery** 37:214–218, 1995
- Caldarelli M, Novegno F, Vassimi L, Romani R, Tamburrini G, Di Rocco C: The role of limited posterior fossa craniectomy in the surgical treatment of Chiari malformation Type I: experience with a pediatric series. **J Neurosurg** 106 (3 Suppl):187–195, 2007
- Dure LS, Percy AK, Cheek WR, Laurent JP: Chiari type I malformation in children. **J Pediatr** 115:573–576, 1989
- Ellenbogen RG, Armonda RA, Shaw DW, Winn HR: Toward a rational treatment of Chiari I malformation and syringomyelia. **Neurosurg Focus** 8(3):E6, 2000
- Furtado SV, Reddy K, Hegde AS: Posterior fossa morphometry in symptomatic pediatric and adult Chiari I malformation. **J Clin Neurosci** 16:1449–1454, 2009
- Furtado SV, Thakre DJ, Venkatesh PK, Reddy K, Hegde AS: Morphometric analysis of foramen magnum dimensions and intracranial volume in pediatric Chiari I malformation. **Acta Neurochir (Wien)** 152:221–227, 2010
- Genitori L, Peretta P, Nurisso C, Macinante L, Mussa F: Chiari type I anomalies in children and adolescents: minimally invasive management in a series of 53 cases. **Childs Nerv Syst** 16:707–718, 2000
- Goel A: Is atlantoaxial instability the cause of Chiari malformation? Outcome analysis of 65 patients treated by atlantoaxial fixation. **J Neurosurg Spine** 22:116–127, 2015
- Haroun RI, Guarnieri M, Meadow JJ, Kraut M, Carson BS: Current opinions for the treatment of syringomyelia and Chiari malformations: survey of the Pediatric Section of the American Association of Neurological Surgeons. **Pediatr Neurosurg** 33:311–317, 2000
- Klekamp J: Surgical treatment of Chiari I malformation—analysis of intraoperative findings, complications, and outcome for 371 foramen magnum decompressions. **Neurosurgery** 71:365–380, 2012
- Krieger MD, McComb JG, Levy ML: Toward a simpler surgical management of Chiari I malformation in a pediatric population. **Pediatr Neurosurg** 30:113–121, 1999
- McGirt MJ, Attenello FJ, Atiba A, Garces-Ambrossi G, Datto G, Weingart JD, et al: Symptom recurrence after suboccipital decompression for pediatric Chiari I malformation: analysis of 256 consecutive cases. **Childs Nerv Syst** 24:1333–1339, 2008
- Milhorat TH, Chou MW, Trinidad EM, Kula RW, Mandell M, Wolpert C, et al: Chiari I malformation redefined: clinical and radiographic findings for 364 symptomatic patients. **Neurosurgery** 44:1005–1017, 1999
- Navarro R, Olavarria G, Seshadri R, Gonzales-Portillo G, McLone DG, Tomita T: Surgical results of posterior fossa decompression for patients with Chiari I malformation. **Childs Nerv Syst** 20:349–356, 2004
- Nishikawa M, Sakamoto H, Hakuba A, Nakanishi N, Inoue Y: Pathogenesis of Chiari malformation: a morphometric study of the posterior cranial fossa. **J Neurosurg** 86:40–47, 1997
- Park JK, Gleason PL, Madsen JR, Goumnerova LC, Scott RM: Presentation and management of Chiari I malformation in children. **Pediatr Neurosurg** 26:190–196, 1997
- Rocque BG, George TM, Kestle J, Iskandar BJ: Treatment practices for Chiari malformation type I with syringomyelia: results of a survey of the American Society of Pediatric Neurosurgeons. **J Neurosurg Pediatr** 8:430–437, 2011
- Schijman E, Steinbok P: International survey on the management of Chiari I malformation and syringomyelia. **Childs Nerv Syst** 20:341–348, 2004

21. Sgouros S, Kountouri M, Natarajan K: Posterior fossa volume in children with Chiari malformation Type I. **J Neurosurg** **105** (2 Suppl):101–106, 2006
22. Trigylidas T, Baronia B, Vassilyadi M, Ventureyra EC: Posterior fossa dimension and volume estimates in pediatric patients with Chiari I malformations. **Childs Nerv Syst** **24**:329–336, 2008
23. Tubbs RS, Beckman J, Naftel RP, Chern JJ, Wellons JC III, Rozzelle CJ, et al: Institutional experience with 500 cases of surgically treated pediatric Chiari malformation Type I. **J Neurosurg Pediatr** **7**:248–256, 2011
24. Tubbs RS, Hill M, Loukas M, Shoja MM, Oakes WJ: Volumetric analysis of the posterior cranial fossa in a family with four generations of the Chiari malformation Type I. **J Neurosurg Pediatr** **1**:21–24, 2008
25. Tubbs RS, Wellons JC III, Smyth MD, Bartolucci AA, Blount JP, Oakes WJ, et al: Children with growth hormone deficiency and Chiari I malformation: a morphometric analysis of the posterior cranial fossa. **Pediatr Neurosurg** **38**:324–328, 2003
26. Valentini L, Visintini S, Saletti V, Chiapparini L, Estienne M, Solero CL: Treatment for Chiari 1 malformation (CIM): analysis of a pediatric surgical series. **Neurol Sci** **32** (Suppl 3):S321–S324, 2011
27. Yundt KD, Park TS, Tantuwaya VS, Kaufman BA: Posterior fossa decompression without duraplasty in infants and young children for treatment of Chiari malformation and achondroplasia. **Pediatr Neurosurg** **25**:221–226, 1996
28. Brockmeyer DL, Oakes WJ, Rozzelle C, Johnston J, Rocque BG, Anderson RCE, et al: Chiari malformation Type 1 and atlantoaxial instability: a letter from the Pediatric Cranio-cervical Society. **J Neurosurg Spine** [epub ahead of print September 4, 2015. DOI: 10.3171/2015.3.SPINE15233] (Letter)

INCLUDE WHEN CITING

Published online September 18, 2015; DOI: 10.3171/2015.6.PEDS15339.

©AANS, 2015