


A Balanced Perspective on Surgery of the Craniovertebral Junction



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The craniovertebral junction (CVJ), which encompasses the axis, atlas, and base of the occiput, is the most mobile segment within the spine.¹ The CVJ houses prime real estate, as critical neurological and vascular structures traverse this region. The operative treatment of disorders of the CVJ is challenging and requires a highly nuanced understanding of the complex regional anatomy and biomechanics.^{2,3}

This special issue of *Neurospine* includes articles which address a number of technical and management challenges related to the CVJ, such as endoscopic approaches to address various pathologies, complication avoidance, and the need to assess congenital anatomical variations with careful preoperative planning.

Of particular controversy is Professor Goel's review article and perspective piece. Professor Goel is a recognized pioneer in surgery of the CVJ, having first described the technique of C1–2 fixation with C1 lateral mass and C2 pedicle screws;^{4,5} this was later modified by Harms and Melcher to use polyaxial screws and rods.⁶ Professor Goel's review article is predicated upon a novel theory he has proposed regarding the etiology of Chiari I malformation. His basic contention is that Chiari malformation, syringomyelia, and basilar invagination are secondary phenomena resulting from atlantoaxial instability; and accordingly, the principal treatment for these conditions is C1–2 fixation. Expectedly, this theory has been met with skepticism. Nonetheless, in evaluating such divergent, but potentially transformative, ideas, it is important that our natural cautions and reservations are counterbalanced with open-mindedness; this is how we, as an academic community, can advance science.

There are merits to Professor Goel's assertions. Certainly, there is at least a subset of patients with Chiari malformation, syringomyelia, and/or basilar invagination where atlantoaxial instability is a central etiopathological factor that needs to be addressed. Generally, the cases presented within the review article, in our view, were managed reasonably, with sound indication for C1–2 fixation. Cases 1, 2, and 5 showed overt atlantoaxial instability; there is little to no debate of the merits of C1–2 fixation here. Nonetheless, under our care, we would have treated these patients with (anterior or posterior) decompression in addition to C1–2 fixation. Cases 3 and 4 demonstrated no gross atlantoaxial instability, but there was basilar invagination with ventral compression. We agree with Professor Goel – the rationale for C1–2 fixation in these latter such cases is: (1) the presence of basilar invagination itself may suggest some element of CVJ instability; and (2) the ventral compression may be addressed with reduction and fixation, with or without the use of interarticular spacers for joint distraction.⁷ Direct decompression in such cases can be by transoral resection of the odontoid or posterior fossa decompression; Professor Goel elected to rely upon indirect decompression alone, which is different from our own preference, but also a fair approach.^{8,9}

Where our thoughts diverge with Professor Goel is in the belief that *all* patients with Chi-

ari malformation or syringomyelia should be treated with C1–2 fixation, which we feel is an overly dogmatic approach. In medicine, we seldom deal with 0% and 100% scenarios, and this is no different. The pathologies that affect the CVJ are widely heterogeneous; the proposition that all cases of Chiari malformation, syringomyelia, or basilar invagination are unified by a singular etiology – atlantoaxial instability – and best treated by a single operation – C1–2 fixation – is unlikely, and represents an overly simplistic approach to an immensely complex problem. Rather, treatment decisions should be tailored to the individual patient based on close clinical and radiological evaluation. Patient risk-profile and preferences also need to be weighed – the correct operation for one patient may be incorrect for another patient, despite similarities in clinical presentation and radiological parameters. Clearly, high-quality prospective data are required to address these issues.

While Professor Goel has published a number of personal clinical series in the peer-reviewed literature over the past 5 years to support his views, as for any scientific finding, confidence in the results would be greater if replicated in large prospective, multi-center studies; ultimately, validation is required before such divergent thought can become more mainstream. To that end, there is robust evidence to support the efficacy of posterior fossa decompression in patients with Chiari malformation without basilar invagination or atlantoaxial instability.¹⁰⁻¹² In this subgroup of patients, it is difficult to justify abandoning a safe, effective, and well-established therapy. By contrast, the reality is that C1–2 fixation is not a benign operation and carries material risks, perhaps most notable and feared, vertebral artery injury. It is unnecessary, at best, and irresponsible and unethical, at worst, to subject patients to such risks in the absence of strong clinical evidence.

In summary, close evaluation for the presence of atlantoaxial or occipitocervical instability is an integral component of the assessment of a patient with Chiari malformation – whether we believe atlantoaxial instability here is a cause, effect, or simply an association is perhaps less relevant. A ‘one size fits all’ approach is not appropriate, and we must tailor our therapy to the individual patient. This will entail a C1–2 fixation in a reasonable proportion of patients, but this is not a panacea. For many, perhaps most, patients with Chiari malformation with/without associated syringomyelia, a posterior fossa/foramen magnum decompression with duraplasty will be sufficient in bringing about clinical and anatomical improvement. As surgeons, we

need to remember that sometimes, less is more; high-quality prospective data with objective outcomes assessments are key.

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Title: Friendship
Artist: Pablo Picasso
Year: 1908

Picasso painted *Friendship* in 1908. Executed with great fluency and confidence. It has been interpreted as an image of both lesbian and heterosexual love, but since Picasso concealed the figures' genitals and endowed each with a massive physique of ambiguous gender they were perhaps supposed to be the androgynies of 'primitive' ancestor myths.

More information: <https://www.pablocicasso.org/friendship.jsp>
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