Expert's comment concerning Grand Rounds case entitled “Treatment strategies for severe C1C2 luxation due to congenital os odontoideum causing tetraplegia” (by C. M. Bach, D. Arbab and M. Thaler, doi:10.1007/s00586-012-2329-5)

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Accepted: 7 October 2012 / Published online: 31 October 2012
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Options for craniovertebral stabilization

The authors have treated a complex case having severe craniovertebral deformity and instability [1]. The patient, a 13-year-old girl, presented with progressive quadriparesis. The result of treatment has been good and as they say ‘nothing succeeds like success’. However, I feel that there is a scope of learning a lot more from this case. Obviously, there are several ways to bell a cat.

Craniovertebral junction is the most mobile and most stable regions of the spine. The centre of stability is the C0–C1 joint, whereas the centre for mobility is the C1–C2 joint. Craniovertebral junction instability generally refers to atlantoaxial instability. The authors mention about presence of translatory and vertical dislocation at C1–C2

region. Such a dislocation could have been demonstrated by dynamic CT scan. We perform dynamic CT scan in all our cases where instability of the region is suspected. Simultaneously, we perform CT-angiography to assess the traverse of the vertebral artery in relationship to the lateral masses.

Due to the presence of ‘steel-like’ ligaments in the region, C0–C1 instability is extremely rare. In general, the treatment of atlantoaxial instability is atlantoaxial fixation. Inclusion of occipital bone and subaxial bones in the fixation construct reduces the effectiveness of the stabilization procedure and can cause great limitation in the range of neck movements. The authors mention that there was an irreducible C0–C1 dislocation in the case. However, this does not seem to be convincing.

The subject of os-odontoideum has been extensively discussed. Presence of os-odontoideum indicates strong possibility of instability. However, the need for surgery in such cases will depend on clinical symptoms, association of abnormal mobility on dynamic imaging and presence of cord signal variations on MRI. The surgery of atlantoaxial dislocation have now become so safe that it is better to err in favour of surgery in cases wherever there is any doubt about the presence of instability.

The facets of craniovertebral junction of C0, C1 and C2 are the largest and strongest of all facets of the spine [2, 3]. The facet joints are the centre point or the fulcrum of all movements of the craniovertebral junction. In the preoperative evaluation of status of instability, it is crucial to assess the status of the facets. The presence of articular cavity and smooth articular surface confirm the presence of a functioning joint, even when they are not in alignment. The facets of atlas are like vertebral bodies on both sides of midline. In the presented case, the facet of atlas and facet of axis are remarkably dislocated, the facet of atlas being

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anterior and inferior to the facet of axis. We had earlier labelled such a facet dislocation as ‘spondyloptosis’ of C1 over C2 [4]. In long-standing situation, wherein, due to mal-alignment the facets of atlas and axis are not weight bearing, the facets become relatively osteoporotic and quality of purchase of screw in their substance is not as strong.

There is a frequent mention of term ‘irreducible’ atlantoaxial dislocation. From our experience in the field, this term now needs to be re-evaluated as the anomaly that looks ‘fixed’ or ‘irreducible’ on dynamic images can be surgically reduced in majority of cases. Historically, patients having a basilar invagination (Group A) were also included in the group having irreducible dislocation [5, 6]. The dislocation in these cases also can be surgically reduced. Cases with basilar invagination (Group A) have vertical instability that is more pronounced than translational instability. Mobile and reducible vertical instability, or mobile and reducible basilar invagination, is also occasionally encountered [7]. As authors mention, patients with rheumatoid arthritis (and even tuberculosis of craniovertebral junction) also have vertical instability [8, 9]. Distraction of facets and vertical reduction of dislocation is an effective operation for cases with basilar invagination and basilar impression [5, 6].

The authors have shown an innovative form of traction procedure. Traction is an effective method of reducing the atlantoaxial dislocation, even when it is as severe as in the case in question. Such a form of traction can be included in the armamentarium of surgeons dealing with instability of the craniovertebral junction. The possibility of reducing the dislocation by traction confirms that the dislocation is not ‘irreducible’ and can be reduced. However, a prolonged traction (6 weeks in the presented case) can be difficult for many to tolerate. Preoperative traction test can be a useful evaluation. Clinical and radiological improvement following traction can suggest that the region is unstable and odontoid compression on the spinomedullary cord is reversible, either by transoral surgery or by distraction-fixation of the facets. In the year 1998, we reported our experience with four cases having basilar invagination (Group A), wherein the basilar invagination reduced after cervical traction and posterior occipitocervical fixation was done in the reduced position [5]. However, the reduction could not be sustained by the implant and all four patients ultimately needed transoral decompression.

Currently, we do not give preoperative traction. Traction is given only as an intraoperative manoeuvre essentially to keep the head stable during surgery and to keep the head position ‘floating’ on the head rest to avoid pressure over the face and eyeballs [10, 11]. It appears to us that even heavy and prolonged external traction has only a marginal effect on the craniovertebral junction even when it can put

the entire neck on stretch. On the other hand direct manual (surgical) facet distraction can be an extremely effective way to reduce the dislocation. Such a form of treatment was identified by us as an effective method to treat ‘irreducible’ dislocations, basilar invagination and rotatory dislocation [6, 12–14]. We have labelled such a reduction as ‘craniovertebral realignment’ [15]. Considering this possibility, our indication for transoral surgery for craniovertebral junction anomalies has almost entirely finished. The authors have carried out arch of atlas resection; a procedure that I feel could have been avoided. The surgical procedures of both anterior and posterior muscle-ligament and bone ‘release’ need to be re-evaluated. Facetal realignment is possible even in cases with C1 over C2 spondyloptosis, as in the presented case [4].

Direct joint opening and facet distraction is a formidable surgical procedure, particularly in the presence of ‘irreducible’ dislocation and in the presence of basilar invagination. The presence of a large venous plexus in the lateral gutter makes the procedure difficult and tedious. C2 ganglion resection is mandatory in such cases to facilitate exposure of the joint and the facets [16]. Despite the formidable surgical–technical difficulties, the possibility of opening up of the joint, wide removal of the articular cartilage and manipulation of the facets presents a new dimension to the treatment of craniovertebral junction instability. Placement of bone graft within the articular cavity provides remarkable stability to the construct and a large area for bone fusion. We have earlier discussed the possibility of placement of metal spacers within the articular joint cavity to assist in distraction [17, 18]. The indications of placement of spacers need to be carefully evaluated.

Conflict of interest None.

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