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Surgical consideration in posterior C1-2 instrumentation in case of vertebral artery anomaly

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ABSTRACT

Anatomical variations in the course of the vertebral artery have been previously described in the literature. Generally, these predictable patterns of variations commonly observed in lower cervical vertebral artery anatomy and less commonly described for upper cervical vertebral artery anatomy. Due to presence of these variations, treatment options for upper cervical spine pathology may be influenced and sometimes prevent commonly performed stabilization procedures. Herein author presented a case of vertebral artery anatomic variation at the craniovertebral junction and management option for such variations.

Keywords
vertebral artery anomaly, cervico-vertebral junction, cervical stabilization

INTRODUCTION

Steady advances have been made in fixation of an unstable atlantoaxial complex over the last century. There are many options for fixation of the atlantoaxial complex like posterior clamps or wiring techniques, C1-C2 transarticular screw fixation, posterior C1 lateral mass screw with C2 pars or pedicle screw fixation, and anterior transoral C1 lateral mass to C2 vertebral body fixation[1].

Advantage of the C1-2 screw technique is that it can completely obliterate rotational, flexion or extension motion of the atlantoaxial joint. However, the disadvantages of this technique are the steep learning curve and risk of serious complications like injury to spinal cord, hypoglossal nerve or vertebral artery laceration. To avoid these complications, pre-operative computerized tomography (CT) scanning of the cervical spine is necessary. This is mainly to identify an anomalous vertebral artery course, bony status of the intended site of screw fixation, or unacceptably small C2 pars[1].

To minimize the risk of vertebral artery injury, screw placement should be done only if the preoperative CT scan confirms the normal anatomic position of the vessel. If aberrant vessel present on unilateral side then screw placement should be done on normal side. If vertebral artery injury occurred during screw placement, then screw placement

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should be done to tamponade the bleeding and contralateral screw placement should be avoided in order to prevent the risk of bilateral vertebral artery injury[1,2].

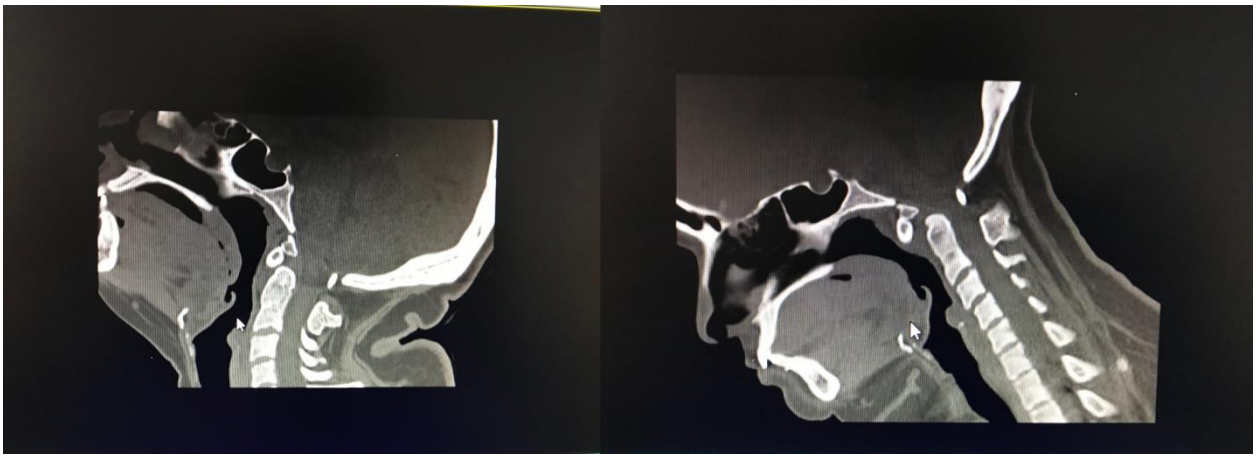
Herein we presented a case of type 2 vertebral artery anomaly which was managed by placing C1 lateral mass and C2 translaminar screw on normal side and sublaminar wiring on abnormal side.

Case report

16 years old male admitted in Neurosurgery department with chief complaints of heaviness in neck and weakness in all four limbs for 4 months. On examination, his power was 4/5 in all four limbs as per MRC (Medical Research Council) grading. Tone was increased in all four limbs and hyperreflexia was present. Bladder- bowel was normal. Magnetic resonance imaging (MRI) cervical spine showed compression over cervicomedullary junction with hyperintense signals in cord (Image 1). Dynamic CT of craniovertebral (CV) junction showed reducible atlantoaxial dislocation (AAD) with os odontoidum (Image 2). MRI angiogram neck showed anomalous origin of left posterior inferior cerebellar artery (PICA) at C1-C2 level and intradural entry from left side at C1-2 interlaminal space (Image 3). Thus preventing safe placement of C1 and C2 screw from left side. To minimize the risk of vertebral artery injury, we placed C1 lateral mass screw (40x34mm) and C2 translaminar screw (35x28 mm) (C2C system) on right side and sublaminar wiring with iliac crest graft on left side (Image 4). Patient tolerated the procedure well and showed improvement.

Image 1: Preoperative MRI cervical spine showed compression over cervicomedullary junction with hyperintense signals in cord.

Image 2: Dynamic CT of craniovertebral junction showed reducible atlantoaxial dislocation (AAD) with os odontoidum.



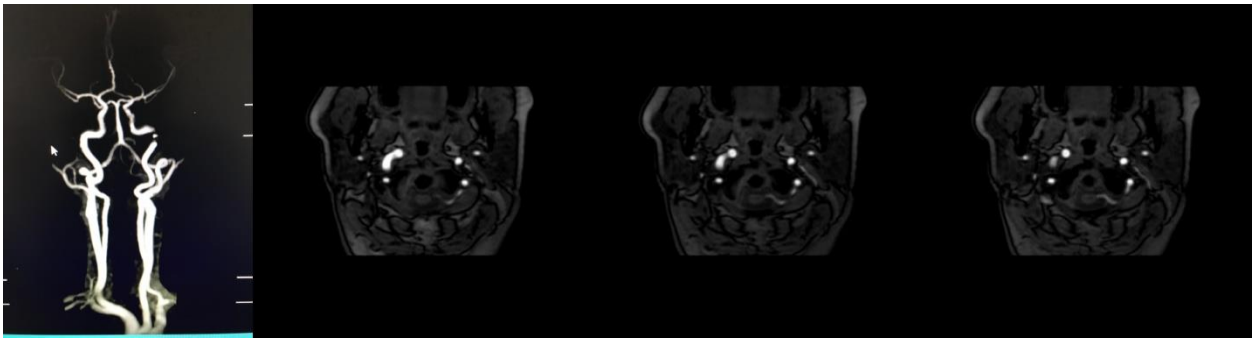


Image 3: MRI angiogram neck showed anomalous origin of left posterior inferior cerebellar artery (PICA) at C1-C2 level and intradural entry from left side at C1-2 interlaminal space.

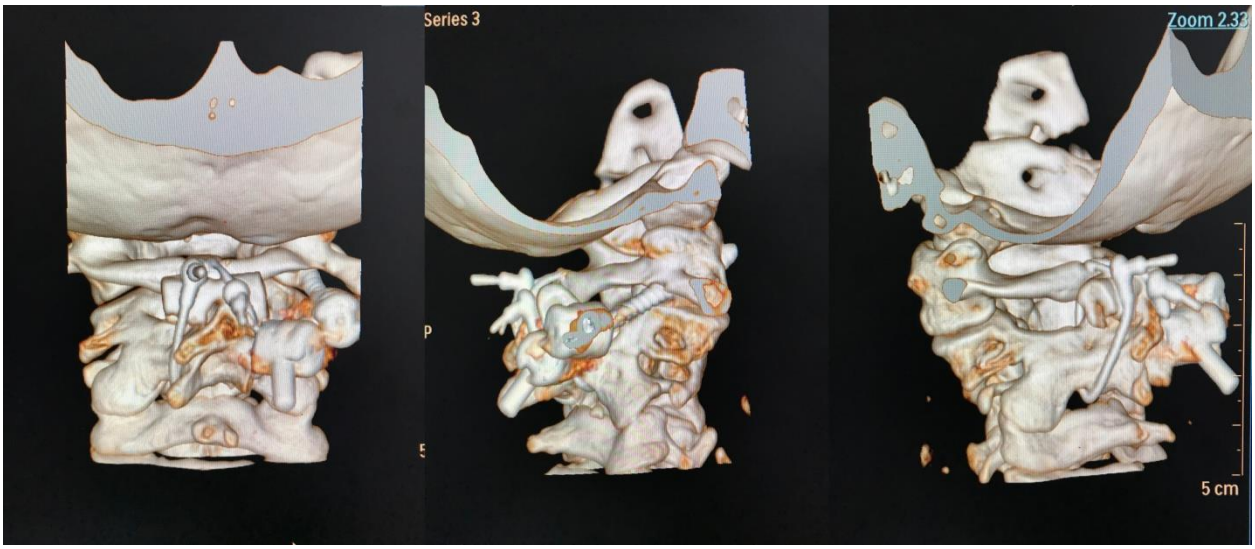


Image 4: C1 lateral mass & C2 translaminar screw on right side and sublaminar wiring with iliac crest graft on left side.

Discussion

The presence of vertebral artery variation at the craniovertebral junction may influence treatment options so it should be identified preoperatively. This helps the surgeons for planning of surgery and minimizes the risk to the vertebral artery injury[3].

Three types of vertebral artery variation at the craniovertebral junction have been described in the literature. The most common variant is a persistent first intersegmental artery (FIA), in this the aberrant vertebral artery have taken an anomalous course and enter the spinal canal between C1 and C2 and the normal vertebral artery branch is absent. It found in 3.2% of patients. The second most common variation is an extracranial C1/2 origin of the posterior inferior cerebellar artery (PICA). It present in 1.1% of patients. In this variant, the FIA continues to the PICA without reuniting with the vertebral artery. The third variant is fenestration of the vertebral artery and it is also the least common variant. It presents in 0.9% of patients. All 3 of those variants could have an effect on screw placement because the abnormal vertebral artery passes directly dorsal to the C1 lateral mass. Other less common variants have been described but are beyond the scope of this article [3,4,5].

There is no algorithm for surgical consideration in posterior C1-2 instrumentation in case of vertebral artery anomaly. Only few case reports are available in the literature. Hong JT et al used as C1 superior lateral mass as an entry point in case of type 1 vertebral artery anomaly [5]. Abtahi AM et al performed occiput-C3 fusion in case of type 1 vertebral artery anomaly [6]. Yamazaki M performed

occiput - C2 fusion in case of type 3 (fenestration of vertebra artery) vertebral artery anomaly [7]. Song et al in his case series conclude that unilateral C1-2 facet screw fixation with interspinous bone graft wiring is an excellent alternative in the treatment of atlantoaxial instability when bilateral screw fixation is contraindicated. But in his case series there was no vertebral artery anomaly presents [8]. In our case there was type 2 vertebral artery anomaly on left side so C1 lateral mass and C2 translaminar screw insertion was done from right side and sublaminar wiring with iliac crest graft from left side.

There are multiple reports of injury to the vertebral artery during anterior cervical decompression surgery exist in the literature. Five studies reported rates of 0.10 to 1.96%, depending on the type of anterior cervical spine procedure. There is paucity of literature with respect to vertebral artery injury associated with a posterior cervical surgical exposure. Molinari et al recently reported vertebral artery injury in two cases involving a persistent first intersegmental artery in the region of C1–C2. Both injuries were occurred with routine posterior exposure of the C1–C2 anatomy [8,9,10].

Conclusion

This particular vertebral artery anomaly produces great risk to the conventional placement of C1 lateral mass screws through previously described techniques. These anomalies can be identified preoperatively by computed tomography angiography.

To minimize the risk of complications, thorough assessment of the vascular anatomy is recommended before operative intervention in the upper cervical spine pathology.

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