

Technical Notes & Surgical Techniques

Axial osteochondroma causing myelopathy – A technical note and discussion on atlantoaxial fusion following C2 laminectomy



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ARTICLE INFO

Keywords:

Osteochondroma
Laminectomy
Atlantoaxial fusion

ABSTRACT

Osteochondromas are one of the commonest benign bone tumours, but are rarely found in the spine. Cord compression due to these lesions is even rarer. We describe a case of a C2 lamina osteochondroma causing cord compression in a 20 year old patient who presented with progressive myelopathy. We report on the technical aspects of the operation which resulted in a good decompression and complete excision. Post-operatively the patient made an uncomplicated recovery. We recommend spinal cord monitoring as routine for such procedures. However, whether or not fusion is necessary following a C2 laminectomy is unclear. Given the unique nature of the atlantoaxial joint, we elected to do this, but the literature is uncertain on the biomechanical aspects of this subject. Biomechanical data exists on single and multi-level subaxial laminectomies, but we argue that dedicated studies into post C2 laminectomy biomechanics should be undertaken.

1. Introduction

Osteochondromas account for nearly 30–50% of benign bone tumours, however they rarely arise from the spine [1,2]. Spinal involvement is between 1 and 4% of all osteochondromas with 56% being in the cervical spine [1–3]. Several cases of cervical osteochondromas have been reported over the years with common presentations including pain and progressive myelopathy, while rarer presentations include vertebral artery occlusion and dysphagia [1,4–10]. Here we describe a case report of an axial osteochondroma and describe our operative management with further discussion into the utility of C1/C2 fusion following a C2 laminectomy.

2. Case report

We describe a case of a 20 year old normally fit and well male who sustained a neck injury 5 years prior to presentation following a fall while playing on the monkey bars. He complained of pain and numbness in arms and legs since, although this was not initially investigated. His symptoms gradually worsened over the subsequent 1 to 2 years leading to his GP arranging an outpatient MRI scan. Following the MRI scan findings (Fig. 1 a/b), he was sent immediately to his local hospital from where was referred to our neurosurgical unit.

On arrival he additionally reported stiffness in his limbs worse on the left side associated with progressive difficulty walking. He was

found to have MRC grade 5/5 power in all four limbs with generally brisk reflexes associated with clonus of the left leg. On gait examination, he objectively had a normal tandem gait and a negative Romberg's test.

A CT of his cervical spine was conducted as part of pre-operative planning (Fig. 2a/b).

3. Technical note

A C2 laminectomy with complete excision of the osseous lesion and C1/2 posterior instrumented fusion was undertaken. The aim was diagnosis and removal of the lesion to alleviate the myelopathic symptoms. It was decided that due to the location of the lesion, spinal cord monitoring in the form of muscle evoked potentials (MEPs) and somatosensory evoked potentials (SSEPs) should be utilised for safety intra-operatively. Unfortunately, after positioning the patient, the left sided MEP's were not present. The decision was made to wake patient and assess him clinically. No motor deficit was found and following a discussion with the patient and parents, it was decided to proceed with surgery. Prior to re-anaesthetising the patient he was clinically assessed while awake in flexion and extension. Following the 2nd anaesthetic, the left sided MEPs were once again absent and the decision was made to respond to the right sided MEPs which were good.

The patient was positioned prone with head fixation in a Sugita frame. Following standard prep and drape, a midline incision and

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<https://doi.org/10.1016/j.inat.2018.12.003>

Received 4 July 2018; Received in revised form 21 November 2018; Accepted 9 December 2018

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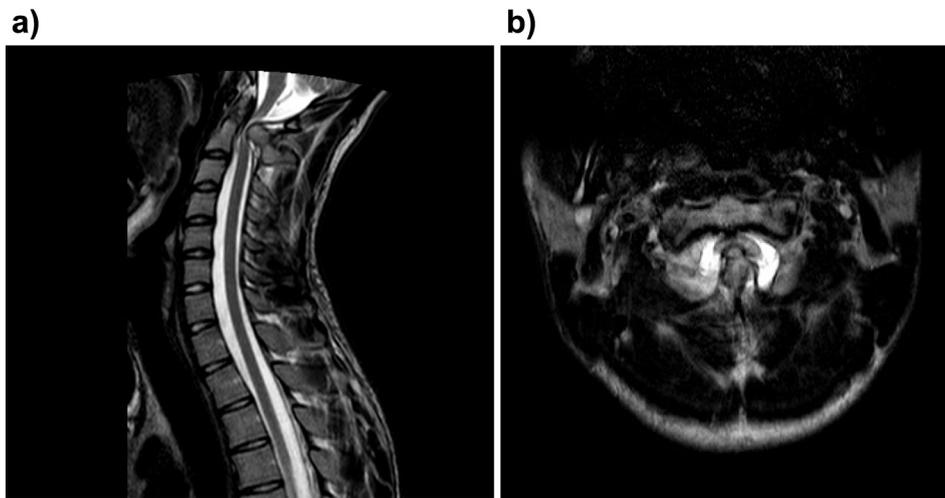


Fig. 1. a/b – T2 sagittal and axial images showing the lesion arising from the posterior aspect of C2 causing cord compression with signal change.

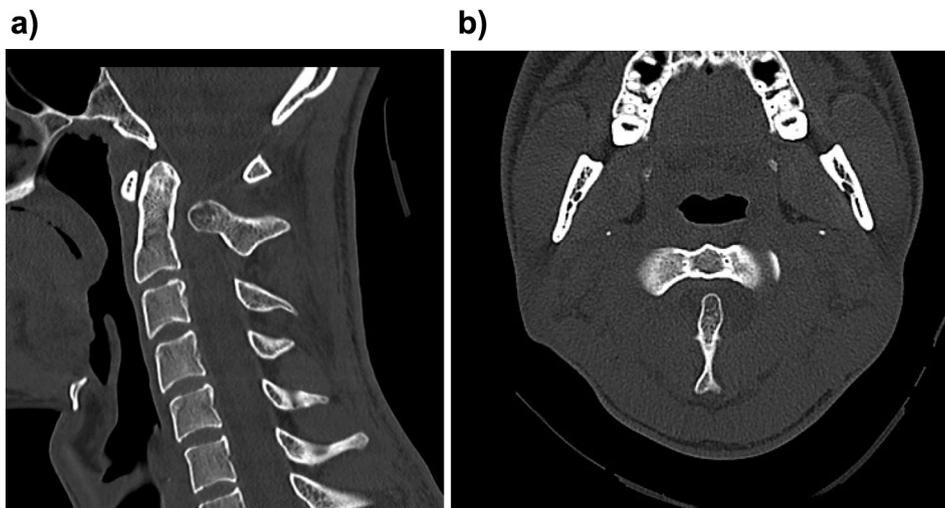


Fig. 2. a/b – CT Cervical spine sagittal and axial images showing the compressive lesion arising from the posterior aspect of C2.



Fig. 3. The osseous lesion excised en bloc following the C2 laminectomy (Arrow – Cartilage Cap).

posterior approach was performed. Exposure was gained via a midline avascular and subperiosteal dissection from foramen magnum to C3. The C2 laminectomy was performed using a combination of a 4 mm burr, microscope and 1 mm upcuts. The extradural lesion was identified

and was resected in its entirety and sent for histology (Fig. 3). As the lesion was completely extradural and not adherent to the surrounding structures, the cartilage cap did not need to be dissected out and was easily excised along with the tumour during the laminectomy. The cord which was flattened was then noted to bulge back. There was no CSF leak.

For the fusion, the C1/2 and C2/3 joints bilaterally were dissected and the lateral masses of C1 were exposed. A 1.5 mm matchstick burr was used to carefully decorticate the C1/2 joint. Smooth shank screws (28 × 3.5) were inserted into C1 and polyaxial pars screws (26 × 4mm) were inserted into C2 under direct vision. After confirmation of position with Xrays, titanium rods were contoured and secured and subsequently autologous bone (from the laminectomy) together with synthetic bone graft were inserted lateral to the instrumentation to assist fusion at the joint (Fig. 4).

After haemostasis, a Lo Vac drain was inserted and the wound closed in layers. All SSEPs/MEPs remained stable throughout procedure and as per baseline at the end. Post-operative CT images were obtained (Fig. 5a/b).

The patient woke from the procedure with no deficits and reported sensation in his fingers slowly returning. He was discharged home a few days later with no complications and at his follow up he was walking independently, with resolved upper limb sensations. However, he still had occasional upper limb tingling and persistent brisk reflexes. A post-



Fig. 4. Intra-operative image following C2 laminectomy and atlantoaxial fusion.

op MRI showed good decompression (Fig. 6a/b), but ongoing cord signal change, for which he is under ongoing follow up. The histology later came back as a benign osteochondroma with no atypical features.

4. Discussion

In our case, compressive myelopathy was the main presenting feature which improved following complete excision of the lesion via a C2 laminectomy. The atlantoaxial fusion technique we employed was the previously described Goel-Harm's technique [11,12]. Prior to the operation, we debated whether or not to perform an atlantoaxial fusion following the laminectomy, but could find no clear literature to guide us on this. Indications for C1/2 fusion include any cause of atlantoaxial instability which includes trauma, destructive tumours, inflammation and congenital malformations [13–15].

A 2014 biomechanical study by Kode et al. used computer modelling software to simulate a C3-C6 laminectomy and then demonstrated nearly a 57% increase in flexion compared to an intact spine with associated increased annular stress at the operated levels [16]. A 2009 cadaveric study on multi-level laminectomy also showed a 14% increase in range of motion, specifically in flexion/extension following laminectomy [17]. Additionally there are some computational studies of single level sub-axial laminectomies (specifically C5) that report increased disc stresses and significantly increased adjacent segment motion on flexion/extension [18,19]. Another consideration is the

disruption of soft tissues such as musculature and ligaments as part of the laminectomy procedure, which confer additional stability to the intact spine [20].

The increased range of motion post cervical laminectomy without fusion is concerning for the loss of normal cervical lordosis, subluxation and the development of post-operative kyphosis [21–24]. It has been recommended for multi-level laminectomies that fusion is considered to prevent kyphosis with subsequent neurological compromise due to disruption of the posterior tension band and increased vertebral stresses [22,23]. It has been suggested that fusion is considered if patients are young with few comorbidities, and with less than 10 degrees of cervical lordosis [23]. It has been argued that in older patients with several comorbidities that laminectomy alone may be sufficient especially if the facets have not been involved in the resection [23,25]. Degrees of facet resection ranging from as little as 25% to 50% during a laminectomy have been linked to increasing risk of instability [18,19,23,24].

Despite this biomechanical data, we could not find any data on the biomechanical implications of a C2 laminectomy in isolation. Considering that 50% of the rotational movement in the cervical spine occurs at the C1/C2 level, the biomechanical implications cannot be readily extrapolated from sub-axial biomechanical studies [15,26]. There was only one 1989 study by Katsumi et al., that we identified that specifically referred to C2 laminectomy being an additional risk factor for instability, however only in relation to 7 cases of post multi-level laminectomy instability [27]. That study also quoted younger age, pre-operative kyphosis, more than 4 level laminectomy and destruction of facet joints as other risk factors [27].

Looking specifically at the literature for osteochondromas, a recent case series by Yakkanti et al. described several cases of cervical osteochondroma including a lesion causing myelopathy that needed a vertebrectomy and posterior fixation, although this was a subaxial lesion [28]. Their literature review, however, did reference several C2 lesions similar to ours that were operated. Among the cases included Kouwenhoven et al. who describe a case that they treated with a C1–2 laminectomy, which was not subsequently fused [29]. Their rationale was that the facets were left intact so posterior fixation was not necessary. Similarly, Gille et al. and Zinna et al. describe cases treated with C2 laminectomies without fusion [30,31]. It would be interesting to know what the long term outcomes of these patients were and whether they went on to develop any kyphotic deformity. Our patient was young and while we did not do a facetectomy, the facet joints were intentionally entered as part of the fusion procedure. Due to his age, we felt he would be at risk of instability or post-operative kyphosis in the future and elected to fuse him to prevent this.

Fusion itself comes with its own disadvantages, which include

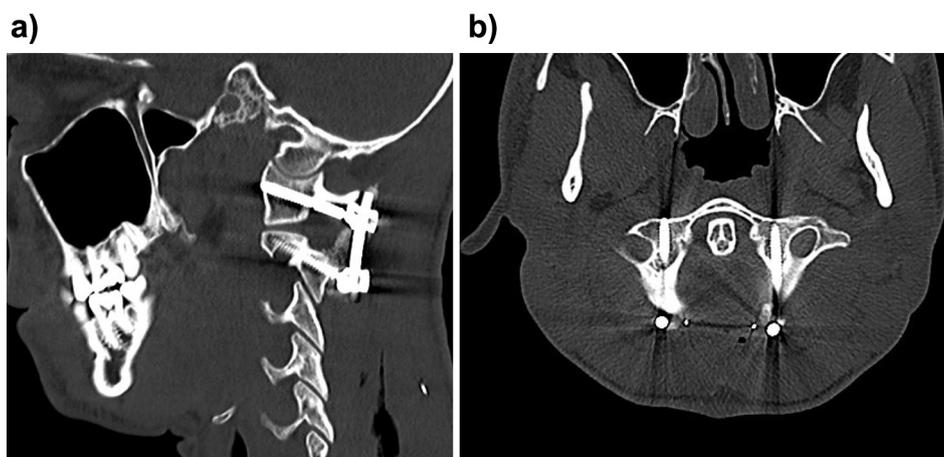


Fig. 5. a/b – Post-operative sagittal and axial CT images of the C spine showing the fusion construct.

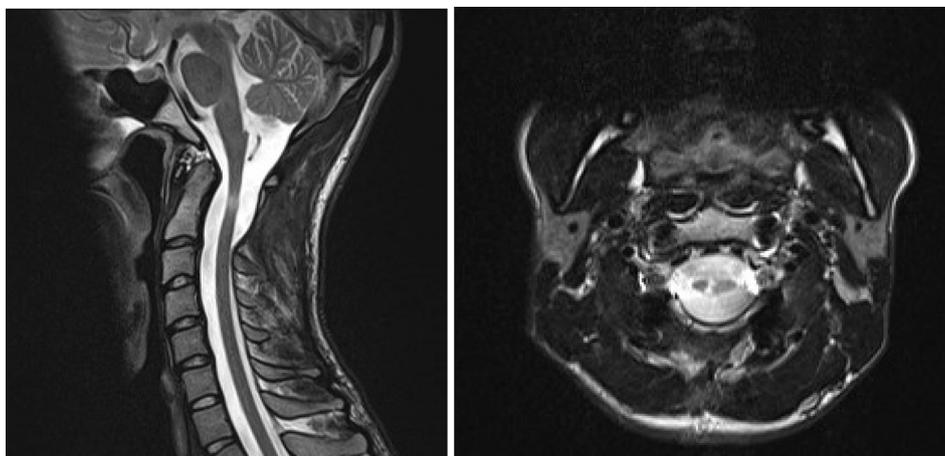


Fig. 6. a/b – Post-operative sagittal and axial MRI images of the C spine showing some residual cord signal change.

longer operation time, increased blood loss, instrumentation complications (e.g. vertebral artery injury) and adjacent segment disease [22,23,32]. Therefore, we believe that it would be helpful to have some evidence that addresses whether single level C2 laminectomies require subsequent fusion and if so, in which patient groups.

5. Conclusions

This interesting case is by no way unique despite its rarity. However, the questions it raises do not appear to have been discussed previously in the literature. While we recommend spinal cord monitoring as routine for such operations, we also posit that atlantoaxial fusion following a C2 laminectomy may be beneficial due to the dynamic instability that may occur following operative intervention. However, there is no clear evidence for this and we suggest that further biomechanical studies are done on this question to illuminate the topic further.

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