



Spine surgery education

Unilateral biportal endoscopic supralaminar, posterior spinous process sparing approach for en bloc cervical laminectomy in case of cervical osteochondroma causing myelopathy: A case report

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ABSTRACT

Background Context: Cervical osteochondroma is a rare cause of myelopathy. Traditional treatment is open laminectomy with or without fusion. There is limited literature on unilateral bi-portal endoscopic en-bloc resection of cervical osteochondroma.

Study Design: We describe a case of a 39-year-old male diagnosed with cervical compressive myelopathy. The pathologic site is located on the ventral surface of C4 lamina. Herein we describe a step-by-step method of unilateral biportal endoscopy (UBE) en-bloc resection of extra-dural sublamina osteochondroma for patient who had cervical myeloradiculopathy. Spinous process sparing osteotomy was performed to conserve the spinous process and supraspinous ligament.

Outcome Measures: The patient was successfully treated via UBE and the operative time was 50 minutes with no intra-operative complications. Patient symptoms improved in the immediate postoperative period and by 3 months he regained fine motor functions of hand.

Conclusions: Unilateral biportal endoscopic en bloc cervical laminectomy can effectively decompress cervical spine and remove posterior benign cervical tumor. UBE preserves musculature and posterior ligamentous complex and thus reduces postoperative neck pain and postlaminectomy kyphosis.

Introduction

With the advancement of minimally invasive spine surgery endoscopic techniques have become common for treating diseases of the spine [1]. Indications for unilateral biportal endoscopy (UBE) have recently expanded to cervical degenerative pathologies, spinal tumors, spinal canal stenosis [2–4]. Compressive myelopathy occurs from compression of cervical spinal cord and its causes are cervical disc herniation, osteophytes, spinal osteochondroma, extradural mass, ossified ligamentum flavum, and ossified posterior longitudinal ligament [5,6]. Meticulous diagnosis is important in deciding the approach of surgery.

We classify dorsal compressive extradural spinal cord benign lesions suitable for UBE decompression by: (1) lesion ventral to the ligamen-

tum flavum epidural lesion, (2) at the ligamentum flavum, (3a) at the lamina lateral sided, (3b) at the lamina medial sided, (4) dorsal to lamina.

The posterior ligamentous complex (PLC) which comprises of the ligamentum flavum, supraspinous ligaments, interspinous ligaments, and the facet capsules play a pivotal role in cervical spine stability [7,8]. Removal of these ligaments leads to instability during flexion [9]. Osteochondroma is the most common benign bone tumor of spine [10]. There is very limited literature on use of UBE in cervical bony tumors. We describe the technique of unilateral biportal endoscopic supralaminar approach posterior spinous process sparing en bloc cervical laminectomy removal of sublamina osteochondroma which allowed us to spare tip of the spinous process maintaining the posterior tension band like a suspension bridge.

FDA device/drug status: Not applicable.

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Clinical presentation

Thirty-nine year old male presented to us with history of neck pain and left upper limb radiculopathy since 6 months. He also complained of loss of hand dexterity and his other clinical signs (Ankle clonus present, plantar reflex upgoing) were suggestive of cervical compressive myelofasciopathy (mJOA score- 11). His MRI and CT scan showed dorsal extradural compression at C4 level with myelomalacia and the lesion being located at medial part of the lamina on its ventral aspect (Fig. 2)

Description of technique

Anesthesia and positioning and skin marking

Patient was positioned prone on a radiolucent table with Mayfield clamp. Procedure was done under general anesthesia with neuromonitoring. The surgeon stood on the left, the same side of the lesion. The midline, upper, and lower border of C4 lamina were marked with a marker with the help of a wire under fluoroscopic guidance. Two skin incisions were planned at upper and lower border of C4 lamina on the left side at medial pedicle line, 2 cm apart. Intraoperative fluoroscopy guided two needles were inserted along the intended direction of the working and endoscopic portals to confirm trajectory (Fig. 3A, B-G).

Creation of endoscopic and working portals with their triangulation

Chief surgeon is right handed, hence the cranial portal viewing portal and caudal working portal (Fig. 3E, F-H) with two 8 mm incisions were made at the needle docking sites to triangulate instrument at spinolaminar junction of C4. Triangulation was confirmed again under fluoroscopy (Fig. 3C, D). Using a 0° endoscope and continuous saline irrigation is essential part of the procedure. We used biportal endoscopic spine surgery set and Bonss radiofrequency plasma surgical systems for radiofrequency ablation (Bonss Medical, Jiangsu, China) along with high-speed diamond burr for surgery.

Ipsilateral laminectomy

Anatomical landmarks were identified by clearing the soft tissues using radiofrequency ablator. With the help of burr lamina was thinned out medial to lamino-facet junction on the left side (Fig. 4A). C-arm was used to confirm the burr tip position (Fig. 3E). Laminectomy was completed using Kerrison Rongeur (Fig. 4B).

Osteotomy of spinous process

With the help of burr osteotomy was performed below the tip of spinous process (Fig 4C). Then the osteotomized part of the tip of spinous process was flipped to the right side. Sparing the attachments at the tip of spinous process is essential part of the procedure.

Supralaminar approach to contralateral laminectomy

Osteotomy of the spinous process created space for burr to reach contralateral side. In the same manner as left side right side lamina was thinned out with the burr and laminectomy was performed with Kerrison Rongeur (Fig 4D).

En bloc excision of lamina with the lesion and dural decompression

With the help of penfield dissector space was created between the lamina and ligamentum flavum both cranially and caudally. Kerrison Rongeur was used to detach flavum from the superior and inferior borders of C4 lamina. With the help of pituitary forceps entire lesion was removed en bloc (Fig 4I). Dural decompression was confirmed under the endoscope (Fig 4E). Adequate hemostasis was achieved with the

help of radiofrequency ablation (Fig 4F). Achieving adequate margins around the lesion is mandatory for this technique which was done preoperatively by determining the anatomical landmark of osteochondroma in relation ipsilateral pedicle as well as whether it is crossing the midline. Intraoperatively anatomical margin of medial border of ipsilateral pedicle is marked with the help of fluoroscopy. Under endoscopic vision lateral margin of resection was aided by superior articular process tip ipsilateral side and medial by ligamentum flavum cleft. Superior and inferior margins of resection were aided by ligamentum flavum drop-off of C3–C4 and C4–C5 respectively.

Confirmation of adequate decompression by CT and MRI

CT scan and MRI done postoperatively shows (Fig. 5) complete removal of the lesion and adequate decompression. The tip of the spinous process was seen preserved which maintains the integrity of PLC. Fig. 1B–F shows schematic diagram of the entire procedure discussed above.

Outcome

The operation lasted 50 minutes and intraoperative blood loss was very minimal. There were no intraoperative complications and his pain in the neck and upper extremities decreased from VAS 8 to VAS 1 immediately. There were no wound healing issues. Histopathology report confirmed the diagnosis of benign osteochondroma which was then conveyed to the patient. At 3 months his mJOA score was 17 out of 18 and he was doing independently all the activities of daily routine.

Discussion

There is limited literature on application of UBE in cervical tumors. Previous study by Kim et al [4] reported use of UBE for extra-dural tumor in lumbar spine. We applied the same technique to cervical spine. En bloc removal of lesions is recommended which cause extra-dural spinal compression. Open surgery inevitably leads to stripping of soft tissues and increased chances of post-operative neck pain. Studies have shown that laminectomy per se does not cause post-operative kyphosis but damage to other vital structures like muscles and facet joints [11]. Muscle sparing technique also maintains the sagittal balance post-operatively [12]. Endoscopic spine surgery has advantages of less muscle stripping, shorter hospital stay and less postoperative neck pain. Compared with uniportal, biportal technique allows greater freedom of movement for the instruments and easy bone removal [13]. After lumbo-sacral spine endoscopy is gradually expanding its indications in cervical spine. Jung et al had favorable results with UBE in cases of cervical disc herniation [13]. High-definition imaging system allows easier identification of anatomical structures and reduces the inadvertent iatrogenic dural injury. We recommend use of UBE for extradural compression of spinal cord caused by ligamentum flavum or a bony lesion. All posterior based benign pathologies causing extradural compression in cervical spine can be treated by UBE.

There are two approaches in UBE for cervical spine, the supralaminar approach in which lamina is removed en bloc sparing the spinous process and the sublaminar approach in which we perform unilateral laminotomy and over the top decompression on contralateral side to remove ligamentum flavum. If the lesion is involving lateral lamina we should do hemi-laminectomy and conserve contralateral structures. A full laminectomy is recommended for medial or central lamina lesions. For such lesions supralaminar approach can be used to prevent intralesional excision. For lesions at the ligamentum flavum en bloc resection should be done by a sublaminar approach. Extra-dural lesions ventral to the ligamentum flavum can be approached by either UBE approaches. For intradural dural tumors UBE is performed with dural repair [14]. UBE is not recommended for intramedullary tumors or sub-

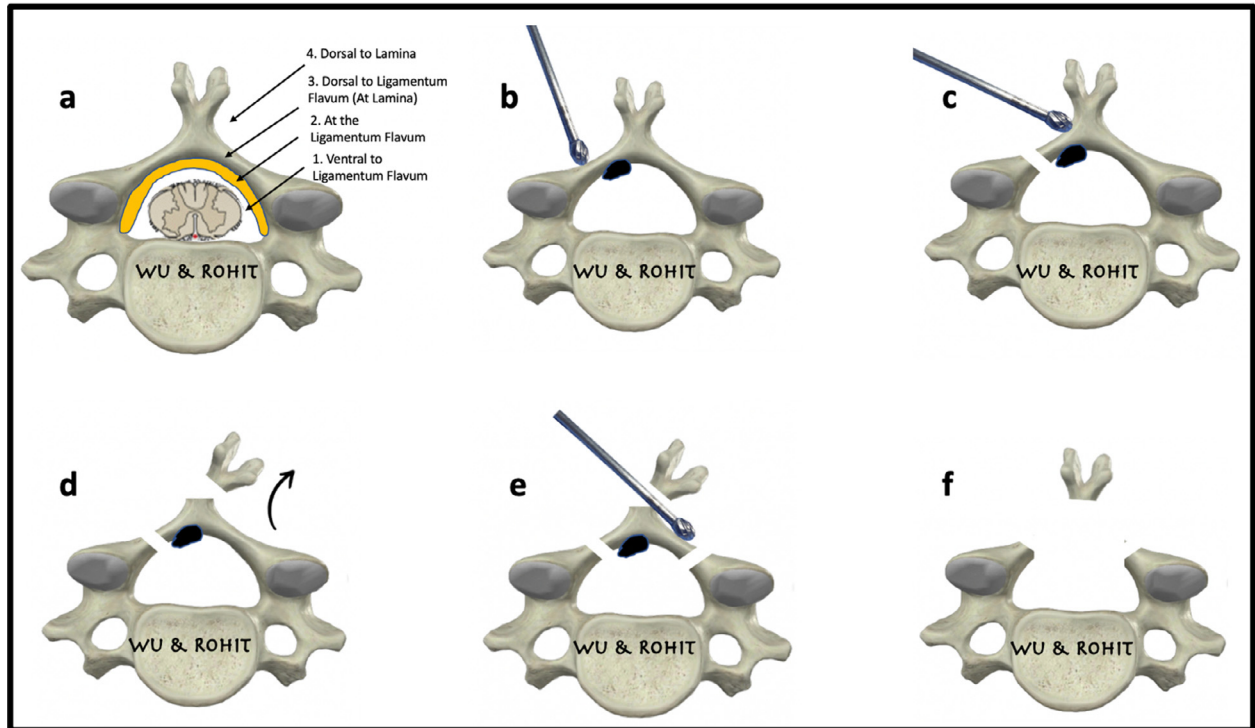


Fig. 1. Schematic diagram to show (A) diagram to classify location of the lesion causing extra-dural compression (B) ipsilateral laminectomy, (C) drilling below tip of spinous process (D) reflecting spinous process towards opposite side (E) contralateral laminectomy (F) en bloc removal of lesion.

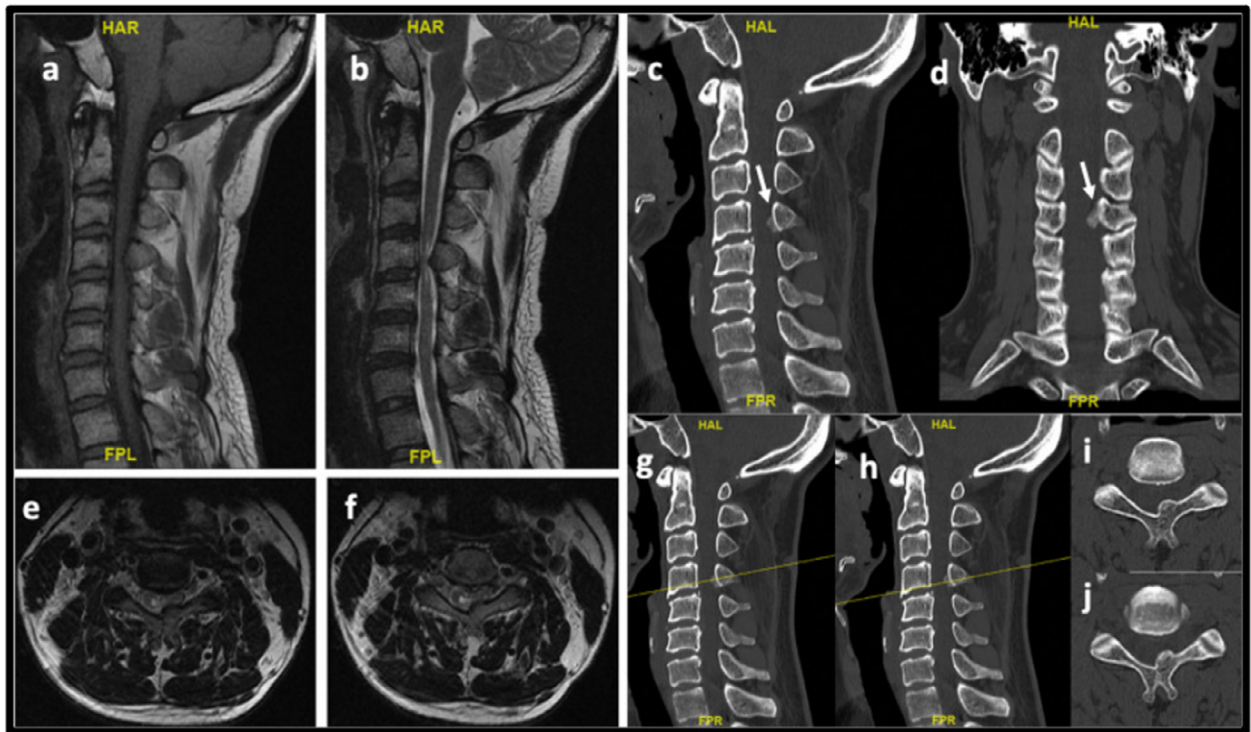


Fig. 2. MRI images showing extra dural cord compression due to C4 osteochondroma (A) T1 Sagittal (B) T2 Sagittal (E) and (F) subsequent axial images at pathological level. Preoperative CT scan showing osteochondroma at ventral surface of C4 (C) Sagittal (D) Coronal (G) line to indicate axial level (I), (H) line to indicate axial level (J).

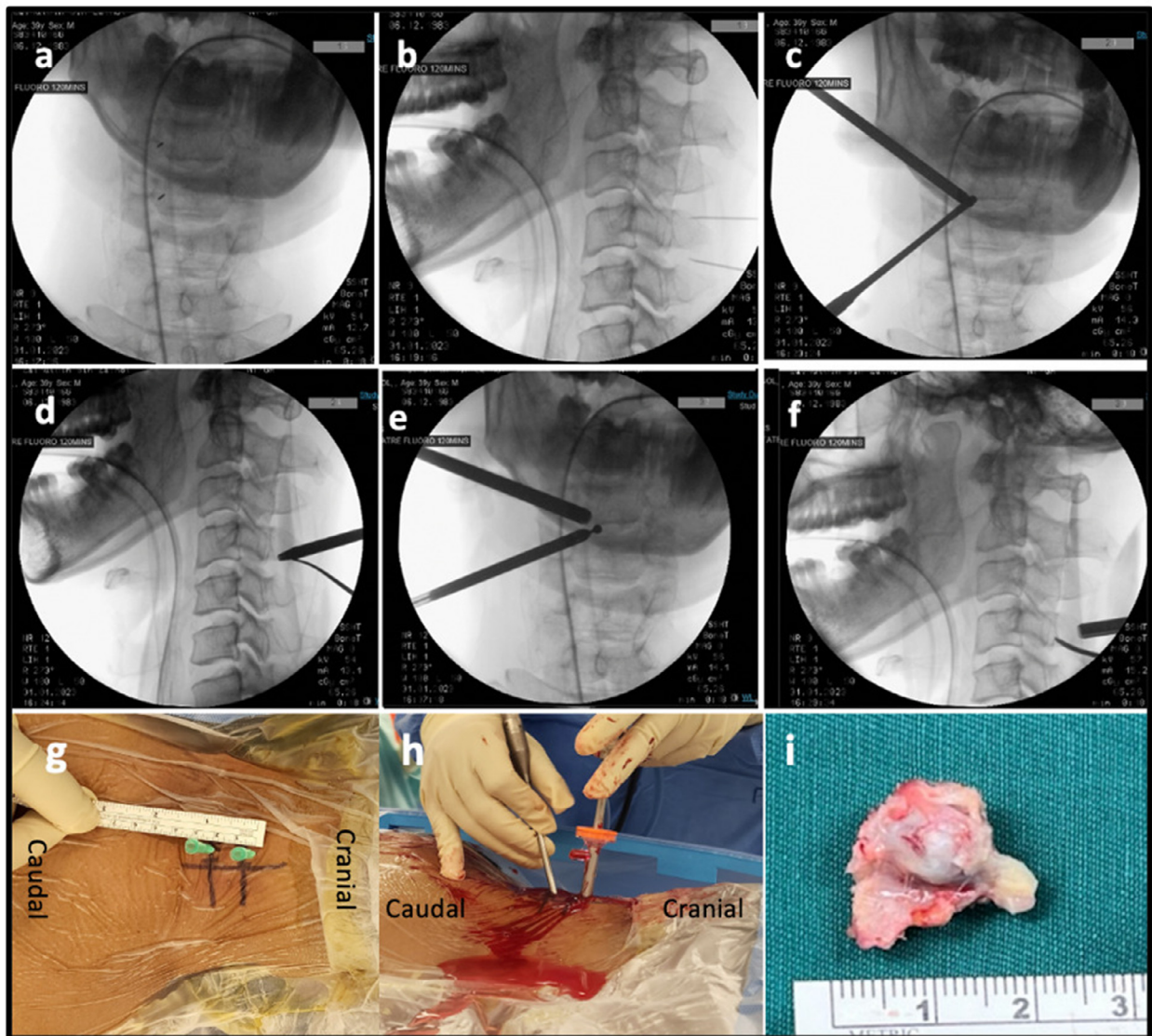


Fig. 3. Intraoperative C-arm images (A) needle position in AP view, (B) needle position in sagittal view, (C) and (D) confirmation of triangulation AP view and in lateral view, (E) and (F) cranial endoscopic portal and caudal working portal, (G) needles showing 2 cm gap between planned incision sites, (H) right hand working portal, left hand viewing portal, (I) en bloc specimen of removed osteochondroma.

Table

Guide to the management of extradural lesion causing spinal cord compression based on its location in cervical spine

1) Ventral to the ligamentum flavum	Cervical Endoscopic Unilateral Laminotomy Bilateral Decompression by Unilateral Biportal Endoscopy (sublaminar approach) or Unilateral biportal endoscopic posterior spinous process sparing en bloc cervical laminectomy(supralaminar approach)
2) At the ligamentum flavum (Ossified or thickened ligamentum flavum)	Cervical Endoscopic Unilateral Laminotomy Bilateral Decompression by Unilateral Biportal Endoscopy by sublaminar approach
3a)Dorsal to ligamentum flavum at cervical lamina: lateral sided lesion	Unilateral Biportal Endoscopic hemilaminectomy (Full conservation of contralateral side)
3b) Dorsal to ligamentum flavum at cervical lamina: medial or central lesion	Unilateral biportal endoscopic supralaminar posterior spinous process sparing en bloc cervical laminectomy(supralaminar approach)
4) Dorsal to cervical lamina	Cervical unilateral biportal endoscopy is not suitable, open excision biopsy

cutaneous tissue lesion involving or sparing cervical lamina. (Table) and Fig. 1.

Chances of developing neurodeficit and dural tear due to intimate working with the dura must be explained in detail to the patient. This technique requires certain level of endoscopic experience. Possibility of recurrence of the tumor in near future was discussed. Main limitation of our study is that it is a single case report. Learning curve is steep for en

bloc removal of lesion from cervical lamina. In our case the operation was done by senior experienced endoscopic spine surgeon and it done in 50 minutes. Anterior and centrally located pathologies occupying >50% spinal canal and causing extradural compression are difficult to treat with UBE. Treatment of more than three contiguous levels of pathology is not recommended by this technique. Use of this technique is limited to benign lesions and same should be confirmed preoperatively.

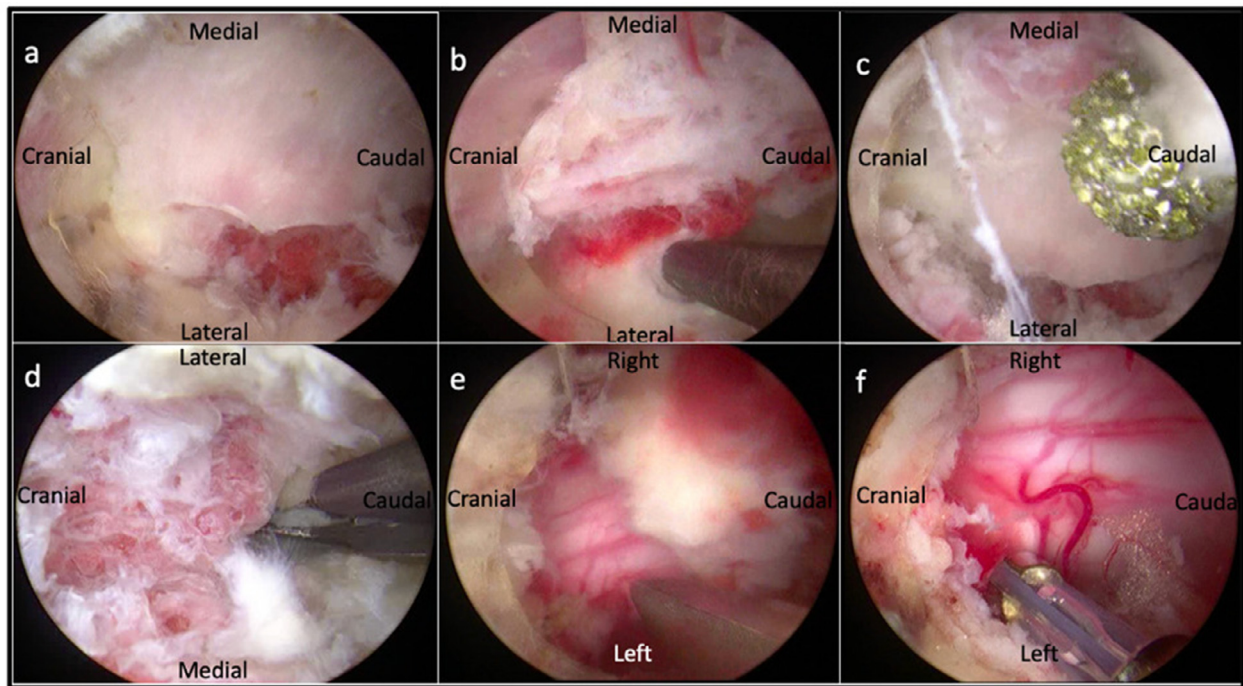


Fig. 4. (A) Left side thinning of lamina (B) Left side laminectomy with the help of Kerrison Rongeur (C) Osteotomy below the tip of spinous process (D) contralateral (right) side laminectomy (E) Adequate decompression of cord (F) Achieving adequate hemostasis.

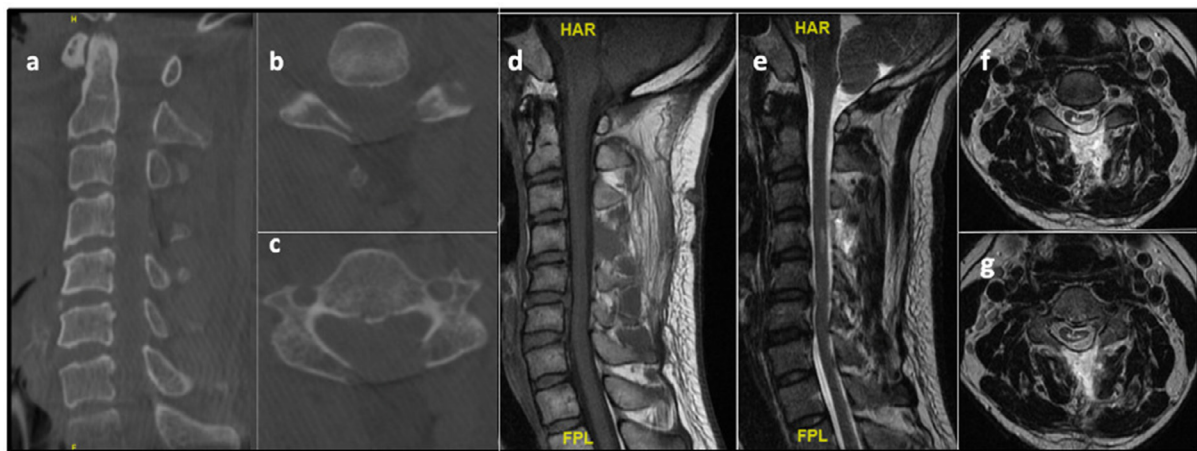


Fig. 5. CT (A) Sagittal view showing decompression and preserved tip of spinous process (B) and (C) Axial view showing removed osteochondroma and preserved tip of spinous process. MRI (D, E, F, G) showing adequate decompression of spinal cord with residual myelomalacia along with preserved posterior ligamentous complex.

How to avoid complications

1. Do not use Kerrison Rongeur more than size 2 for the laminectomy.
2. Burr the lamina to paper thin before proceeding with laminectomy.
3. Confirmation on ipsilateral and contralateral side for the extent of laminectomy prevents inadequate decompression.
4. En-bloc resection of tumor should be done only after flavectomy is completed cephalad and caudal to the lamina.
5. Meticulous hemostasis should be ensured to avoid formation of hematoma.

Conclusion

Saving the PLC and less soft tissue dissection in unilateral biportal endoscopic surgery reduces the post-operative axial neck pain and chances of postlaminectomy kyphosis. Unilateral biportal endoscopic en-

bloc cervical laminectomy can effectively decompress cervical spine and remove posterior benign cervical tumor. We recommend the less experienced surgeons to do this technique under supervision.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the National Health Group Ethics Committee, Singapore and the national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Declarations of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.xnsj.2023.100225](https://doi.org/10.1016/j.xnsj.2023.100225).

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