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Case Report

# Minimally Invasive Anterolateral Approach for C2 Neurofibroma in Elderly Patient


## Abstract

Conventionally ventrally located spinal tumor is approached through anterior vertebrectomy which requires bony fixation and then immobilization for a couple of months. The alternative route to deal with such type of tumor is anterolaterally to avoid the surgical and nonsurgical complications. We are reporting a minimally invasive anterolateral approach for C2 neurofibroma in an 84-year-old patient. Postoperatively this patient did not require cervical brace and postoperative discomfort was minimal. It was observed that dumbbell-shaped cervical tumor with no intradural pathology and wide neural foramina could also be taken care through the anterolateral route which did not require bony fusion or immobilization, but the expertise of the surgeon is necessary for performing these types of minimally invasive procedure to achieve the best results.


**Keywords:** *Dumbbell-shaped neurofibroma, extramedullary tumor, neurofibroma*


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## Introduction

Neurofibroma constitutes almost one-third of the primary spinal tumor.[1] These tumors in the upper cervical region tend to grow as dumbbell morphology. Dumbbell-shaped tumor accounts for 15% of all cervical neurofibroma.[2] Most commonly, these tumors diagnosed in the fifth decade of life.[3] Heuer defined these tumors as a group of tumors that arise along the spine.[4] During the growing phase, the dumbbell tumor acquires an hourglass shape as they cross the different anatomical barriers such as dura, neural foramina, or paraspinal spaces. There is a lot of controversy over the surgical approach of cervical dumbbell-shaped neurofibroma. Conventionally ventrally located spinal tumor is approached through anterior vertebrectomy which requires bony fixation and then immobilization for a couple of months. To minimize invasiveness in the elderly patient and maximize the preservation of normal anatomy and function, we are presenting a case report of C2 neurofibroma approached by anterolaterally.

## Case Report

A 84-year-old female presented with a left side neck mass. She had earlier underwent lumbar fixation 6 months back when she noticed this neck mass. Besides this complaint, she had no other symptoms. There were no neuropathic symptoms such as tingling or burning sensation, paresthesia, and no feature suggestive of myelopathy. She had no associated comorbidities. No family history of such illness. Neurological examinations were within normal limits. Motor and sensory examinations were within normal limits. On magnetic resonance imaging, the tumor was T1 isointense, T2 heterogeneous intensity and on contrast brightly enhancing, C2 extradural dumbbell-shaped tumor extending in the left paraspinal space through neural foramina and displacing the spinal cord toward the right side [Figure 1]. Computed tomography scan suggests that the left C2 neural foramen was wide open and a little part of the vertebral body was also eroded [Figure 2]. Because the life expectancy of the Japanese population is higher as compared to other countries,[5] hence as per patient's wish, we planned for excision of the tumor.



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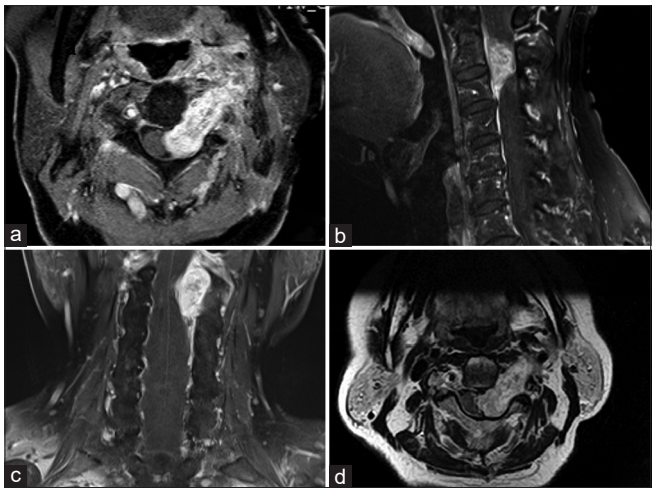


**Figure 1: Magnetic resonance imaging of cervical spine. (a) axial T1 contrast images contrast enhancing dumbbell-shaped tumor in cervical canal with extension into the paravertebral space and widening of left neural foramen, (b) sagittal T1 contrast, (c) coronal T1 contrast image showed anterolaterally situated extramedullary tumor, displacing the spinal cord towards right side with cord signal changes, (d) axial T2 images shows hyperintense tumor and loss of cerebrospinal fluid around spinal cord with significant cord compression**

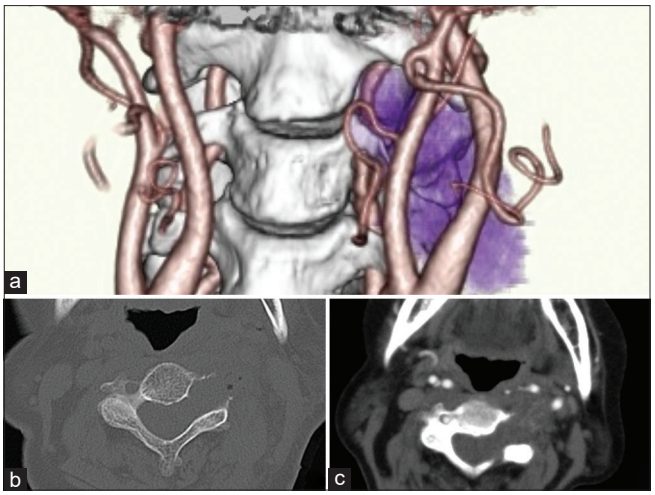


**Figure 2: Computed tomography images of cervical spine. (a) Fusion image of angiography with bony image and tumor with three-dimensional reconstruction shows tumor eroding the neural foramen and displacing the left vertebral artery anteriorly, (b) axial bony image shows erosion of left neural foramen and a part of vertebral body, (c) axial contrast computed tomography of spine with slight enhancing lesion**

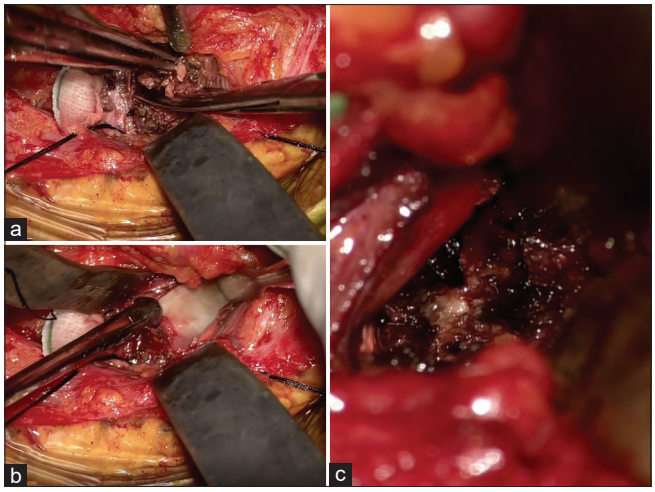


**Figure 3: Intraoperative images. (a) Initial debulking of tumor through anterolatral approach, (b) separation of tumor capsule with surrounding structures, (c) after complete excision of tumor**

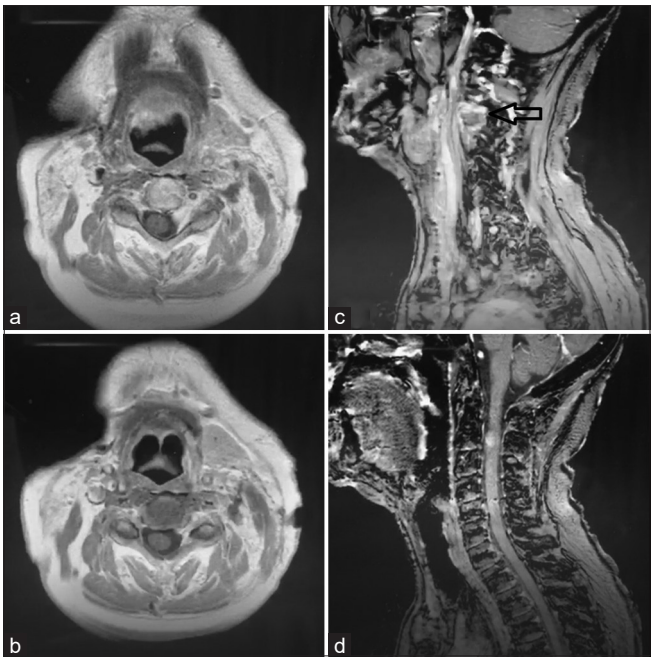


**Figure 4: Postoperative T1 contrast-enhanced magnetic resonance imaging of cervical spine. (a and b) Axial images showing little residual tumor with postoperative cavity, (c and d) sagittal images of cervical spine showing op-cavity (black arrow) and small residual tumor**

## Operative steps

Surgery was performed under general anesthesia. During the surgery, we used Somatosensory Evoked Potential and Motor Evoked Potential (SSEP and MEP) monitoring. The patient was positioned supine without turning of the head to be more anatomically oriented during surgery. A bolster was placed behind the shoulders to keep neck extended.

The surgical trajectory was planned in such a way to provide the nearest access to the tumor. We used a 5 cm vertical incision just on the medial border of the sternocleidomastoid muscle (SCM). After dividing subcutaneous tissue and platysma, SCM and carotid artery retracted laterally and the esophagus and trachea medially. Deep in the muscular plane, we found the capsule of the tumor. Using a microscope, we decompressed the tumor and gradually, we reached up to the spinal part of the tumor and dissected away from the thecal sac [Figure 3]. After decompression, it was easy to separate and excised the capsule from surrounding structures and the great vessels. No cerebrospinal fluid (CSF) leak was noticed. The platysma was closed with fine absorbable suture and subcuticular suture used for skin closure [Figures 4 and 5].

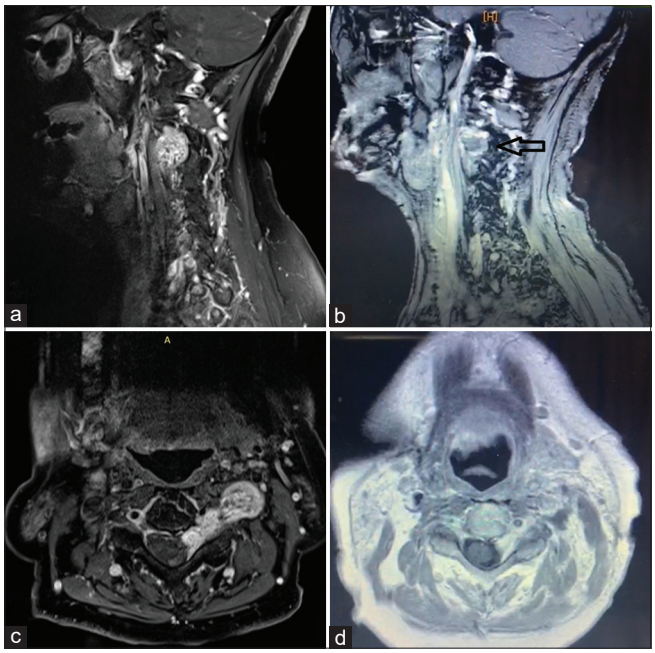


**Figure 5: (a) Preoperative T1 contrast sagittal magnetic resonance imaging showing C2 neurofibroma impinging the spinal cord. (b) Postoperative T1+C sagittal magnetic resonance imaging picture showing operative cavity (black arrow). (c) Preoperative T1+C axial image showing tumor compressing the cord and coming out from the neural foramen laterally. (d) Postoperative axial contrast image showing small residual tumor in the spinal canal with no residual lesion laterally**

Postoperatively, the patient recovered well and discharged.

## Discussion

Primary spinal neurofibroma ranges from 1.3 to 10/1,00,000 population annually and about one-third of these tumors arise from the nerve sheath.[6,7] Spinal nerve root gives origin to spinal nerve sheath tumor and these tumors further grow along the direction of these nerve roots.[8] Based on location, these tumors may be entirely intradural, extradural or partly intradural and partly extradural. Some studies suggest male dominance.[3,9]

Spinal tumors are found most commonly in the thoracic and lumbar region however dumbbell-shaped tumors are more common in the cervical spine.[10] The incidence of dumbbell-shaped tumors varies from 13.7% to 17% and the cervical spine dumbbell tumors constitute 44% of all dumbbell tumors.[10] Based on the classification by Eden, Asazuma *et al*. gave a new classification of dumbbell-shaped tumors in which he described tumor based on axial spread.[11,12]

Surgical planning of a dumbbell-shaped tumor is different from the other types of spinal tumors.[13] There are various debates on the surgical planning of dumbbell-shaped tumors. Posterior is a conventional approach for tumors in the spinal canal.[13,14] Combined anterior and posterior were also described by many authors. The posterior approach is a very familiar approach for neurosurgeons. Several authors prefer the anterolateral approach.[15,16] while George and Lot reported a lateral approach for the complete excision of extradural tumors.[17]

These types of tumor produce varieties of symptoms which ranges from asymptomatic to radiculopathy/myelopathy or palpable mass in the neck.[18] Ozawa *et al*. found the most common histopathology of the dumbbell-shaped tumor to be schwannoma and followed by the meningioma, the rest of the pathology like neuroblastoma, ganglioneuroma are more common in the pediatric age group.[10]

The goal of surgical treatment is the gross total removal of tumor and preservation of neurovascular structures.[13] If the dumbbell tumor is limited to the spinal canal and only small part is in paraspinal then the posterior cervical approach will better but if the majority of tumors in paraspinal spaces then consideration of alternative approaches is required. Verbiest described the anterolateral approach for the treatment of cervical spondylosis.[16] This approach was previously used for vertebral artery surgery. Hakuba *et al.* described transuncodiscal approach for the removal of cervical spinal canal tumors.[15] He went the same way as Verbiest described and went further in such a way that after mobilization of vertebral artery to reach the canal he excised the intervertebral disc after spreading the intervertebral space he excised the tumor but this approach sometimes caused spinal cord injury.

George *et al.* described the oblique transcorporeal approach.[19] Jho and Ha also performed the anterolateral approach in anteriorly situated cervical lesion.[20] In this approach, he went through the same tissue plane instead of removing anterior tubercle of the transverse process, he removed the uncovertebral joint and did anterior foraminotomy. The vertebral artery was displaced laterally (not exposed). With this foraminotomy, he excised the lesion.

However, in our case, we went the anterolateral route as described by Verbiest.[16] In this technique, the surgical corridor is very much similar as most of the neurosurgeon does for anterior cervical discectomy and fusion. After the lateralization of vessels and the trachea and esophagus, we found a tumor in the intermuscular plane in the neck so after intracapsular decompression we gradually reached in the spinal canal part. We did not require foraminotomy or corpectomy unlike the described techniques by the above-mentioned authors because neural foramen was already too wide. After tumor decompression, we removed the capsule part of the tumor. During capsule removal, we gradually dissected the capsule from surrounding tissues and neurovascular structures. In this way, we completely excised the tumor. Tumor debulking is a good technique because without tumor decompression it was very difficult to handle the great vessels and nerves because all the neurovascular structures were displaced by enlarged tumor mass. As the tumor had no intradural component, we did

not have to open dura. No CSF leak was noticed after tumor excision. If the tumor had its intradural component also then we have to repair the dural defect.

For knowing the necessity of fixation of spine preoperatively, we assessed the stability of the cervical spine with dynamic X-ray of cervical spine lateral view but we found no mobility of the cervical spine. We did not perform any bony drilling, foraminotomy, or corpectomy hence there was no need to fix the spine. In the postoperative period of posterior surgery, the patient has to suffer a lot of pain and analgesics which may cause metabolic derangement in the elderly patient and prolong the hospital stay. In our case, we managed to ambulate the patient form very 1st day and also the patient did not suffer severe pain.

## Conclusion

We observed that in the extreme of age this minimally invasive technique help for a quick recovery without damaging the neurovascular structures. However, the expertise of the surgeon is necessary for performing these types of minimally invasive procedures to achieve the best results. Hence, in selected cases of dumbbell-shaped cervical neurofibroma can be excised by minimally invasive techniques.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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