Case Report

Upper thoracic dumbbell-shaped tumor resected in one stage posterior approach: case report

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Abstract: Upper thoracic tumors may develop spinal cord compression. By surgery at the time of diagnosis, a neurological deficit can be avoided. However, this particular localization requires a double approach to decompress the spinal cord and thoracic structures. The posterior extracavitary approach results in resection of the spinal canal, the foraminal component, and the extraspinal fragment, but is not routinely used by most neurosurgeons. A 56-year-old woman with a two-month history of axial thoracic pain and cough. The patient has a normal neurological examination. Thoracic computed tomography (CT) scan with contrast agent was performed, evincing a dumbbell-shaped tumor on the left T3–T4. Magnetic resonance imaging (MRI) confirms the diagnosis, showing a 4 cm diameter tumor that compresses the spinal cord without myelopathy. The surgery was performed posteriorly, with costotransversectomy, allowing complete resection under intraoperative neurophysiological monitoring. The patient developed no thoracic or neurological complications. One-stage posterior approach is possible and effective during the treatment of the upper thoracic dumbbell-shaped tumors, avoiding a change in surgical position, thoracic morbidity, and dependence on assisting surgeons.

Keywords: Spinal cord neoplasms; spinal cord compression; laminectomy; facet joint; intraoperative neurophysiological monitoring

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Introduction

Spinal schwannomas account for approximately 25% of all spinal tumors. They are most commonly found in the thoracic region and also in the cervical and lumbar regions (1).

Currently, the term dumbbell-shaped tumor does not refer to the hourglass shape but is a conceptual term, which means separate tumors that connect and include two or more separate regions, such as intradural space, epidural space, and locations outside the paravertebral space (2).

Intraspinal schwannoma may occur in the spinal canal or sometimes extend along the root to the extravertebral space through the intervertebral foramen and become dumbbell tumors (3).

Dumbbell-shaped tumors account for 6% to 14% of all spinal tumors (1,2), and about 35% of all neuromas of the spinal canal originate from the thoracic region (3). The standard procedure for the removal of the posterior mediastinal neurogenic dumbbell-shaped tumors is a combined neurosurgical and thoracic approach in two stages with thoracotomy (4). Most dumbbell-shaped tumors can be effectively resected with partial laminectomy or unilateral hemilaminectomy or unilateral facetectomy (5,6). However, if the extraforaminal tumor component is large, a combined posterolateral approach should be used (3).

Giant schwannomas invade three compartments, the spinal, the foraminal, and the mediastinal, thus posing a

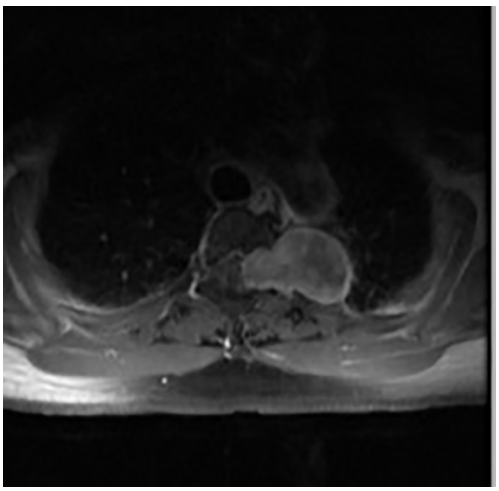

Figure 1 T1-weighted magnetic resonance imaging of the thoracic dumbbell tumor with extension to posterior mediastinum.

Figure 2 Unilateral left sided approach. Note 3rd and 4th ribs and posterior bone elements of spine, costovertebral union of T3 and T4.

surgical challenge and often requiring staged surgeries with a multidisciplinary surgical team (1). Some effort has been made to perform a single-stage surgery, decompressing the spinal cord through a posterior approach of thoracotomy or thoracoscopic assisted mediastinal component (4-6).

We would like to present a case of a giant Schwannoma of the upper thoracic spine, where we carried out a single-stage, posterior surgery only, that achieved complete resection and posterior fusion with pedicle screws.

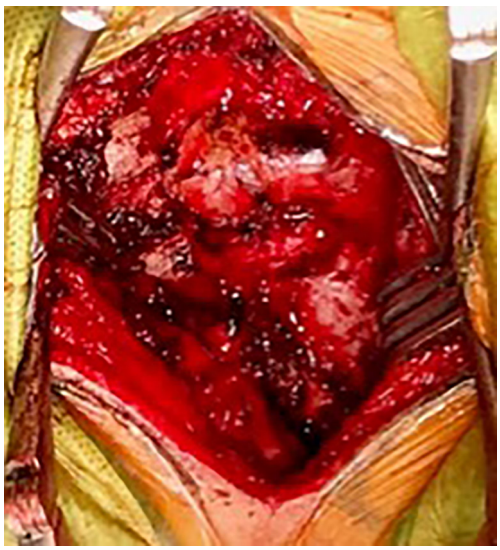

Figure 3 Third and fourth left side ribs partially resected, achieving extraforaminal tumor component exposed.

Case presentation

A 56-year-old woman with axial thoracic pain and cough in the last 2 months. The patient has a normal neurological examination. Thoracic computed tomography (CT) scan with contrast evincing a dumbbell-shaped tumor on the left T3–T4 with a mediastinal component compressing the upper left lung. Magnetic resonance imaging (MRI) confirms the diagnosis, with a tumor of 4 cm in diameter compressing the spinal cord without myelopathy (*Figure 1*).

We planned to perform a single-stage surgery, one incision, by performing only an open posterior approach exposing the left side of the spine, from the spinous processes T3–T4 to the third and fourth ipsilateral ribs (*Figure 2*). Under intraoperative neurophysiological monitoring with somasosensory evoked potentials and motor evoked potentials, the patient was placed in a prone position. A T3 hemilaminectomy with facetectomy and costotransversectomy was performed, whereby the proximal 4 cm of the third rib was resected and the partially superior border of the fourth rib, to expose the intraspinal, foraminal and mediastinal components of the tumor (*Figure 3*). The entire tumor capsule was gently separated from the surrounding structures, with internal tumor debulking using a cavitron ultrasonic surgical aspirator. Complete excision of the tumor was achieved by ligating the proximal and distal attachment to the intercostal nerve root. No pleural or dural disruption was observed. The posterior unilateral

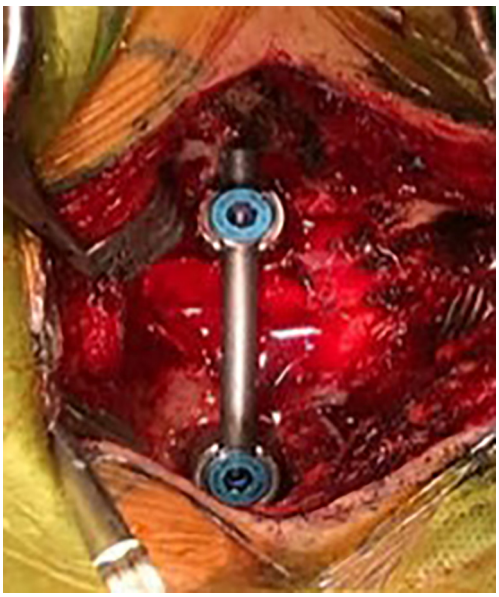

Figure 4 Shows surgical bed post tumor resection, with transpedicular fixation in T2 and T4.

Figure 5 Postoperative sagital scanner image reveals no evidence of residual tumor and transpedicular fixation.

instrumentation with pedicle screws at T2 and T4 was performed (*Figure 4*).

Postoperatively, the patient developed no neurological deficit and pulmonary symptoms were absent. The postoperative CT scan shows that the screws are well placed

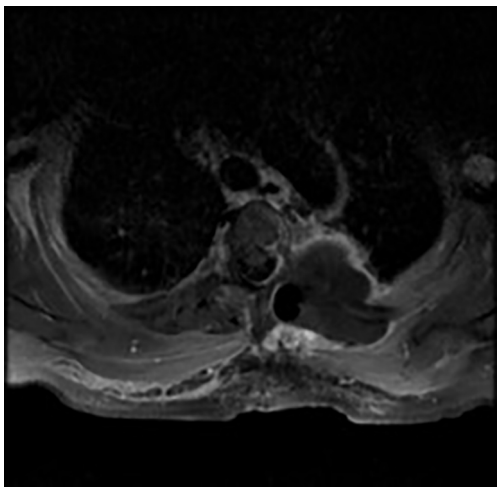

Figure 6 T1-weighted magnetic resonance imaging. Evidence total tumor resection with recovery of spinal cord mass effect.

(*Figure 5*) and the MRI confirms complete excision of the tumor, restoring the spinal cord space (*Figure 6*). During follow-up, the patient does not show any radicular pain, and she is symptom-free, being self-sufficient in daily life activities and with a good quality of life, returning to work 1 month postoperatively.

Histopathological analysis with hematoxylin-eosin stain, the tumor showed compact spindle cells (Antoni A arrangement), interspersed with collagen fibers. The nuclei are also fusiform and are aligned in palisade with lined nucleus mixed with some enucleated fibrillary areas (Verocay bodies). Blood vessels have thick hyalinized walls. No atypia or mitosis was seen and S100 stain was positive, compatible with schwannoma.

Discussion

McCormick reported dumbbell-shaped tumors with significant intraspinal and paravertebral involvement and classified them into four types based on the location of the tumor: intramedullary, intradural extramedullary, epidural, and dumbbell (3). These tumors must be focused on size and compartment.

Sridhar proposed a classification of spinal schwannomas by tumor size and location component seen in MRI (1). This case presented would be a grade IV B in classification, this means an intraspinal tumor with extraspinal extension (dumbbell tumors) and extraspinal component greater than 2.5 cm, called a giant tumor. There is no doubt that

preoperative planning is crucial to achieving a complete resection without damaging the neurovascular and thoracic structures.

Usually, giant schwannomas are treated in multiple stage surgery and in the current case in single stage surgery. Multiple stage surgery requires a posterior approach and a lateral or anterolateral supplementary approach to achieve a complete resection. Cases of posterior surgery alone, not using a thoracic approach have been reported, but they achieved a subtotal removal in all 16 cases analyzed (7).

Other authors have achieved complete excision of the tumor with a modified, single-stage posterior approach in a case report without instrumentation (5) and in 8 other patients with good results and instrumentation (8). In our case, the instrumentation was necessary after the facetectomy and the costotransversectomy was performed, this may lead to postoperative spinal instability

The total resection of giant thoracic dumbbell tumors depends on adequate exposure requiring costotransversectomy and hemilaminectomy when defining the posterior extracavitary approach. The instrumentation is necessary when the facets are violated, thus avoiding instability. We believe that with this surgical planning of these tumors, it is possible to avoid the morbidity of a thoracic approach and to obtain better clinical results. On the other hand, thoracic surgeons are not always available to assist with other surgeries. However, spinal instability due to wide bone removal including facet joints, transverse processes and the rib heads is, undoubtedly, one of the main disadvantages of the approach used. This obligates to use instrumentation, increasing neurovascular risk subsequent to malposition, intercostal vessels and pleural morbidity during bone removal, and increasing surgical cost.

The anterior approach requires an open thoracotomy or video-assisted thoracoscopy techniques for the resection of the extraforaminal component (9). A combined posteroanterior approach with thoracoscopic surgery for dumbbell thoracic cord tumors consists of two stages with two incisions and two surgical teams (10). This two-stage surgery can be performed by changing the surgical position of the patient or simultaneously. In this case, however, we have shown that single-stage surgery, one incision, one surgical team, no change in surgical position and control of the *en bloc* tumor is an effective and reproducible technique. Nevertheless, a less invasive approach consisting on laminectomy and thoracoscopy (VATS), which is becoming the strategy of choice when thoracic surgeons are available in the same hospital, has some advantages over our approach, particularly important in elderly patients: bone resection and muscle disinsertion is minimal, less bleeding, avoid instrumentation, offers direct visualization of the tumor-spine interface, reducing the likelihood of spinal-cord injury with tumor manipulations, and can be performed in a single stage as well (11).

Costotransversectomy was first described by Menard in 1894 for the drainage of tuberculous abscesses in patients with Pott paraplegia (12). However, it has been used and modified for various pathologies of the thoracic spine, such as tumors, trauma, infections, and others. When performed, it is necessary to consider instrumentation with pedicle screws.

Finally, the advantages of the posterior approach can be summarized in less time-consuming, less approach-related complications, independence of approach surgeon and less associated thoracic morbidity for patients. We believe that dumbbell-shaped thoracic spine tumors should be confronted in a single posterior approach to improve surgical outcomes, being a feasible, highly reproductible and cost-effective technique.

Acknowledgments

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Written informed consent was obtained from the patient for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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