

Case Report

The transparaspinal approach: A novel technique for one-step removal of dumb-bell-shaped spinal tumors

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Abstract

Complex dumb-bell spinal tumors are challenging surgical lesions. Combined antero-posterior exposures have traditionally been used in their management. This combined exposure has the disadvantage of a two-stage operation with transthoracic or retroperitoneal dissection. With better understanding of biomechanics of spine and evolution of microsurgical technique, there has been resurgence of single stage surgeries, among which the transparaspinal exposure provides the simplest and the most direct route for resection of dumb-bell tumors. A 16-year-old male was admitted with history of back pain with radiation to left lower limb for 6 months, progressive weakness of both lower limbs for two months, and hesitancy of micturition for 1 month. A clinical diagnosis of cauda-conus lesion was made. Radiological investigations revealed a complex dumb-bell spinal tumor extending from lower part of L2-L4 vertebra, with large paraspinal extension through left L3 intervertebral foramina. Tumor was successfully removed in one step using a transparaspinal approach. We discuss technical details of this novel approach along with limitations and possible complications.

Key words: Conus lesion, dumb-bell spinal tumors, new technique, single stage surgery, transparaspinal approach

INTRODUCTION

Love and Dodge^[1] in 1952, first coined the term dumb-bell tumor, reporting the ingrowths of a neurogenic tumor into the spinal canal. In addition these tumors may grow extensively outside of the spinal canal and compress the paraspinal-iliopsoas complexes as well as the adnexal structures. Various approaches have been described for treating these tumors. Combined antero-posterior approach has been used mostly but carries the disadvantage of two-stage operation. Capener has developed

lateral extra cavitory approach for treatment of pott's spine.^[2] This approach allows one-stage exposure of thoracic and lumbar spine but is a time consuming and technically demanding operation with limited application in selected cases only. We describe an alternative approach, called transparaspinal approach for one-stage removal of dumb-bell-shaped spinal tumors. This approach, developed by W. J. Michelsen, provides the simplest and most direct route for resection of dumb-bell tumors.^[3]

CASE REPORT

A 16-year-old male was admitted with history of low back pain radiating to left lower limb for 6 months, progressive weakness of both lower limbs for 2 month, and hesitancy of micturition for 1 month. There was no history of trauma, fever or bowel incontinence. His general and systemic examination was unremarkable. There was lower motor neuron weakness in both lower limbs with sluggish deep tendon reflexes. There was

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no history or cutaneous lesions suggesting neurofibromatosis. With these findings a clinical diagnosis of cauda-conus lesion was made. Computed tomography (CT) and magnetic resonance imaging (MRI) revealed a dumb-bell shaped tumor occupying the spinal canal and extending into the retroperitoneal space through the left intervertebral foramen between L3 and L4. [Figure 1] Radiological diagnosis of a lumbar dumb-bell shaped neurinoma with necrosis was made. Patient was prepared for surgery and one-stage transparaspinal removal of tumor was planned.

Preoperative preparation

The patient and his relatives were counseled about operative procedure. The risk of neurological deficit from nerve root sacrifice was discussed along with possibility of incomplete resection. Possibility of subsequent anterior surgery was also discussed.

Operative procedure

The patient is placed in prone position after induction of anesthesia and endotracheal intubation. After field preparation a traditional vertical midline skin incision is given, supplemented by a transverse T-shaped extension at L3- L4 disc space [Figure 2a]. A subperiosteal exposure of the spinous process, laminae and facet complex was performed bilaterally. The tumor was identified, eroding through the bony elements and embedded in left-sided paraspinal muscle complex. Fascia was opened laterally directly over the tumor to the edge of paraspinal muscle complex.

Bone removal was done next. Wide laminectomy was done along with left-sided facet joint removal for adequate exposure

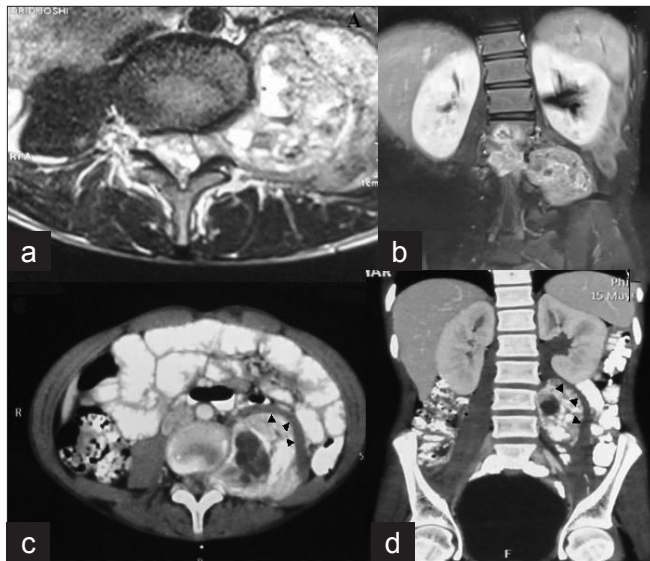


Figure 1: (a) T2W axial image showing heterogenous dumb-bell-shaped mass causing widening of Lt. neural foramina with large extracanalicular component (b) Post-gad T1W coronal image displaying heterogeneously enhancing dumb-bell mass with large intracanalicular component (>3 cm), lateral displacement of left psoas muscle is seen. (c) and (d) Contrast-enhanced axial and coronal CT images revealed retroperitoneal extension of the lesion. A surgical plane can be easily made out bordered by psoas muscle complex. (Black arrow heads)

of the tumor [Figures 2b and 2c]. Unilateral single-level sacrifice of a facet in absence of deformity usually does not produce instability.

We exposed the intradural component first. Intracanalicular component was excised using microsurgical techniques. It was not possible to preserve a functioning nerve root as rootlets were embedded in capsule of tumor. Sacrifice of this root rarely produces any new neurological deficit as long-standing nerve root compression lead to development of alternative pathways of innervation. The rootlets along with part of tumor passing through L3-L4 intervertebral foramina were excised in toto along with attached dura [Figure 2d].

Attention was then directed toward the extra-canalicular component. This portion was first internally decompressed using ultrasonic aspirator with care to avoid perforation of capsule.

Once a generous internal decompression was accomplished, the capsule of the tumor was mobilized. There was a well-defined surgical plane between the tumor capsule and the adjoining adnexal structure [Figures 1c and d]. Blunt dissection was performed in the surgical plane as tumor was well separated from major neurovascular structures by psoas muscle [Figures 1c and d]. Complete dissection was achieved and tumor capsule was delivered in toto. We recommend subtotal resection, if tumor capsule is densely adherent to the surrounding tissues. Dura was closed in water-tight fashion after achieving complete hemostasis. The paraspinal muscles were approximated with interrupted number 1 vicryl sutures. We performed unilateral fixation bridging removed facet using transpedicular rods and screws [Figure 2e]. Wound closure was performed in standard fashion over drain.

Postoperative course was uneventful. Biopsy turned out as paraganglioma, hence no adjuvant therapy was planned. Postoperative CT scan revealed complete excision [Figure 3]. Patient was discharged on 8th postoperative day and was doing well at first follow-up visit at 1 month.

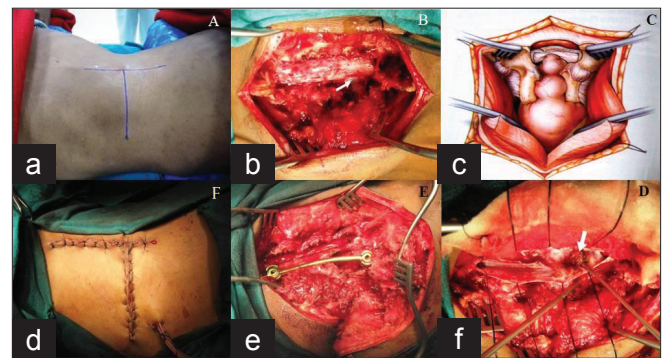


Figure 2: Operative steps (a) T-shaped skin incision with transverse limb over L3-4 neural foramina (b) After laminectomy and unilateral facetectomy, part of tumor passing through foramina is marked with white arrow. (c) Pictorial representation of complete tumor exposure after sectioning of paraspinal muscles and laminectomy. (d) After intradural excision (part of tumor leaving through dura is marked with arrow). (e) After complete excision, dural closure and unilateral fixation. The cut edges of paraspinal muscles are clearly visible. (f) After skin closure

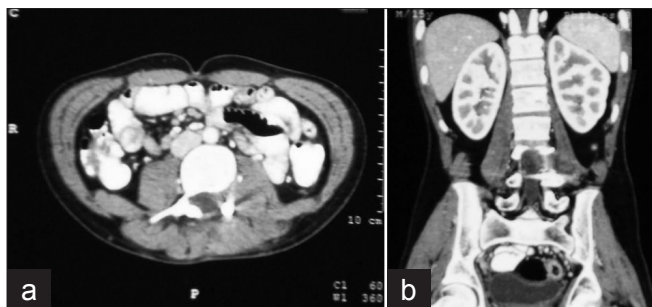


Figure 3: Postoperative axial (a) and coronal (b) CT images showing complete excision

DISCUSSION

Complex spinal dumb-bell tumors are challenging surgical lesions. Often these tumors will compress the paraspinous and iliopsoas muscle complexes as well as the adnexal structures. Combined anteroposterior approach has normally been used for its treatment. This approach is time consuming and has disadvantage of two stage operation with transthoracic and retroperitoneal dissection. Capener developed lateral extracavitary exposure for the treatment of tuberculosis.^[2] Subsequently this approach has been applied for treatment of other spinal pathologies including dumb-bell spinal tumors. Although this approach permits single stage removal of dumb-bell tumors in selected cases, it is time consuming and technically demanding technique, also it only allows the removal of dumb-bell tumors whose intraspinal part does not exceed 3 cm.^[4] Shamji *et al* concluded that it is critical to deal with spinal component first by direct intraoperative after laminectomy, regardless of any large paraspinous component.^[5]

The transparaspinal approach provides direct route for the resection of dumb-bell tumors. It provides direct access to the intradural component; hence intradural extension is no constraint for this technique. This approach is based over two concepts. First, there are minimal biomechanical consequences to complete sectioning of the unilateral paraspinous muscles. Second, there is a well-defined surgical plane between the tumor capsule and the adjacent structures.

It is important to assess the degree of anterior spinal involvement of the tumor, or to determine whether anterior column stability is present. The transparaspinal approach is not appropriate in cases where extensive anterior tumor dissection from spinal cord is required or where reconstruction of anterior column is required. We advocate routine use of CT scan in preoperative preparation of all the dumb-bell tumors. CT is not only superior to MRI in demonstrating bony involvement, but clearly outlines the surgical plane as well [Figure 1]. This permits mobilization of tumor from its surrounding structures and allows complete removal of the tumor from a single posterior approach. We are of opinion that in large intradural/intraspinal tumors with cord compression and displacement, full laminectomy is safer over hemilaminectomy and protects the cord from trauma. Unilateral facetectomy, though does not lead to spinal instability,^[6] can cause problems at transitional spinal region and would certainly destabilize spine in long term or lead to pain and scoliosis.^[7] Hence, we performed unilateral pedicle screw fixation considering young age of the patient.

After generous internal decompression of the intradural component, every attempt should be made to dissect rootlets away from the capsule. Because the root may be severely attenuated from the mass effect of the tumor, it may not be possible to preserve a functioning nerve root. If sacrifice of nerve root is required, it should be done proximal to dorsal root ganglion to prevent neuroma formation. Sacrifice of the root rarely produces a neurological deficit, as long-standing root compression leads to development of alternative pathways of innervations.^[8]

The most difficult part of extracanalicular capsule dissection occurs at the anterior most part, as this is the last area to be exposed through the transparaspinal approach.^[3] Subtotal resection of tumor capsule is recommended, where there is a significant risk of neurological or vascular injury because risk of recurrence is very low.

CSF leakage and neurological injury are potential complications of this technique and should be dealt in the standard manner. Patients with poor nutritional status may experience wound healing difficulties, particularly if the T-shaped skin incision is used. In all such patients, we recommend use of tranverse skin incision whenever possible.

CONCLUSIONS

Various approaches have been described in literature for treatment of complex spinal dumb-bell tumors. The indications for each approach are based on the site and features of the compressive mass and neurological status of the patient. The transparaspinal approach provides rapid and direct exposure of dumb-bell spinal tumors. In selected cases, it provides a simpler and quicker alternative to the lateral extracavitary approach.

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