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The use of an expandable cage for corpectomy reconstruction of vertebral body tumors through a posterior extracavitary approach: a multicenter consecutive case series of prospectively followed patients

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Abstract

BACKGROUND CONTEXT: Posterior decompressions in the form of laminectomies for vertebral body tumors have poor outcomes. Surgical management typically requires anterior decompression and reconstruction; however, these procedures can be associated with significant morbidity and mortality.
PURPOSE: To evaluate the feasibility of anterior spinal column reconstruction using an expandable cage through a posterior approach.
STUDY DESIGN/SETTING: Multicenter consecutive case series of 21 prospectively followed patients.
PATIENT SAMPLE: Twenty-one patients with vertebral body tumors treated with anterior and posterior resection and reconstruction from a single posterior approach were followed prospectively.
OUTCOME MEASURES: Pre- and postoperative neurologic status, number of levels instrumented and fused, length of surgery, length of stay after surgery, and complications related directly or indirectly to surgery were analyzed. In addition, pre- and postoperative radiographs, computed tomography (CT) scans, and magnetic resonance imaging (MRI) scans were evaluated for involvement of the vertebral body and associated posterior elements. Particular attention was paid to the presence of either unilateral or bilateral pedicle and/or middle column involvement.
METHODS: Patients were placed in a prone position on a rotating radiolucent table. Corpectomy was performed from an extracavitary approach, and anterior column reconstruction was completed with an expandable cage. The posterior tension band and spinal fusion was completed with segmental pedicle screw fixation and performed through the same posterior exposure. No patient required a separate anterior procedure.
RESULTS: Patients' average age was 60.3 years (range, 17–78); there were 12 women and 9 men. Eighteen underwent single-level corpectomies (11 thoracic and 7 lumbar), and 3 underwent two-level corpectomies (T4–T5, T11–T12, and T12–L1). Average estimated blood loss (EBL) and length of surgery per level were 1,360 cc (range, 200–2,500) and 5.3 hours (range, 2.7–8.6), respectively. Average postoperative stay was 4.7 days. Nine patients had at least one partial motor grade improvement. One patient had postoperative left lower extremity weakness after surgical decompression and reconstruction secondary to iatrogenic nerve root traction but remained ambulatory. No chest tubes or postoperative bracing was required. At the most recent follow-up, six patients were alive at an average of 16.1 months (range, 3–33). For the 15 patients who died, the average life span after surgery was 6.8 months (range, 1–16). In addition to the iatrogenic nerve root injury, one cage required repositioning on postoperative Day 2 and one cage demonstrated radiographic evidence of settling but did not require surgical intervention; there were no deep venous thromboses (DVTs), pneumothoraces, pneumonias, ileus, or other complications, with a total complication rate of 14.3%.

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CONCLUSIONS: This is the largest study that specifically examines the use of an expandable cage through a posterior extracavitary approach for reconstruction after vertebral body tumor resection. The use of an expandable cage combined with an extracavitary approach is feasible and allows the surgeon to address both the anterior and posterior columns through a single incision. Although technically challenging, both one- and two-level corpectomies in the thoracic and/or lumbar spine can be performed with this technique. Furthermore, insertion of the expandable cage in the collapsed position and then expansion in situ after implantation allowed for all lumbar reconstructions to be completed without sacrificing any of the lumbar nerve roots. Our 14.3% complication rate is similar to those reported in anterior-alone and circumferential spinal procedures.

Keywords: Corpectomy; Spinal tumor; Metastases; Extracavitary; Spinal reconstruction; Expandable cage

Introduction

Surgical management of primary or metastatic tumors of the vertebral body can be challenging. In cases where there is extensive involvement, the lesion can involve the pedicle and posterior elements through direct extension. When there is resulting canal involvement and the presence of either actual or impending neurological deficits or mechanical instability, surgical intervention is often required.

Isolated posterior decompressions in the form of laminectomies have poor reported outcomes [1–4]. Surgical management focuses on addressing the site of anterior compression and reconstructing the spinal column. Typically, this requires an anterior approach with or without a posterior fusion and instrumentation [2,5,6]. These procedures can be associated with significant morbidity and mortality. Furthermore, complete decompression and spinal reconstruction for tumors of the upper thoracic and lumbosacral junction anteriorly can be difficult [7–10]. Studies evaluating the role of the posterior extracavitary approach for management of vertebral body tumors are limited [11].

We describe here our experience with a single-stage decompression and reconstruction of vertebral body tumors with an expandable cage through a single posterior-only approach.

Materials and methods

This study was a multicenter consecutive case review of 21 prospectively followed patients with vertebral body tumors who underwent a single-stage corpectomy and anterior and posterior column reconstruction through a single posterior approach. The surgeries were performed by four fellowship-trained spine surgeons at two institutions. Indications for surgery were either evolving neurologic deficits or actual or impending mechanical instability secondary to vertebral body tumors.

In all 21 cases, the corpectomy and complete spinal canal decompression were performed through an extracavitary approach. The anterior column reconstruction was performed with an expandable titanium cage (Synex; Synthes, Paoli, PA) through the same extracavitary approach. The posterior tension band was reconstructed with segmental pedicle screw fixation during the same surgical sitting through the single posterior incision. No patient required an additional anterior procedure.

Patients were positioned prone on a radiolucent table that could be rotated. Preoperative antibiotics and intraoperative neuromonitoring were used in all but two cases (two patients with L5 vertebral body tumors). At the thoracic level, when necessary, the segmental nerves at the corresponding level were ligated to allow for an extracavitary approach to the vertebral body. In all the lumbar cases, the segmental nerves were preserved, and the cage was inserted at 90° (horizontal to final position), then rotated vertically and expanded into its final position [12]. In all cases, a complete corpectomy and full decompression of the spinal canal could be performed from the posterior-only approach.

Postoperative management included antibiotics, steroid taper, mechanoprophylaxis, and immediate mobilization for deep venous thrombosis (DVT) prophylaxis. No chest tubes or postoperative bracing was used. In cases where systemic chemo- or regional radiation therapy was recommended, it was delayed until the incision had healed. Changes in neurologic status, number of levels fused, length of surgery, estimated blood loss (EBL), total hospital stay, length of stay after surgery, and associated medical complications related either directly or indirectly to the surgery were reviewed. In addition, preoperative and postoperative radiographs, computed tomography scans, and magnetic resonance images were evaluated for involvement of the vertebral body and associated posterior elements. Particular attention was paid to the presence of either unilateral or bilateral pedicle and/or middle column involvement.

Results

In this study, there were 12 women and 9 men. The average age was 60.3 years (range, 17–78). The final diagnoses were six lung adenocarcinomas, four renal cell carcinomas, two plasmacytomas, two bladder cancers,