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ScienceDirect
Surgical Neurology 69 (2008) 138–142
SURGICAL NEUROLOGY
www.surgicalneurology-online.com

Neoplasm-Spine

Giant cell tumor of the lumbar spine: operative management via spondylectomy and short-segment, 3-column reconstruction with pedicle recreation

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Received 14 June 2006; accepted 4 January 2007

Abstract

Background: Giant cell tumors of the lumbar spine are uncommon lesions. Aggressive management of such lesions via spondylectomy to obtain local control and prevent recurrence is often necessary. Spinal reconstruction after total spondylectomy can be challenging. Traditional reconstructions typically require multisegment fixation with an association loss of segmental motion and limited 3-column reconstruction.

Methods: The authors report a case of a GCT of the lumbar spine occurring in a 49-year-old woman. The authors describe the surgical management of such a lesion via a 1-stage posterior-anterior-posterior procedure that entails a lumbar spondylectomy and short-segment posterior fixation with 3-column reconstruction using a stackable carbon-fiber–reinforced cage device with direct posterior rod connection for pedicle reconstruction.

Results: At 33 months postoperative follow-up, neither tumor recurrence nor instrumentation-related complications were noted, bone fusion was prevalent, and sagittal alignment was well maintained. The patient reported no loss of functions, was neurologically intact, and remained active.

Conclusions: Aggressive operative management via spondylectomy of a lumbar GCT provides local tumor control. In select patients, spinal reconstruction after a spondylectomy via a 1-stage posterior-anterior-posterior approach to establish short-segment, 3-column reconstruction with recreation of the pedicles is a promising procedure that provides immediate spinal stabilization without evidence of early instrumentation-related complications, maintains spinal alignment, promotes a quick return to daily activities, and avoids sacrificing excessive motion segments and biomechanical function associated with more traditional procedures.

Keywords: Giant cell tumor; Lumbar; Spondylectomy; Stackable carbon fiber cage; Instrumentation; 3-Column; Short segment; Pedicle reconstruction

1. Introduction

Giant cell tumor of the mobile spine is an uncommon lesion noted to be locally aggressive [4,6,12,16,21]. To achieve spinal stabilization in spondylectomy cases for local tumor control, multisegmented constructs, resulting in extension of the posterior instrumentation several segments cephalad and caudal to the anterior column reconstruction, have traditionally been advocated [10,13,17]. However, such spinal reconstruction increases the number of mobile spinal units being fused, thereby potentially leading to loss of mobility as well as segmental and adjacent level

Abbreviations: GCT, giant cell tumor.

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doi:10.1016/j.surneu.2007.01.038

degenerative changes. Newer spinal implants that directly couple the anterior and posterior spinal columns through pedicle reconstruction may allow for short-segment fixation. As such, this report describes a case of an uncommon manifestation of a lumbar GCT with anterior and posterior vertebral involvement in a 49-year-old woman. The authors describe the operative management and intermediate-term clinical follow-up of such a lesion via a spondylectomy with a unique short-segment posterior fixation and 3-column vertebral reconstruction using a stackable carbon-fiber–reinforced polymer cage system to facilitate recreation of the pedicles by a 1-stage posterior-anterior-posterior approach.

2. Case report

A 49-year-old woman presented with a 1-year history of back pain and right lower extremity sciatica attributed to a biopsy-confirmed GCT of L3 involving the vertebral body, right pedicle, and epidural compartment (Fig. 1A, B). Due to the patient's symptoms as well as the extent and nature of the tumor, surgical intervention was undertaken.

A combined posterior-anterior-posterior approach was adopted for treating this lesion. The initial posterior procedure with the patient in the prone position included left- (base of the uninvolved pedicle) and right-sided

Fig. 1. Preoperative lateral (A) and axial (B) computed tomographic images of the lumbar spine noting extensive tumor involvement of the L3 vertebral body, right pedicle, and possible epidural space.

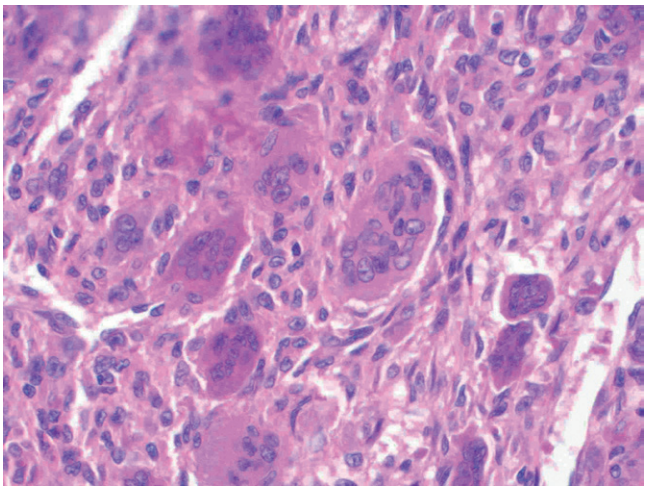

Fig. 2. Resection specimen demonstrating features typical of a GCT. Note the presence of numerous multinucleated giant cells in a background of mononuclear stromal cells. Hematoxylin and eosin staining with 400× original magnification.

osteotomies (junction of the lamina/pedicle), subperiosteal dissection carried around the lateral left vertebral body, and the application of L2-L4 pedicle screws and rods. The second procedure, performed in the right lateral decubitus position, consisted of a right-sided retroperitoneal resection of the L3 vertebral body and right pedicle, accompanied by L2-L3 and L3-L4 discectomies. Anterior reconstruction used stackable carbon-fiber–reinforced polymer cages packed with iliac crest autograft harvested during the posterior procedure. Finally, the patient was again placed prone and the prior incision was reopened. A complete 3-column vertebral reconstruction was created by linking the posterior longitudinal rods into the anterior cage, thereby reconstructing the pedicles bilaterally [1]. The remaining autologous iliac crest bone graft was placed into the posterolateral gutter. A cross-link was placed, increasing the rigidity of the construct, and the incision was closed. The patient was transferred to the intensive care unit in stable condition.

The operative time was 15 hours and the estimated blood loss was 3400 mL. No intraoperative or postoperative complications were noted. The patient was ambulating independently on postoperative day 3, and discharged home on postoperative day 6. Histologic evaluation of the resected specimen confirmed the presence of a GCT (Fig. 2), and the patient required no further chemotherapy or radiation treatment. At 33 months follow-up, radiographic evaluation noted the following: solid fusion, no instrumentation-related complications, spinal alignment was maintained, and no tumor recurrence (Fig. 3A-F). Furthermore, the patient reported no loss of functions, was neurologically intact, and maintained an extremely active lifestyle.

3. Discussion

Of all GCTs of the bone, up to 5.6% of cases have been noted to occur in the mobile spine, largely in the thoracic