CASE REPORT

Giant Cell Tumors of Dorsal and Lumbar Spine: Management with 360-degree Fusion

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Abstract

Background data: Spinal giant cell tumor (SGCT) is rare, with an incidence of 2%–15% out of GCT in all bones and incidence in the mobile segment of the spine is 2%–4%. Due to high recurrence rates, various available treatment modalities have been explored for the management.

Purpose: We are presenting two cases, thoracic and lumbar giant cell tumors (GCT) with pathological vertebral fractures, treated with subtotal spondylectomy and 360° stabilization following preoperative selective arterial embolization (SAE) without the use of denosumab with no recurrence on follow-up.

Study design: Case presentation.

Patients and methods: We present two cases: one thoracic and another lumbar pathological fracture, diagnosed with GCT based on CT scan and MRI appearance and confirmed with histopathology of transpedicular biopsy specimen. Both were managed with preoperative SAE followed by near total spondylectomy through anterior and posterior combined approach and fusion, without denosumab therapy.

Conclusion: Preoperative SAE makes intralesional total excision of tumor easy by reducing hemorrhage. Total intralesional resection of vertebrae through anterior retroperitoneal and posterior approach is associated with satisfactory local control of lesion.

Keywords: Spinal giant cell tumor, Spinal tumor, Spondylectomy, Selective arterial embolization, Anterior-posterior combined fusion

Introduction

The giant cell tumor (GCT), also known as osteoclastoma, is a locally aggressive benign primary bone tumor commonly seen in skeletally mature individuals in the metaphysis of long bones [1]. Spinal giant cell tumor (SGCT) is rare, with an incidence of 2%–15% out of GCT in all bones, sacrum forms the most common site for SGCT seen in 1.7%–8.2% cases, and incidence in the mobile segment of the spine is 2%–4%. It commonly presents as pain in an over-affected spine region and may be associated with variable weakness depending on the degree of cord compression. Different treatments have been tried for SGCT, like arterial embolization, denosumab, and surgical resection of the tumor with or without postresection radiotherapy [2,3]. Surgical resection is challenging due to proximity to vital structures like the spinal cord, nerve roots, and major vessels [4]. Postoperative complications include mainly local recurrence and malignant transformation [2]. We are presenting two cases: the first with thoracic (D8) and the second with lumbar (L4) GCT with collapsed unstable...
vertebra treated with subtotal spondylectomy and 360° stabilization following preoperative Selective arterial embolization (SAE) without use of denosumab with no recurrence on follow-up.

**Case presentation**

**Case 1**

A 30-year-old male presented in the spine clinic of a tertiary care orthopedic hospital with complaints of dorsal back pain for three months, which was radiating along the right side of the trunk. On examination, bilateral knee and ankle reflexes were brisk and the Babinski sign was positive; however, there was no sensory or motor deficit. On radiological examination, the X-ray was suggestive of a D8 vertebral osteolytic lesion with a pathological fracture with reduced vertebral body height. On blood investigations, he had anemia with Hb 9 mg/dl, erythrocyte sedimentation rate (ESR) of 56, and normal serum calcium, phosphorus, and vitamin D values. Magnetic resonance imaging (MRI) of the thoracic spine (Fig. 1) was suggestive of pathological fracture at D8 vertebral body with the convexity of the posterior cortex of the body. Hypointensity on T1 and T2 weighted images and hyperintensity on short tau inversion recovery (STIR) images with paraspinal soft tissue edema was favoring neoplastic etiology. Computed tomography (CT) guided transpedicular biopsy (Fig. 2 A, B) was done and was sent for microbiological and histopathological evaluation, which was suggestive of GCT (Fig. 2 C). Preoperative SAE was done 4–6 h before definitive surgical intervention. Complete obliteration of the vessel was confirmed.

Anterior corpectomy and reconstruction of the anterior column, followed by posterior stabilization, were planned during the same session. In the left lateral position, the right thoracotomy approach with rib resection was utilized to approach the D8 body. Piecemeal near total corpectomy was done and reconstructed with a mesh cage and screwed with clip and rod construct. This is followed by posterior midline exposure in a prone position and D6-10 instrumented fusion done with pedicle screws and rods (Fig. 3 B, C).

**Case 2**

A 25-year-old female presented in the spine clinic of a tertiary care orthopedic hospital with complaints of lower back pain of a nonradiating nature for four months, for which an X-ray was done elsewhere. She was diagnosed with a fracture of the L4 vertebra, for which she was on conservative management with bed rest. Fifteen days back, the patient’s symptoms aggravated after an episode of jerk while traveling by car. On examination, axial tenderness was present at a lower lumbar region with no sensory or motor neurological deficit. A fresh X-ray was suggestive of L4 vertebral osteolytic expansile lesion within the body with a thinned-out anterior cortex with pathological fracture. CT scan suggested the involvement of the right pedicle and body (Fig. 4). MRI showed hyperintense signals in T1 and T2 weighted images and hyperintensity on STIR images with the convexity of the posterior margin of the L4 vertebral

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![Fig. 1. (A, B) T2 weighted images sagittal and axial D8 lesion with hypointense signals with the convex posterior surface of body with cord compression. (C, D) T1 weighted images sagittal and axial D8 lesion with hypointense signals with paravertebral soft tissue invasion. (E, F) Sagittal and coronal STIR images—hyperintense lesion with paraspinal invasion.](image-url)
body, suggesting neoplastic etiology (Fig. 5). Positron emission tomography (PET-CT) scan showed increased uptake of fluorodeoxyglucose (FDG)-18 tracer (Fig. 6 A) with no other location of increased uptake. C-arm guided L4 transpedicular biopsy was done, and the sample was sent for microbiological and histopathological evaluation. The diagnosis of GCT was confirmed on histopathological evaluation (Fig. 6 B). Preoperative SAE of the feeding vessel was done 4–6 h before definitive surgical intervention (Fig. 6 C, D). Complete obliteration of the vessel was confirmed.
Posterior stabilization followed by anterior corpectomy and reconstruction of the anterior column was planned. In a prone position through the posterior midline approach, L3-L5 stabilization was performed and no screws were inserted in the L4 vertebra. L4 laminectomy and right pedicle excision were done. Then, for the L4 corpectomy, the anterior retroperitoneal approach in the right lateral position was utilized. Piecemeal near total corpectomy was done and reconstructed with an expandable cage (Fig. 7C). The wound was closed in layers. The patient was mobilized in bed for four weeks. Patients were followed up for four years and one year, respectively, with follow-up CT scans and showed no recurrence.

**Discussion**

SGCT is a relatively rare entity with an incidence of 2%–15% of bone GCT (spinal + appendicular). The incidence of SGCT in the axial skeleton is higher in the sacrum (1.7%–8.2%) than that in the mobile segment of the vertebral column (2%–4%). The common age group for SGCT is 20–45 years, with an equal male-to-female ratio [2,3].

En bloc resection, curettage, extended curettage (mechanical and chemical), radiotherapy, and arterial embolization are different modalities used to manage GCT in long bones [3]. En bloc excision is challenging in the spine due to proximity to the spinal cord, which leads to incomplete resection of tumor and increased incidence of local recurrence, 25%–30% [5].

Luksanapruska et al. reviewed patients with SGCT and they recommended an approach to tumor based on the Weinstein–Boriani–Biagini classification [6]: if posterior elements are also involved, then total spondylectomy with three-column reconstruction is indicated; however, total spondylectomy is associated high morbidity and mortality [2]. Total spondylectomy has a better
recurrence-free survival rate than subtotal spondylectomy [7]. Intralesional curettage is associated with increased local recurrence [8].

The anterior and posterior approach ensures complete resection of the tumor and instrumentation through both approaches; total or subtotal spondylectomy mandates anterior reconstruction along with posterior instrumented fusion [9]. In our two cases, we performed gross-total spondylectomy with 360° stabilization. Posterior fixation with anterior column reconstruction ensures adequate tumor resection and less incidence of recurrence and prevents delayed collapse of the anterior column. Total spondylectomy is challenging and not possible in all cases due to proximity to neural structures and other vital vascular structures, which increase the risk of recurrence. Adjuvant therapy plays an important role in such cases.

Preoperative SAE is done with Gelfoam particles or poly vinyl alcohol (PVA); it reduces blood flow to tumor mass, significantly reducing intraoperative bleeding, maintaining clean surgical field, and allowing piecemeal resection [2]. SAE does not influence the recurrence of SGCT [7]. It reduces tumor vascularity and size and stimulates reossification. Preoperative SAE was studied by Zhou et al. in 28 patients with SGCT; they performed intralesional resection of tumors and reconstruction within 48 hrs of embolization, and the average blood loss was 1500 ml as compared to that without embolization, which was 7500 ml as per literature review [10]. In our cases, we used preoperative PVA embolization within 12 h of surgery, which reduced intraoperative bleeding significantly, helped in the intralesional resection of the tumor, and allowed both procedures to be done simultaneously.

In the past few years, the role of denosumab in the treatment of bone GCT and SGCT has been extensively studied. It can be used as either monotherapy if en bloc excision of the tumor is not possible or wide local excision is too morbid. Adjuvant denosumab therapy is debatable - few studies recommend it after intralesional resection of GCT [11]. Neoadjuvant therapy with denosumab 120 mg is recommended monthly for 3–4 months, which causes neocortex formation and osteoid formation within the lesion; on histological evaluation, the disappearance of giant cells is replaced by fibrous tissue that is less vascular [12,13]. However, few studies have observed cellular atypia and haphazard osteoid deposition within the tumor, resembling osteosarcoma [14,15]. Scoccianti et al. observed 47% recurrence with the use of denosumab as compared to 12% recurrence with resection alone [16], and Chinder et al. observed 42% recurrence with denosumab use and 18.5% recurrence with curettage [17]. Palmerini et al. in their study observed a higher recurrence rate after discontinuation of long-term denosumab [18]. Hence, in both cases, we are reporting that denosumab therapy pre- or postoperatively was not used.

In cases where incomplete resection is done, postoperative radiotherapy is indicated to reduce the recurrence rate. The use of postoperative RT is controversial as complications like myelitis, malignant transformation, and bone graft-related complications. Other indications are recurrent GCT and inoperable tumor [2,9,19].

**Conclusion**

SGCT is a highly vascular tumor with a high incidence of local recurrence; preoperative SAE

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**Fig. 7.** (A) Intraoperative image of anterior left retroperitoneal approach after tumor resection. (B, C) AP and lateral postoperative X-ray, anterior column reconstruction with expandable cage and posterior stabilization with pedicle screws.
makes intralesional total excision of the tumor easy by reducing hemorrhage. Total intralesional resection of vertebrae through anterior retroperitoneal or thoracotomy and posterior approaches is associated with satisfactory local control of lesion.

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Ethics Information
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Conflicts of interest
None declared.

Abbreviations

CT Scan  Computed tomography scan  
FDG  Fluorodeoxyglucose  
GCT  Giant cell tumor  
MRI  Magnetic resonance imaging  
PET-CT  Positron emission tomography-computed tomography  
PVA  Polyvinyl alcohol  
SAE  Selective arterial embolization  
SGCT  Spinal giant cell tumor  
STIR  Short tau inversion recovery  
WI  Weighted images

References