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Case Report

Giant cell tumor of the thoracic spine: An unusual cause for spinal cord compression ☆

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ABSTRACT

Giant cell tumors (GCTs) of bone are uncommon neoplasms, typically located in the metaphysis of long bones, with rare occurrences in the spine, especially in the thoracic region. We report the case of a 34-year-old woman with a history of psoriasis and celiac disease, who presented with progressive inflammatory back pain and paraparesis. Imaging revealed an osteolytic mass at the T11 vertebra, causing dorsal spinal cord compression. Emergency surgery was performed, with histopathology confirming GCT. Despite initial recovery of motor function, surgical stabilization was later necessary to prevent spinal instability. The patient was started on adjuvant Denosumab therapy and remained asymptomatic on follow-up. This case highlights the rarity of GCT in the thoracic spine and associated diagnostic and therapeutic challenges. Though benign, GCTs can cause severe spinal cord compression, necessitating prompt surgical intervention to preserve neurological function. Denosumab therapy shows promise in controlling tumor progression and enhancing surgical outcomes. Multidisciplinary management and regular follow-up are essential to prevent recurrence and improve prognosis.

Introduction

Giant cell tumors (GCTs) are benign but locally aggressive bone tumors that can compromise adjacent tissues. Most commonly located near joints such as the knee, wrist, ankle, or hip, GCTs account for approximately 5% of all primary bone tumors [1,2]. In rare cases (2%-4%) [3], GCTs occur in the spine, primarily in the sacrum and, less commonly, the thoracic spine [4]. These osteolytic lesions predominantly affect females in their twenties and thirties [5].

Managing spinal GCTs presents unique challenges due to anatomical complexities. When GCTs develop within the spinal canal, they may cause neurological deficits by com-

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pressing the spinal cord, the conus, cauda equina, exiting nerves and other paraspinal structures [6]. Treatment often involves wide en bloc resection, though this approach is sometimes impractical in spinal lesions due to the risk of vascular or neural injury [1]. Adjuvant therapies, including radiotherapy and Denosumab, are frequently employed; however, despite these treatments, local recurrence and distant metastasis remain common [1,2].

Case report

We report the case of a 34-year-old woman with a history of psoriasis, celiac disease, and penicillin allergy, who presented with a 2-week history of worsening inflammatory back pain unrelieved by analgesics. The pain was associated with gait difficulties and heaviness in both lower limbs, without sphincter dysfunction. The patient denied any history of trauma, fever, night sweats, or weight loss. There was no report of bowel or bladder dysfunction.

On examination, the patient exhibited a spastic gait and proximal paraparesis, predominantly affecting hip flexion and knee extension bilaterally. Hyperreflexia was noted in the lower limbs, along with a bilateral Babinski sign. No sensory deficits were observed, and the remainder of the systemic examination was unremarkable.

Initial laboratory investigations were within normal limits, including complete blood count, inflammatory markers (C-reactive protein and erythrocyte sedimentation rate), and metabolic panel. Serum calcium, alkaline phosphatase, and parathyroid hormone levels were also within reference values. A comprehensive infectious workup, including blood cultures and tuberculosis screening, yielded negative results.

Given the progressive neurological deterioration, urgent spinal imaging was performed.

Spinal cord MRI (Fig. 1) revealed a lesion originating from the vertebral body of T11, with considerable extension into the spinal canal, resulting in significant spinal cord compression.

A spinal CT scan was also performed (Fig. 2), showing osteolysis associated with the lesion, along with significant spinal instability and balance abnormalities. The radiologic features initially raised suspicion of metastatic epiduritis, prompting a multidisciplinary discussion. Due to the severity of the neurological deficit and the risk of further deterioration, an urgent surgical intervention was planned.

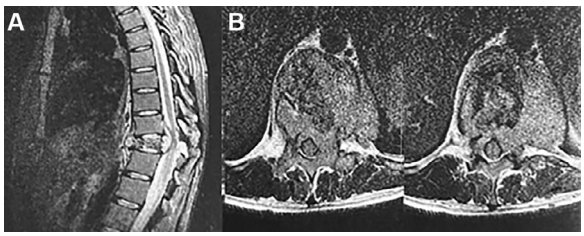

Fig. 1 – Sagittal (A) and axial (B) sections of a spinal cord MRI on T2-WI (A) and T1-WI with injection of Gadolinium showing a lesion originating from the vertebral body of T11 associated to an extension inside the spinal canal and responsible for a spinal cord compression.

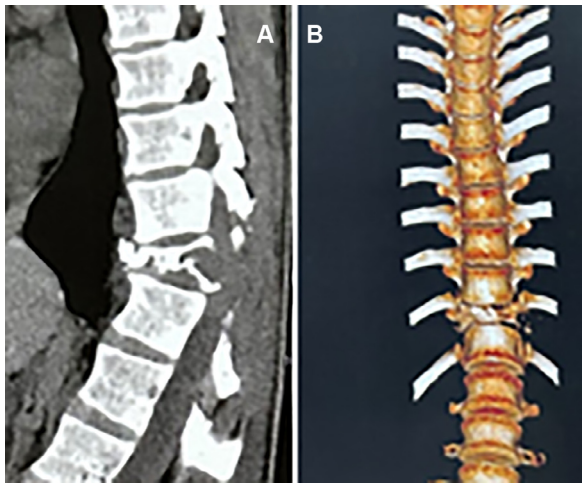

Fig. 2 – Sagittal section (A) and 3D coronal reconstruction (B) of a spinal CT scan showing the osteolytic nature of the lesion responsible of a kyphotic alignment disorder.

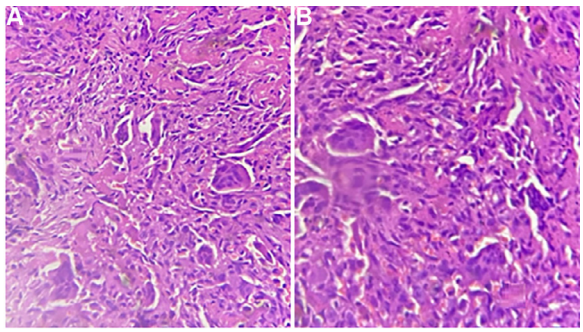

Fig. 3 – Medium (A) and high (B) magnification of the pathologic exam stained with Hematoxylin and Eosin showing mononuclear neoplastic cells surrounded by reactive bone.

The patient underwent a T10–T12 laminectomy allowing a decompression of the spinal cord. Intraoperatively, the lesion was noticed to be highly hemorrhagic. Postoperative course was uneventful, and the patient showed a noticeable improvement of her preoperative motor deficit. Histopathological exam (Fig. 3) revealed cortical bone erosion by osteoclasts and mononuclear neoplastic cells, bordered by reactive bone. Neoplastic cells showed a diffuse syncytial pattern with ovoid shapes, eosinophilic cytoplasm, and numerous mitotic figures, confirming the diagnosis of a GCT.

Considering her young age, the benign nature of the tumor, and the risk of static disorders, a decision was made to perform surgical stabilization. The patient underwent posterior T9–L1 fixation with posterolateral bone grafting (Fig. 4).

The patient recovered well postoperatively and was discharged 3 days after surgery with improved motor function. She was referred to the oncology department for adjuvant Denosumab therapy to prevent tumor recurrence and optimize long-term outcomes. After 6 months follow up, she is doing well and did not show any clinical signs of recurrence.

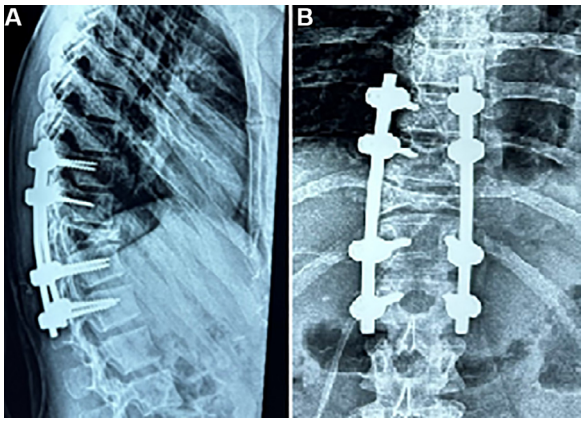

Fig. 4 – Postoperative X-ray of the thoracic spine showing screw positioning.

Discussion

First described in 1818 by Cooper and Travers, GCTs are known for their aggressive growth, especially in the metaphysis of long bones, accounting for approximately 4–5% of primary bone tumors [1,5]. GCTs of the spine are uncommon, comprising only 2-4% of all GCTs, with a predilection for the sacrum and lumbar regions [3,7]. In contrast, thoracic spine involvement is extremely rare and presents unique challenges due to both anatomical complexity and potential for neurological impairment related to spinal cord compression [1,2]. In fact, only a few reports and series have discussed this condition in the literature (Table 1). GCTs are benign but locally aggressive, with a tendency to erode bone, compromise structural stability, and invade surrounding tissues, including the spinal canal [5].

The diagnosis of spinal GCTs involves a combination of clinical, radiological, and histopathological assessments. Spinal GCTs generally cause nonspecific symptoms related to spinal cord compression. Conventional radiography may reveal a classic “soap bubble” appearance in GCTs, characterized by osteolytic lesions with cortical thinning, while CT scans provide more detailed views of cortical destruction and soft tissue extension [4]. In this case, MRI was critical, not only for diagnosing the extent of spinal cord compression but also for evaluating the tumor’s involvement in surrounding soft tissues. MRI findings, such as hypointensity on T1-weighted images and hyperintensity on T2-weighted images, are typically seen in GCTs, and contrast enhancement aids in delineating the tumor margins [7,8].

The differential diagnosis includes primarily metastatic disease, aneurysmal bone cysts (ABCs), chordomas, lymphoma, myeloma, and other aggressive benign lesions, each with distinctive radiological features [1,3,7]. Although differential diagnosis may be challenging, several key elements aid in differentiation [9]. TCGs predominantly involve the vertebral body rather than the posterior elements [4,5,10]. This is an important distinction because the anatomical site of the lesion provides valuable clues [5,6]. Lesions involving the posterior elements should raise suspicion for osteoblastoma, ABC, or osteoid osteoma, whereas metastatic disease and myeloma commonly affect the vertebral body and spare the posterior elements [4–7,10]. Radiological features also vary: metastatic disease typically presents as osteolytic; ABCs are multiloculated, expansile lesions with fluid-fluid levels on MRI, frequently involving the posterior elements rather than the vertebral body; chordomas usually involve the sacrum or clivus rather than the mobile spine and exhibit a lobulated appearance with high T2 signal intensity and calcifications on imaging; lymphoma frequently presents as a vertebral lesion with preservation of the intervertebral discs, often associated with paraspinal soft tissue involvement and minimal bone destruction; myeloma is characterized by multiple small osteolytic lesions, diffuse bone marrow infiltration, and a "punched-out" appearance on radiographs. Biological behavior, clinical presentation and patient demographics may also help in addressing the right diagnosis.

Surgical resection remains the cornerstone of treatment for spinal GCTs, as it offers the possibility of immediate decompression of the spinal cord, may alleviate pain, and may restore neurological function [9,11]. However, surgical management is challenging due to the tumor’s high vascularity, risk of bleeding, and the need to maintain spinal stability. In the case presented, an initial decompressive laminectomy was performed as an urgent intervention to prevent neurological deterioration [9,12]. This was followed by posterior instrumentation and fusion to mitigate spinal instability, which would have been further exacerbated by the initial decompressive laminectomy. Total en bloc resection is typically the preferred surgical approach for long-term outcomes, as it reduces recurrence risks, but achieving this in the thoracic spine is difficult due to proximity to vital structures and increased risk of morbidity [9,10,12].

Table 1 – Summary of reported cases of giant cell tumor in the thoracic spine.

Author, Year	Study type	N	Location	Age (years) and (sex)	Treatments
Al-Shamary et al. [11]	Case report	1	T1	29 (Female)	Surgery and fusion
Shivers et al. [10]	Case report	1	T9	30 (Female)	Biopsy then surgery and fusion
Singh et al. [3]	Case series	3	C2	24 (Male)	Surgery and radiotherapy
			C7-T1	24 (Female)	
			T4	30 (Female)	
Lucasti et al. [6]	Case report	1	T7-T9	21 (Female)	Surgery, fusion and Denosumab
Torres et al. [9]	Case report	1	T7	21 (Female)	Surgery, fusion and radiotherapy
Huang et al. [4]	Case report	1	T10	36 (Female)	Surgery
Miao et al. [13]	Case report	1	T9	30 (Female)	Surgery, fusion, zoledronic acid and stereotactic radiotherapy

Denosumab, a monoclonal antibody targeting the RANKL (Receptor Activator of Nuclear Factor Kappa-B Ligand) pathway, has emerged as a promising adjuvant therapy in the management of GCTs, particularly for unresectable or advanced cases [13]. By inhibiting osteoclast activity, Denosumab reduces tumor growth and may facilitate surgical resection by limiting local invasion and vascularity [13,14]. Several studies have demonstrated Denosumab's efficacy in reducing tumor size, stabilizing bone, and even achieving radiological remission in some cases [1,13,14]. Although Denosumab has shown potential in managing spinal GCTs, its optimal duration, long-term efficacy, and safety profile, including potential rebound growth upon discontinuation, require further investigation through controlled studies [13].

The prognosis for patients with spinal GCTs largely depends on the extent of resection and the effectiveness of adjuvant therapy [2,13]. Incomplete resection is associated with a higher recurrence rate, which may necessitate additional surgical interventions and, in some cases, radiotherapy [1,8]. However, given the propensity for local recurrence and potential for metastasis, long-term follow-up with periodic imaging is crucial. Serial CT and MRI scans will be essential for monitoring disease progression, while ongoing Denosumab therapy may further reduce recurrence risks [2,9].

Conclusions

This case emphasizes the importance of a multidisciplinary approach in managing spinal GCTs. Collaboration between neurosurgeons, radiologists, oncologists, and pathologists is essential for accurate diagnosis, effective treatment planning, and long-term follow-up. Total en bloc resection remains the gold standard. The risk of spinal balance disorders should be considered while proceeding with the therapeutic plan. The integration of adjuvant therapies such as Denosumab offers new hope in treating these challenging cases, though further research is needed to optimize treatment protocols and improve patient outcomes.

Patient consent

A written consent has been obtained from the patient regarding this publication.

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