EDITORIAL

2686  Antifungal pipeline: Is there light at the end of the tunnel?  
Schinas G, Spernovasilis N, Akinosoglou K

2692  Cracking the silent gallstone code: Wait or operate?  
Goswami AG, Basu S

2698  Metabolic dynamics in chronic gastritis: Examining urinary profiles post Helicobacter pylori eradication  
Musharaf I, Nashwan AJ

2701  Pearls of meta-analyses and systematic review in scientific evidence  
Au SCL

MINIREVIEWS

2704  Advanced nanomedicines and immunotherapeutics to treat respiratory diseases especially COVID-19 induced thrombosis  
Wu J, Zheng Y, Zhang LN, Gu CL, Chen WL, Chang MQ

ORIGINAL ARTICLE

Retrospective Cohort Study

2713  Clinical efficacy of intradermal type I collagen injections in treating skin photoaging in patients from high-altitude areas  

Retrospective Study

2722  Multimodal imaging in the diagnosis of bone giant cell tumors: A retrospective study  
Kou MQ, Xu BQ, Liu HT

2729  Treatment for paragangioma with stereotactic radiotherapy  
Pontoriero A, Critelli P, Zeppieri M, Angileri FF, Ius T

2738  Effect of endoscopic full-thickness resection assisted by distal serosal turnover with floss traction for gastric submucosal masses  
Liu TW, Lin XF, Wen ST, Xu JY, Fu ZL, Qin SM

2745  Relationship between ultrasound parameters of the umbilical and middle cerebral arteries and intrauterine fetal distress  
Chen J, Liu FX, Tao RX
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2751</td>
<td>Effect of psychological nursing interventions on effectiveness and quality of life in schizophrenia patients receiving modified electroconvulsive therapy</td>
<td>Lu J</td>
</tr>
<tr>
<td>2758</td>
<td>Effect of percutaneous electrical stimulation at the Baliao point on preventing postpartum urinary retention after labor analgesia</td>
<td>Wang XQ, Guan LS</td>
</tr>
<tr>
<td>2765</td>
<td>Perceptions and factors influencing exercise interventions in elderly patients with debilitating spinal surgery and healthcare professionals: A qualitative study</td>
<td>Cheng RR, Li R</td>
</tr>
<tr>
<td>2773</td>
<td><em>Helicobacter pylori</em>: High dose amoxicillin does not improve primary or secondary eradication rates in an Irish cohort</td>
<td>Costigan C, O'Sullivan AM, O'Connell J, Sengupta S, Butler T, Molloy S, O'Hara FJ, Ryan B, Breslin N, O'Donnell S, O'Connor A, Smith S, McNamara D</td>
</tr>
<tr>
<td>2789</td>
<td>Causal association between 25-hydroxyvitamin D status and cataract development: A two-sample Mendelian randomization study</td>
<td>Wang CH, Xin ZK</td>
</tr>
<tr>
<td>2796</td>
<td>Fat management in upper blepharoplasty: Addition or subtraction blepharoplasties, how and when</td>
<td>Miotti G, Di Filippo J, Grando M, Salati C, Parodi PC, Spadea L, Gagliano C, Musa M, Zeppieri M</td>
</tr>
<tr>
<td>2803</td>
<td>Iron and ferritin effects on intensive care unit mortality: A meta-analysis</td>
<td>Yang DC, Zheng BJ, Li J, Yu Y</td>
</tr>
<tr>
<td>2813</td>
<td>Secondary diabetes due to different etiologies: Four case reports</td>
<td>Song WR, Xu XH, Li J, Yu J, Li YX</td>
</tr>
<tr>
<td>2822</td>
<td>Giant cavernous aneurysms occluded by aneurysmal thrombosis, calcification, parent artery occlusion: A case report and review of literature</td>
<td>Wang MX, Nie QB</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Authors</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>2831</td>
<td>Computed tomography three-dimensional reconstruction in the diagnosis of bleeding small intestinal polyps: A case report</td>
<td>Zhang SH, Fan MW, Chen Y, Hu YB, Liu CX</td>
</tr>
<tr>
<td>2837</td>
<td>Managing adult-onset Still's disease in pregnancy: A case report</td>
<td>Kang JH</td>
</tr>
<tr>
<td>2847</td>
<td>Conversion therapy of a giant hepatocellular carcinoma with portal vein thrombus and inferior vena cava thrombus: A case report and review of literature</td>
<td>Song WJ, Xu J, Nie Y, Li WM, Li JP, Yang L, Wei MQ, Tao KS</td>
</tr>
<tr>
<td>2856</td>
<td>Migration of varicocele coil leading to ureteral obstruction and hydronephrosis: A case report</td>
<td>Alamri A</td>
</tr>
<tr>
<td>2869</td>
<td>Giant vascular malformations invading the skull: A case report</td>
<td>Xie MC, Wang FX, Xu J</td>
</tr>
<tr>
<td>2876</td>
<td>Uterine epithelioid trophoblastic tumor with the main manifestation of increased human chorionic gonadotropin: A case report</td>
<td>Huang LN, Deng X, Xu J</td>
</tr>
<tr>
<td>2887</td>
<td>Clinicopathological analysis of EWSR1/FUS::NFATC2 rearranged sarcoma in the left forearm: A case report</td>
<td>Hu QL, Zeng C</td>
</tr>
<tr>
<td>2894</td>
<td>Thoracic giant cell tumor after two total en bloc spondylectomies including one emergency surgery: A case report</td>
<td>Liang HF, Xu H, Zhan MN, Xiao J, Li J, Fei QM</td>
</tr>
<tr>
<td>2904</td>
<td>Primary thoracolumbar intraspinal malignant melanoma: A case report</td>
<td>Huang JB, Xue HJ, Zhu BY, Lei Y, Pan L</td>
</tr>
</tbody>
</table>

*World Journal of Clinical Cases*

Thrice Monthly Volume 12 Number 16 June 6, 2024
ABOUT COVER
Peer Reviewer of World Journal of Clinical Cases, Shyam Sundar Das Mohapatra, DNB, MBBS, Surgeon, Department of Comprehensive and Community Ophthalmology, Sri Sankaradeva Nethralaya, Guwahati 781028, Assam, India. drssdasmohapatra@gmail.com

AIMS AND SCOPE
The primary aim of World Journal of Clinical Cases (WJCC, World J Clin Cases) is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

INDEXING/ABSTRACTING
The WJCC is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJCC as 1.1; IF without journal self cites: 1.1; 5-year IF: 1.3; Journal Citation Indicator: 0.26; Ranking: 133 among 167 journals in medicine, general and internal; and Quartile category: Q4.

RESPONSIBLE EDITORS FOR THIS ISSUE
Production Editor: Si Zhao; Production Department Director: Xu Guo; Cover Editor: Jin-Lei Wang.

NAME OF JOURNAL
World Journal of Clinical Cases

ISSN
ISSN 2307-8960 (online)

LAUNCH DATE
April 16, 2013

FREQUENCY
Thrice Monthly

EDITORS-IN-CHIEF
Bao-Gan Peng, Salim Surani, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati

EDITORIAL BOARD MEMBERS
https://www.wjgnet.com/2307-8960/editorialboard.htm

PUBLICATION DATE
June 6, 2024

COPYRIGHT
© 2024 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS
https://www.wjgnet.com/bpg/gerinfo/204

GUIDELINES FOR ETHICS DOCUMENTS
https://www.wjgnet.com/bpg/gerinfo/287

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH
https://www.wjgnet.com/bpg/gerinfo/240

PUBLICATION ETHICS
https://www.wjgnet.com/bpg/gerinfo/288

PUBLICATION MISCONDUCT
https://www.wjgnet.com/bpg/gerinfo/208

ARTICLE PROCESSING CHARGE
https://www.wjgnet.com/bpg/gerinfo/242

STEPS FOR SUBMITTING MANUSCRIPTS
https://www.wjgnet.com/bpg/gerinfo/239

ONLINE SUBMISSION
https://www.f6publishing.com

© 2024 Baishideng Publishing Group Inc. All rights reserved. 7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
E-mail: office@baishideng.com https://www.wjgnet.com
Thoracic giant cell tumor after two total en bloc spondylectomies including one emergency surgery: A case report

Hai-Feng Liang, Hao Xu, Meng-Na Zhan, Jian Xiao, Juan Li, Qin-Ming Fei

Abstract

BACKGROUND
For patients with acute paraplegia caused by spinal giant cell tumor (GCT) who require emergency decompressive surgery, there is still a lack of relevant reports on surgical options. This study is the first to present the case of an acute paraplegic patient with a thoracic spinal GCT who underwent an emergency total en bloc spondylectomy (TES). Despite tumor recurrence, three-level TES was repeated after denosumab therapy.

CASE SUMMARY
A 27-year-old female patient who underwent single-level TES in an emergency presented with sudden severe back pain and acute paraplegia due to a thoracic spinal tumor. After emergency TES, the patient's spinal cord function recovered, and permanent paralysis was avoided. The postoperative histopathological examination revealed that the excised neoplasm was a rare GCT. Unfortunately, the tumor recurred 9 months after the first surgery. After 12 months of denosumab therapy, the tumor size was reduced, and tumor calcification. To prevent recurrent tumor progression and provide a possible cure, a three-level TES was performed again. The patient returned to an active lifestyle 1 month after the
second surgery, and no recurrence of GCT was found at the last follow-up.

**CONCLUSION**

This patient with acute paraplegia underwent TES twice, including once in an emergency, and achieved good therapeutic results. TES in emergency surgery is feasible and safe when conditions permit; however, it may increase the risk of tumor recurrence.

**Key Words:** Giant cell tumor; Thoracic spine; Emergency treatment; Total *en bloc* spondylectomy; Denosumab therapy; Case report

---

**Core Tip:** For patients with acute paraplegia caused by spinal giant cell tumor (GCT) who require emergency decompressive surgery, there is still a lack of relevant reports on surgical options. This study is the first to present the case of an acute paraplegic patient with a thoracic spinal GCT who underwent an emergency total *en bloc* spondylectomy (TES). Despite tumor recurrence, three-level TES was repeated after denosumab therapy. The patient returned to an active lifestyle 1 month after the second surgery, and no recurrence of GCT was found at the last follow-up.

---

**INTRODUCTION**

Giant cell tumor (GCT) of the bone were newly classified as intermediate malignant tumors with high local infiltration ability by the World Health Organization in 2020[1]. Only approximately 1.4%-15% of GCT occur in the spine and most commonly appear in patients aged 20-40 years, with female sex predominance[2]. The complications of spinal GCT include pathologic fracture, lung metastases, nerve root compression in vertebral location, and high postoperative recurrence rate[3]. Patients with a spinal GCT most commonly present with persistent back pain and varying degrees of neurological dysfunction[5]. A large cervical/thoracic GCT will result in sensory and motor deficits, or even paraplegia of extremities secondary to spinal cord compression. A lumbar GCT with the involvement of the sacral plexus may induce bladder and bowel symptoms.

Total spondylectomy is the treatment of choice for eradicating spinal GCT. The Spinal Tumor Research Group (2009) recommended total *en bloc* spondylectomy (TES) for better control of spinal GCT[4]. Although total spondylectomy might be the best strategy to avoid recurrence, surgical technique is challenging with the possibility of severe complications. Because spinal GCT is adjacent to the spinal cord, nerve root, aorta, vena cava, and vertebral artery[3]. It is difficult and risky to achieve the goal of *en bloc* resection, leading to higher incidence of complications (vascular injury, pleural effusion, cerebrospinal fluid leakage, neurological deterioration, etc.) compared with other spine surgeries.

Some patients with spinal GCT may experience rapid neurological compromise owing to tumor compression, resulting in paraplegia, which often requires immediate emergency surgery to relieve spinal cord compression. To the best of our knowledge, emergency TES for sudden paraplegia caused by spinal GCT has not yet been reported. Emergency surgery must be performed under extreme stress and time constraints, sometimes without a thorough understanding of the patient's condition and clinical information, which further increases the difficulty of performing TES. Therefore, the efficacy and prognosis of emergency TES should be evaluated.

The surgical treatment of recurrent spinal GCT requires special attention. Repeated surgical treatment may be difficult because of the extent of adhesions surrounding the recurrent lesions and disorganized anatomical structures[3]. Regarding treating spinal GCT recurrence after TES, few reports have described a second TES for recurrent multilevel spinal GCT. This is because procedures with high technical requirements often discourage orthopedist from performing multilevel revision surgeries and leave patients with palliative care.

This report describes a case of a 27-year-old female patient who experienced acute paraplegia due to a thoracic spine GCT and underwent single-level TES in the emergency department, successfully recovering spinal cord function and avoiding permanent paralysis. Although the spinal GCT recurred 9 months after the first surgery, we performed three-level TES again after 12 months of neoadjuvant denosumab therapy. The patient returned to an active lifestyle 1 month after the second surgery, and no recurrence of the GCT was observed at the 18-month of the second postoperative follow-up. The timeline of the major clinical events during treatment and follow-up is shown in Figure 1.
CASE PRESENTATION

Chief complaints
A 27-year-old female patient presented to a local hospital with sudden severe back pain and complete paraplegia.

History of present illness
After insertion of an indwelling urethral catheter, the patient was transferred to the emergency department of our hospital by ambulance the following day.

History of past illness
The patient had no history of trauma, fever, weight loss, or infection.

Physical examination
Physical examination revealed bilateral lower limb paraplegia with a power of 0 out of 5, loss of knee reflexes, and a negative Babinski’s sign. Superficial sensory function was lost below the T8 level. Fortunately, deep sensory function was still present.

Imaging examinations
Emergency magnetic resonance imaging (MRI) revealed a vertebral tumor and pathological fracture of the T6 vertebra, and the spinal cord was severely compressed (Figure 2A and B). Emergency chest, abdominal, and pelvic computed tomography (CT) performed at our hospital revealed an osteolytic lesion involving the T6 vertebra that extended into its accessory process (Figure 2C and D).

FINAL DIAGNOSIS
Based on the patient’s age, medical history, imaging data, and physical signs, the possibility of a primary spinal tumor was considered.

TREATMENT
To relieve spinal cord compression as soon as possible and rescue spinal cord function, we performed emergency TES for T6 through a single posterior approach 8 h after the patient developed complete paraplegia. The patient was placed in a prone position for pedicle screw placement.

After pedicle screws were inserted into the T4-5 and T7-9 bilateral vertebral pedicles, the T5-7 costovertebral joint was exposed, and the ribs were transsected approximately 4 cm laterally from the T6 costotransverse joint. Intercostal blood vessels were ligated. The superior articular processes of T7 and inferior articular processes of T5 were removed. The laminae at T5, T6, and T7 were resected using an ultrasonic bone knife to expose the spinal canal and dural membrane. The dural pulsation was weak. Subsequently, gentle blunt dissection of the anterior T6 vertebral body and careful electrocoagulation of segmental blood vessels were performed.

A pair of long, homemade, S-shaped protective retractors were inserted, with their anterior tips overlapping at the anterior T6 vertebral body. Before bilateral resection of T6 pedicles, temporary stability was maintained by using a posterior fixation rod on the left side. At the level of the T5-6 and T6-7 intervertebral discs, cross-puncture needles were
used on both sides, and the intervertebral discs were cut with a stainless-steel thread wire saw (T-saw) in a reciprocating motion. After all disc dissections were completed, the freed anterior column was rotated around the spinal cord and carefully removed from the right side. A total en bloc resection of the vertebral tumor was performed. The residual disc and cartilaginous endplates were removed. Subsequently, a titanium mesh cylinder of appropriate length was selected and filled with autogenous bone graft. It was then placed in the middle of the cutting space. A connecting rod and transverse connection were used for fixation (Figure 2E and F). Finally, the wound was closed after the drain insertion. The total surgical time was 6 h, and the total amount of blood loss was 800 mL. Hematoxylin and eosin staining and immunohistochemical analyses confirmed a GCT characterized by multinucleate giant cells surrounded by neoplastic mononuclear mesenchymal stromal cells with H3F3A mutations (Figure 3). The patient was discharged on the 13th postoperative day with superficial sensory restoration approximately 10 cm below the knee joint.

OUTCOME AND FOLLOW-UP
One month postoperatively, the patient’s neurological deficits had recovered, and she was able to ambulate with crutches. The patient was able to walk without crutches 2 months postoperatively. After 3 months of postoperative follow-up, activities of daily living were normal, with no evidence of local recurrence. Approximately 9 months after the initial surgery, the patient started experiencing mild back pain. She was followed-up at our outpatient clinic, and tumor recurrence was noted. Radiographic analysis revealed osteolytic destruction of the T7 vertebral body and formation of soft tissue masses beside the titanium mesh cylinder without additional metastatic lesions (Figure 4A-F).

The mass pushed the thoracic aorta laterally. Considering the extensive soft tissue involvement of the recurrent GCT, the patient received denosumab 120 mg subcutaneous injections weekly for 3 wk, followed by monthly subcutaneous injections of 120 mg for 11 months. The back pain disappeared after initial denosumab treatment. One year after denosumab treatment, MRI and CT revealed significant sclerotic rim formation at the tumor site and tumor shrinkage (Figure 4G-L).

To prevent further progression of the recurrent thoracic spinal GCT, TES was performed at three levels (T5-T7) of the thoracic spine using a single posterior approach following denosumab treatment. Preoperative angiography and embolization of the segmental artery from T5 to T7 were performed the day before the surgery to reduce intraoperative bleeding. A skin incision was made along the surgical scar on the patient’s back. Lateral dissection was performed to expose the lamina at T2-10. Pedicle screws were placed at T2, T3, and T10, and a posterior fixation rod was used to maintain temporary stability.

The previously placed tail caps, connecting rods, and transverse connections on the left side were removed from the spine. Surgeons carefully exfoliated the scar tissue and exposed the T5-8 costovertebral joint. The ribs were transected approximately 4 cm lateral to the costotransverse joint. Parts of the T4 spinous process, T4 laminae, and T8 laminae were excised, and the spinal canals at the levels of T4 and T8 were fully exposed. Dissection between the scar tissue and the dura was carefully performed, and good dural pulsation was observed. Gentle blunt dissection was performed on the left vertebral of T5-T7 to cross the median line, and segmental arteries were electrocoagulated. A temporary fixation rod was
placed on the left side. Blunt dissection was continued on the right side of the vertebral body until the hands joined the front of the vertebral body. Expansive changes in the T7 tumor mass and a limited paravertebral tumor mass on the left side of T6 were observed that did not break through the capsule. S-shaped protective retractors were placed in front of the vertebral body to separate and protect the pleura and the great vessels. After the two discs were thoroughly cut from T4-5 to T7-8 using sharp-pointed knives and a T-saw, the fixation rod was replaced on the right side, and en bloc laminectomy was performed after T5 and T7 pediculotomy. The freed vertebral bodies at T5-7 were rotated around the spinal cord and carefully removed from the left side. A suitable artificial vertebral body filled with autogenous bone is placed at the middle of the cutting space. After verification of placement with the C-arm on radiographs, the posterior instrumentation was slightly adjusted to compress the inserted mesh. The wound was closed following inserting a drain. Thus, total en bloc resection of the three vertebrae involved in the tumor was achieved (Figure 5).

The operative time was 11 h, with a blood loss of 1500 mL. Pathological findings showed a significant increase in woven bone at the peripheral lesion in transverse vertebral sections (Figure 6). Multinucleated giant cells were not observed (Figure 6). The patient was discharged on the 10th postoperative day and was able to ambulate without neurological deficits. Furthermore, the patient returned to an active lifestyle 1 month after surgery. Three months postoperatively, radiography showed a stable construct. No local tumor recurrence was detected at the follow-up after the second surgery (Figures 7 and 8).

DISCUSSION

GCT is a rare, locally aggressive primary bone tumor recently classified as an intermediate malignancy, with an estimated
The incidence of 1.3 per million per year, and is less common in the spine[6,7]. The most common clinical presentation in patients with spinal GCT is back pain, but the symptoms often progress slowly[7]. Surgical treatment is the foundational treatment strategy for spinal GCT, aiming to preserve functionality, relieve pain, control local recurrence, and prolong survival[2]. A variety of surgical procedures are applicable, from the simplest subtotal resection (curettage) to the most complex TES[4]. Due to the complex anatomy of the spine, subtotal resection is a common surgical option for surgeons but has proven to be inadequate for the treatment of spinal GCT[2]. Compared with subtotal resection (50%-80%), both total en bloc spondylectomy and total piecemeal spondylectomy could significantly reduce the recurrence rate of spinal GCT[8,9]. Further studies on the two types of total spondylectomy found that total piecemeal spondylectomy (14.8%-26.9%) was associated with a higher recurrence rate than TES (0%-15%)[4,9-13]. Hence, TES is recommended for spinal GCT because it can result in better oncological control, lower risk of local recurrence, and obviation of comorbidities associated with repeat surgery[1,14,15].

There is still a lack of relevant reports on surgical options for patients with acute paraplegia caused by spinal GCT who require emergency decompressive surgery. TES remains a challenge in emergency surgeries. Evidence regarding the use of TES shows its theoretical feasibility in emergency surgery; however, the safety of surgery and patient prognosis remains poor. The safety of TES in emergency surgery under extreme stress and time constraints requires further investigation. Table 1 gives a summary of case reports of spinal GCT treated with total spondylectomy. None of these patients had acute progression of paraplegia secondary to a spinal GCT and did not undergo total spondylectomy in emergency surgery[10,16-20]. Lucasti et al[7] reported a patient with T8 GCT presented with acute paraplegia of bilateral lower
Table 1 Summary of previous case reports of total spondylectomy for spinal GCT

<table>
<thead>
<tr>
<th>Ref. (country)</th>
<th>Age (yr), gender</th>
<th>Site of GCT</th>
<th>Treatment</th>
<th>Follow-up (month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hua et al[16] (China)</td>
<td>41, male</td>
<td>T5 vertebra</td>
<td>TES</td>
<td>24</td>
</tr>
<tr>
<td>Kinoshita et al[10] (Japan)</td>
<td>20, female</td>
<td>L3 vertebra</td>
<td>TES</td>
<td>24</td>
</tr>
<tr>
<td>Al-Shamary et al[17] (Saudi Arabia)</td>
<td>29, male</td>
<td>T1 vertebra</td>
<td>Total spondylectomy</td>
<td>10</td>
</tr>
<tr>
<td>Yonezawa et al[18] (Japan)</td>
<td>51, male</td>
<td>T12 vertebra</td>
<td>Total spondylectomy</td>
<td>12</td>
</tr>
<tr>
<td>Inoue et al[19] (Japan)</td>
<td>35, female</td>
<td>T11 vertebra</td>
<td>TES</td>
<td>3</td>
</tr>
<tr>
<td>Matsumoto et al[20] (Japan)</td>
<td>47, female</td>
<td>T5 vertebra</td>
<td>Total spondylectomy</td>
<td>30</td>
</tr>
</tbody>
</table>

GCT: Giant cell tumor; TES: Total en bloc spondylectomy; T: Thoracic; L: Lumbar.

Figure 7 The 15-month follow-up imaging of the patient after the second three-level total en bloc spondylectomy. The images show a stable construct, biological fusion, and no local recurrence at the 15-month follow-up after the second three-level total en bloc spondylectomy. A and B: Anteroposterior and lateral radiographs; C-E: Three-dimensional computed tomography scan images; F: Magnetic resonance imaging.

Figure 8 The 18-month follow-up imaging of the patient after the second three-level total en bloc spondylectomy. A and B: Anteroposterior and lateral radiographs; C: Magnetic resonance imaging shows a stable construct and no local recurrence at the 18-month follow-up after the second three-level total en bloc spondylectomy.

extremities, but this patient only received laminectomy and excisional biopsy of the epidural mass. Therefore, to our knowledge, this is the first case report of a patient who suffered sudden back pain and acute paraplegia secondary to a GCT of the thoracic spine and underwent emergency TES, successfully recovering spinal cord function and avoiding permanent paralysis. Unfortunately, the tumor recurred 9 months after initial TES. Careful examination of the emergency CT scan before the first operation revealed signs of bone destruction in the lateral wall of the adjacent vertebra (T7) below T6 (Figure 9). Therefore, we believe that the first surgery was eager to gain time for spinal cord decompression, leaving
hidden dangers in determining the extent of tumor invasion. Another possible reason may be that because the tumor involves T6 bilateral vertebral pedicles, it is difficult to avoid exposure of the tumor, resulting in tumor cell contamination in the surgical field. In addition, surgeons should pay attention to the possibility of multiple GCTs of bone to avoid missed diagnosis.

Management of recurrent GCT in the spine is challenging. Owing to the complicated anatomical structure, serious tissue adhesions, and significant surgical obstacles after repeated surgeries, revision surgery for recurrent multisegmental GCT of the thoracic spine is technically demanding\textsuperscript{[14,21]}. However, if the condition permits, patients with recurrent spinal GCT would benefit from TES because surgically removing the GCT in a intact piece could significantly reduce the recurrence of spinal GCT and improve the survival rate\textsuperscript{[14,22]}. In order to avoid lethal complications, our experience is to use an ordinary wire saw from the intervertebral foramen to the inner wall of the vertebral pedicle to cut off the pedicle, or use a nerve stripper to stick to the inner wall of the vertebral pedicle to protect the nerves and dura mater, and use a special curved osteotome to cut off vertebral pedicles. Moreover, our hospital has made a self-made foldable front large blood vessel baffle, and used a self-made wire saw or long surgical knife to cut the intervertebral disc by two-step technique. In addition, unlike the emergency situation of the first TES, our patient was well prepared for the second TES 1 year after denosumab treatment. Selective arterial embolization was performed the day before surgery to reduce intraoperative bleeding. Our patient recovered well after the second TES operation, and the results of the last follow-up were satisfactory.

Denosumab, as a neoadjuvant therapy or standalone treatment for GCT, has been used to inhibit progressive bone destruction by replacing multinuclear giant cells with non-proliferative, differentiated, densely woven new bone\textsuperscript{[23,24]}. Denosumab can harden the edges of GCT and facilitate tumor calcification\textsuperscript{[25]}. According to previous studies, denosumab is suitable for neoadjuvant use before the wide resection of GCT, including spinal lesions, and for maintenance use to control symptoms and tumor growth in unresectable or metastatic GCT\textsuperscript{[26,27]}. Agarwal et al\textsuperscript{[26]} reported a case of recurrent T6 GCT that was previously considered unresectable after tumor resection. Complete resection was performed after 10 months of denosumab therapy, complete resection was performed\textsuperscript{[26]}. In our case, imaging after 1 year of denosumab treatment revealed a reduction in tumor size and calcification, which facilitated subsequent TES and reduced surgical risk.

However, denosumab treatment of GCT remains controversial. Yonezawa et al\textsuperscript{[18]} presented a case of T12 GCT that was completely removed by total spondylectomy following 10 courses of denosumab therapy. They found that, although the administration of denosumab resulted in shrinkage of the epidural extraosseous tumor, the progression of vertebral collapse and massive callus formation made the tumor margins unclear and increased the difficulty of performing posterior-approach TES. In addition, high-grade sarcomas arising from bone GCT in patients treated with denosumab have been reported\textsuperscript{[28,29]}. The preoperative and postoperative durations of denosumab treatment, long-term safety, and maintenance dose remain to be elucidated.

CONCLUSION

This is the first report of a patient with sudden back pain and acute paraplegia secondary to thoracic spinal GCT who underwent emergency TES, successfully recovering spinal cord function and avoiding permanent paralysis. Although GCT recurred after the first surgery, we performed a second three-level TES after denosumab treatment to avoid tumor recurrence as much as possible. Therefore, under permitted conditions, such as the patient’s general condition, the surgical experience of the treatment team, and adequate blood preparation in the hospital, TES in emergency surgery is feasible and safe but may increase the risk of spinal GCT recurrence.

FOOTNOTES

Author contributions: Liang HF and Xu H contributed equally to this work as co-first authors; Li J and Fei QM contributed equally to the
Liang et al. GCT of the thoracic spine

manuscript; Liang HF, Xu H and Zhan MN contributed to study design, data collection and analysis; Li J and Fei QM contributed to conceptualization; Liang HF contributed to original manuscript writing; Fei QM, Li J and Xiao J contributed to language check, review and editing. All authors commented on previous versions of the manuscript, read and approved the final manuscript.

Supported by The Shanghai Municipal Health Commission Clinical Research Project, No. 202140140.

Informed consent statement: Informed written consent was obtained from the patient for publication of this report and any accompanying images.

Conflict-of-interest statement: The authors declare that they have no conflicts of interest to disclose.

CARE Checklist (2016) statement: The authors read the CARE Checklist (2016), and this manuscript was prepared and revised according to its guidelines.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

Country/Territory of origin: China

ORCID number: Qin-Ming Fei 0000-0003-0853-1773.

S-Editor: Zheng XM
L-Editor: A
P-Editor: Zhang YL

REFERENCES


16 Hua W, Guo T, Li X, Wu Q, Yang C. Total en bloc spondylectomy of thoracic giant cell tumor with secondary aneurysmal bone cyst: case


