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Editor
Nancy E. Epstein, MD
Clinical Professor of Neurological Surgery, School of Medicine, State U. of NY at Stony Brook

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Case Report

Posterior resection of sacral osteosarcoma utilizing cement-infused chest tube interbody reconstruction and lumbopelvic fusion

Amanda M. Carpenter[1], M. Omar Iqbal[1], Neil Majmundar[1], Gino Chiappetta[2], Shabbar Danish[1], Volker Sonntag[3]

[1]Department of Neurosurgery, Rutgers University, Newark, [2]Department of Orthopaedic Surgery, Rutgers-Robert Wood Johnson University Hospital, New Brunswick, New Jersey, [3]Department of Neurosurgery, Barrow Neurological Institute, Phoenix, Arizona, United States.

E-mail: *Amanda M. Carpenter - amc578@njms.rutgers.edu; M. Omar Iqbal - mi191@njms.rutgers.edu; Neil Majmundar - majmunne@njms.rutgers.edu; Gino Chiappetta - saabyp@uognj.com; Shabbar Danish - danishsh@rwjms.rutgers.edu; Volker Sonntag - volker.sonntag@barrowbrainandspine.com

***Corresponding author:**
Amanda M. Carpenter, Department of Neurosurgery, Rutgers University, Newark, New Jersey, United States.

amc578@njms.rutgers.edu

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ABSTRACT

Background: Primary osteosarcoma (OS) of the spine is very rare. *En bloc* resection of spinal OS is challenging due to anatomical constraints. Surgical planning must balance the benefits of *en bloc* resection with its potential risks of causing a significant neurological deficit. In this case, we successfully performed a posterior-only approach for decompression with S1 reconstruction via a cement-infused chest tube interbody device, along with a navigated L4 to pelvis fusion.

Case Description: A 49-year-old female presented with a primary sacral OS. Computed tomography (CT) and magnetic resonance (MR) imaging revealed an S1 lytic vertebral body lesion with severe stenosis and progressive L5 on S1 anterior subluxation. Surgical decompression with tumor resection and S1 corpectomy with S1 reconstruction via a cement-infused 32-French chest tube interbody device accompanied by L4 -pelvis fusion utilizing S2-alar-iliac screws was completed. 6 months postoperatively, the patient continues to have significant pain relief and the instrumentation remains intact.

Conclusion: A 49-year-old female with an S1 OS successfully underwent a posterior-only approach that included an S1 corpectomy with anterior column reconstruction via a cement-infused chest tube interbody plus a navigated L4 to pelvis fusion.

Keywords: Osteosarcoma, Pelvic fixation, Spine oncology

INTRODUCTION

Primary osteosarcomas (OSs) of the spine is very rare. *En bloc* resection of OS of the spine is challenging due to anatomical constraints of nearby critical structures. Standard of care for OS is neoadjuvant chemotherapy followed by surgery for *en bloc* tumor resection with wide margins, and adjuvant chemotherapy.[6] Radiation therapy is usually not pursued due to the relative radioresistance of OS. A meta-analysis of five studies that included 108 patients studied extent of tumor resection for spinal OS and effect on survival. They conclude that patients who had Enneking appropriate resection (with marginal or wide margins) have increased survival at 24 months than those who had Enneking inappropriate resection (intralesional or contaminated), although there is no survival benefit at 12 months.[5] Surgical planning must balance the benefits

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of *en bloc* resection with the risks of potential neurologic deficits. Here, we present the case of a 49-year-old female who was successfully managed with a posterior-only operative approach to a primary OS of the S1 vertebra.

CASE DESCRIPTION

Presentation

The patient is a 49-year-old female who presented with 6 weeks of severe low back pain and left-sided radiculopathy with focal bilateral S1 numbness on neurological exam. Her lower extremities exhibited full strength.

Magnetic resonance (MR) and computed tomography (CT) diagnostic workup

The lumbosacral MR imaging (MRI) with and without contrast revealed small enhancing lesions in the vertebral bodies of T3, T12, L2, and L3, and a large enhancing lesion of the S1 body with epidural extension causing central canal stenosis and compression of both descending S1 nerve roots [Figure 1]. The CT showed an S1 lytic lesion with an accompanying pathologic fracture. There was also a lytic lucency involving the left iliac wing [Figure 2]. The patient underwent a CT-guided biopsy of the lytic sacral lesion within 36 h of admission. The following day, the patient had urinary retention and she emergently underwent a L5 to S2 laminectomy for decompression of stenosis; additionally, an open sacral tumor biopsy was performed. The patient was able to void on postoperative day 1; however, within a few days, she developed increasing pain in her back, buttocks, and down the back of both legs. The follow-up MRI showed progression of the tumor at S1, increased anterior subluxation of L5 over S1, and recurrent central canal stenosis [Figure 3].

Due to the increased pain, the patient was placed on multiple medications including intrathecal opioids, without any relief. At this point, we felt that resection of the mass followed by stabilization would improve the patient's pain, improve her function, as well as reduce her tumor burden.

Operative procedure

An L4 to sacroiliac instrumented fusion with bilateral transpedicular sacral tumor debulking and S1 reconstruction with a cement-infused chest tube interbody prosthesis was planned.

Using navigation assistance, pedicle screws were placed bilaterally at L4 and L5, along with two S2-alar-iliac (S2AI) screws on each side. The tumor was readily identified and resected easily with suction. We then measured 24 mm between the inferior endplate of L5 and the superior endplate

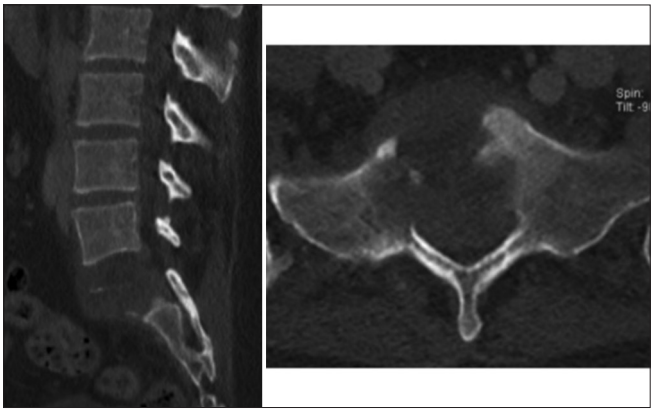

Figure 2: Preoperative sagittal and axial cuts of the computed tomography lumbar spine without contrast demonstrate a lytic lesion throughout the body of S1.

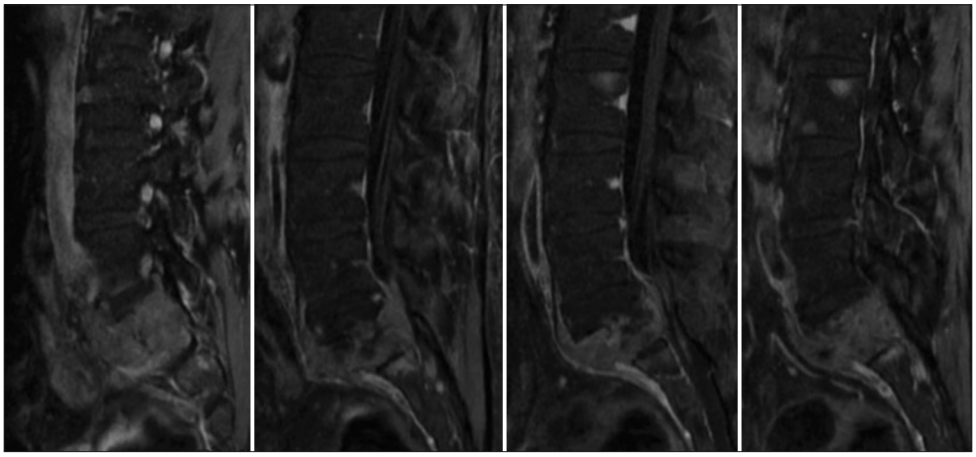

Figure 1: Preoperative magnetic resonance imaging lumbar spine, sagittal T1 with contrast sequence shows an enhancing lesion throughout the body of S1 with invasion ventral to the vertebral body and dorsal into the spinal canal.

of S2 from the repeat intraoperative CT obtained after screw placement.

Unique 32-french tube interbody corpectomy construct

A 32-French chest tube (10.7 mm diameter) was cut to span the L5 to S2 defect. Two small windows were cut on the lateral surface of the chest tube through which cement would be injected. Two small stab incisions were made, superiorly and inferiorly, lateral to the midline lumbar incision, to allow the cement infusion cannulas to be inserted and angled appropriately to engage in the holes made along the lateral surface of the chest tube. A temporary rod was placed between the left L5 and S2AI screws. Under c-arm fluoroscopy, the chest tube strut was inserted into the corpectomy defect, inferior to the right-sided L5 nerve root and lateral to the right-sided S1 nerve root. The chest tube fit nicely onto the S2 endplate which measured 18 mm in anterior-posterior dimension. The lateral cement cannulas were then inserted percutaneously, engaged in the lateral chest tube holes and cement was injected to fill the implant through the inferior hole. The cement filled the strut graft until appropriate contact at both endplates was achieved [Figure 4]. After the cement hardened, we fashioned two rods that would engage the posterior L5-S1 screws in-situ without reduction. Three 5.5 mm rods were placed — the third rod was used to provide extra stability to the construct [Figure 4]. A final intraoperative CT scan showed all hardware to be in satisfactory position [Figure 5].

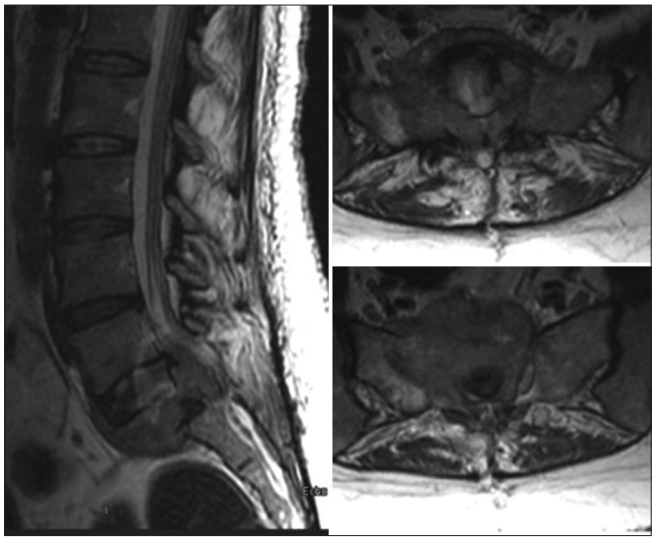

Figure 3: Sagittal and axial T2-weighted images of the magnetic resonance imaging lumbar spine that was completed after the first surgery demonstrates L5 anterior subluxation over S1 with severe stenosis.

Postoperative course

Within 5 days, the patient was able to walk a few steps and had significant pain relief. On postoperative day 8, chemotherapy was initiated with cisplatin and doxorubicin. Six months postoperatively, the patient remains on chemotherapy, is neurologically intact, with a follow-up CT showing all hardware in good position without tumor recurrence.

DISCUSSION

Surgery remains the gold standard treatment in cases of spine instability and/or epidural tumor with spinal cord

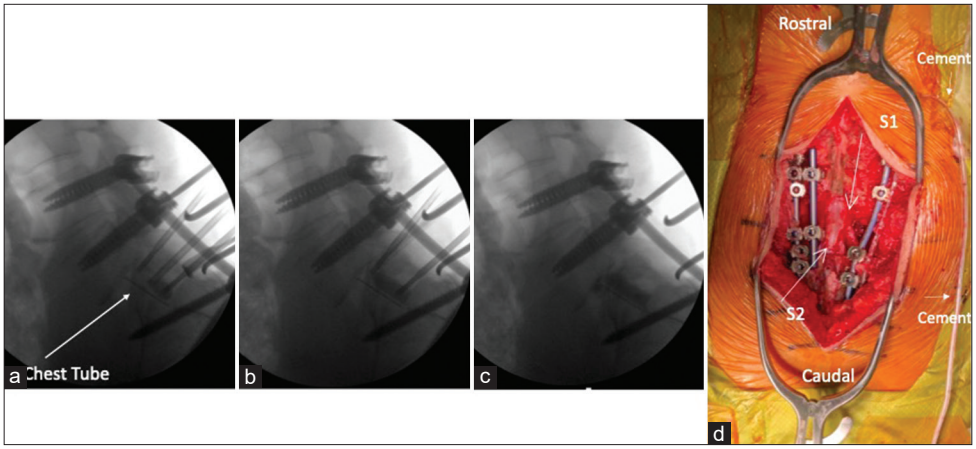

Figure 4: Intraoperative fluoroscopy images are shown in photos a, b, and c. Pedicle instrumentation is seen at L4 and L5, and S2-alar-iliac screws caudally. A chest tube is positioned between the inferior endplate of L5 and superior endplate of S2. Progressive cement injection into holes in the chest tube can be seen in a, b, and c, respectively, until the implant was filled and there was appropriate contact at both endplates. In d, a photo of the operative field demonstrates the three-rod construct, as well as the plastic tubing through which cement was injected.

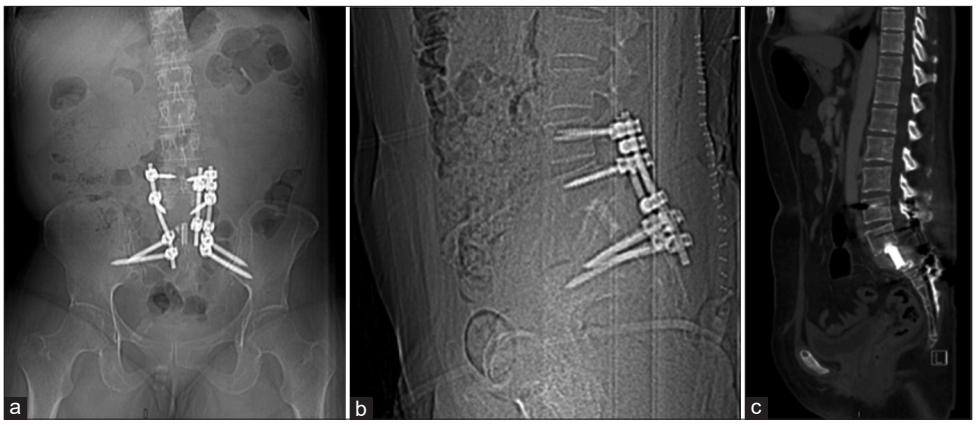

Figure 5: Anterior-posterior (a) and lateral (b) X-rays at the end of the operation demonstrate the instrumentation at L4, L5, and S2-alar-iliac fixation points. A midline slice of an intraoperative computed tomography scan (c) demonstrates the cement interbody in good position.

compression. The Spinal Instability Neoplastic Score is a tool to help determine stability in the setting of spine tumors.[4] Surgery frequently consists of tumor resection and spinal column fixation. Less invasive procedures such as vertebral cement augmentation procedures are an option for patients with refractory back pain who are neurologically intact. An S1 vertebroplasty would not have achieved neural decompression in our patient; furthermore, it likely would have extravasated cement beyond the lytic posterior wall of the vertebral body.

In this case, conservative management of the OS pain -- including the use of opiate infusions and intrathecal therapies -- were ineffective in managing our patient's pain and rendered her bedbound. Laminectomy alone in our patient led to worsening of her pain likely secondary to increased instability and anterior subluxation following posterior element disruption. We performed a posterior-only approach to resect tumor, decompress the spinal canal, and provide fixation in the form of a unique cement-infused chest tube interbody and fusion from L4 to the pelvis.

To overcome the difficulty of placing an interbody device through a narrow corridor via a posterior approach, we utilized the technique of customized cement-infused chest tube interbody placement.[2,3] The smallest available expandable cage could not be placed through this corridor, notwithstanding the small size of the S2 endplate, and the awkward angle between the two endplates to which a modern expandable cage could not conform. Before expandable interbody cages, surgeons employed cement augmentation of the anterior column following vertebral body resection. Cement alone, without silastic tubing to contain and collect the cement was fraught with failure, especially when not supplemented with instrumentation.[1] This "old-school" strategy of cement-infused interbody placement integrated with a modern-day technique of guided posterior instrumentation with neuro-navigation.

CONCLUSION

OS of the S1 vertebral body can be safely managed with a posterior-only approach to accomplish tumor decompression and stabilization. In this case, we performed decompression and tumor resection followed by an S1 corpectomy and interbody placement of a unique cement-infused chest tube plus instrumentation from L4 to the pelvis.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Black P. Spinal metastasis: Current status and recommended guidelines for management. Neurosurgery 1979;5:726-46.
2. Cooper PR, Errico TJ, Martin R, Crawford B, DiBartolo T. A systematic approach to spinal reconstruction after anterior decompression for neoplastic disease of the thoracic and lumbar spine. Neurosurgery 1993;32:1-8.
3. Errico TJ, Cooper PR. A new method of thoracic and lumbar body replacement for spinal tumors: Technical note. Neurosurgery 1993;32:678-80; discussion 680-71.
4. Fisher CG, DiPaola CP, Ryken TC, Bilsky MH, Shaffrey CI,

Berven SH, *et al*. A novel classification system for spinal instability in neoplastic disease: An evidence-based approach and expert consensus from the spine oncology study group. Spine (Phila Pa 1976) 2010;35:E1221-9.

5. Pombo B, Cristina Ferreira A, Cardoso P, Oliveira A. Clinical effectiveness of Enneking appropriate versus Enneking inappropriate procedure in patients with primary osteosarcoma of the spine: A systematic review with meta-analysis. Eur Spine J 2020;29:238-47.
6. Ritter J, Bielack SS. Osteosarcoma. Ann Oncol 2010;21 Suppl 7:vii320-5.

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