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Technique

En bloc sacrectomy and reconstruction: technique modification for pelvic fixation

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Abstract

Background: When the management of sacral tumors requires partial or complete sacrectomy, the spinopelvic apparatus must be reconstructed. This is a challenging and infrequently performed operation, and as such, many spine surgeons are unfamiliar with techniques available to carry out these procedures.

Case Description: A 34-year-old man presented with severe low back pain, mild left ankle dorsiflexion weakness, and left S1 paresthesias. Imaging revealed a large sacral mass extending into the L5/S1 and S1/S2 neural foramina as well as the presacral visceral and vascular structures. Needle biopsy of this mass demonstrated a low-grade chondrosarcoma. A 2-stage anterior/posterior en bloc sacrectomy with a novel modification of the Galveston L-rod pelvic ring reconstruction was carried out. Our modification takes advantage of new materials and implant technology to offer another alternative in reconstruction of the spinopelvic junction.

Conclusion: Understanding the anatomy and biomechanics of the spinopelvic apparatus and the lumbosacral junction, as well as having a familiarity with the various techniques available for carrying out sacrectomy and pelvic ring reconstruction, will enable the spine surgeon to effectively manage sacral tumors.

Keywords: Sacrectomy; Sacrum; Spinal tumor; Spine surgery; Spinopelvic reconstruction

1. Introduction

The treatment of primary sacral tumors can be challenging, both because of the anatomy of the spinopelvic complex and the frequently large tumor size on presentation. For tumors unresponsive to radiation and/or chemotherapy, radical resection has been shown to prolong disease-free survival [2,3,16]. The extent of sacral resection depends on the location and character of the tumor. Subtotal sacral resection caudal to the midportion of the S1 vertebral body does not destabilize the pelvis [12]. Total sacrectomy results in dissociation of the spine and pelvis and requires reconstitution of the pelvic ring.

Various techniques for pelvic ring reconstruction after total sacrectomy have been described [4,18,19,21]. Our technique is derived from the work of Gokaslan et al [11], who initially used a Galveston L-rod technique. To improve biomechanical stabilization, particularly between the L5 pedicle screw and the ilium, they modified their technique to make use of a transverse threaded rod (transiliac bar) [10].

Our modification to the technique exploits newer materials, such as segmentally fixated carbon fiber cages, and extrapolates the observation of improved fusion rates in the thoracolumbar spine to the problem of pelvic ring reconstruction.

2. Case report

A 34-year-old man presented to the emergency department with a 1-year history of low-back pain and a sacral

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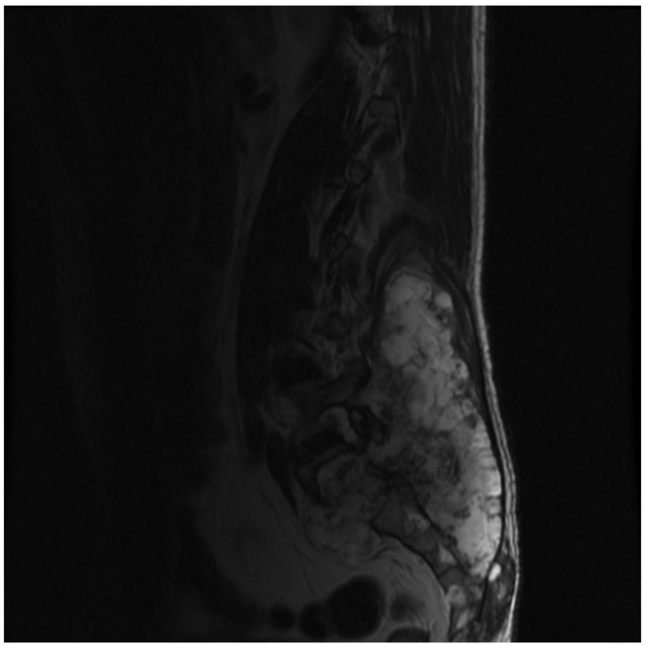

Fig. 1. Preoperative T2 sagittal magnetic resonance image of the lumbosacral spine, demonstrating a large heterogeneous sacral mass.

mass. The mass was incidentally discovered during the work-up of a work-related accident at an outside hospital approximately 1 year before presentation. The patient elected not to pursue additional care at that time because of lack of health care insurance.

Plain films of the lumbar spine demonstrated a complex large left lumbosacral mass. Magnetic resonance images of the lumbar spine and pelvis were then obtained, which revealed a large heterogeneous tumor centered at the left superior sacroiliac joint with extension into the left L5/S1 and S1/S2 neural foramina and the retroperitoneum and paraspinous muscles from L3 to the inferior sacrum (Fig. 1). A core needle biopsy was performed, which confirmed the diagnosis of aggressive chondrosarcoma.

On physical examination, the patient reported mildly decreased sensation to light touch and pinprick in the left S1 dermatome. He had slight weakness (4+/5) in the left ankle plantar flexion but otherwise had full strength in proximal and distal muscle groups bilaterally. His muscle stretch reflexes were nonpathologic. He exhibited an unremarkable station and gait. He did not report a history of urinary incontinence or constipation; however, he did state that he had been unable to achieve an erection for more than 1 year.

3. Operation

A standard 2-stage en bloc sacrectomy was carried out as has been previously described [10,11]. The anterior portion of the procedure was carried out first. A laparotomy was performed, and the colon and iliac vessels were mobilized off of the sacrum by our vascular surgery colleagues. The tumor was readily identifiable at this time as a mass on the midline sacral promontory. Care was made not to disrupt the tumor capsule. The left iliolumbar vein was ligated for ventral access to the tumor. Having successfully mobilized and safely retracted all adjacent visceral and vascular structures, an L5 through S1 anterior discectomy was performed. An anterior sagittal osteotomy was performed in the normal bone of the left ilium, providing for adequate tumor margin. The right sacroiliac joint was used to demarcate the other lateral border, and this was curetted free. Gore-Tex mesh was then placed on the anterior border of the sacrum, and the posterior portion of the operation was carried out. The rectus muscle was then mobilized by plastic surgery and placed in the presacral space.

For the posterior portion of the procedure, the skin incision was carefully planned with the assistance of plastic surgery. We anticipated the need for a large skin flap after our reconstruction. In addition, great care was taken to completely excise the needle biopsy tract from several days before the operation (Fig. 2). The spine from L1 to the coccyx was exposed, as well as both iliac wings. Pedicle screws were placed bilaterally from L1 through L4 in the standard fashion. Partial pediculectomies were performed at L5, preventing pedicle screw placement at that level. Posterolateral fusion with morcellized autograft from distant sites and allograft was performed from L1 through L5. Osteotomies of the left ilium and right sacroiliac joint were then carried out to mobilize the sacrum. The sacrum was dissected circumferentially. Dorsal sacral roots were ligated. The ventral membrane was identified. Laminectomies were carried out from L4 to S1. Again, care was made not to disrupt the tumor capsule. The thecal sac was ligated immediately caudal to the takeoff of the L5 nerve roots. The sacrum and the en bloc tumor were then passed off the field.

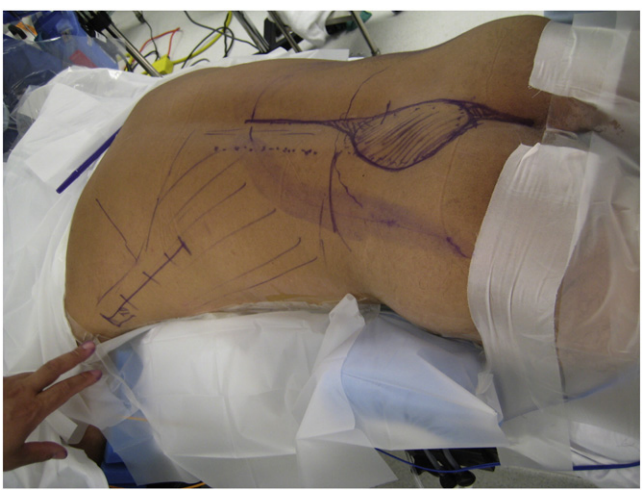

Fig. 2. Skin incision marked out for latissimus flap, biopsy needle tract excision, and en bloc sacral resection.