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Technical Notes

Tailored sacroplasty for sacral fracture secondary to an epileptic seizure

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ABSTRACT

Background: Sacral fractures causing neurological deficits secondary to epileptic seizures are very rare. They are traditionally treated by laminectomy and sacral fixation. However, minimally invasive techniques such as sacroplasty offer more limited surgery with decreased morbidity. Here, a 23-year-old male with a seizure-induced sacral fracture was successfully treated with a decompressive laminectomy and transcorporal sacroplasty.

Methods: After a grand-mal seizure, a 23-year-old male presented with severe paraparesis accompanied by bilateral S1/S2 radiculopathy and urinary/fecal incontinence (Gibbons grade 4). When studies documented a Roy-Camille type 2 sacral fracture with severe central compression of the S1/S2 spinal canal, he underwent an S1-S2 laminectomy with transcorporal sacroplasty.

Results: On the 1st postoperative day, he ambulated without assistance and demonstrated only mild residual sensory deficits (Gibbons grade 2); 1-month later, he walked without assistance.

Conclusion: A 23-year-old male with a seizure-induced sacral fracture was successfully treated with a decompressive S1/S2 laminectomy/transcorporal sacroplasty.

Keywords: Epilepsy, Sacral fracture, Sacroplasty, Seizure-induced fractures

INTRODUCTION

Seizure-induced spinal fractures typically involve the midthoracic to thoracolumbar regions.[9] We were only able to identify two cases of purely sacral fractures that occurred following epileptic seizures.[12] Here, we introduce a third case involving a 23-year-old male who, following a seizure-induced sacral fracture, was successfully treated with a decompressive S1/S2 laminectomy/transcorporal sacroplasty.

METHODS

Presentation and surgery

A 23-year-old male presented with cauda equina syndrome (Gibbons grade 4) secondary to an unprovoked epileptic seizure. On examination, he exhibited lower-limb paraparesis 2/5 on the Medical Research Scale with loss of bladder and bowel control. The lumbar computed tomography scan showed a U-shaped sacral fracture with bilateral lateral mass damage and posterior dislocation of the S1-S2 segment engaging the promontorium [Figure 1]. The magnetic resonance imaging further showed occult fractures and ventral angulation of the fractured S1/S1 segment with severe accompanying stenosis of the spinal canal [Figure 2]. The patient underwent an S1-S2 decompressive laminectomy with a percutaneous vertebroplasty/transcorporal sacroplasty (i.e., using bone cement); intraoperative leakage of bone cement was readily removed.

RESULTS

Postoperative course

On postoperative day 1, the patient was mobilized without a walking aid; the Visual Analog Scale score deteriorated from 9.0 to 3.0; the patient was discharged on postoperative day 4 with only mild tenderness in the operative area and a mild residual bilateral sensory deficit in S1-S2 dermatome distribution (Gibbons grade 2). Antiepileptic therapy was also optimized, and the patient was switched to levetiracetam from valproic acid.

One month later, he ambulated without assistance, exhibiting no residual limb, and sensory and sphincteric complaints had fully resolved. Follow-up X-ray studies showed satisfactory distribution of bone cement in the transverse S1/S2 fracture site with stable consolidation of the sacrum [Figure 3].

DISCUSSION

Incidence of vertebral fractures in patients with epilepsy

Vertebral fractures secondary to tonic-clonic seizures are most commonly attributed to (1) the powerful contraction of the paraspinal muscles during a seizure (primary) and (2) falls or other accidents resulting from the seizure.[9] We

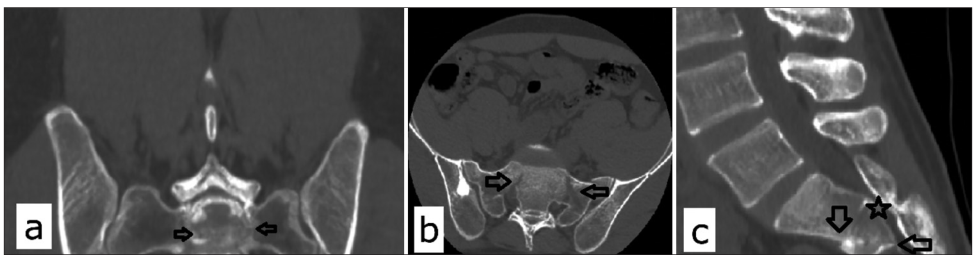

Figure 1: Appearance of the sacral fracture on a computed tomography scan: (a) Coronal plane. Black arrows point to the vertical parts of the fracture on each side. (b) Axial plane. Black arrows point to the oblique parts of the fracture on each side. (c) Sagittal plane. Black arrows point to the anterior and posterior end of the transverse part of the fracture. A black star indicates the level of the most significant central canal stenosis.

Table 1: A literature review on seizure-induced sacral fractures.

Author	Journal	Year	Case Data	Site of Fracture on MR/CT	Neurological Deficits	Surgery	Outcome
Farah *et al.*[4]	Neurochirurgie	2022	Generalized convulsive seizure while sitting in a passenger seat fixed with a three-point seatbelt	Nontraumatic, seizure-induced U-type C3 sacral fracture	Low back pain, urinary retention, and saddle anesthesia with no motor deficit	S1-S3 laminectomy, bilateral pedicle L5-S1, and iliac screw placement with S2 osteotomy	No motor deficiency, improved sensitivity, persistent self-polling at 6-month follow-up
Wang *et al.*[12]	Journal of Surgical Case Reports	2017	Generalized convulsive seizure while sitting in a passenger seat fixed with a three-point seatbelt, preexisting Harrington rod stabilization from T10 to L3 vertebrae	U-type bilateral zone two sacral fracture with a transverse component at the S2/S3 junction	Acute severe lower back pain	Percutaneous iliosacral screws at S1-S2 levels	Mobilized with help on postoperative day 1, decreased pain

MR/CT: Magnetic resonance /computed tomography

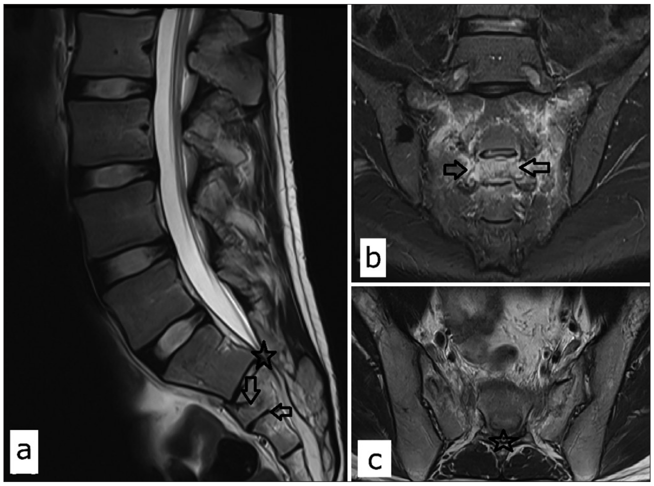

Figure 2: Appearance of the sacral fracture on a Magnetic Resonance Imaging scan: (a) Sagittal plane. Black arrows point to the transverse part of the fracture. A black star indicates the level of the most significant central canal stenosis. (b) Coronal plane. Black arrows point to the vertical parts of the fracture. (c) Axial plane. The black star indicates the level of the most significant central canal stenosis.

were only able to identify two cases of epilepsy-related sacral fractures in the literature[4,12] [Table 1].

Antiepileptic therapy may include liver enzyme-inducing drugs, such as valproic acid, that are discussed to promote osteoporosis, but there has not been a unanimous conclusion on whether they could be a reason for the increased risk of bone fractures in epileptic patients.[10,11] Regardless of the contradictory data, the consulting neurologist decided to switch the antiepileptic medication to a drug with a better pharmacokinetic profile, namely levetiracetam.[8]

Sacral fracture diagnosis and management

Sacral fractures are often misdiagnosed and/or missed on imaging studies and undergo a variety of decompressions/fusions.[2] Li *et al*. describe satisfactory results in patients with sacral fractures and cauda equina syndrome who underwent decompression only (laminectomy).[6] Most surgeons use iliosacral screws and lumbopelvic fixation for the treatment of sacral fractures, especially involving the higher S1/S2 sacral levels.[1-3] Unstable fractures may additionally require spinopelvic osteosynthesis, whereas stable ones warrant iliosacral screws.[3]

Tailored sacroplasty for sacral fracture management

The major issue was to decompress the cauda equina compression attributed to the S1-S2 sacral fracture (Roy-Camille type 2). Here, we assumed that the vertical incomplete unilateral fracture of the anterior portion of the lateral mass was stable; the bone cement was utilized to stabilize the transverse/oblique parts of the fracture to prevent malunion. An approximate illustration of our technique is shown on the diagram [Figure 4].

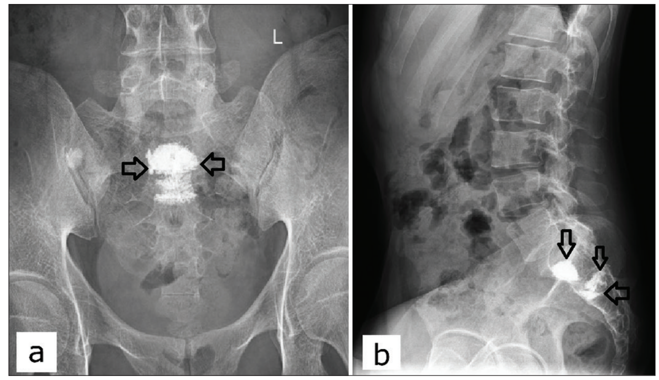

Figure 3: Postoperative X-ray image after 1 month. (a) Anterior-posterior view. (b) Lateral view. The bone cement is distributed along the transverse fracture line, mostly in the superior endplate of S2 and the anterior part of S1 which had a discrete fracture line on the preoperative computed tomography and magnetic resonance imaging. The arrows point to the bone cement distribution along the fracture line which is shown to be mostly in the transverse and oblique plane (the bottom part of the U-shape that is prone to the largest axial load).

Figure 4: Illustration of the technique. The green circle shows the S1-S2 laminae, which are resected to achieve bony decompression. The blue color demonstrates bone cement distribution in the fractured parts of the vertebrae.

According to Frey *et al*., the major axial load is carried by the sacral corpus; bone cement augmentation used here at the fracture zone would prevent micromotion, stabilize the segment, and significantly decrease pain.[5,7]

Implantation of fixation device

Implantation of fixation devices overall increases infection rates, the risks of hardware malfunction, and the potential for catastrophic consequences from future epileptic seizures.[1,3] Using percutaneous bone cement augmentation, as demonstrated in this case, posed a minimal risk of infection and no risk for the future failure of implants/instrumentation.

CONCLUSION

A 23-year-old male with a seizure-induced sacral fracture was successfully treated with a decompressive S1/S2 laminectomy/transcorporal sacroplasty.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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