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Case report

Spinal nerve compression after malunion of vertical sacrum fractures

Nantawit Sugandhavesa, Noparoot Kritworakarn, Borvornsake Rojdumrongrattana, Peem Sarasombath, Wongthawat Liawrungrueang *

Department of Orthopaedics, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand

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ABSTRACT

Introduction and importance: Unstable pelvic ring injuries often occur in high energy traumas. Vertical sacrum fracture is an associated injury. This report describes a late spinal nerve compression that occurred following surgical reduction and fixation of pelvic ring injuries caused by traumatic L5-S1 disc herniation and malposition of the sacral fracture.

Case presentation: A 61-year-old female presented with radiculopathy in her right leg after surgical reduction and fixation of a sacral and pelvic fracture. Physical examination revealed numbness and weakness of the right leg. Radiographic studies showed spinal compression caused by a fracture spike from the malunion of the sacrum and protruding disc from the L5/S1 level. The fracture spikes were removed by laminectomy and discectomy after which the patient's condition had improved and she had no recurrent symptoms at the one-year follow-up.

Clinical discussion: Malunion of a posterior pelvic ring fracture and a herniated adjacent intervertebral disc can cause sacral nerve root compression. This complication can be managed and satisfactory results achieved by surgical intervention.

Conclusion: Traumatic L5-S1 disc herniation and malposition following surgical reduction and fixation of a sacrum fracture can be avoided. Posterior decompression by laminectomy and discectomy is an effective alternative treatment for patients with this condition.

1. Introduction and importance

Pelvic ring disruptions are associated with a significant risk of morbidity and mortality [1,2]. Neurologic disturbance following unstable pelvic injury occurs in about 50–68% of cases, and the odds of the disturbance occurring are increased if vertical shear or spinopelvic dissociation is present [2,3]. Depending on the area affected and the level of stability, e.g., the cauda equina, nerve root and peripheral nerve, including the lumbosacral plexus, can usually be treated nonoperatively in cases of stable nondisplacement, while significantly displaced fractures require reduction and internal fixation [4]. Direct decompression of the compressed neural element is achieved during the procedure [5]. The recovery level varies and patients are often left with some deficits [6].

As has been previously reported, L5 nerve root compression is often a result of a displaced sacral fracture [7]. The L5/S1 nerve root can be directly compressed by a combination of a herniated intervertebral disc and the malunion of a displaced sacral fracture [8]. In this report, the compression was managed by posterior spinal decompression with laminectomy and discectomy. The patient's condition improved postoperatively. This work was reported in accordance with the SCARE 2020 guidelines [9].

2. Case presentation

A 61-year-old female was brought to the emergency department after a motor vehicle accident. She had undergone the advanced trauma life support (ATLS) protocol. She presented with severe pelvic pain. The primary survey found she could move both legs equally and had no radicular pain or neurological deficits. The pelvic x-ray and computed tomography (CT) showed bilateral pubic rami fractures (straddle fracture) and right side sacral fracture Denis' classification [10] type II (Fig. 1A–F). After becoming hemodynamically stable, a secondary interview determined she had no history of smoking, drinking alcohol or using recreational drugs. The operative management was cancellous screw fixation for the sacrum fracture and pelvic reconstruction plate fixation for the bilateral rami fractures (Fig. 2A–C). During intermediary postoperative care, the patient had radiating pain from the right thigh to

* Corresponding author.
E-mail address: mint11871@hotmail.com (W. Liawrungrueang).

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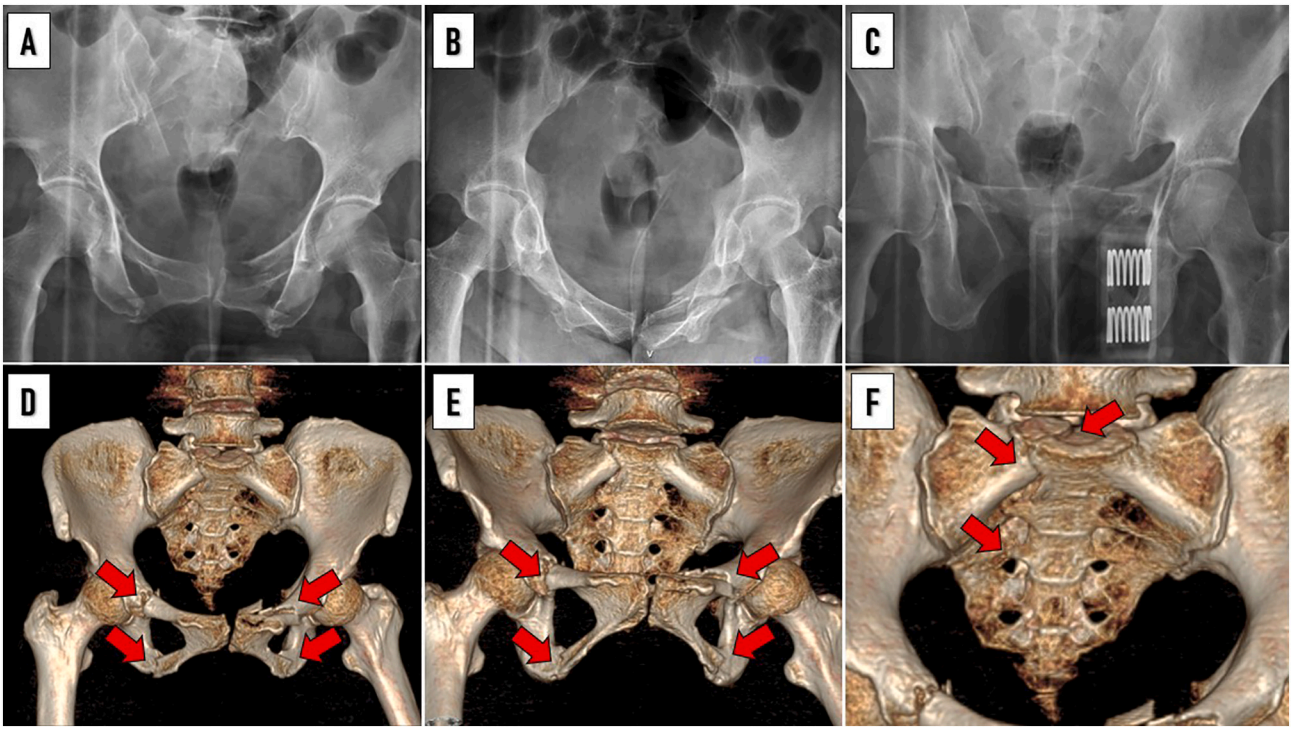

Fig. 1. The initial radiographic study of the pelvis. Antero-posterior view (A), Inlet view (B), Outlet view (C). CT 3-dimensional reconstruction images showing straddle fracture and vertical sacral fracture (Denis classification type II) (D-E): Vertical sacral fracture (F).

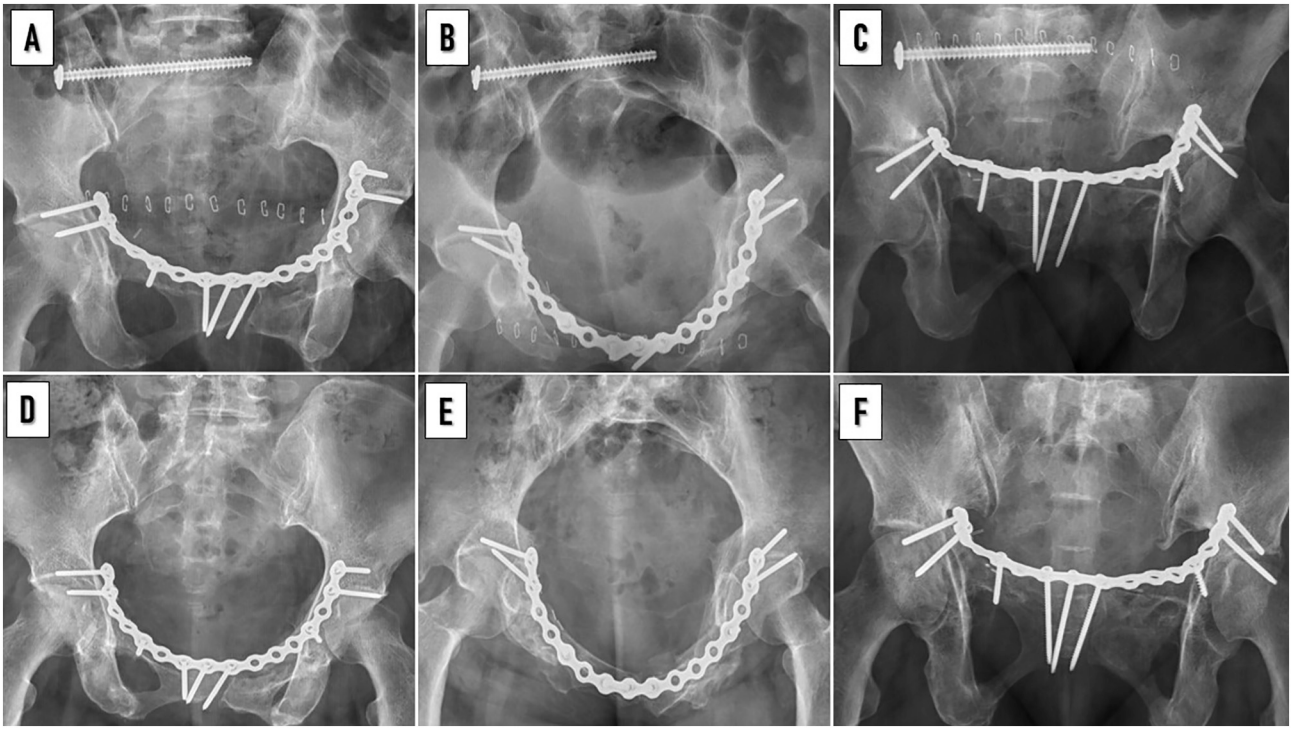

Fig. 2. Post-operative radiographs after initial pelvic ring fixation. Antero-posterior view (A), Inlet view (B), Outlet view (C). Post-operative radiographs after sacroiliac screw removal. Antero-posterior view (D), Inlet view (E), Outlet view (F).

the calf, numbness of the L1-S1 dermatomes. The CT showed the cancellous screw trajectory at the sacrum did not involve the neural foramen on the right side. Nevertheless, the screw was removed (Fig. 2D–E) when we became aware that on exiting the screw had penetrated the sacral nerve root. After follow up 3 months, her right leg pain remained. Magnetic resonance imaging (MRI) and CT scans of the lumbar spine showed a protruded disc at L5-S1 and the spike of the fracture of the sacrum (S1) had compressed the L5 and S1 nerve roots (Fig. 3A–F). The surgical procedure was performed by an experienced spine surgeon (NS) with the patient placed in the prone position using

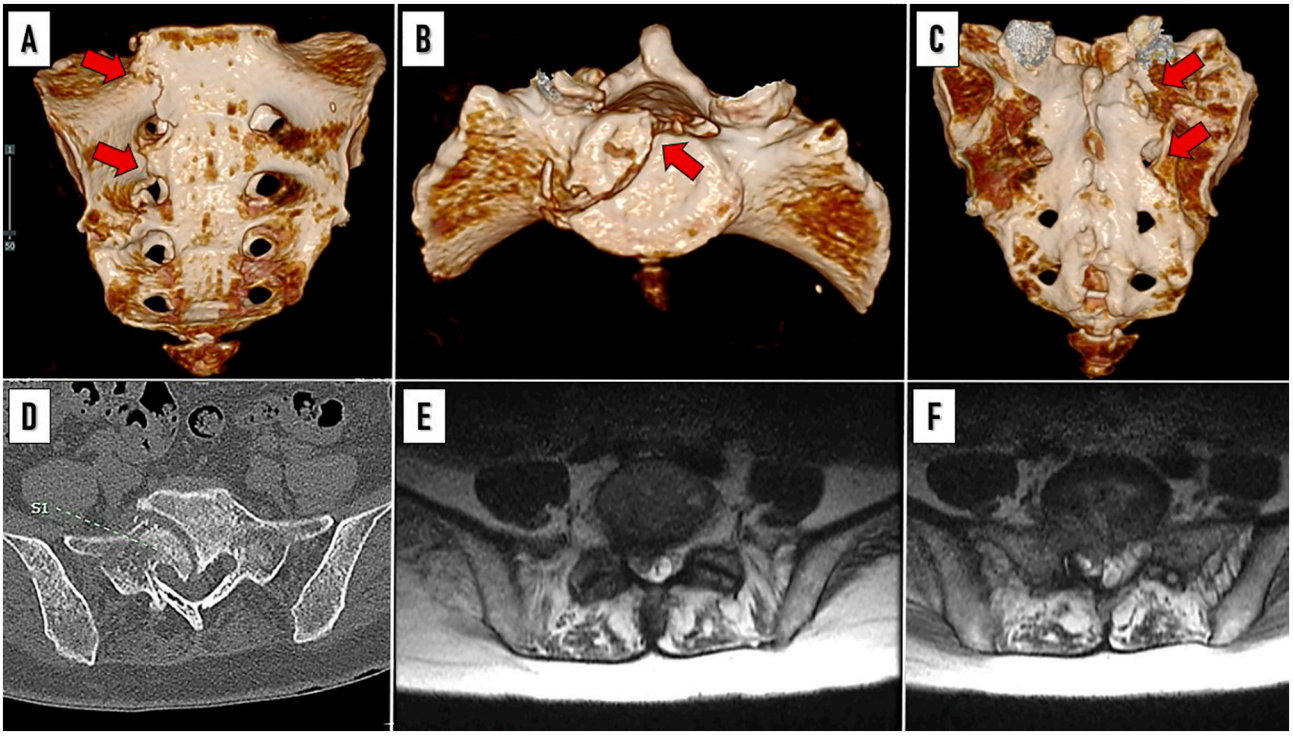

Fig. 3. Reconstruction CT scan of sacrum after sacroiliac screw removal. Anterior view (A), Superior view (B), Posterior view (red arrows, C). CT scan of sacrum. Axial view (D). MRI of L5/S1 level (E) and S1 level (F).

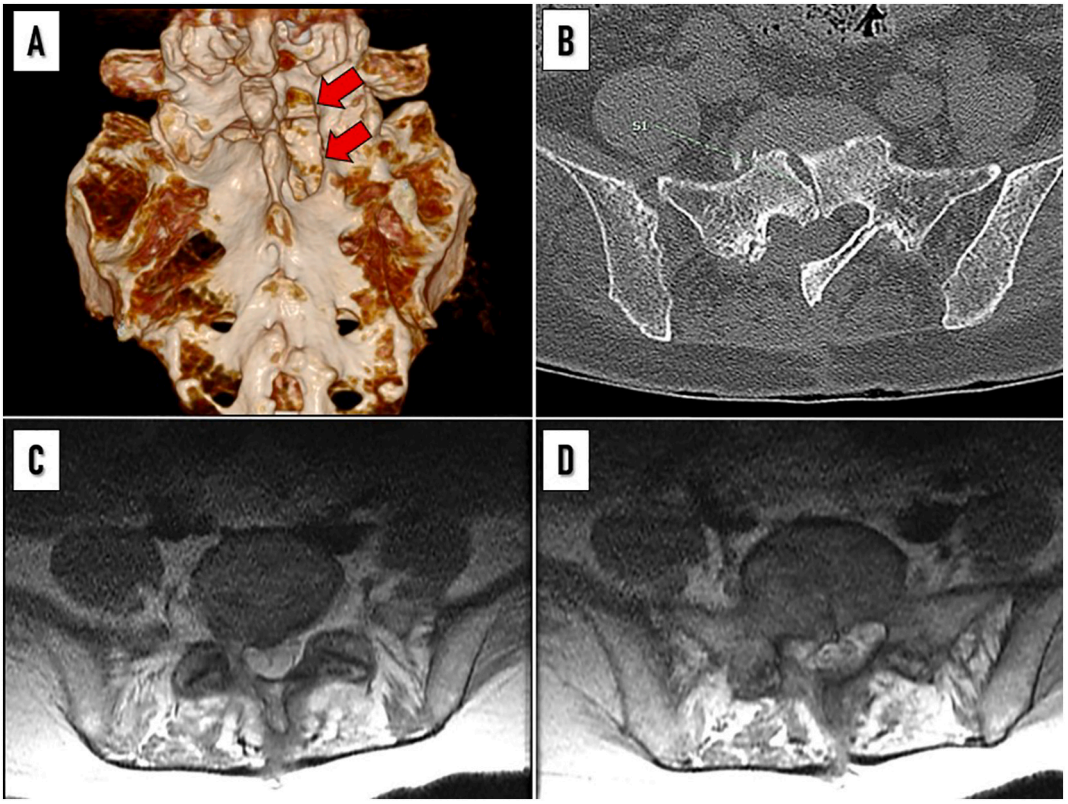

Fig. 4. Reconstruction images of sacrum after decompression. Posterior view (A). CT scan of S1 level, Axial view (B). Axial view of MRI, L5 level (C) and L5/S1 level (D).

the standard midline exposure of the posterior lumbosacral area. The patient underwent decompression by right laminectomy at the S1 level, discectomy of the L5/S1 disc and removal of the spike of the fracture.

The patient had symptomatic relief following the surgery and the numbness improved. After the pain had subsided, the patient participated in rehabilitation and ambulation training programs. The follow-up CT/MRI showed no L5/S1 nerve root compression (Fig. 4A–D). At the 1-year follow-up, her clinical condition had significantly improved with no recurrent symptoms. The patient was highly satisfied with the treatment and the outcome.

3. Clinical discussion

High-energy trauma is the most common cause of unstable pelvic injuries [10–13]. In the context of a vertical shear component or spinopelvic separation, neurologic impairment is not uncommon, while posterior pelvic fracture and associated neurologic injury can be found in 24% to 60% of cases [3,14]. The standard treatment for this combination of injuries is fracture reduction and fixation followed by indirect decompression of the neural components and, if necessary, additional direct decompression [8]. The degree of neurological healing varies, and a level of residual neurologic deficiency frequently remains a hindrance [6].

The callus from the malunion of a displaced sacrum fracture can itself directly compress the nerve roots requiring late spinal nerve decompression [8]. Percutaneous iliac-sacral screw is the treatment of choice in posterior pelvic fractures [5,6]. However, a minimally displaced or comminuted fracture of the sacrum can cause both early and late complications. In this patient, compression of the L5 and S1 nerve roots was caused by a spike from the posteriorly-displaced sacral fracture and the intervertebral disc at the L5-S1 level. Operative management was decompression by laminectomy of the L5-S2 and discectomy of the L5-S1 discs. Decompression was found to be an effective means of managing the sacral nerve root compression after a posterior pelvic fracture.

The J.J. Alexander et al. study [8] in which the patients presented with L5 nerve root compression after malunion of pelvic ring injuries is similar to our study. In that study, a hemilaminectomy of the L5 level was done, and the L5 nerve root was identified with unilateral L5–S1 facetectomy. All their patients received adequate decompression and removal of bone from the anterior aspect of the sacral ala to the level of the superior endplate of S1, and there was resolution of the L5 radiculopathy [8]. Our case modified their technique by including laminectomy and discectomy, giving excellent surgical results and providing long-term relief of radicular symptoms without significant complications.

Keys to successful surgical management include identification of the main problem and pathologies. The need for decompression by laminectomy and discectomy is determined by the presence of bone fragments and a herniated disc after reduction of the fracture. The authors prefer CT and MRI for preoperative planning and surgical management to achieve an effective and optimal outcome. To completely decompress the nerve root at the time of the operation in this patient, a significant amount of ala resection was needed. All patients require bone removal anteriorly and inferiorly to the level of the S1 endplate, the normal anatomical superior anterior corner of the sacral ala.

4. Conclusion

Sacral nerve root compression resulting from a displaced posterior pelvic fracture and lumbosacral disc herniation may be unavoidable. The treatment of choice is a percutaneous iliac-sacral screw with proper reduction. Recognition of complications is important and should be responded to correctly, e.g., the displaced fragments or the intervertebral disc. The described management procedure described in this study can provide long-term relief of radicular symptoms without significant complications.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Ethical approval

This study was conducted in accordance with the Declaration of Helsinki and with approval from the Ethics Committee and Institutional Review Board of Faculty of Medicine, Chiang Mai University.

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Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review from the Editor-in Chief of this journal upon request.

Registration of research studies

None.

Guarantor

Wongthawat Liawrungrueang, MD.

CRediT authorship contribution statement

Nantawit Sugandhavesa (NS): Writing original draft and data curation.

Noparoot Kritworakarn (NK): Writing original draft, review and editing.

Borvornsake Rojdumrongrattana (BR): Data curation and editing.

Peem Sarasombath (PS): Data curation, review and editing.

Wongthawat Liawrungrueang (WL): Conceptualization, methodology, artwork design, writing-original draft, editing and revision the final version for publication.

Declaration of competing interest

None.

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