

Case Report

Unstable sacral fracture with neurogenic bladder and bowel dysfunction following high energy trauma: a case report

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ABSTRACT

Sacral fractures are uncommon but potentially devastating injuries, most commonly resulting from high-energy trauma. They are frequently associated with pelvic instability, neurological deficits, and multiple system injuries. Delayed diagnosis is common because of the complex sacral anatomy and limited sensitivity of plain radiographs. Early recognition and timely surgical management are essential for optimizing neurological and functional outcomes. We report the case of a 24-year-old female who sustained an unstable Denis zone II–III sacral fracture following a high-energy road traffic accident. The patient presented with severe lower back pain, urinary retention, decreased perianal sensation, and reduced voluntary anal contraction, consistent with neurogenic bladder and bowel dysfunction. Computed tomography confirmed an unstable sacral fracture involving the sacral foramina and central canal. The patient underwent early posterior decompression with lumbopelvic fixation to restore pelvic stability and decompress the neural elements. The postoperative course was uneventful. Progressive neurological recovery was observed, with restoration of bladder and bowel function, satisfactory pain relief, radiological evidence of stable fixation, and independent ambulation during follow-up. Early diagnosis using advanced imaging, prompt posterior decompression, and stable lumbopelvic fixation can provide excellent neurological and functional recovery in patients with unstable sacral fractures associated with neurogenic bladder and bowel dysfunction. This case supports the growing evidence favouring early surgical intervention in unstable sacral fractures with neurological compromise.

Keywords: Sacral fracture, Denis classification, Neurogenic bladder, Neurogenic bowel, Posterior decompression, Lumbopelvic fixation, Pelvic trauma

INTRODUCTION

Sacral fractures are uncommon injuries accounting for approximately 1–5% of all spinal fractures and up to 30–45% of pelvic ring injuries following high-energy trauma such as road traffic accidents and falls from height. These fractures are frequently associated with severe soft-tissue injury, pelvic instability, and multiple system trauma, contributing to significant morbidity and mortality.^{1,2}

Because of the complex anatomy of the sacrum and overlapping bowel shadows on plain radiographs, sacral

fractures are often missed during the initial evaluation. Several studies have reported delayed or missed diagnoses in up to one-third of patients, particularly in those with associated pelvic injuries. Computed tomography (CT) with multiplanar and three-dimensional reconstruction has therefore become the imaging modality of choice for accurate diagnosis, fracture classification, and preoperative planning.^{3,4}

The Denis classification remains the most widely accepted system for categorizing sacral fractures according to their anatomical location and associated neurological risk. Zone

II and zone III fractures have a substantially higher incidence of sacral nerve root or cauda equina injury, frequently presenting with sensory disturbances, motor weakness, and bladder or bowel dysfunction. Neurological impairment is one of the most important determinants of long-term functional outcome in these patients.^{5,6}

The management of unstable sacral fractures with neurological deficit remains challenging. Although conservative treatment may be appropriate for stable fractures without neurological compromise, clinically reported studies increasingly support early surgical decompression and stable spinopelvic or lumbopelvic fixation in patients with unstable fracture patterns and neural compression. Early intervention facilitates neural decompression, restores pelvic stability, permits early mobilization, and may improve neurological recovery while reducing complications associated with prolonged immobilization.^{7,9}

We present a case of an unstable Denis zone II–III sacral fracture with neurogenic bladder and bowel dysfunction following high-energy trauma that was successfully managed with early posterior decompression and lumbopelvic fixation. The case highlights the importance of prompt diagnosis using advanced imaging, timely surgical stabilization, and multidisciplinary postoperative rehabilitation in achieving favourable neurological and functional outcomes.

CASE REPORT

A 24-year-old female presented after a road traffic accident with severe lower back pain, pelvic pain, and urinary retention. Examination revealed decreased perianal sensation and reduced voluntary anal contraction, while lower limb motor power was preserved. CT scan demonstrated an unstable Denis type II–III sacral fracture with canal involvement. An undisplaced calcaneal fracture was managed conservatively. Early posterior decompression and lumbopelvic fixation were performed. The postoperative period was uneventful. Gradual neurological recovery was observed, with restoration of bladder and bowel function and independent ambulation at follow-up.

Radiological evaluation

Plain radiograph of the pelvis showed subtle irregularity in the sacral region, raising suspicion of a sacral fracture (Figure 1).

Given the clinical findings and equivocal radiographic appearance, a CT scan of the pelvis and lumbosacral spine was performed.

CT imaging revealed an unstable sacral fracture extending through the sacral foramina with involvement of the central canal, consistent with a Denis type II–III fracture. Axial, coronal, and sagittal CT images demonstrated

fracture lines traversing the sacral ala and body with potential sacral nerve root compression. Three-dimensional CT reconstruction further delineated the fracture configuration and instability, aiding in surgical planning (Figure 2).



Figure 1: Plain radiograph of pelvis showing subtle sacral irregularity.

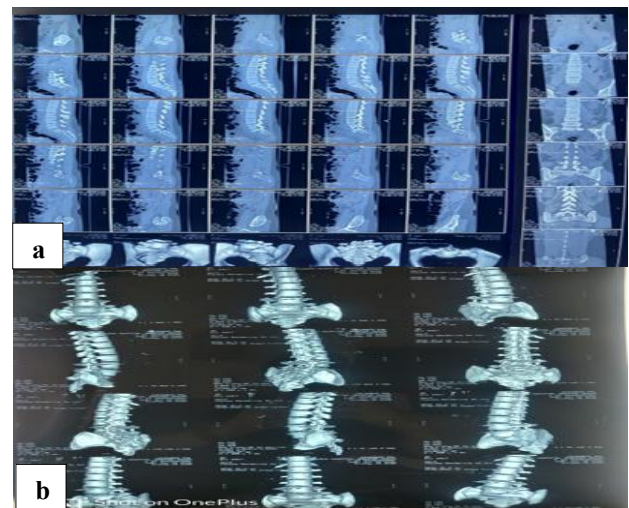


Figure 2 (a and b): Three-dimensional CT reconstruction of the pelvis showing fracture configuration and sacral instability.

Additionally, the patient was found to have an undisplaced fracture of the right calcaneum, which was planned for conservative management.

Surgical management

Given the unstable nature of the fracture and the presence of neurological deficit, early surgical intervention was planned. The patient was positioned prone on a radiolucent table. Posterior midline approach was used to expose the lumbosacral region.

Posterior decompression of the sacral canal was performed to relieve neural compression. Lumbosacral pelvic fixation was achieved using pedicle screws in the lumbar vertebrae and sacro- iliac screws bilaterally, connected with rods to

provide stable fixation. Intraoperative C-arm fluoroscopy was used to confirm correct placement of screws and adequate alignment, (Figure 3). The wound was closed in layers over a drain.



Figure 3: Intraoperative C-arm images demonstrating pedicle and iliac screw placement during lumbosacralpelvic fixation.

Postoperative course and follow-up

The postoperative period was uneventful. The patient was mobilized gradually with support after pain control.

Postoperative anteroposterior and lateral radiographs of the pelvis and lumbosacral spine confirmed satisfactory implant placement and stable fixation (Figure 4).

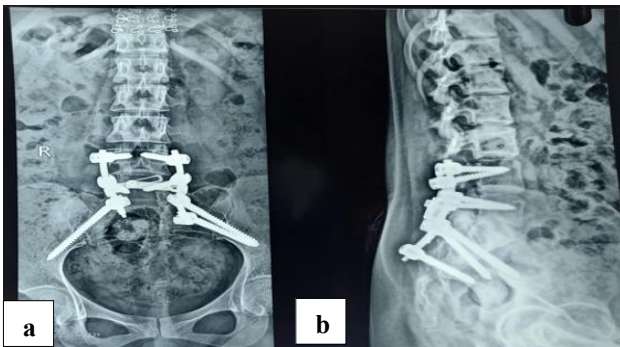


Figure 4 (a and b): Postoperative anteroposterior and lateral radiographs of the pelvis and lumbosacral spine showing stable lumbosacralpelvic fixation.

Neurologically, the patient showed gradual improvement. Bladder function began to recover, and the Foley catheter was removed after successful trial voiding. Bowel function also improved progressively. At follow-up, the patient was able to ambulate independently without support.

Clinical photographs at follow-up demonstrated a well-healed posterior surgical scar without complications

(Figure 5d). Functional recovery was evident with improved posture, standing

Balance, and single-leg stance, indicating good neurological and musculoskeletal recovery (Figure 5a-c).

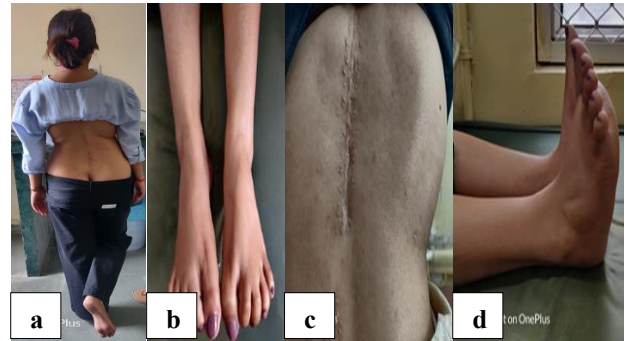


Figure 5 (a-d): Follow-up clinical photographs demonstrating improved posture, independent standing, and functional recovery.

DISCUSSION

Sacral fractures are uncommon but potentially devastating injuries, usually resulting from high-energy trauma and frequently associated with pelvic ring disruption and multisystem injuries. Neurological deficits occur in approximately 20–50% of unstable sacral fractures, particularly in Denis zone II and zone III injuries, because of involvement of the sacral nerve roots and central sacral canal. Our patient sustained a high-energy road traffic injury with an unstable Denis zone II–III fracture associated with neurogenic bladder and bowel dysfunction, consistent with the neurological patterns described in previous studies.¹⁻³

Early diagnosis of sacral fractures remains challenging because plain radiographs may fail to demonstrate fracture lines owing to the complex sacral anatomy and overlapping bowel shadows. In our patient, the initial pelvic radiograph suggested only subtle sacral irregularity, whereas computed tomography clearly demonstrated fracture extension through the sacral foramina with central canal involvement. This observation agrees with previous studies showing that multidetector CT with multiplanar and three-dimensional reconstruction is the gold standard for identifying fracture morphology, assessing instability, and planning surgical intervention.^{4,5}

Neurological impairment is one of the strongest predictors of long-term functional outcome after sacral fractures. Neurogenic bladder and bowel dysfunction indicate injury to the sacral nerve roots or cauda equina and are associated with significant disability if treatment is delayed. In our patient, decreased perianal sensation, reduced voluntary anal contraction, and urinary retention were the principal neurological findings. Similar neurological presentations have been reported by Denis and subsequent investigators, who demonstrated a higher incidence of neurological

deficits in zone III fractures and combined zone II–III injuries.^{6,7}

The optimal timing of surgical decompression remains an area of ongoing discussion; however, increasing evidence supports early decompression in patients with neurological deficits and radiological evidence of neural compression. Early surgery minimizes persistent neural compression, facilitates neurological recovery, and allows earlier rehabilitation. In the present case, posterior decompression was performed soon after diagnosis, resulting in progressive recovery of bladder and bowel function. These findings are consistent with reports by Vaccaro and colleagues and other contemporary series demonstrating improved neurological outcomes following early decompression compared with delayed intervention.^{8,9}

Stable fixation is equally important in the management of unstable sacral fractures. Lumbopelvic fixation provides rigid stabilization by linking the lumbar spine to the pelvis, effectively resisting vertical, rotational, and shear forces while allowing early mobilization. Biomechanical and clinical studies have demonstrated that lumbopelvic fixation provides excellent stability in vertically unstable sacral fractures and facilitates fracture union with low rates of fixation failure. In our patient, rigid lumbopelvic fixation achieved satisfactory alignment, maintained fracture stability, and permitted progressive mobilization without implant-related complications, findings comparable to previously published reports.^{10,11}

Functional recovery following unstable sacral fractures depends on the severity of neurological injury, timing of decompression, adequacy of stabilization, and structured rehabilitation. Our patient demonstrated gradual recovery of bladder and bowel function together with independent ambulation during follow-up. Similar improvements have been described in recent studies where early decompression combined with stable lumbopelvic fixation resulted in superior neurological and functional outcomes compared with delayed treatment or non-operative management.^{12,13}

Although this report describes a single patient, it reinforces current evidence supporting early recognition, CT-based assessment, timely neural decompression, and rigid lumbopelvic fixation in unstable sacral fractures associated with neurological deficits. Larger prospective multicentre studies with longer follow-up are required to determine prognostic factors influencing neurological recovery and to establish standardized treatment protocols for these complex injuries.

CONCLUSION

Early diagnosis, detailed imaging, and timely decompression with lumbopelvic fixation can lead to good neurological and functional recovery in unstable sacral fractures with bladder and bowel dysfunction.

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