

Case Report

Isolated zone I vertical sacral fracture: a case report

Asim AlBarazanji, Isam Sami Moghamis*, Aiman Mudawi, Abdulla Ahmed Ajaj,
Munir Khan, Saeed Ahmed Qaimkhani

Department of Orthopaedics Surgery, Hamad Medical Corporation, Doha, Qatar

Received: 10 December 2024

Revised: 01 February 2025

Accepted: 10 February 2025

*Correspondence:

Dr. Isam Sami Moghamis,

E-mail: dr.isammoghamis@gmail.com

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ABSTRACT

Isolated sacral fractures are not common. This is attributed to the lack of segmental motion of the sacral bones, and most sacral fractures are transversely oriented. However, vertically oriented sacral fractures are never isolated and are usually associated with pelvic ring fractures due to the shearing force of the pelvic ring. There are only a few case reports of such injury presented in isolation. We are reporting a case of isolated zone I vertical sacral fracture in a 25-year-old female following a road traffic accident with a lateral compression mechanism of injury. Only a few cases related to isolated sacral fractures have been reported in the literature. To our knowledge, there have only been a few reports of vertical sacral fracture following a lateral compression injury. Complete vertical sacral fracture with significant displacement in isolation is a rare injury, as it is usually associated with pelvic ring injuries. Surgical stabilization is an indication of such injury to restore the stability of the pelvic ring.

Keywords: Sacral bone, Vertical fracture, Isolated, Pelvic injury

INTRODUCTION

Sacral fractures usually occur after a high-energy trauma following a fall from a height or a road traffic accident. More than 90% of sacral fractures are presented as a part of pelvic ring injuries, of which these fractures are presented in 45% of the cases.¹⁻⁵ The unique biomechanical feature of the sacrum is the lack of segmental motion; hence, isolated sacral fractures are seen in less than 5-10% of cases, and most isolated fractures are transversely oriented.^{6,7}

Sacral fractures associated with pelvic ring injury are vertically orientated. These fractures occur secondary to a shearing force and are, therefore, associated with breaks in the pelvic ring.⁶⁻⁸ There are only a few case reports of such injury presented in isolation. Consequently, we present a case of isolated zone I vertical sacral fracture in a 25-year-old female following a road traffic accident with a lateral compression mechanism of injury.

CASE REPORT

A 25-year-old female car driver, previously healthy, was transported to the trauma center's emergency department by ambulance services after sustaining a motor vehicle collision (MVC). The car sustained a direct hit to the driver's side, resulting in the ejection of the patient from the vehicle. The patient landed on her left side. On initial clinical examination, the patient was conscious and oriented, and there was no reported loss of consciousness, vitally stable. She was complaining of right-sided chest pain, bilateral lower limb pain, and deformity. Local examination of the lower limbs revealed a left tibia open fracture and a right ankle fracture, both of which were operated on the second day after the admission, and surgical stabilization was done. However, the patient had significant tenderness over the posterior aspect of the left hip. The lower limbs had no neurological deficit, and both had good palpable distal pulses. Plain radiographs of the pelvis revealed a left-sided vertical sacral fracture with no

associated other pelvis fracture (Figure 1). Furthermore, the patient was taken for a whole-body computed tomography (CT) scan following the advanced trauma life support (ATLS) protocol. Pan CT scans revealed a fracture of the right 5th rib, which was treated conservatively. Additionally, the abdominal CT scan showed a better orientation of the fracture line vertical orientation of the fracture involving the left sacrum lateral to the neural foramen, consistent with Denis, type I fracture. However, the fracture was in isolation, and no other associated pelvic fractures existed (Figure 2).

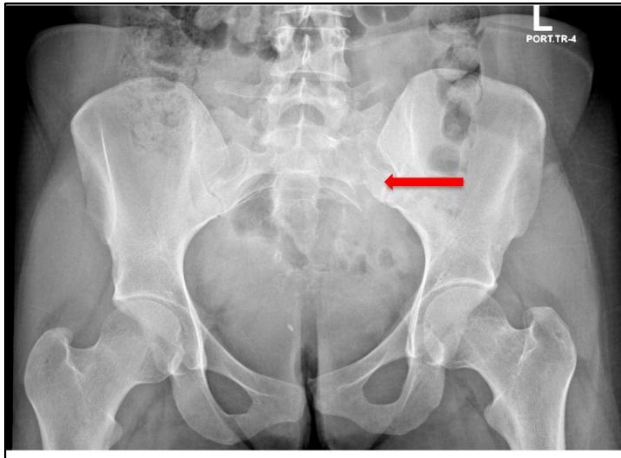


Figure 1: anteroposterior radiograph of the pelvis showing left sacral fracture (red arrow); there is no widening of the pubic symphysis and no other associated pelvic fractures.

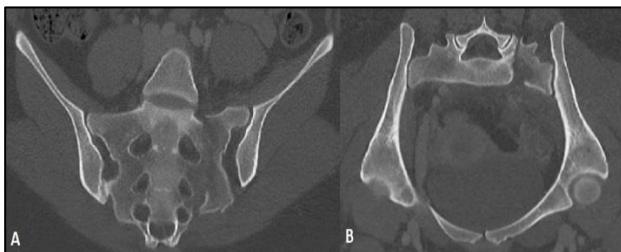


Figure 2: (A) Coronal; (B) axial computed tomography (CT) images of the pelvis demonstrating a vertical sacral fracture lateral to the neural foramina, consistent with a Denis zone 1 classification.

Further imaging of the pelvis was obtained. These included the inlet, outlet, and Judet views, which showed no disruption of the anterior pelvic ring (Figure 3). The multiple bony injuries were addressed at different stages from hospitalization, with the pelvis being the last to be addressed.

On the 12th day following admission, the patient underwent surgical fixation of the fracture. Before the procedure, a comprehensive review of preoperative imaging was conducted, including conventional anteroposterior (AP), inlet, and outlet radiographs of the

pelvis, as well as computed tomography (CT) scans with 2-mm slice thickness. This evaluation was crucial to assess the full extent of the injury, including fracture location, orientation, displacement patterns, comminution, anatomical variations, and available space for screw placement.

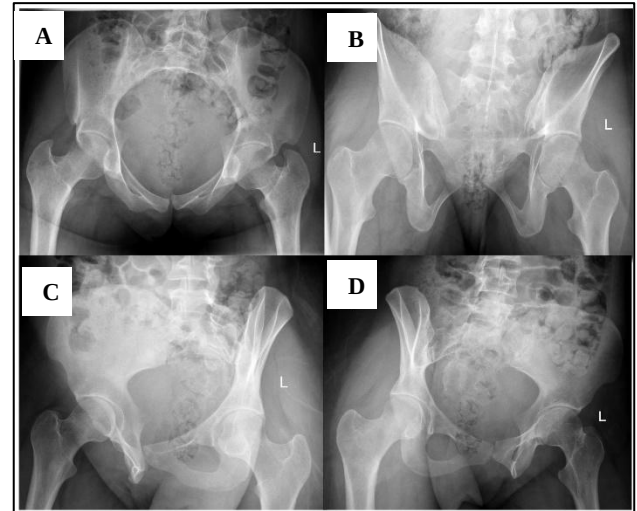


Figure 3: (A) Inlet, (B) outlet, (C & D) Judet views, redemonstrating the isolated sacral fracture without disrupting the pelvic ring.

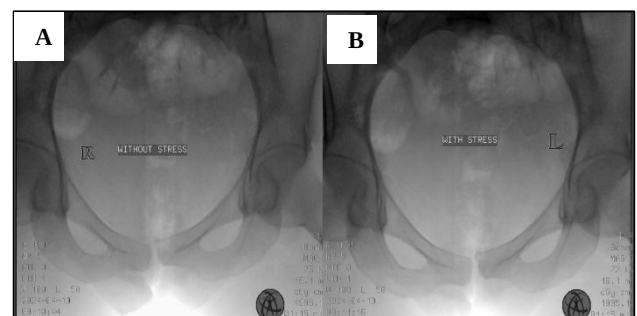


Figure 4: (A) Intraoperative anteroposterior (AP) fluoroscopy of the pelvis without stress; (B) intraoperative anteroposterior (AP) fluoroscopy of the pelvis with stress shows no symphysis pubis widening.

The patient was positioned supine on a radiolucent table, with the pelvis slightly elevated by a sacral pad placed under the buttocks. True lateral views of the pelvis, inlet, outlet, and AP views were obtained to confirm a proper reduction of the sacral fracture. Initial examination under general anesthesia, including stress view radiographs, indicated no widening of the pubic symphysis (Figure 4).

Following draping and preparation, intersecting landmark lines were drawn from the anterior superior iliac spine (ASIS) perpendicular to the floor and along the axis of the femur. A stab incision was made in the posterior cranial quadrant. The entry point for the sacral screw was confirmed on the lateral view, situated below and behind the iliac cortical densities (ICD). A 3.2 mm guide wire was

gently inserted into the iliac blade at the entry point. The C-arm was used to obtain inlet, outlet, and AP views to advance the guide wire to the contralateral lateral border of the sacral body. The wire's positioning was confirmed in all views: superior to the S1 foramen in the outlet view, below the L5-S1 intervertebral disc space in the AP view, and within the S1 body in the inlet view.

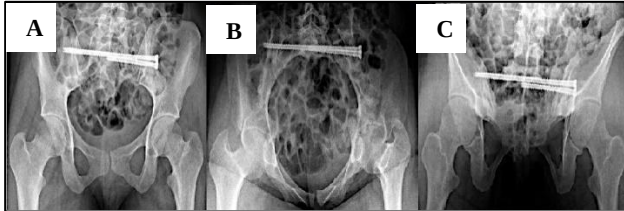


Figure 5: Immediate postoperative pelvic radiographs including (A) A/P; (B) inlet, and (C) outlet views demonstrating percutaneous screws fixation of the left sacral fracture.

The required screw length was measured, and a 4.9 mm cannulated drill was used. A fully threaded cannulated screw, size 6.5 mm in diameter, was then inserted. The same procedure was repeated for a second screw, placed trans-iliac trans-sacral in S1. Screws were not put in S2 due to the narrow corridor, which was deemed unsafe. Final radiographic images showed that the pelvic ring was well reconstructed, and all screws were placed in optimal positions (Figure 5).

Fortunately, the patient did not have any intraoperative or postoperative complications. Initially, she was allowed to mobilize from bed to wheelchair due to her other injuries, which involved both lower limbs. She was discharged home on the 3rd postoperative day following sacral fracture fixation, and a follow-up appointment in the outpatient department was given to her for routine follow-ups. She was not allowed to bear weight for a total of 8 weeks following the surgery. After that, she started ambulation with weight bearing as tolerated with a walking assistance device. At 6 months follow-up, the patient was ambulating without assistance, and she was complaining of tolerable left sacroiliac joint pain with no distal neurological deficit.

DISCUSSION

Fractures of the sacrum are rare, and in more than 90% of the cases, they are associated with pelvic fractures.⁹ Sacral fractures are classified according to the anatomic location of the fracture line, which divides the sacrum into three zones; if the fracture line is lateral to the neural foramen, this is considered zone I; when the fracture line is through the foramina, this is considered zone II, and when the fracture line is medial to the foramina then it is zone III.¹⁰ In our case, the fracture line was in zone I; a similar case was reported by Bilgic et al.⁷

The vertical orientation of a sacral fracture is not commonly isolated as the force traverses from the anterior part of the pelvic ring through the ilium.⁸ However, it has been suggested that such vertical fractures are usually secondary to a lateral-directed force on the body.^{6,7} In our case, the patient sustained a road traffic accident in which the car was hit from the side. This may suggest the possibility of a lateral compression mechanism of injury. Furthermore, the patient was ejected from the vehicle and landed on her left side, which also adds to the suggested lateral compression mechanism of the injury.

As such injuries are rarely seen, we were not convinced about the possibility of an isolated vertical sacral fracture. Hence, as mentioned before, we had to do stress views intraoperatively, which showed no widening of the anterior pelvic ring. On the contrary, some earlier case reports reported them as isolated vertical sacral fractures of the first sacral vertebra. Still, the injury was not in isolation, and it was associated with a significant pelvic injury and widening of the pubic symphysis, suggesting a different mechanism of injury leading to this type of fracture.⁶ The fracture pattern in our patient was significantly rotationally unstable as judged by the degree of initial displacement and complete fractures from anterior to posterior. Therefore, surgical fixation of the fracture was carried out. However, successful non-surgical treatment has been reported to have good clinical outcomes if the fracture involves a single sacral vertebra.^{6,7}

CONCLUSION

Complete vertical sacral fracture with significant displacement in isolation is a rare injury, as it is usually associated with pelvic ring injuries. A high index of suspicion is necessary, and a CT scan should be obtained for complete assessment as plain radiographs may not always detect the fracture. Such a fracture's management depends on the fracture line's orientation, displacement, and the number of involved vertebrae. Vertically and rotationally unstable fractures are indications for surgery with good clinical and functional outcomes.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: AlBarazanji A, Moghamis IS, Mudawi A, Ajaj AA, Khan M, Qaimkhani SA. Isolated zone I vertical sacral fracture: a case report. *Int J Res Orthop* 2025;11:411-4.