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Case Report

Management of a rare case of isolated U-shaped displaced sacral fracture in a young female high school student

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ABSTRACT

Sacral fractures in young healthy patients are usually linked to high-energy trauma. They are often associated with multiple other injuries. Isolated sacral fractures are rare and can be easily missed in the absence of other surrounding pelvic or spinal injuries. In this article, we present a rare case of isolated U-shaped displaced sacral fracture despite the high-energy mechanism of injury being missed on initial presentation. This is a 17-year-old healthy female who presented to the emergency department after falling from five-meter height. She complained of lower back pain and inability to ambulate. Physical examination revealed significant sacral tenderness, bilateral lower limb weakness and hypoesthesia, anesthesia of the saddle area, weak anal tone and absent anal reflex. Initial radiographs showed no apparent fractures. Further imaging by pelvic computed tomography, however, revealed an isolated U-shaped displaced sacral fracture. The patient was treated by decompression and lumbopelvic fixation by triangular osteosynthesis and iliosacral screw. This fixation method restored stability of the spinopelvic junction and allowed for early mobilization. At her 18-month follow-up visit, she showed minimal disability score (10%) on the Oswestry Disability Index. In conclusion, sacral fractures are considered exceedingly rare to occur in isolation and in young healthy patients.

Introduction

Sacral fractures can occur due to two mechanisms: high-energy trauma, or low-energy trauma in patients with specific disorders (such as osteoporotic elderly patients, and patients with metabolic or neoplastic disorders). Motor vehicle accidents and falling from heights (including suicidal jumps) are the most common high-energy mechanisms of injury for sacral fractures [1]. Hence, they are usually accompanied by multiple other associated injuries; these may include head, spine, thoracic, pelvic, abdominal organs and extremities injuries. Sacral fractures are reported in non-osteoporotic patients as 2.1 per 100,000 people [2]. Of those, isolated fractures constitute only 5% of all sacral fractures [3,4].

In this article, we present a rare case of isolated U-shaped displaced sacral fracture due to high-energy trauma, treated successfully with triangular osteosynthesis and iliosacral screw fixation.

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Case report

A 17-year-old female presented with a complaint of severe low back pain after falling from 5-meter height and landing directly on the buttocks area. She had been transferred to the nearest hospital immediately after the fall. The family was informed that the radiographs at that time revealed no fractures, and the patient was discharged to home on analgesia. Two days later, she arrived at our emergency department complaining of severe lower back pain and inability to ambulate. She described profound numbness in the saddle area and both lower limbs. The patient's medical, surgical and family histories were unremarkable.

Advanced Trauma Life Support (ATLS) protocol was followed in the emergency department. The primary and secondary surveys revealed preserved airway, breathing and circulation. Rigid neck collar was applied. Vital signs were within normal ranges. No open wounds were noticed. The initial assessment revealed an isolated lower back injury.

On physical examination, the patient showed a Glasgow Coma Scale of 15/15 and intact cranial nerves. Upper limb power was 5/5 according to the Medical Research Council (MRC) muscle grading system, with intact sensation and deep tendon reflexes. The MRC power grade testing of both lower limbs revealed weaknesses on right knee extension 4/5, right big toe extension 4/5, right ankle plantar flexion 3/5, right knee flexion 3/5, left knee extension 4/5, left big toe extension 3/5, left ankle plantar flexion 2/5, and left knee flexion 2/5. She had a diffuse hypoesthesia of lower limbs (more on the left side), anesthesia of the saddle area, weak anal tone, sacral tenderness and absent anal reflex. Abdominal reflexes were preserved, and Babinski reflex was negative on both sides. Results from complete blood count and kidney function tests were within normal ranges.

Initial radiographs of the cervical spine, chest, and pelvis showed no apparent injuries (Fig. 1).

The chest and abdominal computed tomography (CT) scan revealed no internal organ injury. Pelvic CT scan showed an isolated displaced U-shaped sacral fracture compressing the spinal canal (Fig. 2).

The diagnosis of isolated unstable sacral fracture with cauda equina syndrome was established. We decided to treat this fracture with decompression and lumbopelvic fixation by triangular osteosynthesis and iliosacral screw (Fig. 3).

Under general anesthesia and fluoroscopic guidance, bilateral L4 and L5 pedicular screws and two iliac screws were inserted and connected by a rod on each side. Decompression of bilateral sacral nerve roots was performed. A dural tear was identified and repaired. Then, percutaneous iliosacral screw was fixed from the left to the right side. Intraoperative Neurophysiologic Monitoring was conducted, and no signal changes were noticed during the surgery. The surgery was performed by cooperation between neurosurgery and orthopedic teams. No intraoperative complications were encountered, and the postoperative course was uneventful. The immediate postoperative CT scan is shown in Fig. 4. No further displacement or internal fixation failure, wound infection or delayed healing was encountered.

The patient started assisted ambulation on postoperative day 3. She was discharged after one week of hospitalization. We followed the patient for 18 months. A CT scan was obtained 18 months after the surgery, and the bone at the site of the fracture showed good yet incomplete union (Fig. 5).

She was also able to ambulate without assistance. The muscle power of lower limbs was 5/5 (MRC score) and sensation was intact bilaterally. Minimal perineal paresthesia was still present. Her Oswestry Disability Index was 10%. Of note, the screws were prominent at the surgical site which the patient noted as bothering occasionally, but the skin was intact. Processed bone fragment was added to enhance fusion. The metal was planned to be removed.

Discussion

Diagnosis of sacral fractures is usually delayed or missed, mainly because of the severity of other associated injuries. ATLS protocol should be applied to all patients of high-energy trauma to exclude life-threatening conditions. Despite the rarity of sacral fractures, they should be suspected when there is a neurological insult evident on examination that cannot be explained by initial radiographs. As



Fig. 1. The initial pelvic radiograph with no apparent fractures.

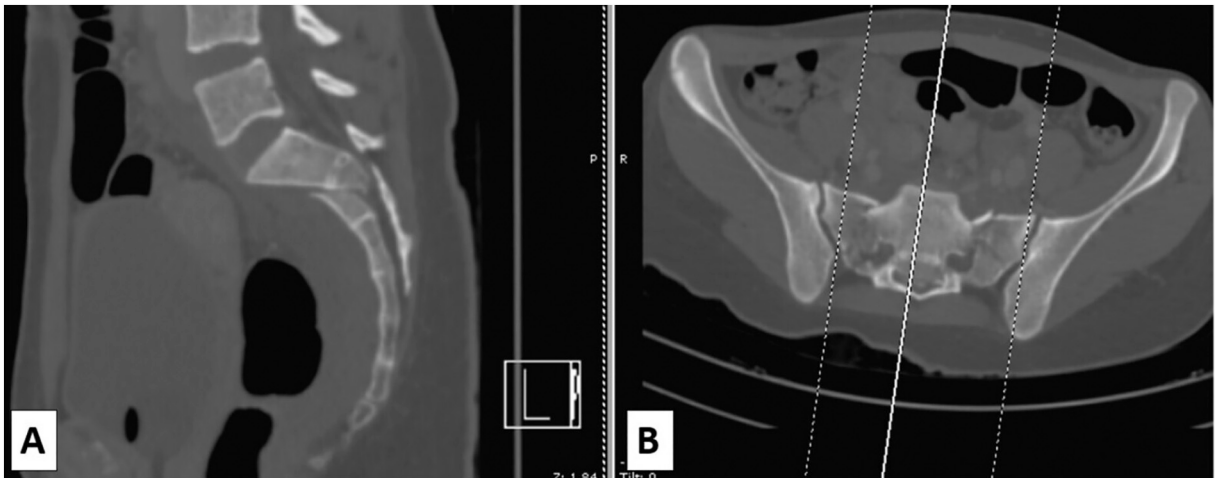


Fig. 2. The preoperative pelvic computed tomography scan. A: Sagittal view showing posteriorly displaced proximal segment; B: Axial view showing isolated U-shaped sacral fracture compressing the cauda equina.

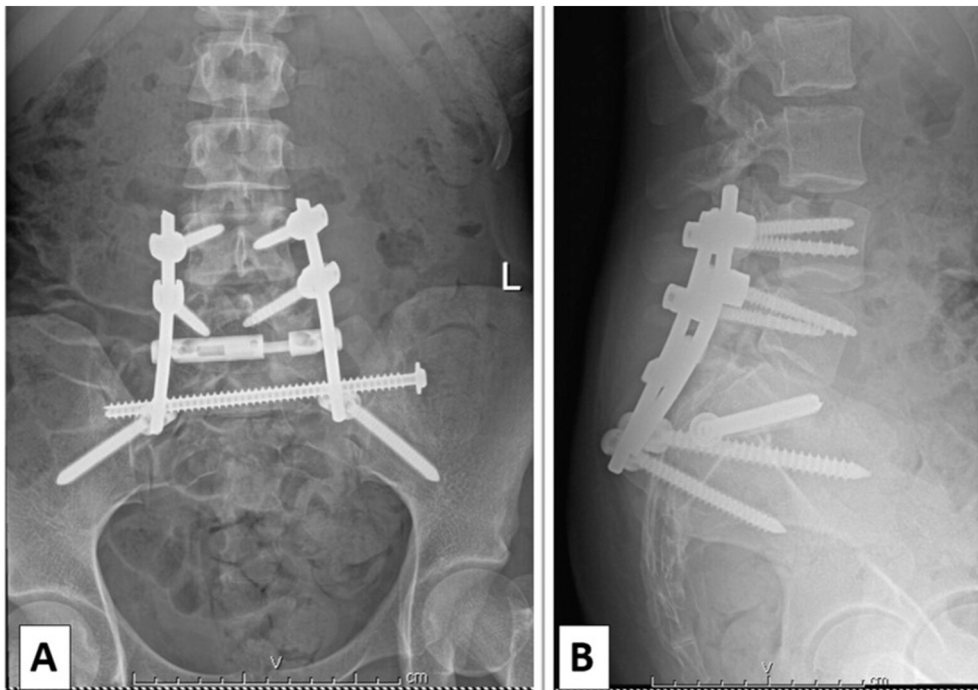


Fig. 3. The postoperative radiographs. A: Anteroposterior view showing well-fixed triangular osteosynthesis and iliosacral screw; B: lateral view showing the lumbopelvic fixation.

such, full neurological assessment is paramount to guide in the diagnosis of these fractures. For our patient, we followed the ATLS protocol, and the neurological examination suggested cauda equina syndrome, despite normal initial radiographs. Further imaging studies led to the diagnosis of displaced sacral fracture compressing the nerve roots.

The fracture pattern in our patient is best classified as zone 3 U-shaped on Denis classification and C3 according to the AO spine classification [5,6]. The neurological deficits associated with sacral fractures can range from incomplete radiculopathy to complete cauda equina syndrome. The fracture pattern is the main determinant of neurological deficit. The clinical presentation of cauda equina syndrome in our patient can be explained by the fracture pattern. AO C3 and Denis zone 3 fractures carry the highest potential (>50%) for neurologic injury, and cauda equina syndrome is the most frequent one [7].

According to existing literature, there are no clear evidence-based treatment protocols for sacral fractures. In general, the treatment options range from conservative to minimally invasive and open surgical spinopelvic fixation, with or without decompression. As the

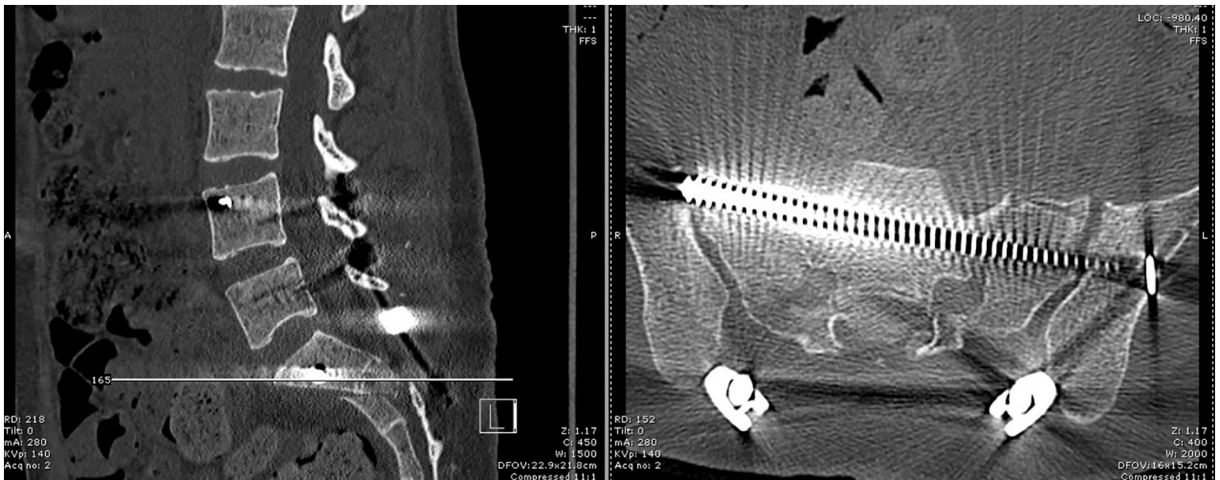


Fig. 4. The immediate postoperative CT scan.

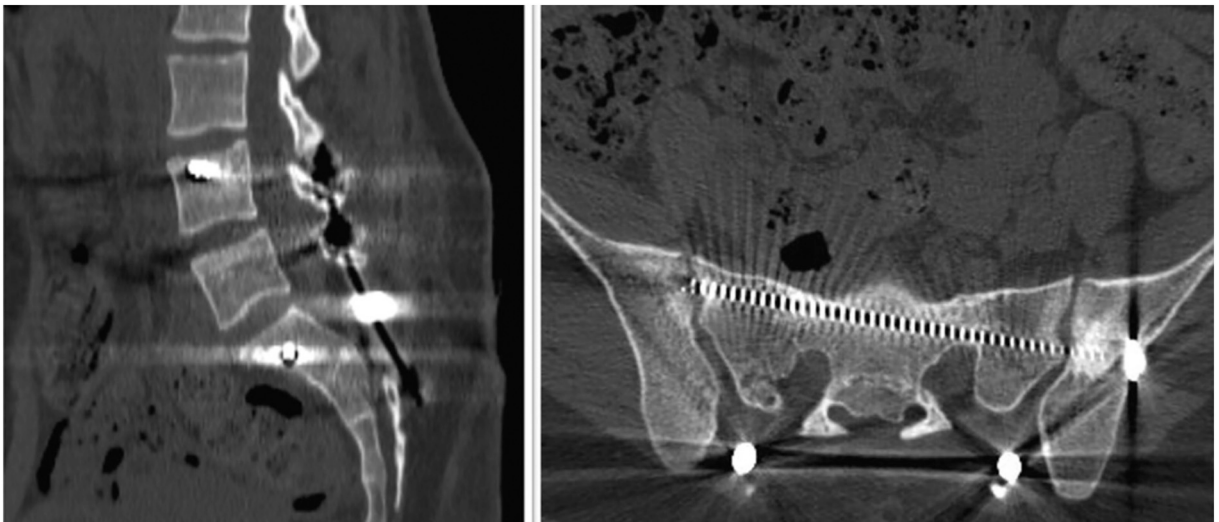


Fig. 5. The follow up CT scan at 18 months postoperatively.

U-shaped sacral fractures are usually unstable and associated with neurological deficits, most recent reports recommend open spinopelvic fixation and percutaneous iliosacral screws [8]. Triangular osteosynthesis is the most relied upon method of fixation for unstable U-shaped sacral fractures. Importantly, this construct provides multidirectional stability and allows for early rehabilitation [9].

The novelty of the study lies in the rarity of isolated U-shaped sacral fractures occurring in healthy young patients, the missed diagnosis without proper imaging, and the resolution of cauda equina syndrome after surgical intervention. Full neurological assessment is of paramount importance to guide diagnosis. Further imaging examinations should be requested if the initial radiographs do not explain the clinical picture. Triangular osteosynthesis and iliosacral screw are reliable methods of fixation that restore stability of the spinopelvic junction and allow for early mobilization. A multidisciplinary team approach is advisable for better outcomes.

Ethics statement

Informed written consent was obtained from the patient and her family for publication of this report and any accompanying images.

Role of the funding source

None declared.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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