

Case Report

Bilateral vertical shear sacroiliac joint dislocations treated with bilateral triangular osteosynthesis in a young female: A case report

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ARTICLE INFO

Keywords:

Vertical shear
Bilateral
SI joint dislocation
Triangular osteosynthesis

ABSTRACT

Case: Type C pelvic ring fractures account for only 0.34% of all pelvic fractures (Zhang, 2012 [1]). Anterior and posterior pelvic fixation is necessary in these injuries and can be accomplished using a variety of techniques. This study presents a case of bilateral vertical shear sacroiliac joint dislocations with an associated hip dislocation and pubic rami fractures that was treated with bilateral triangular osteosynthesis and INFIX.

Conclusion: This is the first reported case of bilateral vertical shear sacroiliac joint dislocation treated with triangular osteosynthesis. Anterior pelvic fixation with INFIX and posterior fixation with lumbopelvic and percutaneous sacroiliac screws resulted in excellent radiographic and clinical outcomes.

Introduction

Bilateral vertical shear pelvis injuries are rarely encountered, with few surgically treated cases having been reported in the literature [2–4], none of which have been reported within the last 10 years. One of these reports utilized iliolumbar fixation in combination with anterior sacroiliac (SI) joint plating [4], with the remaining two cases opting for anterior SI joint plating alone [2,3]. As treatment options and biomechanical studies have led to changes in techniques for definitive fixation, the treatment of this case differs from previous cases described. This also appears to be the only reported case with associated hip dislocation. The purpose of this study is to present a rare injury with associated imaging and to discuss a surgical treatment technique that led to a good functional outcome for the patient. This patient was made aware that data concerning their case would be submitted for publication and the patient agreed.

Case report

A 25-year-old female arrived by ambulance as a “trauma code two” to the emergency department. She was an unrestrained driver of a vehicle which rolled over on the freeway at an unknown rate of speed. She was alert and oriented upon presentation, had stable vital signs, and had a chief complaint of pelvic pain. Her left lower extremity was shortened and externally rotated in comparison to the contralateral leg. Initial imaging in the emergency department demonstrated bilateral vertical shear SI joint dislocations with proximal migration of the ilia in relation to the sacrum: a Tile C injury pattern. She also sustained a posterior left hip dislocation without acetabulum fracture (Fig. 1). Conscious sedation was performed in the trauma bay for closed reduction of the left hip and a pelvic binder

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was applied. Bilateral distal femur traction pins were placed under local anesthesia. The patient was transferred to the surgical intensive care unit where she subsequently became hemodynamically unstable and was stabilized with use of intravenous fluids, four units of packed red blood cells, and two units of fresh frozen plasma. Computed tomography (CT) scan of the pelvis redemonstrated bilateral complete SI joint disruption and showed minimally displaced rami fractures and bilateral L5 transverse process fractures (Fig. 2A–B).

The patient was taken to the operating room (OR) the following morning, placed in a prone position on a Jackson table, and open reduction with internal fixation was performed utilizing bilateral lumbopelvic fixation, followed by bilateral sacroiliac screws at S1, and an S2 trans-sacral screw. First, bilateral Wiltse incisions were made and L5 pedicle Schanz pins were placed bilaterally, followed by iliac Schanz pins bilaterally. A spinal distractor was then used to reduce the SI joints in both lateral to medial and cephalad to caudad orientations with the aid of fluoroscopy. Connecting rods were then placed and each construct was tightened and secured. Sacroiliac screws were then placed to assist in lateral to medial compression as well as provide additional fixation. After bilateral S1 screws were placed, the left SI joint remained slightly distracted, so a trans-sacral screw was placed at S2. This screw provided excellent purchase with additional compression of the left SI joint.

The patient returned to the OR two days later for stabilization of her anterior pelvic injuries with application of INFIX (Fig. 3). INFIX is an anterior subcutaneous pelvic fixation system. It consists of pedicle screws inserted bilaterally at the anterior inferior iliac spine (AIIS) connected by a subcutaneous rod at the bikini line [5]. The patient was instructed to be non-weightbearing to both lower extremities except for transfers immediately post op. Full weight bearing was achieved at 6 weeks post op. Removal of INFIX was performed approximately 18 weeks after application (Fig. 4A), and removal of bilateral lumbopelvic constructs at 12 months post op. Follow up radiographs after lumbopelvic removal demonstrates satisfactory healing of the pelvic ring with good alignment of bilateral SI joints (Fig. 4B). At 21 months post-op, the patient has 5/5 muscle strength to bilateral lower extremities without motor or sensory abnormality. She does rely on the use of a cane only when ambulating long distances, and occasionally utilizes NSAIDs for pain relief.

Discussion

Pelvic ring fractures account for approximately 3% of all patients with fractures. Of those, only 0.34% of all adult pelvic ring and acetabulum fractures were found to be considered type C by the AO classification. The patient presented in this study had complete posterior arch disruptions bilaterally, which is an injury pattern accounting for only 0.01% of all adult fractures [1].

Bilateral vertical shear injuries are, by definition, Tile type C injuries, as there is complete disruption of the posterior sacroiliac complex as well as the pelvic floor, allowing for both posterior and vertical displacement, resulting in a completely unstable pelvis. As discussed by Tile, anterior fixation in addition to posterior fixation for type C fractures provides excellent stability of the pelvic ring [6].

With regards to posterior pelvic fixation for unstable sacral fractures, a cadaveric and biomechanical study by Schildhauer et al. demonstrated triangular osteosynthesis to have statistically significant smaller displacement when compared to standard iliosacral screw fixation under initial peak load at 10,000 cycles, suggesting that triangular osteosynthesis provides greater stability than iliosacral screw fixation alone [7]. Triangular osteosynthesis also allows for percutaneous application, a technique that has become increasingly common among trauma surgeons. Both open and percutaneous techniques were shown to produce similar, good, or



Fig. 1. Initial AP pelvis X-ray in resuscitation bay in ED. Note bilateral vertical shear SI joint dislocations and left hip dislocation.



Fig. 2. CT scan (bone window) of pelvis, showing complete disruption of bilateral SI joints. Axial (A) and coronal (B) views.



Fig. 3. Intra-op fluoroscopic image after application of bilateral triangular osteosynthesis and INFIX showing satisfactory reduction of both the posterior and anterior pelvis.

excellent reductions [8]. Limitations to percutaneous fixation include: inadequate percutaneous reduction of sacroiliac joints, associated acetabular fracture necessitating open reduction, poor intraoperative imaging such as abundant bowel gas or intra-abdominal contrast agents, sacral dysmorphism preventing safe passage of percutaneous screws, and the presence of neurologic injuries where decompression is indicated [6,8].

When compared to percutaneous posterior pelvic fixation, lumbopelvic fixation offers the advantage of immediate full weight bearing postoperatively due to increased stability of the construct [9]. Due to the bilateral injury pattern in this patient, we elected for a more conservative weight bearing protocol. The patient was made weight-bearing-as-tolerated immediately postoperatively for transfers only. She was then slowly transitioned to full weight bearing bilaterally which she was able to achieve by six weeks.

Multiple treatment options exist to stabilize the anterior pelvis, including external fixation, plate fixation, or INFIX. Vaidya et al. compared INFIX to external fixation in anterior pelvic ring injuries. They performed a biomechanical analysis of the two fixation methods which showed external fixation to have higher peak torque and torsional stiffness, while INFIX had superior results in stiffness while under loads causing distraction [10].

There are also multiple techniques to stabilize the posterior pelvis, including triangular osteosynthesis, iliosacral screws alone, transiliac bars, and SI joint plating. Plate fixation on the posterior pelvic ring can be open or percutaneous and can be placed posterior or anterior. There have only been two cases of this injury in the literature treated with anterior SI joint plating [2,4]. All pelvic fixation

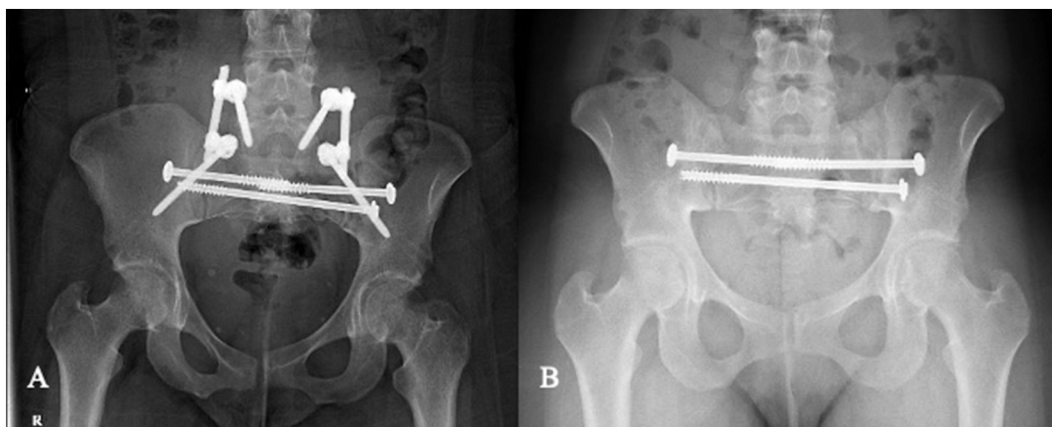


Fig. 4. AP pelvis after removal of INFIX (A) and after removal of bilateral lumbopelvic fixation (B).

strategies have their own unique indications and contraindications, as well as numerous advantages and disadvantages given the clinical scenario.

Conclusion

Bilateral vertical shear SI joint dislocations are rarely encountered injuries and are associated with significant pelvic instability. These Tile C pelvis injuries are both vertically and rotationally unstable. Anterior fixation in addition to posterior fixation can provide excellent stability for these types of pelvic injuries. Posterior fixation was performed first in this case via bilateral lumbopelvic fixation, using spinal distractors between the L5 and iliac screws to reduce the sacroiliac joints. This was supported by bilateral S1 iliosacral screws and a single trans-sacral S2 screw to complete the triangular osteosynthesis. Anterior fixation was then performed utilizing INFIX. There are multiple effective modes of treatment of unstable pelvic injuries, and treatment techniques are at the discretion of the surgeon. Further study is needed to determine the best treatment protocol for this rare injury.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

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