

Isolated Zone III Vertical Sacral Fracture: A Case Report of an Alternative Surgical Technique for the Control of Post-Traumatic Pain

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Abstract

The severity of sacral fractures varies from complex fracture patterns, as in cases of high-energy trauma, to insufficiency fractures patients affected from poor bone stock. The management of sacral fractures remains a challenge for the spine surgeon. Isolated sacral fractures are very rare. They are usually due to shear forces that act on the pelvic ring and the fracture pattern is commonly transversely oriented. In our report, we described an alternative surgical technique for an isolated zone III vertical fracture of first sacral vertebra. This technique allows better pain management and a reduction of medico-legal disputes.

Keywords: *Isolated Zone III Sacral Fractures; Minimally Invasive Approach; Percutaneous Screw Fixation; Alternative Surgical Technique*

Introduction

The severity of sacral fractures varies from complex fracture patterns, as in cases of high-energy trauma, to insufficiency fractures patients affected from poor bone stock. The management of sacral fractures remains a challenge for the spine surgeon. Throughout the years, numerous classification systems and fixation techniques have been developed. Currently, although fusion rates remain high, long-term complications, such as residual pain and/or neurological deficits, persist for many patients [1,2] and sometimes can lead patients to charge responsibility profiles in the orthopedic management of post-traumatic pain. Isolated sacral fractures are very rare. They are usually due to shear forces that act on the pelvic ring and the fracture pattern is commonly transversely oriented [3]. We will describe a case of an isolated vertical fracture of the first sacral vertebra that occurred in zone III.

Case Presentation

A 68-year-old male patient was involved in a skiing accident, due to an impact on a stone. As a consequence, he lost his balance and he fell down, obtaining a direct trauma at the level of the sacrum. There was no loss of consciousness and the patient remained hemodynamically stable until his presentation to the emergency department. On admission, the patient complained of bilateral side sacral and low back pain. The medical examination revealed a significant tenderness over the superior gluteal region, bilaterally and an important pain during sacral and iliac compression. Sensory or motor dysfunctions of both extremities neither signs of urinary or anal incontinence were not identified. The X-ray and subsequently the CT evaluation revealed a complete zone III vertical fracture of first sacral vertebra. On CT evaluation, no other type of fractures or dislocations were identified. At the beginning, based on the fracture pattern, the patient was discharged from the hospital for bed-rest. Unfortunately, in the following days the patient experienced, on the sacral level, a growing and unmanageable pain. Therefore the patient was not able to stay in bed because he experienced a significant and growing pain, even during the slightest movements, not responding to any pharmacological treatment. Therefore we decided to surgically treat the patient. Moreover, there have been disputes due to the persistence of sacral pain not administered by drugs or that was treated too late by surgery.

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Principles of surgical management

Each sacral fracture is unique and its management should be tailored to the patient’s general condition. Sacral fractures are commonly defined as stable or unstable, with unstable fractures being those that are likely to change position or become displaced with physiological loads. Instability is most likely to occur in cases of displacement or disruption of the sacroiliac joints, vertical fractures, and cases of avulsion of the sacrotuberous or sacrospinous ligaments; these types of fractures warrant surgical intervention [3-7]. On the other hand, many sacral fractures (such as Zone I fractures) can be managed conservatively with bed rest and pelvic immobilization. Minimally displaced fractures (Zone I, II with a stable pelvic ring and III) may be managed with a short period of bed rest with or without an orthosis; weight bearing is progressively increased afterward. Surgical indications for sacral fractures include: 1) unstable fractures, 2) neurological deficit, and 3) severe axial or sagittal spinal misalignment [8]. Most surgical interventions are based on 1) resection of the distal sacrum 2) posterior or posterolateral neural decompression, 3) direct reduction and fixation, and 4) reduction and fixation of the lumbosacral spine with lumbopelvic fixation [7].

Surgical technique

The surgical technique applied in this case provided two S1 pedicle screws, horizontally connected one with each other by a titanium bar. Subsequently, the distraction of the pedicle screws on the titanium bar was performed, in order to obtain a reduction of fracture on the sagittal plane. This approach was performed percutaneously, with negligible blood loss, reduced surgical time and poor post-operative pain. According to our knowledge, in the literature there are no other cases of isolated zone III vertical fracture of first sacral vertebra, surgically treated by a comparable approach. For similar but not identical cases, sacroiliac screws fixation were performed. However, in a such specific case, this approach would not have been feasible, because the screw would not cross the fracture line, which was superior to the hypothetical trajectory of the screw. The alternative would have been to perform an iliolumbar segmental fixation, that, although biomechanically correct, it approach would be extreme. Our approach allowed us to manage the fracture, without L5-S1 disc biomechanics modification and without spino-pelvic range of motion reduction.



Figure 1: Pre-operative X-ray (fracture identified by red circle).

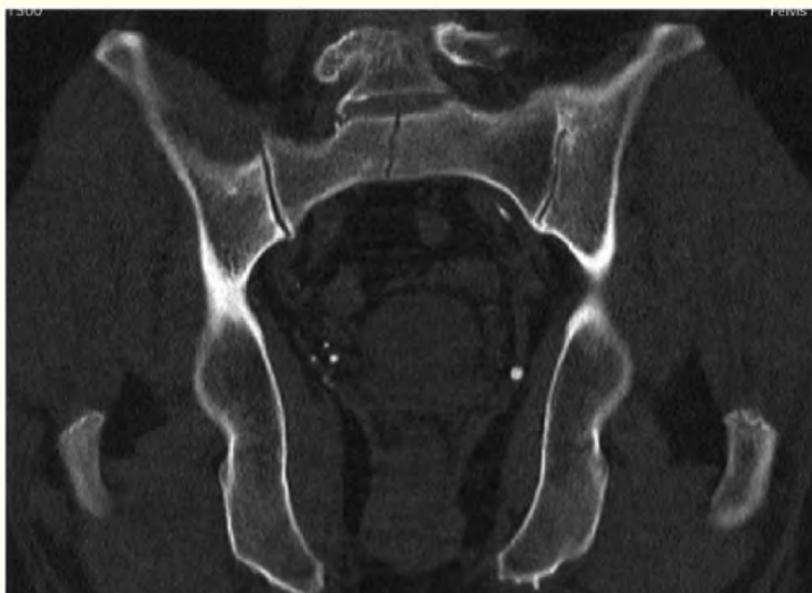


Figure 2: Pre-operative CT (coronal plane).

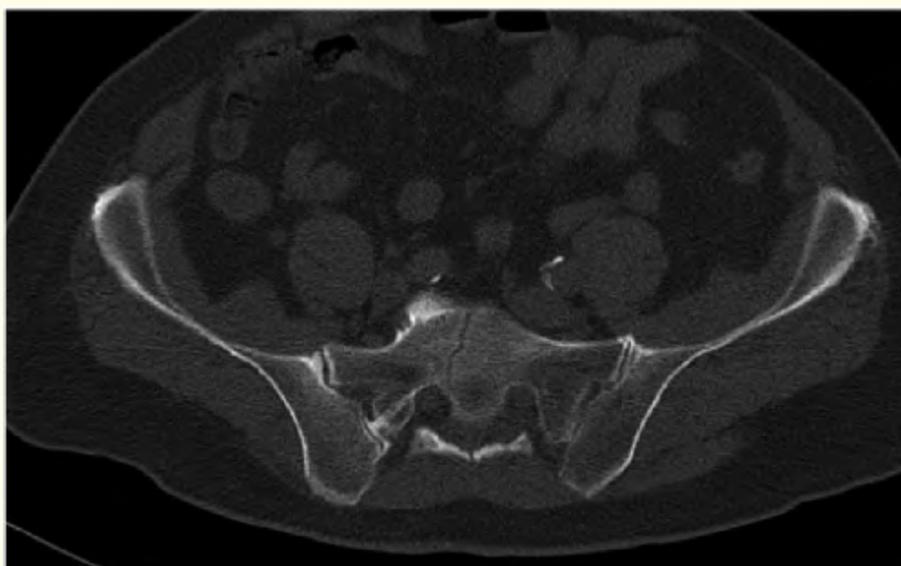


Figure 3: Pre-operative CT (axial plane).

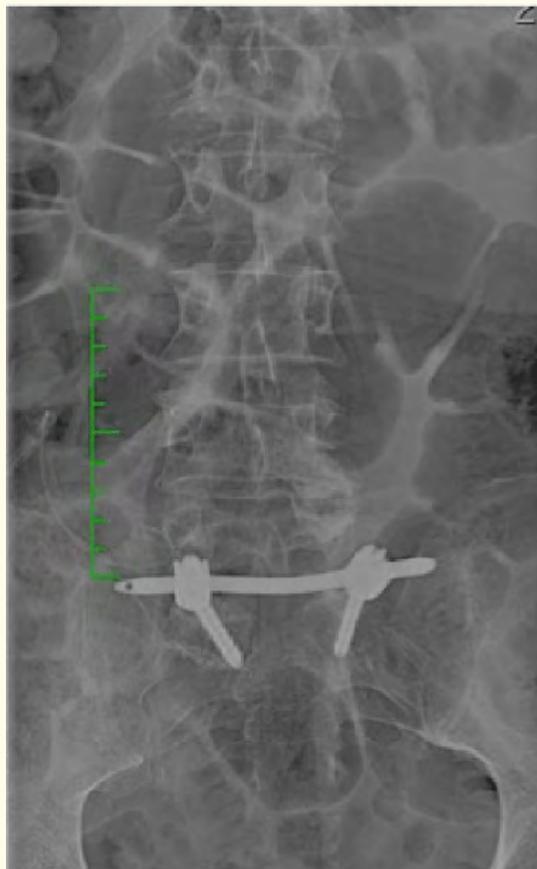


Figure 4: Post operative X-ray (AP projection).



Figure 5: Post operative X-ray (LL projection).

Discussion

The sacrum is the inferior functional part of the vertebral column. Intervertebral structures, iliolumbar and sacrolumbar ligaments make the L5-S1 motion segment more stable than the lumbar spine. The sacrum provides an important function of “load-transferring” and is considered the keystone of the pelvic ring. If surgical treatment is considered, an accurate pre-operative planning must be done, because the sacral anatomy is extremely variable; transitional vertebrae and sacral dysplasia are very frequent with consequently alteration in the relationships among the sacrum, pelvis, and spinal column [9,10]. Different classifications were proposed, during the time [11]. Denis classification correlates the fracture pattern with the risk of neurologic injury [12]. According to this classification three zones are identified in the sacrum. Zone I, that is located lateral to the neuroforamina. Zone II that is located between the ala and the body of the sacrum. Zone III, or central zone fractures, usually involve the spinal canal [12]. Roy-Camille, et al. [13] classified the fractures in three types: I, deformity in flexion of the upper part of the sacrum, type II, deformity in flexion of the upper part of the sacrum with posterior displacement and type III, displacement of the upper part of the sacrum without angulation. Types I and II were usually due to an impact with the lumbar spine in flexion, whereas type III in extension [13]. A lot of different patterns of sacral fractures were identified. Specifically, midline longitudinal Denis zone III sacral fractures, have a low risk of neurologic injury [14]. At the beginning this pattern of fractures, was described by Wiesel and colleagues in 1979, who reported a lower incidence of neurologic injury than transverse fractures. This is probably due to the lateral displacement of nerve roots, instead to a transection [14]. This injury was subsequently described by Bellabarba, et al. [14] as a variant of the anteroposterior compression pelvic ring injury. The fractures that occur in weakened bone, as in postmenopausal women, are defined insufficiency fractures. They are usually due to osteoporosis [15]. This fractures are not the consequence of high-energy trauma and the fracture pattern is usually vertically oriented, although they might be result in more complex “U”-fracture. In these cases, neurologic deficits are uncommon [16]. On the contrary, stress fractures of the sacrum usually occur in normal bone [17], specifically in the patients that usually do repetitive activities. Rarely, low-energy sacral fractures may be due to both insufficiency and repetitive stress [16,17].

Conclusion

Midline sagittal fractures of the sacrum represent an unusual zone III fracture variant. This alternative surgical technique can be useful in case of fracture isolated zone III vertical fracture of first sacral vertebra, otherwise not properly managed by the usual and standard techniques of sacroiliac screws fixation and/or iliolumbar segmental fixation. This surgical technique reduces pain and consequently avoids the risk of medical-legal disputes [18].

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Competing Interests

The authors declare that they have no competing interests.

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