Digital Journal of Clinical Medicine

Volume 5 | Issue 4 Article 7

Fall 8-15-2023

Pelvic Fractures - An Overview

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Recommended Citation

Cheemalapati S. Pelvic Fractures - An Overview. *Digital Journal of Clinical Medicine*. 2023; 5(4): 187-193. doi: https://doi.org/10.55691/2582-3868.1137

Pelvic Fractures - An Overview

Abstract

Pelvic fractures are injuries commonly caused by high-energy trauma, such as motor vehicle accidents and falls from a height. Understanding the anatomy, mechanisms of injury, classification, diagnosis and the management of these fractures is crucial to improve patient outcomes. This short article aims to provide a comprehensive overview of the current state of knowledge regarding pelvic fractures.

Keywords

Pelvic Fracture, Orthopedics, Trauma, Polytrauma, Emergency

This short communication is available in Digital Journal of Clinical Medicine: https://rescon.jssuni.edu.in/djcm/vol5/iss4/7

Introduction –

The pelvic skeleton is made up of the sacrum, ileum, ischium and the pubis (the latter three together known as the innominate bones) – further being divided into the true pelvis and the false pelvis by the pelvic brim. The true pelvis is also known as the lesser pelvis and the false pelvis is also known as the greater pelvis. The innominate bones meet at the acetabulum, which is a medial structure – serving as the point of articulation for the head of the femur. The ileum, ischium and pubis also attach to each other anteriorly at the pubic symphysis, and attach posteriorly to each side of the sacrum, forming the sacroiliac joint. [1]

The acetabulum articulates with the head of the femur, forming a ball-and-socket joint. Normally, the head of the femur is slightly anteverted – and therefore, the lesser trochanter of the femur (in anteroposterior [AP] view on an X-ray) is less visible.

The pelvic bones function to shift the load of the upper body onto the lower limbs during both standing and walking. It also protects the organs that lie within it – including, but not limited to – the bladder and rectum.

Pelvic Fractures –

Traumatic pelvic fractures result from high energy impacts and are usually associated with a high morbidity and mortality. Pelvic injuries are very common in polytrauma patients (accounting for around 10% of all blunt trauma admissions) [2] and, may range from minor lacerations to complex fractures. One of the most important initial investigations in blunt trauma cases is a pelvic X-ray – to rule out pelvic fractures.

In a normal pelvic X-ray, a continuous, smooth line can be drawn in the inferior margin of the superior pubic ramus, which turns laterally towards the medial part of the head and neck- terminating just before the lesser trochanter. This smooth, uninterrupted, imaginary line- is referred to as Shenton’s line. In any kind of disease, fracture or destruction of the hip, Shenton’s line is disturbed.

High-impact pelvic fractures are also associated with other injuries, such as abdominal solid organ injuries (SOIs), and thoracic injuries. The principal vascular structures injured include the presacral plexus and prevescical veins, along with the anterior branches of the internal iliac artery, the pudendal artery, the obturator artery, the superior gluteal artery, and the lateral sacral artery. [3]

Pelvis fractures may be of two types – stable and unstable, wherein stable pelvic fractures (also known as Type A fractures) denote no injury to the ring of the pelvis, and unstable fractures are those with any injury to the ring of the pelvis [Figure 1]. A more definitive classification of unstable fractures (based on the mechanism of injury) – known as the Young and Burgess Classification [4] – divides them into 4 main types:

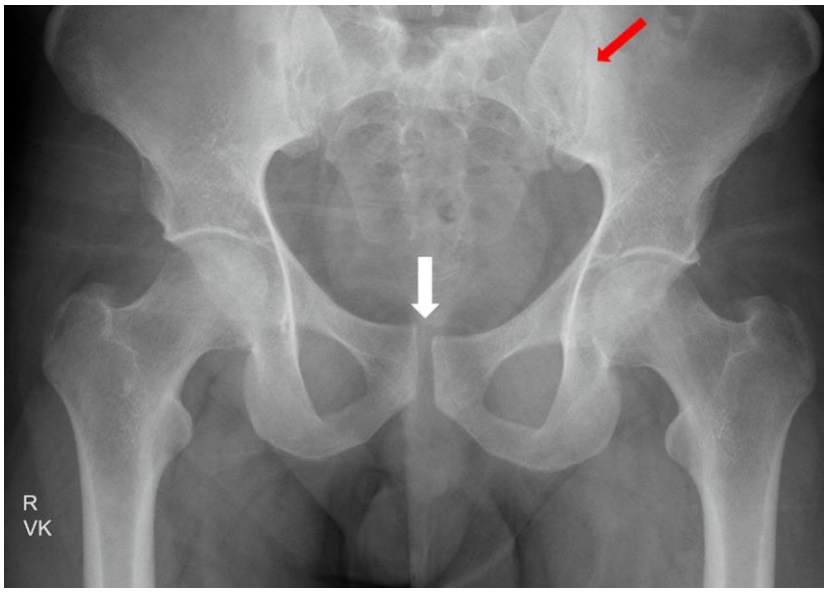
- Anterior Posterior compression of the pelvis
- Lateral compression of the pelvis
- Vertical Shear
- Complex mechanism of injury (where two different force vectors may be applied)

Figure [1] – Right Iliac wing fracture – Seen on Oblique view of Pelvic Radiograph

Reproduced from [5]

Anterior Posterior Compression (APC) of the pelvis lead to the opening up of the pelvis – also known as an open book fracture / pubic diastasis. Although fractures are relatively uncommon in APC-type injuries, if present, may involve the pubic rami. [4] There are three classes of APC injuries – with type I injuries showing symphyseal widening of less than 2.5cm. These injuries have no instability of the posterior pelvis (both radiographically and clinically). Type II injuries result in a widening of the symphysis pubis and posterior pelvic

instability due to the disruption of the anterior sacroiliac complex. Type III injuries are difficult to classify and diagnose but are often associated with complete posterior ligamentous disruption. [Figure 2]

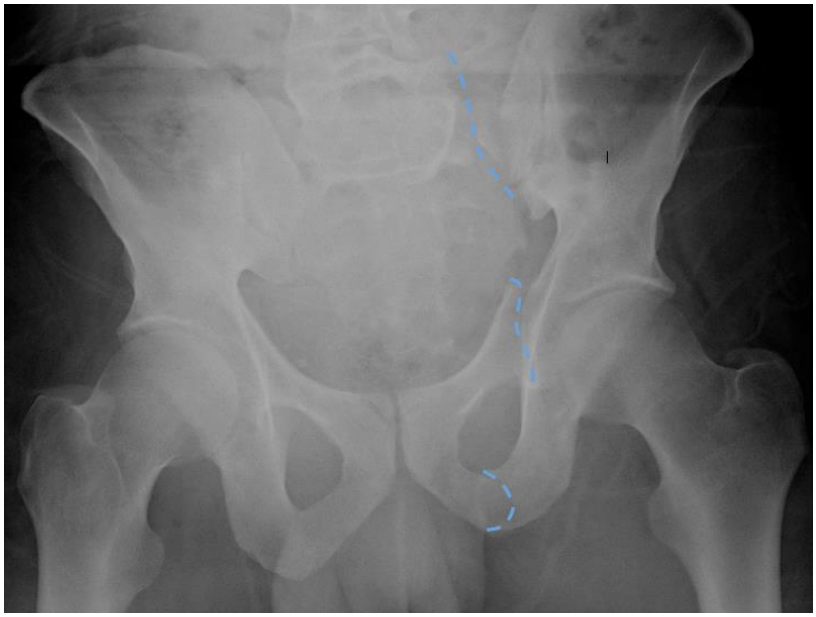


[Figure 2] - Anteroposterior pelvic radiograph, demonstrating a pubic symphysis diastasis of <2.5 cm (white arrow) and no left sacroiliac joint widening (red arrow)

Reproduced from [6]

Lateral Compression (LC) fractures result in what is referred to as a “windswept pelvis”. They are caused as a result of a medially directed force applied to the pelvis. Fractures are more common in LC injuries, with 100% of LC injuries having ramus fractures and 88% having sacral fractures as described by Young et al. [7] LC fractures are further divided into 3 classes over a spectrum of severity of injury.

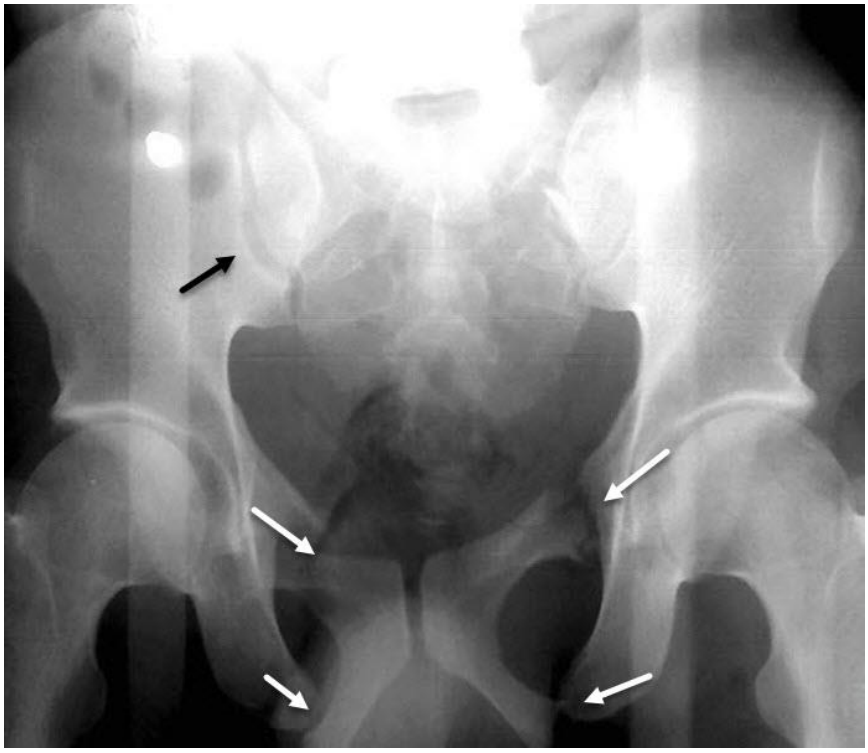
Vertical Shear (VS) fractures are due to the axial loading of force, being distributed over one or both of the hemipelvis [7], resulting in two main types of fractures – a Malgaigne fracture, with ipsilateral sacroiliac disruption and ipsilateral superior and inferior pubic rami fractures – and a Bucket Handle fracture – with sacroiliac joint disruption and contralateral superior and inferior pubic rami fractures [Figure 3]



[Figure 3] – Anteroposterior pelvic radiograph – showing ipsilateral sacroiliac disruption and ipsilateral superior and inferior pubic ramus fracture.

Reproduced from [8]

Complex injuries describe a combination of any of the three primary patterns of injuries (APC, LC, VS). A common example of a complex injury is a Straddle fracture – showing a bilateral superior and inferior pubic rami fracture [Figure 4]



[Figure 4] - Fractures of both superior pubic rami and both inferior pubic rami (white arrows). The right sacroiliac joint is widened (black arrow).

Reproduced from Wheeless' Textbook of Orthopaedics.

Management:

Initial management involves the initial assessment of the patient in accordance with the ABCDE guidelines and simultaneous resuscitation as per the Advanced Trauma Life Support (ATLS) principles. The volume of blood loss in major pelvic injuries can go as high as 3000ml with blood lost at a rate of 1000ml/h. Hypovolemic shock contributes to 80% of all deaths and hence, it is imperative to identify the bleeding source and control the haemorrhage [9]. Scrotal ecchymosis and blood at the urethral meatus indicate damage to the urethra or bladder, with pelvic ring disruption, and therefore a retrograde urethrogram can be used to confirm a urethral injury.

Application of a pelvic binder at the level of greater trochanters stabilises the pelvic ring, reduces bleeding from the fractures sit and does not allow for the formation of clots. [10]

Appropriate pain management with paracetamol (and the addition of opioids if necessary) for low-energy fractures, and dose-titrated intravenous (IV) morphine for high-energy fractures, is important. Timely orthopedic surgery is of utmost importance. External fixation can be used to provide temporary mechanical stabilization, wherein pins inserted at the anterior inferior iliac spine are directed towards the posterior ilium under radiographic guidance, just posterior to the greater sciatic notch. [10] Definitive surgery involves an open reduction and internal fixation with plates and screws.

Complications are very common, especially in high-energy pelvic injuries. Infections may occur in both open pelvic fractures, as well as post-surgical fixation, and need to be treated with high-dose systemic antibiotic therapy.

Plate fixation may also be associated with some complications – early complications include lumbar nerve injuries and internal pelvic fixation failures, whereas late complications may occur in the form of urethral disruptions and urinary incontinence [11].

Pelvic fracture patients are also at an increased risk of developing venous thromboembolisms (VTE), which could lead to deep vein thrombosis (DVT) and pulmonary emboli (PE). This can occur due to prolonged immobilization and damage to vasculature. Urethral injuries are also very common, seen in

between 1.6 to 25% of pelvic fracture cases [8]. An important long-term complication is chronic post-traumatic pelvic pain. It is imperative that all patients follow-up in a specialist pelvic trauma unit or rehabilitation clinic for appropriate management.

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