CLINICAL CASE - TEST YOURSELF | Musculoskeletal Imaging

# Excruciating pain and shortened left leg after a road traffic accident

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## PART A

A 48-year-old male patient was admitted to the emergency department after a road traffic accident. The patient complained of pain in the thorax, pelvis and left hip. His neurological status was unremarkable. On physical examination, his left leg demonstrated minimal movement, excruciating pain and appeared short in length. Plain radiographs (**Fig. 1**) and computed tomography (CT) scans (**Figs. 2, 3**) were performed.

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***Fig. 1.*** *Plain radiograph of the pelvis (AP view).*

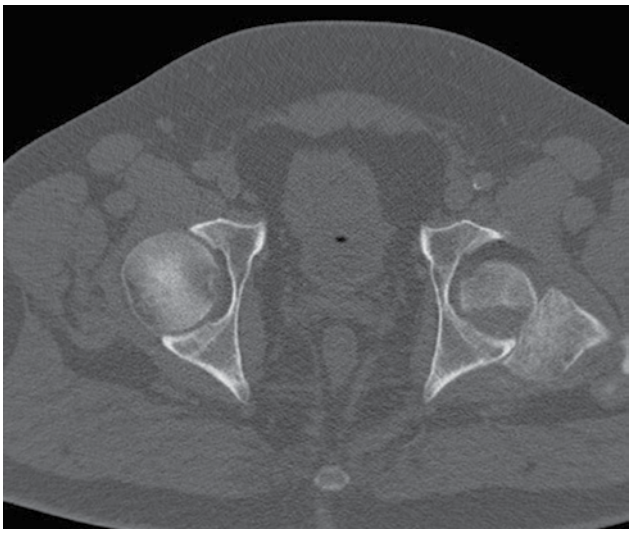

***Fig. 2.*** *CT scan of the pelvis/hip bones, axial slice.*


***Fig. 3.*** *CT scan performed a few hours later than the initial (Fig. 2) CT scan.* ***a.*** *Axial CT scan of the pelvis/hip bones.* ***b.*** *Coronal CT image reconstruction.*

## PART B

### *Diagnosis: Pipkin fracture type II*

It is estimated that more than 250000 incidents of hip fractures are reported in the USA and are related to high mortality and morbidity [1]. Pipkin fractures are a specific and uncommon type of hip fractures of the femoral head associated with dislocation [2, 3]. These fractures are usually caused by high impact energy injuries, such as car accidents. The Pipkin system classifies femoral head fracture-dislocation into four types [2, 4]. Classification relies on morphology of the femoral head fracture and possible association with femoral neck or acetabular fracture [1]. The four types of Pipkin fracture are the following:

- **Type I:** Hip dislocation associated with femoral head fracture below the level of fovea.
- **Type II:** Hip dislocation associated with femoral head fracture above the level of fovea.
- **Type III:** Type I or type II injury associated with a fracture of the femoral neck.
- **Type IV:** Type I or type II injury associated with a fracture of the acetabulum.

Early recognition and accurate reduction are the mainstays of successful treatment of these fractures [5, 6]. Subsequent treatment options include conservative and surgical treatment, although due to the severity and complexity of the injury, non-operative treatment is questionable. The main consideration of surgical treatment is to remove any loose bodies and repair the fracture [3]. Therefore, treatment options for Pipkin fractures are based on the imaging evaluation. Although a dislocation is easily appreciated on radiographs, additional fractures need CT imaging [3].

Pipkin fractures type I and II are candidates for conservative treatment, hence they are infrequently treated surgically [4]. For Pipkin type III fractures, reduction may cause further femoral neck fracture displacement, which increases the risk of complication, such as avascular necrosis. For Pipkin III, IV and for cases of dislocation with failed closed reduction, the best treatment is an urgent open reductions [1, 4].

The anteroposterior (AP) radiograph of the pelvis demonstrates the dislocated femoral head with loss of hip joint congruence together with the disrupted Shenton's line. It is important to determine if there is an additional fracture in the hip, prior to relocation. After the reduction, a second AP pelvic radiograph is necessary to specify the fracture pattern. If there is clinical concern regarding additional fractures such as acetabular fracture, then a Judet view should be added to a routine trauma plain radiograph [3].

Diagnosis based on radiographs is not sufficient for treatment decision, hence CT is effective in demonstrating osseous fragments or osteochondral defects [3, 7]. Axial images and multiplanar reformations are helpful for detailed femoral head fracture pattern and intra-articular chondral or osteochondral free loose fragments [8]. Magnetic resonance imaging (MRI) can clarify clinically suspected non-displaced fractures which are occult on radiographs or CT. MRI is the gold standard examination to access long term complications such as avascular necrosis [4]. MR arthrography is able to show chondral fractures which are occult on CT.

In our case, the patient was admitted to the emergency department after a road traffic accident. Clinically, there was a severe limitation in the range of motion of the left hip, which was very painful. There was a reduced limb length. A radiograph of the pelvis was obtained (**Fig. 1**), showing left hip dislocation with a high suspicion of additional femoral head fracture. After closed reduction, a CT examination of the hip was performed (**Fig. 2**), verifying the dislocated femoral head fracture above the fovea level. Due to the severity of the symptoms, a follow up CT scan few hours later was performed, showing total rotation of the fractured femoral head (**Fig. 3**). CT showed extreme rotation and

KEY WORDS
Pipkin; femoral head fracture; hip fracture-dislocation

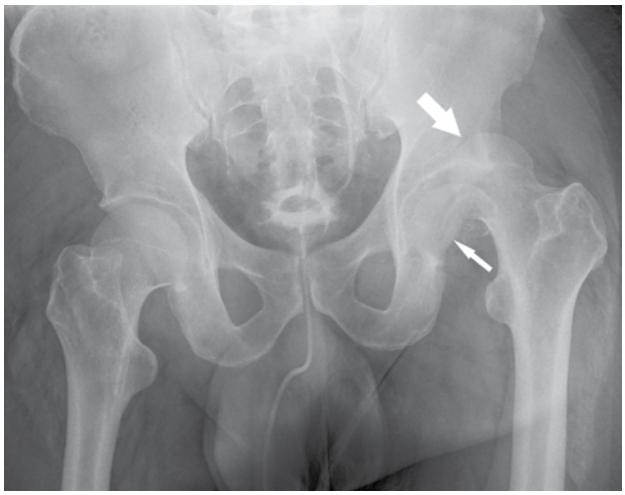

***Fig. 1.*** *Plain radiograph of the pelvis (AP view) showing left hip dislocation (arrow), associated with an osseous fragment trapped within the acetabular fossa, suggesting a femoral head fracture (thin arrow).*

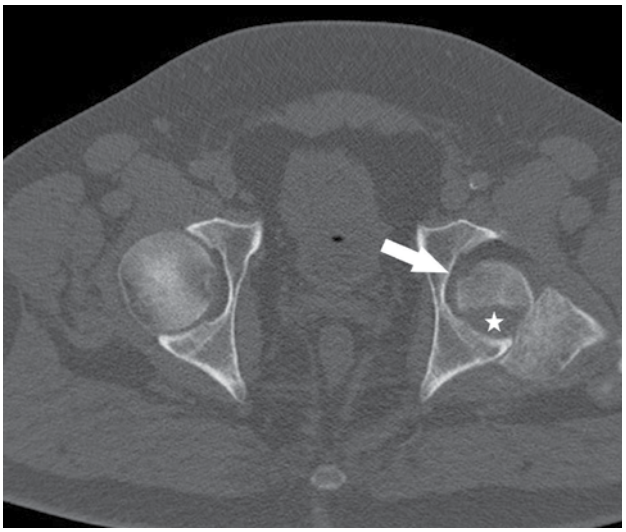

***Fig. 2.*** *Axial CT scan at the hip joint level showing the left femoral head fracture. An osseous fragment is externally rotated (arrow) and there is a significant gap between the osseous fragments (asterisk).*


***Fig. 3.*** *Axial (**a**) and coronal CT reconstruction of the follow up CT scan after reduction (**b**) showing the total rotation of the fractured femoral head (arrow).*

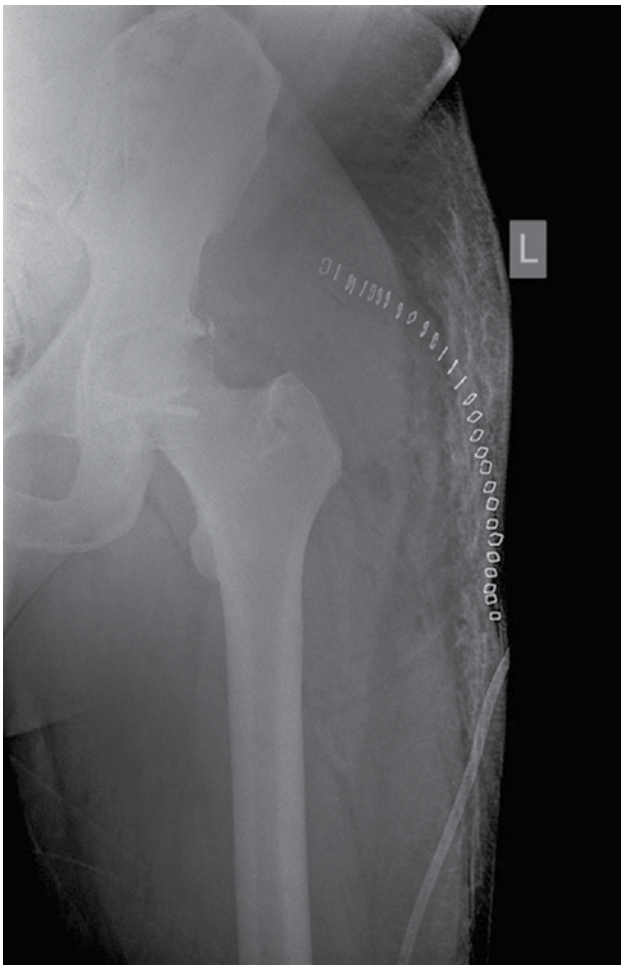


***Fig. 4.*** *A post-operative left hip radiograph demonstrating fixation of the femoral head fracture with two 50 mm mini-fragment screws and complete restoration of the normal anatomy.*


***Fig. 5.*** *The 2-month postoperative AP view of the pelvis shows no signs of short-term complications.*

the patient was admitted to the operating room for urgent surgery. Intraoperative and post-operative radiographs confirmed the restored anatomy of the hip joint and the fixed fracture fragment **(Figs. 4, 5)**.

Complications that may occur are short and long term. Short term complications include: (1) iatrogenic fracture of the femoral neck during attempted closed reduction, (2) paralysis of the peroneal nerve and (3) infection. Long term complication include: (1) heterotopic ossification, (2) avascular necrosis, (3) fatigue fracture of the femoral neck after successful open reduction, (4) mechanical incongruity and post-traumatic arthritis, (5) myositis ossificans of the short rotators and (6) spontaneous fibrous or bone ankyloses [2]. In our case, after two months of follow-up, no short-term complications were present **(Fig. 5)**.

A missed diagnosis of Pipkin fracture is associated with a poor prognosis related to late onset femoral head osteonecrosis and post-traumatic osteoarthritis [9, 10]. The treatment then is total hip arthroplasty.

In conclusion, Pipkin fractures are complex injuries and need to be accurately and promptly diagnosed; failure to do so can provoke invertible complications with a significant impact on patient's functional ability and long term health service expenses. Knowledge of the imaging findings will yield the correct diagnosis and guide the proper treatment. R

## *Conflict of interest*

*The authors declared no conflicts of interest.*

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