Radiology of acute hip and femoral injuries

Introduction

Hip injury involving the femoral neck is one of the more common fractures seen in casualty. It is predominantly seen in the geriatric population and the incidence is increasing as life expectancy increases. Femoral neck fracture most commonly occurs following a fall, and hip fractures are most commonly found in the osteoporotic elderly. Femoral shaft injuries are mostly the result of high energy trauma. Hip dislocation is usually caused by high energy blunt trauma, generally in a road traffic accident. Hip injuries are associated with significant morbidity and mortality.

Anatomy

The hip is a modified ball and socket joint. The femoral head is a smooth convex structure which lies deep in the socket of the acetabulum. At the femoral neck, there should be a normal trabecular pattern, a smooth neck and no horizontal lines of sclerosis.

Radiological assessment and classical signs

The ABCS system of radiological assessment is followed for systemic evaluation:
Adequacy
Alignment
Bones
Congruity
Soft Tissue.

Adequacy

Anteroposterior and lateral views

An anteroposterior view of the whole pelvis (with both hips together) and a lateral view are essential to show fractures.

Alignment

The head of femur should be located within the acetabular capsule, not posterior or anterior to it. The following three lines are useful in the assessment of dislocation or fracture (*Figure 1*).

- Shenton's line. This is an imaginary line drawn along the inferior border of the superior pubic ramus (superior border of the obturator foramen) and along the inferomedial border of the neck of femur. This line should be continuous and smooth, but is disrupted in dislocation or fracture.
- Iliopectineal line. This is a line from the arcuate line (ilium) to the pectineal line (pubis). This line should be continuous – any displacement suggests fracture of the superior pubic ramus or acetabulum.
- Ilioischial line. This is a view of the cortex of the quadrilateral plate to its termination at the obturator groove. This line should be continuous. Any displacement suggests a fracture of the inferior pubic ramus or ischium.

Bones

Fractures generally present as breaks in the cortex with displacements or angulations. The presence of lucent lines suggests an underlying fracture while sclerotic lines indicate an impacted fracture. Any disruption in the trabecular pattern of bone also suggests a fracture.

Congruity

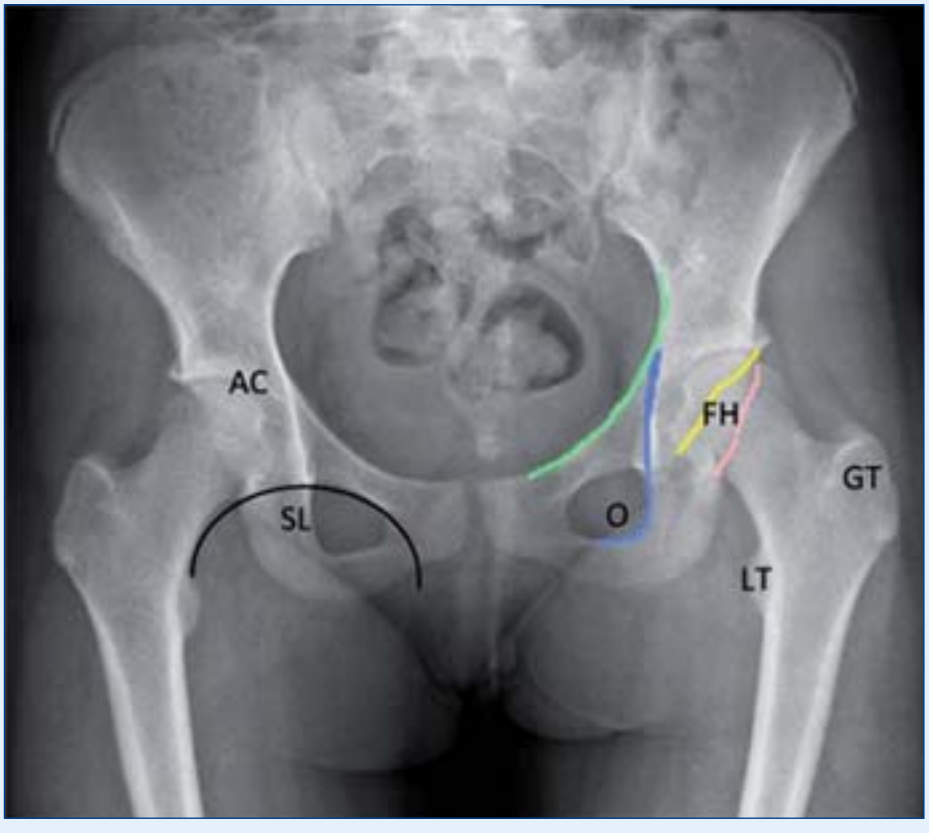
Any asymmetry suggests a fracture or dislocation.

Soft tissue

Soft tissue signs on a radiograph are less obvious in injuries of the femoral neck.

Possible problems with the interpretation of these X-rays include rim osteophytes or the acetabular margins in osteoporotic femoral necks can mimic fracture, and fractures at the pubic ramus may clinically mimic a fractured neck of femur.

Figure 1. Anteroposterior X-ray of normal pelvic anatomy, showing the iliopectineal line (green), ilioischial line (blue), anterior acetabular wall (yellow), posterior acetabular wall (pink) and obturator foramen (O). AC = acetabulum; FH = femoral head; GT = greater trochanter; LT = lesser trochanter; SL = Shenton's line.



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Femoral neck fracture

Fractured neck of femur is a very common injury, particularly among the elderly. It tends to occur after a fall which may be trivial in nature. These fractures are divided into intracapsular and extracapsular fractures, with the former running the risk of avascular necrosis as a result of the disruption of its blood supply.

Radiological classification of fractures of the neck of femur (*Figure 2*) is: subcapital, transcervical, intertrochanteric or subtrochanteric. A femoral neck fracture is called subcapital (*Figure 3*) when it is at the junction of the head and neck while intertrochanteric fractures (*Figure 4*) are fractures extending between the greater and lesser trochanters. The transcervical fractures (*Figure 5*) are fractures through the neck of the femur, in between the sites of the aforementioned fractures. Subtrochanteric fractures are fractures of the proximal femur distal to the lesser trochanter (*Figure 6*).

Magnetic resonance imaging or bone scans are useful in detecting radiographically subtle or occult femoral neck fractures if there is a high index of clinical suspicion.

Figure 2. Anatomy of femur with medial displacement into acetabulum. FH= femoral head; FN= femoral neck with good trabecular pattern; GT= greater trochanter; LT= lesser trochanter. Pink = subcapital fracture; green = transcervical fracture; yellow = intertrochanteric fracture; blue = subtrochanteric fracture. Pink and green are intracapsular and yellow and blue are extracapsular. The difference is in the way they are managed.

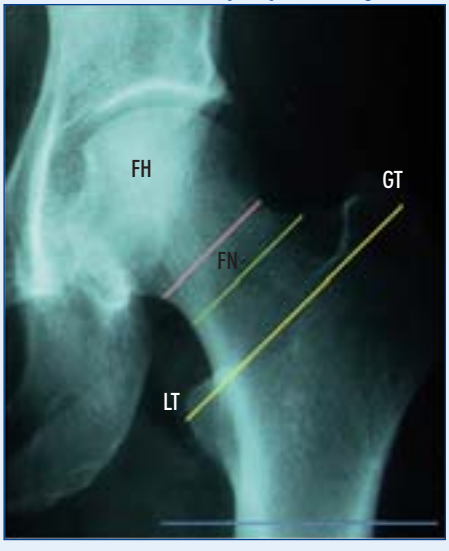

Figure 3. Left subcapital fracture, seen just below the head of the left femur.

Figure 4. Left intertrochanteric fracture. The smooth outline of the femoral neck is lost. Fracture fragments arising from the lesser and greater trochanters are seen.

Figure 5. Transcervical fracture in left femur. Note the loss of symmetry between both femurs and the shortened neck of femur on left.

Figure 6. Right subtrochanteric fracture with overlapping of fracture fragments.

Dislocations

Posterior dislocation

In a posterior dislocation, the femoral head is situated superior and lateral to the acetabulum on an anteroposterior pelvic radiograph (*Figure 7*). This is the most common type of hip dislocation in adults (80–90% of cases). The mechanism of injury is generally the result of a road accident when someone seated in a vehicle is propelled forward, with the knee striking the dashboard. This is often associated with fractures of the acetabulum and occasionally fractures of the femoral head.

Figure 7. Posterior dislocation. Femoral head (FH) is placed posterior and superior to the acetabulum.

Anterior dislocation

The femoral head is situated anterior to the acetabulum, caused by a hyperextension force against an abducted leg. The causes of these dislocations are the same as posterior dislocations but they are relatively uncommon.

Central dislocation

The femoral head lies medial to a fractured acetabulum (*Figure 8*). This is caused by a lateral force against an adducted femur. The causes of these dislocations are the same as posterior dislocations are the same. Note that the femoral head is seen medial of both the iliopectineal and ilioischial lines. BJHM

Figure 8. Femoral head (FH) is situated medial to the acetabulum (white dotted line) and medial to the ilioischial line (blue) and iliopectineal line (green) consistent with a central dislocation of the femoral head.

Conflict of interest: none.

Further reading

Lisle DA (2007) *Imaging for Students.* 3rd edn. Hodder Arnold, London

Raby M, Berman L, Lacey G (2005) *Accident & Emergency Radiology A Survival Guide.* 2nd edn. Elsevier Saunders, London

Solomon L, Warwick DJ, Nayagam S (2005) *Apley's Concise system of Orthopaedics and Fractures.* 3rd edn. Hodder Arnold, London

KEY POINTS

- Fractured neck of femur is the most common hip pathology.
- Acetabular and pubic rami fractures may mimic fractured neck of femur.
- Posterior hip dislocations are more common than central or anterior dislocations.
- Always compare both femoral necks for any asymmetry; subtle features such as a break in the trabecular pattern or sclerotic line may indicate impacted fractures.
- Magnetic resonance imaging or bone scans can help detect radiographically occult femoral neck fractures and should be requested if there is high clinical suspicion.