

FEMORAL SHAFT FRACTURE

The femur is the longest, strongest, and heaviest bone in the body. It accounts for about ¼ of an adult height. It consists of the head, neck, shaft, and condyles.

The neck forms an angle of about 125-135 with the shaft. When the neck-shaft angle is less than 120, this is coxa vara. Coxa vara is when the angle is more. The former deformity is much more common. The neck is also anteverted on the shaft; the degree of anteversion is normally 11°.

The head and a large part of the neck is bereft of any soft tissue attachment, and it is intra-articular, therefore, non-union is common here.

The remaining parts of the bone are heavily swathed in muscle; hence a strong force is necessary to overcome these deforming forces when the bones are fractured. These forces cannot be overcome by manipulation, hence the need for traction.

The distal femur is in close proximity to the popliteal and sciatic nerves, consequently, these structures are in danger when the distal femur is fractured (supracondylar fractures).

Blood supply

The head is supplied by the

- (i) The ascending cervical branches of the medial and lateral circumflex arteries, which run within the capsular retinaculum
- (ii) Intra-medullary vessels in the femoral neck

The artery in the ligamentum teres femoris supplies the area around the fovea in the adult. This is not important in adults.

The shaft is supplied by periosteal branches from the attached soft tissues as well as branches from the nutrient artery.

(1) FRACTURES OF THE FEMORAL NECK

These could either be intra-capsular or extra-capsular.

A) Intra-capsular fractures:

These are further divided into *sub-capital, basal cervical, or trans-cervical*. It is the commonest site of femoral fracture in the elderly.

The commonest risk factor is osteoporosis which is seen in the elderly around the 7th and 8th decade.

Other risk factors are osteomalacia, diabetes mellitus, chronic debilitating diseases, alcoholism, etc.

Mechanism of injury

- **Fall:** This is usually innocuous in the elderly with osteoporotic bone, but in younger individuals, it takes considerable force, e.g a fall from height or RTA, hence they may have associated shaft fractures and multiple injuries involving other organs, bones or systems.

Classification

Gardens classification is the most useful and is based on the amount of displacement in the pre-reduction X-ray.

Stage 1: Incomplete fracture

Stage 2: Complete but undisplaced

Stage 3: Complete fracture with displacement, but the fragments are still in partial contact

Stage 4: Complete fracture with total separation.

The intramedullary blood supply is always interrupted by the fracture; the retinacular vessels may be kinked or torn if the fracture is displaced. Hence, these fractures predispose to non-union and avascular necrosis.

Clinical features

- (i) History of fall (usually innocuous) followed by pain in the hip
- (iii) The limb is usually laterally rotated and short

X-rays

- For staging
- X-ray the shaft too especially in the young adults to rule out shaft fracture

Treatment

Because these fractures are seen in the elderly, operative treatment is almost mandatory because elderly patients tolerate prolonged immobilization very poorly.

Two types of operations are done:

(i) *Internal fixation (CRIF)*

- This is most suitable for Gardens stages 1 & 2. Implants that may be used are
 - . Dynamic hip screw
 - . Jewett's nail and plate
 - . Cannulated screws
 - . Compression screw plate
 - . Knowles pins

(ii) *Prosthetic replacement (hemiarthroplasty)*

- Most suitable for Gardens stages 3 and 4 occurring in patients older than 70 years. In younger patients, CRIF can still be done even for these fractures

Choice of prosthesis

- Austin-Moore prosthesis
- Thompson prosthesis

Complications

- (i) Avascular necrosis of femoral head
- (ii) Non-union
- (iii) Delayed union
- (iv) Osteoarthritis

B) Extra-capsular fractures

Inter (per) trochanteric fractures

These too are common in elderly osteoporotic women, but in contrast to intracapsular fractures; they unite easily and rarely cause AVN. They are prone to malunion due to the pull of the abductors attached to the trochanter.

Classification

- Stable fractures
- Unstable fractures

Clinical features

- . Externally rotated (more so than intracapsular fractures)
- . Short.

Treatment

- Even though these fractures will unite quite easily, internal fixation is preferred to avoid the morbidity of prolonged immobilization in bed and also to ensure accurate reduction.

Subtrochanteric fractures

This is also commonest in the elderly as a result of osteoporosis. It is also a common site for metastasis.

The head and neck are externally rotated and abducted by the gluteal muscles and flexed by the psoas.

Treatment of choice is ORIF.

FEMORAL SHAFT FRACTURES

Commonest in the young adult, and usually results from high-energy trauma. When seen in the elderly, it should be considered pathological, until otherwise proven.

Mechanism

Spiral fractures are usually caused by a fall in which the foot is anchored while a twisting force is transmitted to the femur.

Transverse and oblique fractures are more often due to angulation or direct violence and are more commonly due to RTA. With a combination of direct and indirect forces, comminuted or segmental fractures usually result.

Clinical features.

- Swelling and deformity of the limb, maximal at the fracture site.
- Attempt at movement is painful
- Exclude pelvic and other lower limb injuries by examining these regions.
- Exclude neuro-vascular injuries
- Exclude other injury to other systems.

Note: Because of the high energy involved, femoral fractures may be associated with multiple injuries.

X-ray

Always include the knee and the pelvis to exclude injuries to these structures. Displacements are often common because of the pull of the surrounding muscles.

Treatment

At the accident site the limb should be splinted pain and bleeding and to make transportation easier.

Definitive treatment

(i) Traction.

- Treatment of choice in children and whenever anaesthesia is contraindicated. Main drawback is the length of hospital stay; hence, it is a poor choice in the elderly.

Types of tractions:

Toddlers and infants < 12 kg – Gallows traction

Children – Skin traction

After 2 – 4 weeks, callus would have formed. A hip spica can then be applied for a further 3 – 4 weeks. (Note: Patient can take this home.)

Adults – Skeletal traction with 10% of the patient's weight in Thomas' or Bauhler Brauns frame.

(ii) ORIF

This is the method of choice when a short period of hospital stay is required.

Implants used are:

- . 1. Intramedullary nails: This can be unlocked, e.g. Kuntscher nails which can only be used in the isthmus of the shaft, or locked e.g. Zieckels nail. The former is the most commonly used in this environment because the instruments for the latter are not available. Locked nails are preferable because they can be used for fractures of any part of the shaft.
- . 2. Plates and screws: Can be used for fractures of any part of the shaft, but implant failure is more common than with intramedullary nails.

(iii) **External fixators:** This is useful for open fractures.

Complications

- Early:
 1. . Shock
 2. . Fat embolism
 3. . ARDS
 4. . Thromboembolism
- Late:
 1. . Non – union
 2. . Delayed union
 3. . Mal-union
 4. . Joint stiffness
 5. . Re-fracture
 6. . Implant failure.

SUPRACONDYLAR FRACTURES OF THE FEMUR

- Usually secondary to severe direct violence
- Distal fragment may be angulated as a result of pull by gastrocnemius muscles, putting the popliteal artery at risk

Clinical features

- The knee is grossly swollen
- Check for distal pulses
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Treatment

- Traction followed by cast bracing.
- ORIF with angled blade plate.

Complications

- Arterial damage
- Joint stiffness
- Non-union
- Malunion

FEMORAL CONDYLE FRACTURES

- May be associated with supracondylar fractures where a distal extension into the knee joint may cause one or both condyles to be split apart.

X-ray

- One condyle may be fractured obliquely and displaced upward.
- Split apart so that the fracture line is either T or Y shaped.

Treatment is by traction, bracing or ORIF.

FRACTURE-SEPERATION OF DISTAL FEMORAL EPIPHYSIS

- Equivalent to supracondylar fracture in the adult.
- Displacement is either lateral when due to forced angulation of the straight knee, or forward when due to a hyperextension injury.
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Treatment

- Manual reduction is usually successful, but this must be perfect in order to avoid growth abnormality in the future.
- ORIF with Kirschner wires when manual reduction fails.

Complications

- Vascular injuries especially in hyper-extension injuries
- Growth arrest causing shortening or knee angulation
- Malunion leading to knee angulation.