

Chapter 7

Fracture in Adults

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1) FRACTURES OF UPPER LIMB:

A) Galeazzi fracture:

A Galeazzi fracture is a fracture of the distal third (or junction of the middle and distal thirds) of the radial shaft accompanied by dislocation or subluxation of the distal radioulnar joint (DRUJ). Historically dubbed the “fracture of necessity” by Campbell, it earned the name because non-operative management in adults almost universally fails due to deforming muscular forces.

• Mechanism of Injury

Primary cause: A fall onto an outstretched hand (FOOSH) with the wrist in hyperpronation and hyperextension.

Alternative cause: A direct high-energy blow to the dorsolateral aspect of the wrist or distal forearm.

Deforming forces: The brachioradialis, pronator quadratus, and extensor/flexor tendons exert traction on the distal radial fragment, causing shortening, rotation, and secondary disruption of the triangular fibrocartilage complex (TFCC) and radioulnar ligaments.

• Clinical Presentation & Diagnosis

Signs: Marked wrist and distal forearm swelling, deformity, tenderness, and painful limitation of forearm pronation and supination.

Physical exam: A prominent, ballotable distal ulna (positive “piano-key sign”) indicates gross DRUJ instability.

Radiography: Full-length anteroposterior (AP) and lateral views of the entire forearm—including both the elbow and wrist joints—are mandatory.

- **Management**

Adults (Operative): Open reduction and internal fixation (ORIF) of the radius using a 3.5 mm dynamic compression plate (typically via the volar Henry approach). Restoring anatomic length and alignment of the radius often reduces the DRUJ spontaneously.

- If DRUJ is stable post-fixation: Immobilization in a long-arm splint/cast in supination for 4 to 6 weeks.

- If DRUJ remains unstable: Transfixing the DRUJ with temporary percutaneous Kirschner wires (K-wires) or repairing the TFCC.

Children (Non-operative): Unlike adults, pediatric Galeazzi injuries usually heal reliably with closed reduction and long-arm cast immobilization in supination due to an intact, robust periosteum.

- **Complications**

Persistent DRUJ instability and chronic wrist pain.

Malunion or nonunion resulting in severe loss of forearm rotation.

Triangular fibrocartilage complex (TFCC) tears and secondary radioulnar osteoarthritis.

Nerve injury, most commonly affecting the anterior interosseous nerve (AIN) or the superficial radial nerve.

A) COLLES' FRACTURE:

It was described by Sir Abraham Colles In 1814. It is an extra articular transverse fracture at corticocancellous junction and 2.5cms above the distal end of radius. Anatomically Distal radius is bearing 80% of load and articulates by three columns. Radial column consisting of radial styloid and scaphoid fossa, intermediate column of lunate fossa and ulnar column of TFCC and distal ulna. It is the most common (80%) of all fractures of older people more than 50 years old. It comprises of about 17.5 % of all adult fractures with female predominance in ratio of 2-3:1. In older it is caused by low

energy trauma and in young adults it is due to high energy trauma. This is having higher incidence in post menopausal osteoporosis women. It is strong predictor of subsequent fractures.

Symptoms: wrist pain, wrist swelling and deformity if displaced.

Examination: ecchymosis and swelling, diffuse tenderness and visible deformity and limited motion due to pain.

On X-rays it had shown six displacements and clinically it produces dinner fork deformity on wrist joint. (LIDS)

- 1) Lateral displacement
- 2) lateral tilt
- 3) Impaction
- 4) Dorsal displacement
- 5) Dorsal tilt
- 6) Supination

Treatment: It consists of non- operative and operative.

Non- operative: It is applied in extraarticular fractures having less than 5mm radial shortening. After closed reduction of fracture, POP back slab or cast is applied on affected part with suggestion of limb elevation and finger movements. If it is applied in extreme flexion and ulnar deviation (Cotton Lodar position) , then it can cause carpal tunnel syndrome.

Operative: It is either a closed reduction and percutaneous pinning (CRPP) or open reduction and internal fixation (ORIF). These procedures are used when there is instability, and volar cortex comminution. External fixator is used in highly comminuted fractures.

Complications:

- 1) Carpal tunnel syndrome:

(Median Nerve): This is seen in 1-12% of Colles patients, in which cast is applied in excessive wrist flexion.

2) Malunion is the most common complication of Colles fracture.

3) EPL and FPL rupture: These are very late complications of this fracture.

B) SCAPHOID FRACTURE:

Scaphoid is the largest carpal bone in proximal row. It has a complex 3-D structure, resembling a boat, skiff or twisted peanut which is oriented obliquely from extremity's long axis and also in line of loading between the thumb and forearm. Articular cartilage covers its 75% surface and it articulates with radius, lunate, trapezium, trapezoid and capitate. Dorsal carpal artery which is a branch of radial artery, enters in a non-articular area on dorsal surface. This supplies 80% of its blood supply in a retrograde blood flow. Superficial palmar branch supplies rest of 20% of area of the bone. This produces vascular watershed which is known for poor healing. It produces a link between proximal and distal carpal row. It flexes with wrist flexion and radial deviation and extends during wrist extension and ulnar deviation.

This is the most common carpal bone fractured, constituting about 15% of wrist injuries. It is 75% of all carpal bone fractures having male to female ratio of 2: 1. It is more common in 3rd decade of life and in contact sports. Axial loading across a hyperdorsiflexed pronated and ulnarly deviated wrist is most common mechanism of injury. The fracture mostly occurred through waist (65%) of bone, proximal third (25%) and distal one third (10%).

Patients usually have history of fall on out stretched hand (FOOSH) having pain, swelling and tenderness in wrist joint. Motion may be restricted and painful. There are various provocative tests to diagnose this fracture (anatomical snuff box tenderness, scaphoid compression test, scaphoid tubercle tenderness volarly).

Radio logically there are 4 views (scaphoid series) to diagnose this. (PA, Lateral and two oblique views) semi pronated obliquely 30 degree wrist extension and 20 degree ulnar deviation).

In doubt cases, repeat Xrays at an interval of 14-21 days should be done. Bone scan and CT scan can be done to rule out fresh fractures. MRI can be performed for evaluating ligament ruptures.

Treatment: It is either non-operative Or operative, depending upon displacement of fracture fragment.

Non-operative: In a stable and non displaced fracture, scaphoid cast in a position of glass holding is applied. If X-rays are normal and there is high level of suspicion, a POP Thumb spica cast is applied and reassessed after 14-21 days.

Operative: Percutaneous screw fixation is done in unstable and non displaced fracture. ORIF is done in displaced and humpback deformity.

Complications:

1) Non-union is usually seen after 3weeks of treatment and seen in 5-10% of cases.

2) AVN without treatment is directly correlated with proximity of fracture fragment to proximal pole. Relative sclerosis of proximal fragment is pathognomic of avascular necrosis.

3) Osteonecrosis is seen in 13-50% of cases.

4) SNAC -scaphoid non-union advanced collapse.

5) Malunion

C) BENNETT's FRACTURE:

There are usually three types of fracture of thumb metacarpal.

1) Impacted fracture

2) Bennett's fracture dislocation

3) Rolando fracture

Bennett fracture occurs at the base of first metacarpal bone usually due to punching. It is oblique fracture and unstable in nature and extends into CMC joint.

On examination, there is swelling in CMC region and thumb looks small. X-rays shows a small triangular fragment in contact with medial edge of trapezium and thumb subluxated proximally.

Treatment: In mildly displaced fracture, after reduction is achieved, plaster is applied over it with first metacarpal held in abduction and extension. In all displaced fractures are surgically fixed with K wiring.

D) MALLET FINGER INJURY:

This is a sudden flexion injury (stubbing the tip of the finger) of the terminal phalanx of finger and finger is not straightened actively afterwards. This causes three types of injuries:

- 1) avulsion of distal part of extensor tendon
- 2) avulsion of small flake of bone from base of terminal phalanx
- 3) avulsion of large dorsal bone fragment.

Treatment consists of immobilization of affected part in slight hyperextension using a finger splint. The splint is applied continuously for 8 weeks and at night for further 4 weeks.

Bony avulsion may also be treated in a splint. However this needs 6 weeks of immobilization, as bone heals quickly. If subluxation of distal phalanx is there, then it should be fixed with K wire or a small screw.

E) GAME KEEPER'S THUMB or SKIER'S THUMB:

The ulnar collateral ligament inserts partially into palmar plate. It is tearing of ulnar collateral ligament of thumb at metacarpophalangeal joint. It occurs either acutely or as chronic injury. If it occurs in twisting the neck of animals in olden days- called a Game keeper's thumb or if it is seen in skiers when they fall on extended thumb, forcing it into hyperabduction called as Skiers thumb. This results in loss of stability which interferes with pinching (prehensile) movements of thumb. If only ligament is torn during injury, then thumb will be unstable on flexion and more or less

stable in extension because palmer plate is intact. In complete ruptures, both the ligament proper and palmer plate are torn and thumb becomes unstable in all positions.

Sometimes, distal attachments does not heal and get trapped in front of adductor pollicis aponeurosis – then it is called a Stener lesion.

On examination, there will be tenderness and swelling precisely over the ulnar side of thumb metacarpo- phalangeal joint. Before doing any stress tests for any instability, an X-rays of affected joint are required to rule out the fracture of bone. If there is no undue laxity in both flexion and extension of thumb, then a serious injury is excluded.

Partial tears are treated with short period of immobilization in a splint followed by finger movements. Pinch should be avoided for 6-8 weeks. Complete tears need operative repair.

FRACTURES OF LOWER LIMB:

1) FRACTURE NECK OF FEMUR

The femoral neck is the commonest site of fracture in elderly, usually women of seventh or eighth decade. It's association with osteoporosis is so manifest that, this is considered as measure of age related osteoporosis. In addition, the older people have weak muscles and poor balancing, which leads to an increased tendency to fall. So all at risk patients should be screened for osteoporosis and prophylactic measures should be taken.

These fracture are common in old people with increased incidence of AVN and having high level of morbidity and mortality. They are increasingly common in aging population having more in females as compared to males. US is having highest incidence of hip fracture rates.

Mechanism of injury: In elderly this fracture usually occurred from a simple fall and even a small force is required in osteoporotic patients. (catching a toe in carpet and twisting the hip into external rotation). The younger individual has history of fall from height or a road side accident.

Diagnosis is usually made with pain in hip region and radiographs with orthogonal views. High energy fractures are seen in young persons and low energy fractures are seen in older patients. In 6-9% of patients these are associated with fractures of shaft of femur. Neck of femur is divided into two parts likely intracapsular and extra capsular. The intracapsular part have poor healings usually due to 1) bathed in synovial fluid which prevents clotting of haematoma 2) lack of periosteal layer (Cambium layer), 3) haematoma formation from ruptured vessels (temponade effect) and disruption of retinacular vessels cuts blood supply to femoral head and no contact with surrounding soft tissues, that all lead to less callous formation and non-union. The elderly patients with unexplained pain in hip should be considered as stress fracture until proved otherwise.

Clinical features: There is usually history of fall which is followed by pain in hip. The patient lies with his limb in external rotation and shortening. The patients with impacted fracture, may still be able to walk and debilitated and handicapped patients may not complain of any pain at all.

Anatomically, neck shaft angle is $130^{\circ} \pm 7^{\circ}$ degree and normal anteversion is $10^{\circ} \pm 7^{\circ}$ degree. Blood supply of femoral head majorly from medial femoral circumflex artery (Lateral epiphyseal artery) and some from Anterior and inferior circumflex arteries. Ligamentous teres artery also supplies some part of head. So, displacement of fracture femoral neck is associated with disruption in its blood supply. There are basically two classifications used for this fracture. Undisplaced and displaced. However, the following classifications are used for better functional outcome of these patients.

Garden classifications:

Type-1: Incomplete and valgus impacted

Type-2: Complete and Undisplaced

Type-3: Complete and partially displaced

Type-4: Complete and fully displaced

Pawells Classification: (This is based on angle of fracture line to horizontal)

- 1-Fracture angle <30 degree from horizontal
- 2- Fracture angle between 30-50 degree
- 3-Fracture angle more than 50 degree

Patients with impacted and stress fractures usually complain of slight pain or pain referred along medial side of thigh and knee. There may be pain on percussion of greater trochanter. Patients with displaced fractures have pain in entire hip region with leg in external rotation and shortening.

X-rays: AP and traction internal rotation AP view, cross leg table lateral view are used for diagnosis. In these patients, two questions must be answered: is there a fracture or is it displaced. Displacement is assessed by abnormal shape of bony outlines and degree of mismatch of the trabecular lines in femoral head and neck. CT scan is used to determine the degree of displacement and comminution of fracture.

Treatment:

Non- operative treatment of undisplaced consists of pain relieving and splintage of the limb and traction. Impacted fractures can be treated non surgically, but they may become displaced, then internal fixation is required.

Anatomically perfect reduction of fracture part is of paramount importance and reduction is assessed by Garden alignment index on fluoroscopy. The trabeculae in femoral head and a line along the medial border of the femoral shaft should subtend an angle of 155-180 degrees. The acceptable reduction is within 20 degree of this ideal. The contour of femoral head and neck forms a smooth 'S' on lateral view. If there is any discontinuity in alignment, it's 'S' shape will be deformed.

Intracapsular fractures are usually treated by surgical procedures like ORIF, CCS, DHS or Arthroplasty. However in high risk and non ambulatory patients are treated non-operatively. Anatomical reduction of fracture is of utmost

importance and has more pronounced effect on healing than surgical procedure. The treatment depends upon the degree of displacement, physiological age of patients and ipsilateral fracture of shaft of femur. Fixation with implants like sliding screw permits dynamic compression at fracture site during axial loading leading to shortening of extremity with lowering physiological function of limb and effects biomechanics of hip.

1) ORIF (Open reduction and internal fixation): This procedure is usually used in displaced and young patients.

A) CCS (Cannulated Cancellous Screw): These are used in non-displaced trans-cervical fracture and Garden type 1 and 2 fractures. Anatomical reduction is required for better functional outcome.

B) DHS (Sliding Hip Screw): This is used in basicervical fractures and in young patients.

2) Prosthetic replacement: This is done in patients having more comminution, debilitated and elderly people. Usually performed in stage 3/4 fractures in older people

Complications:

1) General: The elderly patients are prone to general complications like DVT, pulmonary embolism and bed sores. The peri-operative mortality in these elderly patients is about 20% at 4 months after injury.

2) Osteonecrosis: This is seen in 10-45% of patients. It's increased risk is associated with displacement and AVN still develops in non-displaced and non-anatomical reduction.

3) Non-union: This is seen in 5-30% of patients. It's incidence has increased with displaced and varus malreduction.

4) Dislocation: Higher rate is seen in Total hip Arthroplasty procedures.

5) Failure rate: High failure rate is seen in fixation group. This is about 46% in fixation and 8% in arthroplasty group.

6) Osteoarthritis: Secondary osteoarthritis of hip develops in these patients.

Prognosis: This is most expensive fracture treatment on per person basis. Preinjury mobility is most significant determinant for post operative survival.

2) STRESS FRACTURES:

A stress or fatigue fracture is one which is occurring in the normal bone of a healthy patients and traumatic incident is absent. Bending and compression stress are basically of these two types of stress. Stress produces deformations and bone responds by changes the pattern of remodelling. Compressive stresses occur on cancellous bone and with frequent repetition an impacted fracture may results. These fractures typically occurs in athletes, dancers or military personnel. These occurs due to repeated heavy loading of normal bone. This high loading creates minute deformations in bone that initiate normal process of remodelling. So according to Wolfs law there will be combination of bone resorption and new bone formation. In results of repeated and prolonged excess stress and deformation, resorption takes faster than replacement. These areas are liable to fractures at this site. Shaft of humerus (cricketer) tibial shaft (athletes), distal shaft of fibula (runner fracture) femoral neck in adults are common sites. Pain after exercise, pain during exercise and pain without exercise are the common sequence of events. Springing the bone is helpful in diagnosis. On X-rays there will be hazy transverse band of sclerosis with peripheral callous. These fractures can be seen in patients who are on chronic medication which alters the balance between bone resorption and replacement. (steroids or methotrexate) Most of these fractures require no treatment except elastic bandage and avoidance of painful activity until the lesion heals. Stress fractures of femoral neck in elderly is treated prophylactically with internal fixation.