

Supracondylar fracture of humerus

* Incidence:

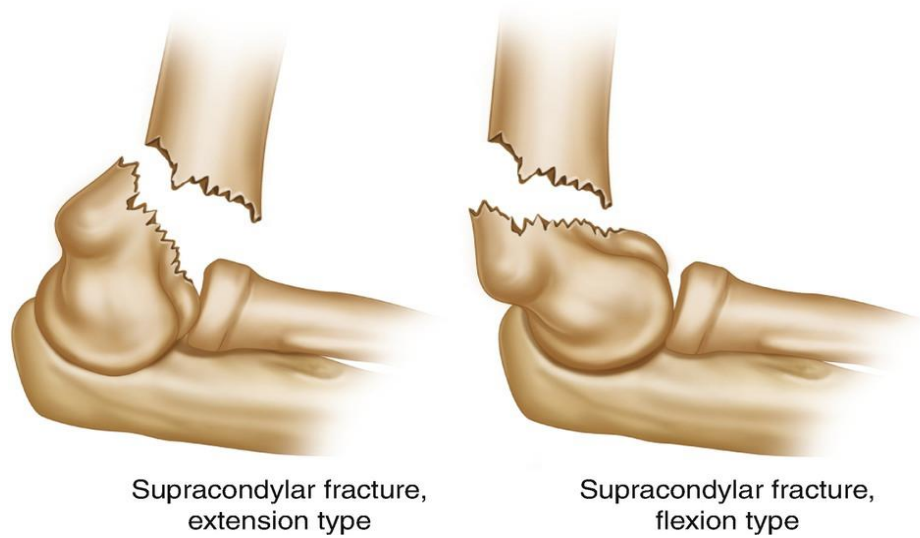
- The commonest fracture in the elbow region in children & more in boys .

* Pathology :

- **Site :** It is a fracture distal part of humerus just above the lateral and medial epicondyles of the humerus , passing through the olecranon fossa.
- **Classification:** (see general) + the fracture is classified into :

	Extension type	Flexion type
1. Incidence	99%	1%
	<ul style="list-style-type: none"> • More common in children • 50% green stick fracture & 50% complete fracture . 	
2. Aetiology	<ul style="list-style-type: none"> • Falling on outstretched hand with the elbow slightly flexed & pronated. 	<ul style="list-style-type: none"> • Falling on the flexed elbow.
3. Line of fracture.	Oblique or transverse	
4. Distal fragment : May be undisplaced or displaced as follows:	<ul style="list-style-type: none"> • Backwards with angulation . • Upwards with overriding . • Pronation (the limb is pronated during trauma) . • Medial or lateral displacement . 	<ul style="list-style-type: none"> • Forwards and upwards • Medial or lateral displacement
5. Complications	<ul style="list-style-type: none"> • Less common. 	<ul style="list-style-type: none"> • More common



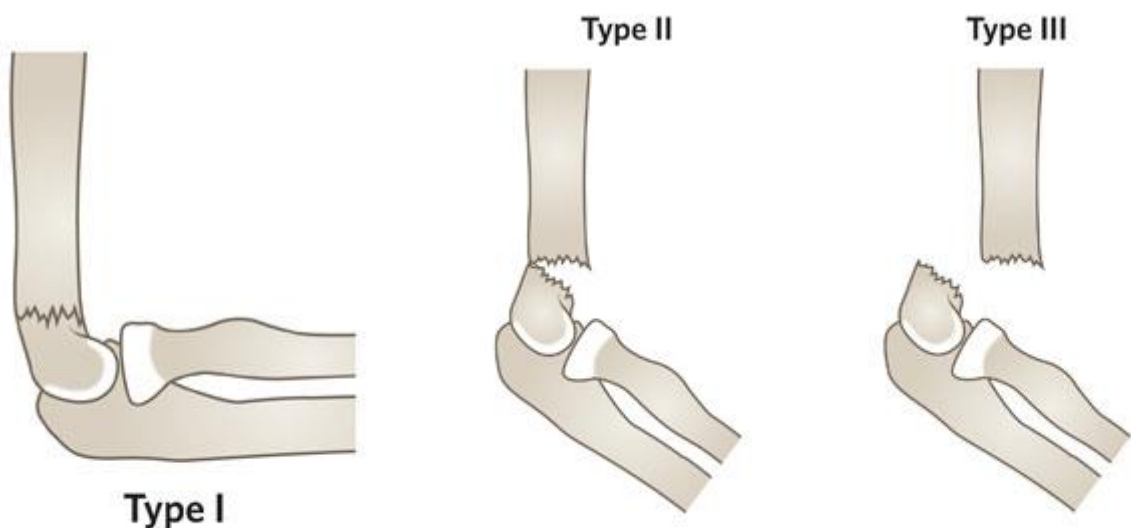


- **The Gartland Classification** : describe the severity of displacement for extension-type supracondylar fractures.

1- **Type I** : Undisplaced fracture .

2- **Type II** : Angulated fracture with intact posterior cortex

3- **Type III** : Displaced distal fragment posteriorly, no cortical contact

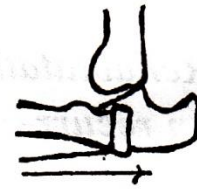




• Flexion Type



• Extension Type



• Post Dislocation Of Elbow



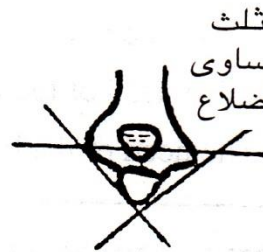
• Normal



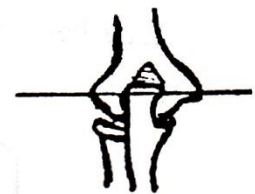
• Valgus



• Varus



• Full Flexion



• Full Extension

* **Complications: (see general).**

1- **Malunion** may lead to :

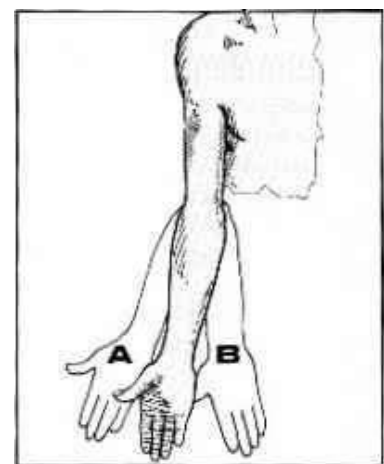
- Cubitus valgus (increase carrying angle).
- Cubitus varus (decrease carrying angle).

2. Median, radial or ulnar **nerve injuries**.

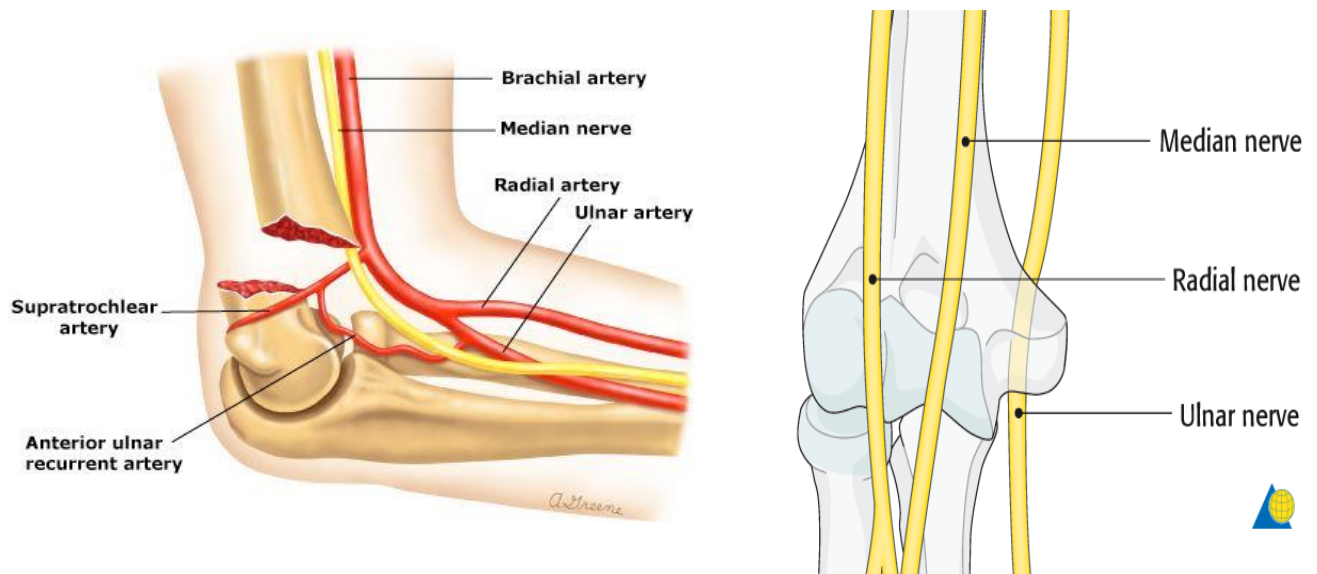
3. Injurury of **brachial artery** by the sharp anterior border of the proximal fragment leading to acute ischemia , gangrene or Volkmann's ischaemic contracture .

4. **Myositis ossificans** are common (mention in short).

4. Stiffness of elbow .



5- **Compartment** syndrome → Compression of median nerve & radial artery.



* **Clinical picture:** (see general principles of fractures)

1. Deformity:

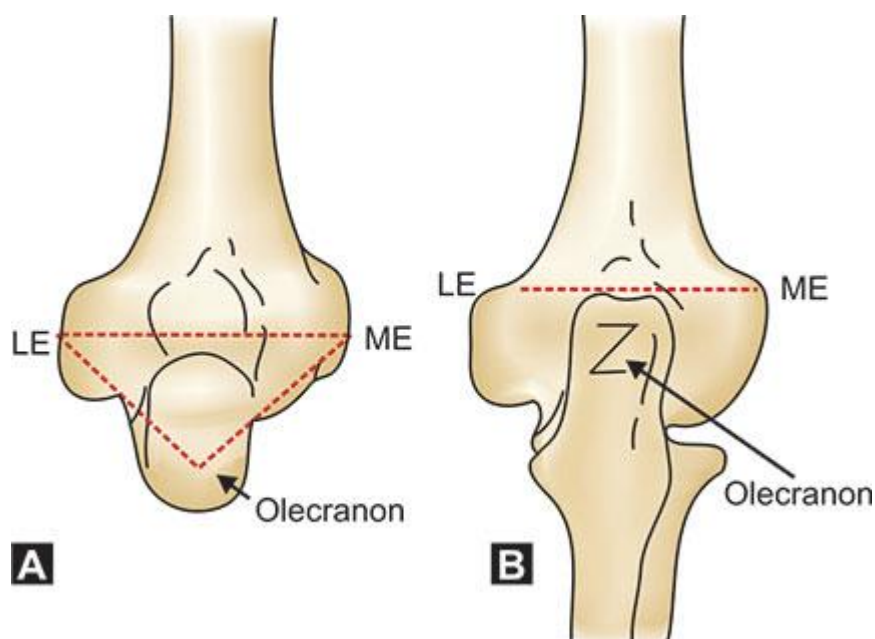
- a. In the **extension** type: The elbow is slightly flexed with the olecranon projecting backwards.
- b. In the **flexion** type : The elbow is slightly flexed with the olecranon displaced forwards.

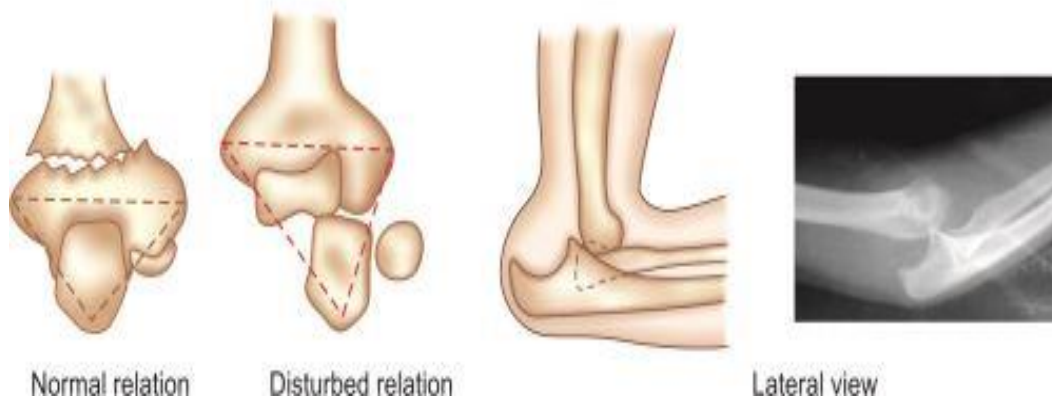
2. **Measurements:** (See D.D).

3. Manifestations of **complications:** Examine for vascular injury (mention 5 Ps + C) or nerve injuries (mention in short the deformity and motor & sensory loss).

* **D.D.** :The extension type from posterior dislocation of elbow joint.

	Supracondylar fracture	Posterior dislocation of elbow
1. Age	Usually in children	Usually in adults.
2. Mobility	Painful limitation of active movements.	Absolute loss of active and passive movements.
3. Anterior palpation.	The sharp edge of the upper fragment can be felt above the elbow crease.	The rounded border of the lower end of the humerus can be felt at the elbow crease.
4. Posterior palpation.	The sharp edge of the lower fragment is felt.	The olecranon is felt.
5. The 3 bony points at the elbow.	Normal i.e. they make a straight line on extension and equilateral triangle on flexion.	Their normal relationship is disturbed.
6. Supracondylar ridge	Interrupted	Intact
7. Crepitus.	Can be done	Absent.
8. From the lateral epicondyle to the styloid of radius	Normal.	Diminished.
9. From the tip of the acromion to the lat. epicondyle :	Diminished.	Normal.
10. X-ray	Fracture line is seen.	Dislocation is seen.





* **Investigations :** (see general principles of fractures)

Extension type



Flexion type



* **Treatment:** (see general principles of fractures)

I- Undisplaced fractures: no manipulation & fixation, by a posterior slab in flexion with collar & cuff for 4 weeks.

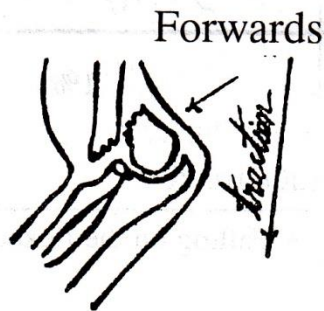
II- Displaced fractures:

A. Closed reduction & external fixation: under general anesthesia and x-ray control .

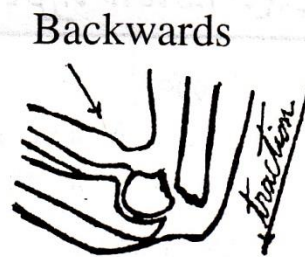
- With elbow flexed, **traction** on the distal fragment in the long axis of arm.
- **Push** it forwards in extension type or backwards in the flexion type.

- Forearm is gradually **extended** then fully supinated & **carrying angle** is corrected .
- In extension type , after achieving reduction , the elbow is flexed to right angle and the radial pulse is palpated , if absent gradually extend the elbow until the pulse return .
- Prophylactic measures to **prevent volkmann's** ischaemia (mention).
- The circulation in the limb should be **observed** for 48 hours after treatment.

* Reduction *



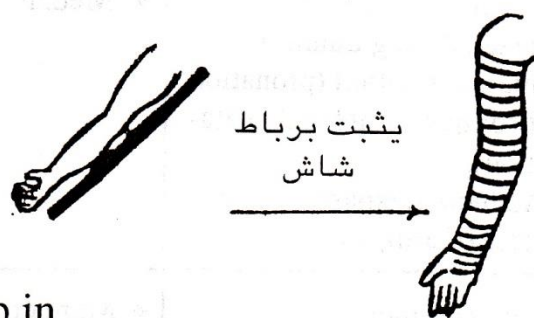
- Extension Type



- Flexion Type



- Full Extension + Supination to Correct Carrying Angle



Post. Slab in full extension

* Fixation *



- **Fixation:** By a posterior slab from the axilla to the metacarpophalangeal joints for 6 weeks.

1. The extension type is fixed with the elbow at 90° flexion with collar & cuff.
2. Recently, all cases are fixed in extension to avoid kinking of brachial artery & to observe the carrying angle during follow up .

B. Closed reduction and percutaneous pinning .

C. Open reduction and internal fixation :

- **In children :** using wires are only indicated if closed reduction fails to obtain satisfactory reduction or vascular injury.
- **In adults :** open reduction and internal fixation is the **recommended** treatment in adults by plate and screws to avoid stiffness .

D. Rehabilitation: Early active movement of the fingers only.

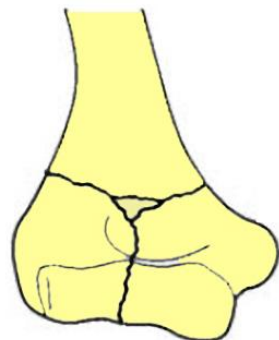


Intercondylar fractures of the humerus

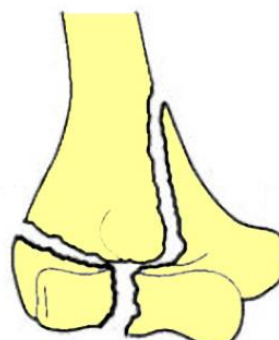
* **Aetiology** : It is the result of direct trauma to the olecranon as it is driven as a wedge between the humeral epicondyles.

* **Riseborough and Radin classification** :

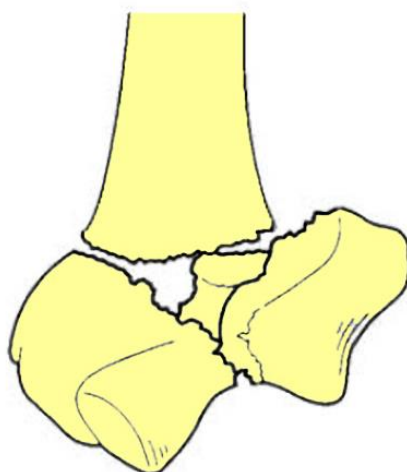
- **Type I**: no displacement of the fracture fragments .
- **Type II**: T-shaped intercondylar fractures with the trochlea and capitellum fragments separated but not rotated .
- **Type III**: T-shaped intercondylar fractures with separation of the fragments and rotation deformity .
- **Type IV**: T-shaped intercondylar fractures with severe comminution of the articular surface and wide separation of the humeral epicondyles .



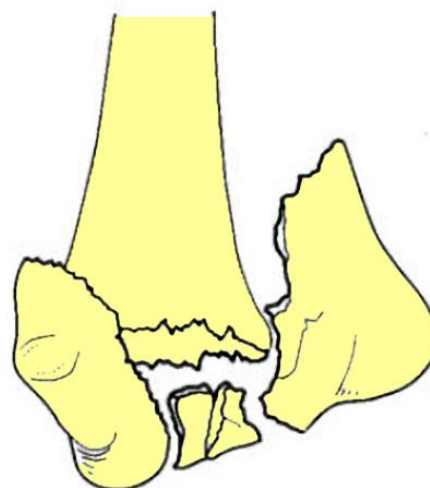
Type I



Type II



Type III



Type IV

- * **Complications:** (as supracondylar fracture)
- * **Clinical picture & investigations :** (as general principles of fractures)
- * **Treatment :**

I) External fixation by above elbow cast for undisplaced fracture .

II) Open reduction & internal fixation :

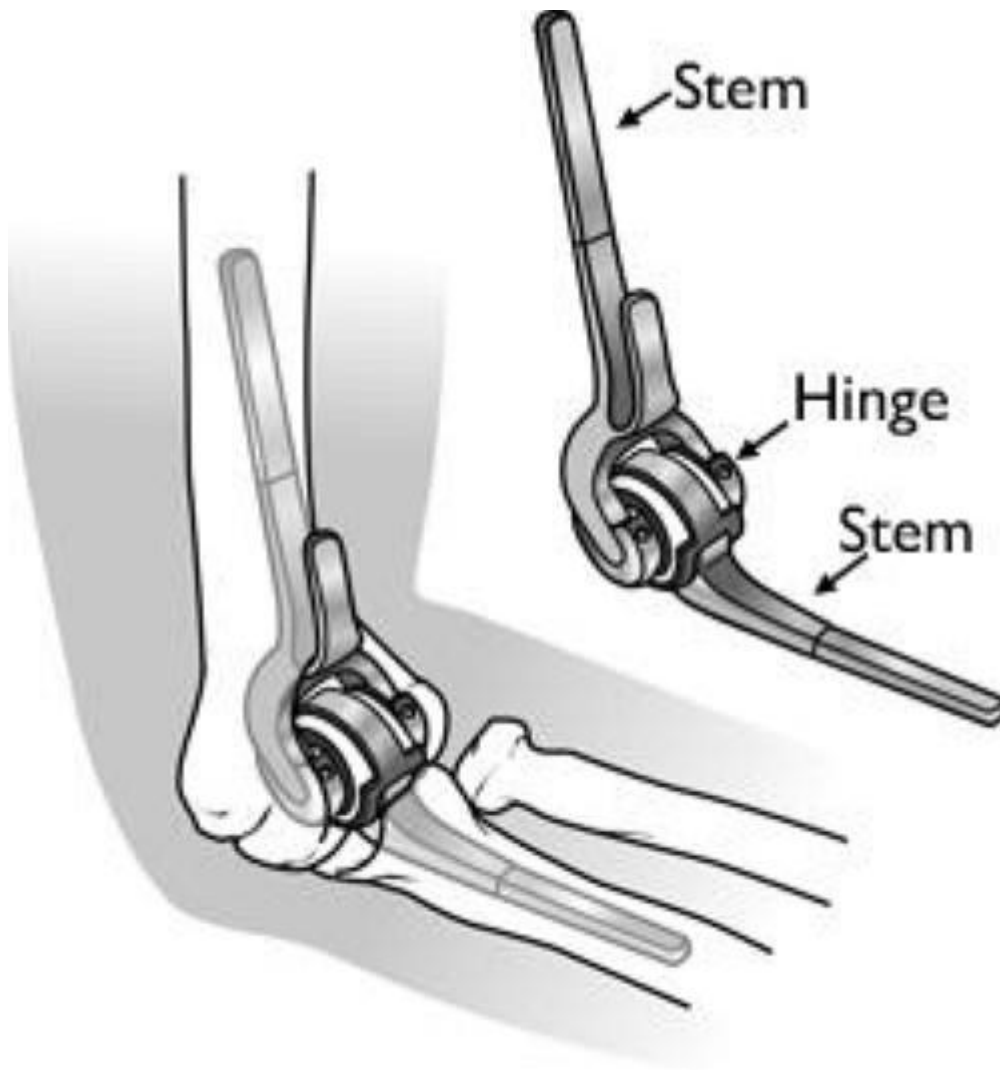
- **Indications :**

- Displaced fracture .
- Comminuted fracture in young age .
- Intra-articular fracture .
- Neurovascular injury .

- **Methods :**

- Screws or plate & screws .
- Elbow arthroplasty : should be considered in elderly patients and non-salvageable fractures.





Elbow arthroplasty



Fracture medial epicondyle of humerus

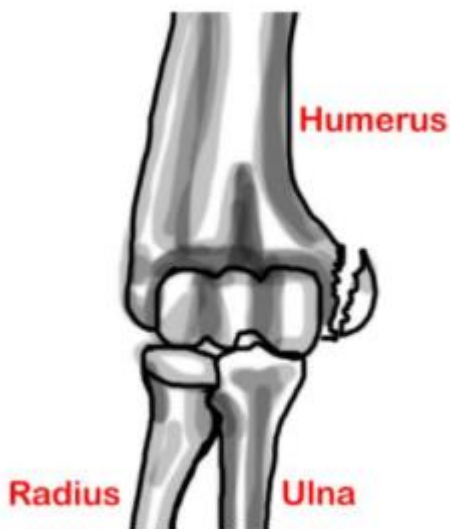
* **Incidence** : More common in children .

* **Aetiology & pathology** :

a) Usually due to fall on outstretched hand with acute valgus strain with pull of common flexor origin → avulsion fracture of medial epicondyle .

- The epicondyle is separated & displaced downwards .
- **Entrapment in the elbow joint** : Valgus strain may lead to rupture of medial part of the capsule and medial ligament of elbow and entrapment of displaced bone and ulnar nerve into the elbow joint .

b) It may occurs due to direct trauma .



* **Complications , Clinical picture & investigations** : (as general principles of fractures)

c) Ulnar nerve injury is common .

d) Fracture dislocation (dislocation of elbow in 50%) .

e) Stiffness of elbow .



* **Treatment :**

I) Non-displaced fracture : Treated with sling and early mobilization of elbow .

II) Displaced fracture or trapped epicondyle : exploration of ulnar nerve followed by open reduction and screw fixation .

Fracture lateral epicondyle of humerus

- * **Incidence** : More common in children .
- * **Aetiology** : Fall on outstretched hand with severe varus strain with pull of common extensor origin → avulsion fracture of lateral epicondyle .
- * **Complications** : Non-union , cubitus valgus , delayed ulnar neuroitis & subluxation of elbow joint .
- * **Clinical picture & investigation** : (as general principles of fractures)
- * **Treatment** :
 - I) Undisplaced fracture** : Posterior slab for 3 weeks .
 - II) Displaced fracture** : Open reduction & internal fixation by wires .



Dislocation of Elbow Joint

* **Incidence** : More common in adults & posterior dislocation is much more common .

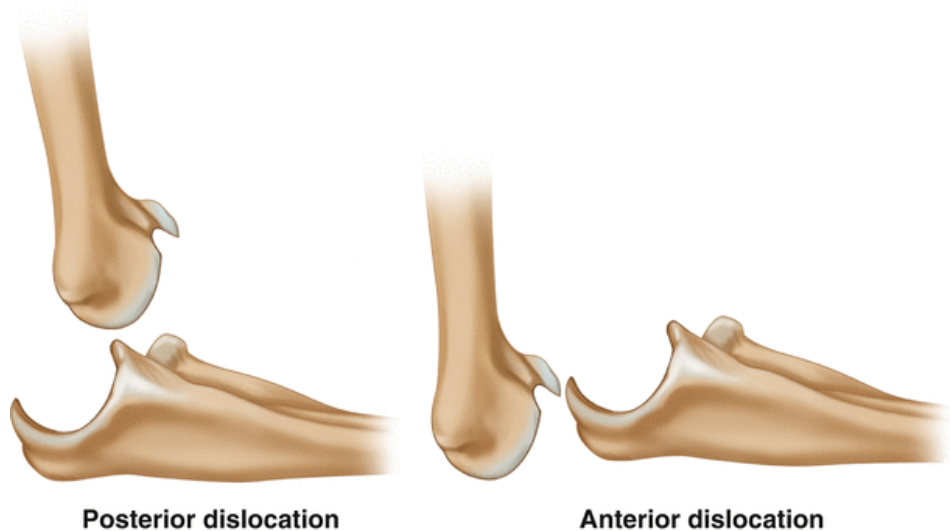
* **Aetiology** :

- **Posterior dislocation** :

- Fall on outstretched hand with the elbow slightly flexed .
- Fracture coronoid with displacement of ulna backwards (fracture dislocation) .

- **Anterior dislocation** :

- Direct trauma to the elbow .
- Fracture olecranon with displacement of ulna forwards (fracture dislocation) .



* **Complications** :

- 1- **Fracture dislocation** (associated coronoid process or olecranon fracture) .
- 2- Median or ulnar nerve injuries

3- Injury of brachial artery is rare .

4- Myositis ossificans .

5- Stiffness of elbow joint .

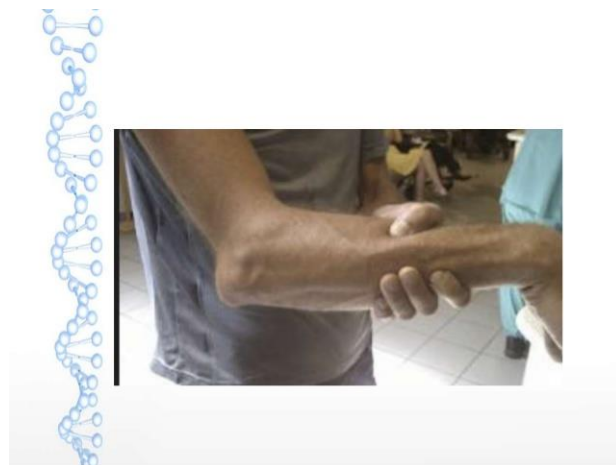
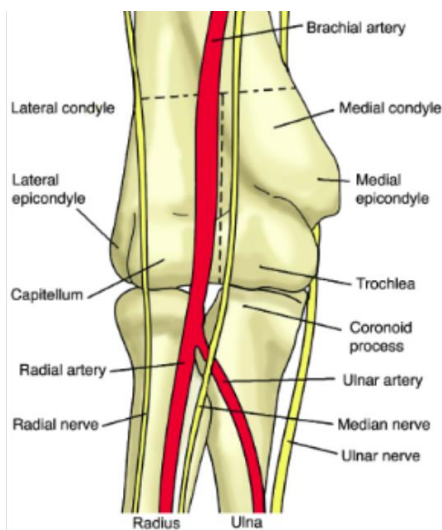
* **Clinical picture & investigations :** (as general principles of fractures)

1- **The olecranon** is abnormally projecting backwards in posterior dislocation or forwards in anterior dislocation .

2- Disturbance in the relation between the **3 bony prominences** around the elbow (see supracondylar fracture) .

3- Exam. the radial pulse , distal sensations & movements to exclude neurovascular injury .

* **D.D :** Extension type of supracondylar fracture .



* **Treatment :**

I) Posterior dislocation :

- **Closed reduction** under general anaesthesia , countertraction on the arm with traction is applied in the long axis of the slightly flexed forearm by one hand and the other hand push the olecranon into the olecranon fossa .
- **External fixation** by above elbow posterior slab for 3 weeks .
- **Early mobilization** of elbow to avoid stiffness .

II) Anterior dislocation : Closed reduction & external fixation by posterior slab for 3 weeks .

III) Open reduction and internal fixation for fracture dislocation .



Fracture of the Olecranon process

* **Incidence** : Rare and usually with anterior dislocation of elbow joint .

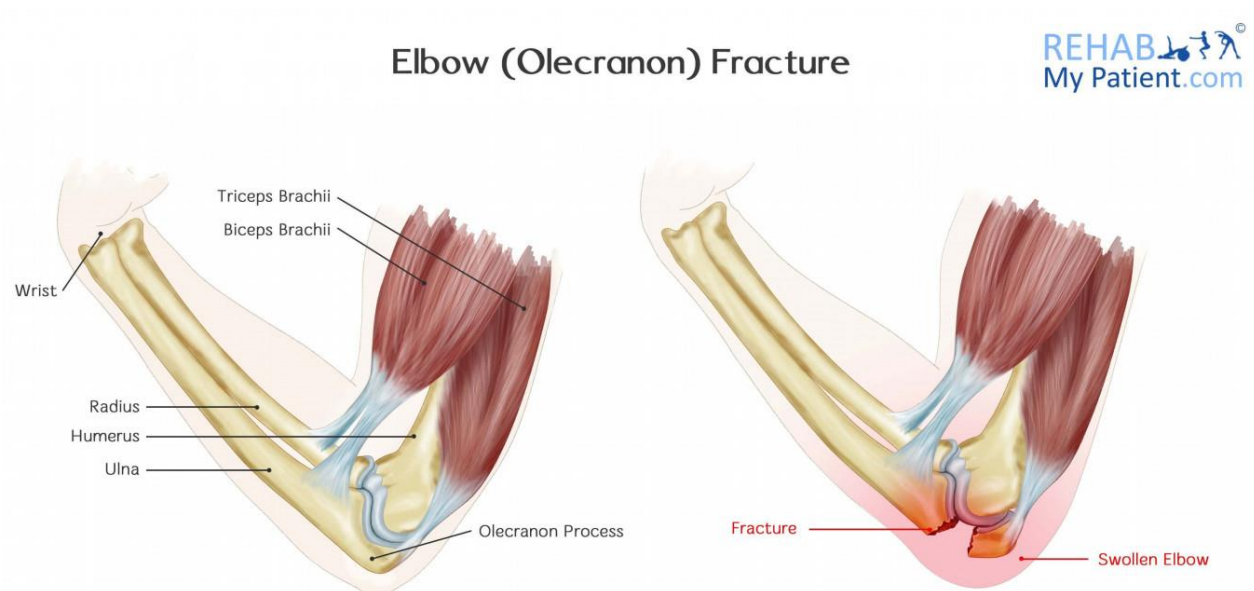
* **Aetiology , pathology & clinical picture** :

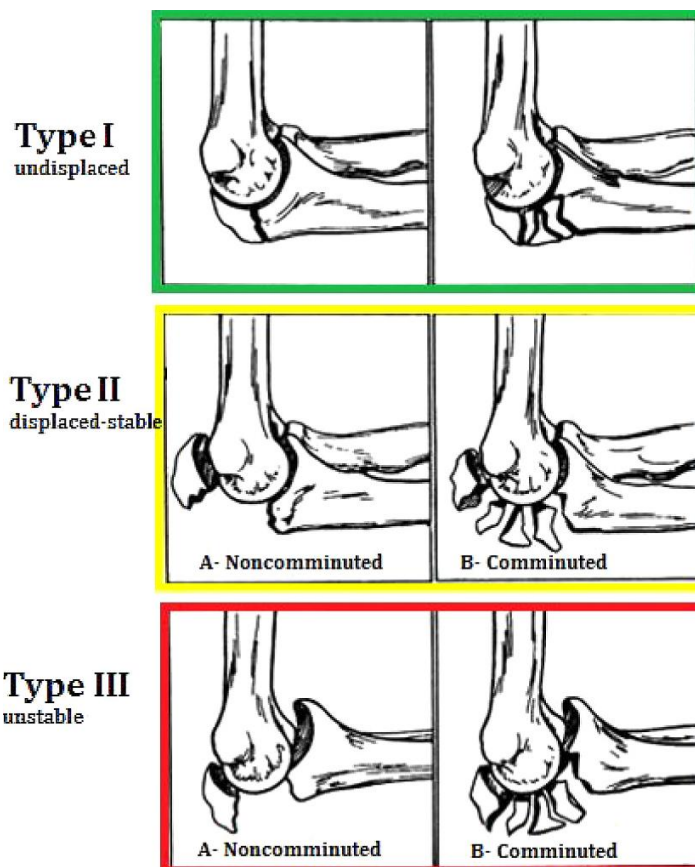
- Usually occur due to fall on flexed elbow .
- According to the integrity of triceps tendons :

▪ **Type I : Non-displaced fracture** , if triceps tendon is intact , active extension of elbow is intact and no gap is detected .

▪ **Type II : Displaced stable fracture** , if triceps tendon is torn , active extension of elbow is lost , the proximal fragment is pulled upwards by triceps and a gap is detected .

▪ **Type II : Displaced unstable fracture** .

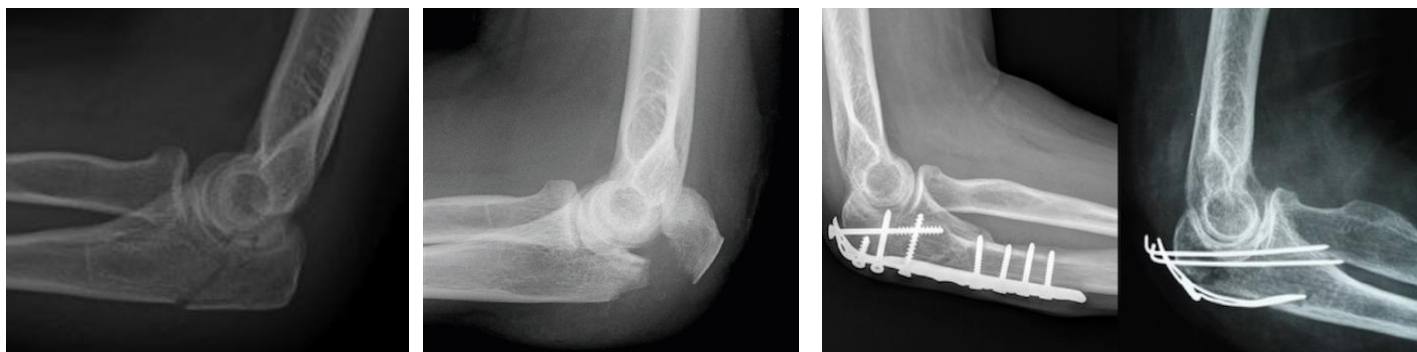




* **Investigations :** (as general principles of fractures)

* **Treatment :**

- **Non-displaced fracture :** Above elbow cast for 6 weeks .
- **Displaced fracture :** Open reduction & internal fixation by screw , wires or pins .



Monteggia & Galezzi Fractures Dislocations

* Definition & Pathology :

- **Monteggia fracture dislocation** : It is a fracture upper 1/3 of shaft of ulna with dislocation of superior radio-ulnar joint . 4 types :
 - **Type I** : Fracture upper 1/3 of shaft of ulna with anterior dislocation of head of radius .
 - **Type II** : Fracture upper 1/3 of shaft of ulna with posterior dislocation of head of radius .
 - **Type III** : Fracture ulna just below the coronoid process with lateral dislocation of head of radius .
 - **Type IV** : Fracture upper 1/3 of shaft of ulna and radius with anterior dislocation of head of radius .

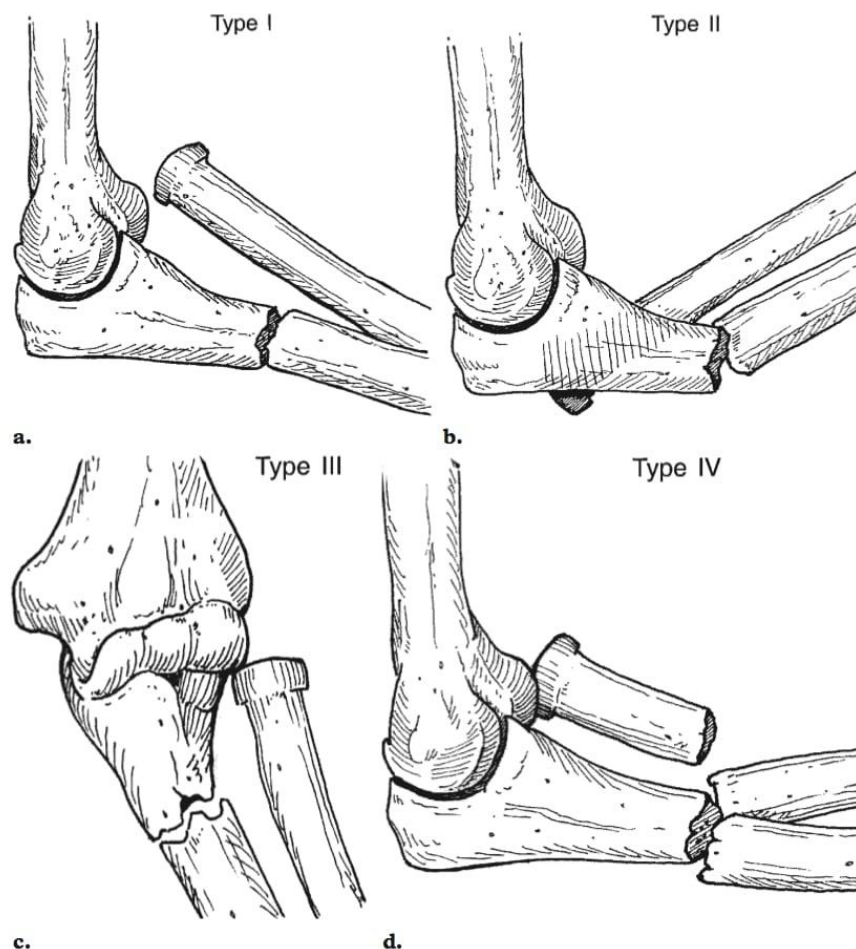
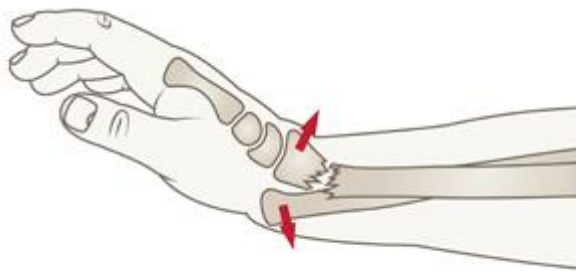


Figure 2. Drawings illustrate Bado's classification of Monteggia fractures: type I (a), type II (b), type III (c), and type IV (d). A type I Bado fracture represents the fracture-dislocation originally described by Monteggia, a fracture of the proximal one-third of the ulna with anterior dislocation of the radial head.

- **Galeazzi fracture dislocation** : It is a fracture lower 1/3 of shaft of radius with dislocation of inferior radio-ulnar joint . 2 types :
 - **Type I** : Posterior displacement of shaft of radius and anterior dislocation of head of ulna .
 - **Type II** : anterior displacement of shaft of radius and posterior dislocation of head of ulna .



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Type I



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Type II

- * **Aetiology** : Fall on outstretched hand .
- * **Clinical picture & investigation** : (as general principles of fractures)

Monteggia fracture dislocation



Galeazzi fracture dislocation



* Treatment :

- **Closed reduction** of the dislocated joint is performed **first** followed by **open reduction and internal fixation** of the fractured bones by plate & screws .



Fracture shaft of radius & ulna

* Incidence :

- Fractures of both bone of forearm are common in severe injuries .
- Single fracture in one bone usually affecting the ulna .

* Aetiology :

- Road traffic accident , falls from heights and direct blow injuries are the commonest causes .

* Pathology :

- **Direct trauma** → transverse fractures of both bones nearly in the same level .
- **Indirect trauma** → oblique fractures at different levels in the 2 bones .
- The fractures may affect **the upper , middle or lower 1/3** of forearm .
- **Displacement** : Over-riding , angulation , side displacement and pronation or supination according to the level of the fracture .

	Proximal fragment	Distal fragment
1- Fracture above insertion of pronator teres .	<ul style="list-style-type: none"> • Flexed by biceps . • Supinated by biceps & supinator . 	<ul style="list-style-type: none"> • Pronated by pronator teres & quadratus
2-Fracture below insertion of pronator teres .	<ul style="list-style-type: none"> • Flexed by biceps . • Midway between pronation & supination (by pronator teres & supinator 	<ul style="list-style-type: none"> • Pronated by pronator quadrates .

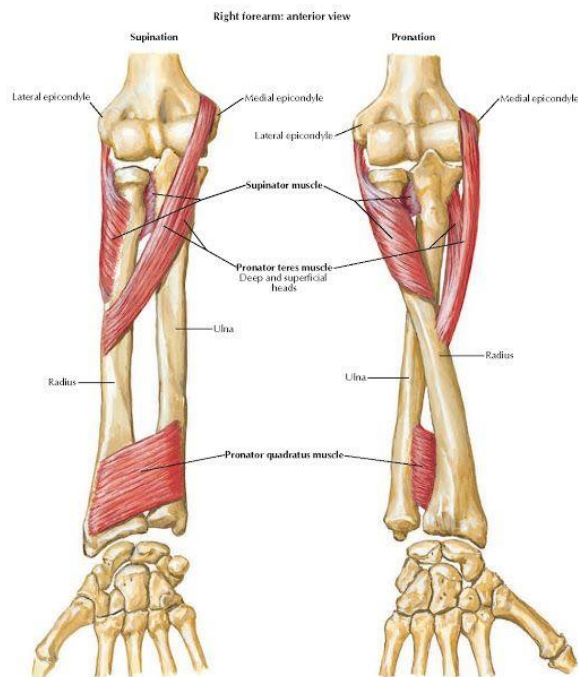
* Complications :

- 1- **Malunion** is the commonest complication.

2- **Neurovascular injury is uncommon** to ulnar & radial arteries ,
anterior & posterior interosseus or ulnar nerves .

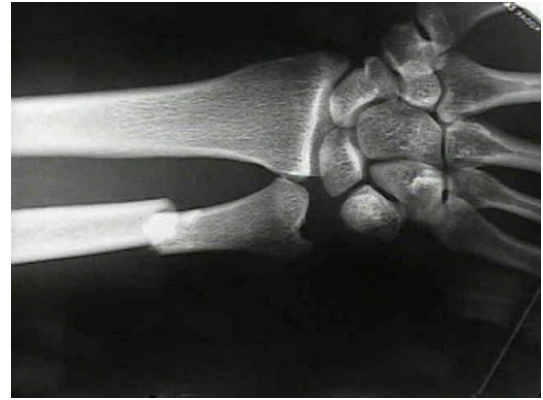
3- **Compartment syndrome** .

4- Synostosis (cross-union) between radius and ulna .



* **Clinical picture & investigations :** (as general principles of fractures)





* **Treatment :**

I) Undisplaced fractures : External fixation by above elbow cast .

II) Displaced fracture :

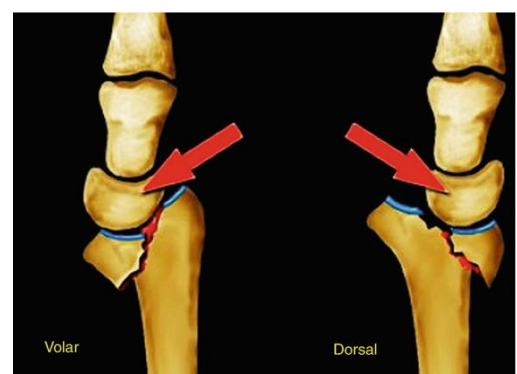
- 1) **In children :** closed reduction & external fixation by above elbow cast .
- 2) **In adults :** Open reduction & internal fixation by plate & screws .

Fractures of Distal Radius

* **Definition :** It is a fracture occurs in the distal 2-3 cm of radius .

* **Types :**

- 1) **Colles' fracture :** It is an extra-articular fracture of distal radius with posterior displacement of distal fragment .
- 2) **Smith's fracture :** It is an extra-articular fracture of distal radius with anterior displacement of distal fragment .
- 3) **Barton's fracture :** It is an intra-articular fracture in which a rim of distal radius is displaced anterior or posterior with the hand .



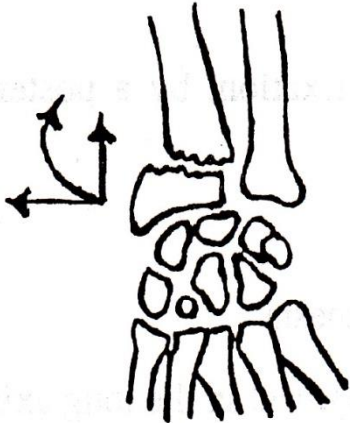
Colles' fracture

- * **Definition:** Fracture of the distal part of radius characterized by backwards displacement of the distal fragment.
- * **Incidence:** Usually in elderly females above 50 years (due to postmenopausal osteoporosis).
- * **Aetiology:** Falling on outstretched hand with wrist extended .

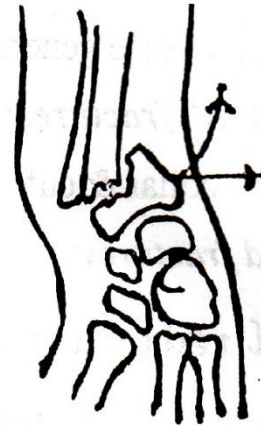


- * **Pathology:.**
 - a. **The line of fracture:** From front of the bone, oblique backwards & upwards .
 - b. **The. distal fragment:** usually shows 3 pairs of displacement:
 1. Upwards displacement with impaction.
 2. Backwards displacement with backwards angulation.
 3. Lateral displacement with lateral angulation.
 - c. **The proximal fragment:** Fully pronated by both pronators.
 - d. There may be **associated** subluxation of inferior radio-ulnar joint and fracture of ulnar styloid process.

* Colle's Fracture *

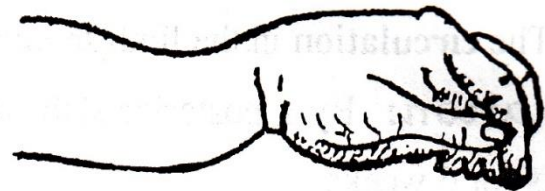
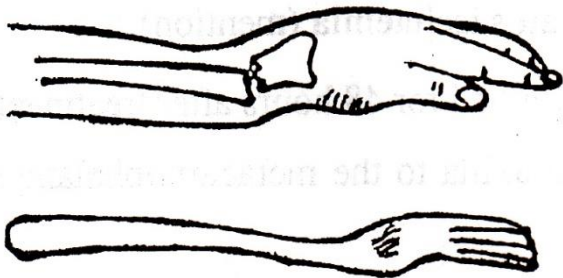


• Ant. View



• Lat. View

• Dinner Fork Deformity



* **Complications:** (see general) +

- Malunion, Sudek's atrophy, stiffness of wrist.
- Injury of Median nerve or radial artery
- Injury of extensor pollicis longus tendon.
- **Carpal tunnel** syndrome: a late complication.
- **Madlung deformity:** In young patient there is arrest of growth of radius → wrist & hand deviate laterally.



* **Clinical picture:** (see general).

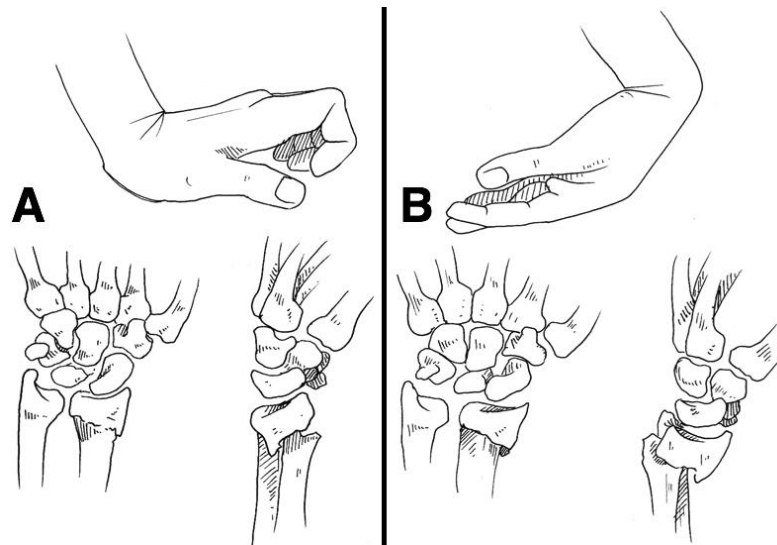
1. Deformity: Dinner fork deformity.

2. The radial **styloid process** is no longer lower than that of ulna

3. Picture of **complications**.



- * **D.D.:** Smith's Fracture (Reversed Colles') Due to fall on the flexed wrist.

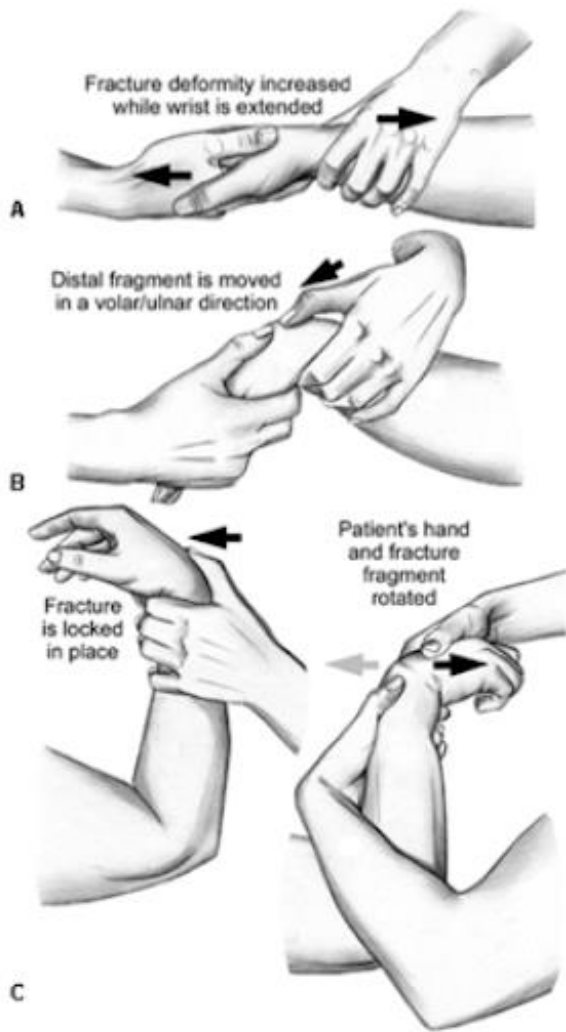


- * **Treatment:**

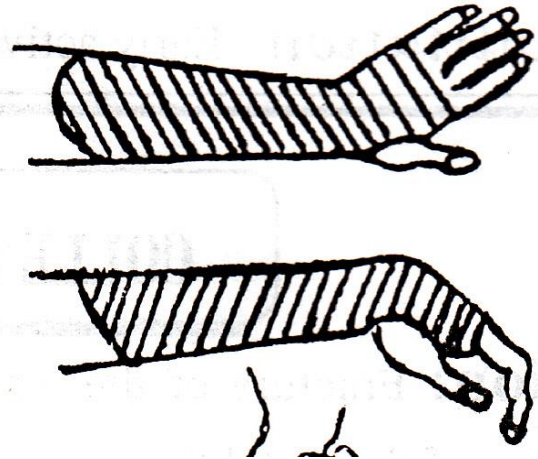
- A. Reduction under general anaesthesia :** 3 grips by:

1. Traction with the surgeon grasps the injured hand (as in shaking hands) with counter traction on forearm by an assistant.
2. The distal fragment is gripped between the thenar eminence and the fingers : then it is pushed forwards & tilted forwards.
3. The distal fragment is pushed medially & tilted medially.

- B. Fixation:** In a below elbow cast for 6 weeks. The forearm should be fully pronated & the hand in a slight palmar flexion & ulnar deviation

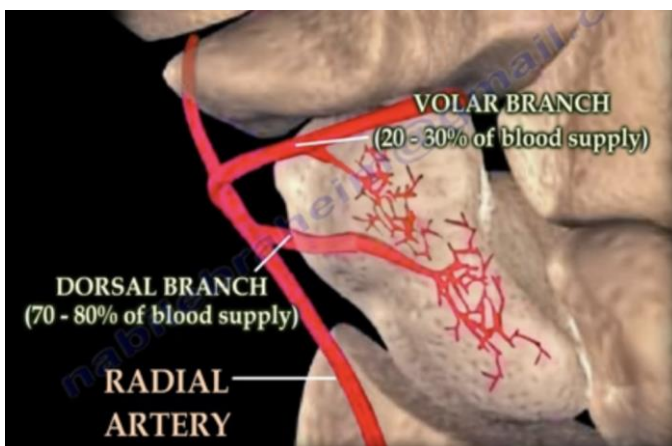


• Fixation •



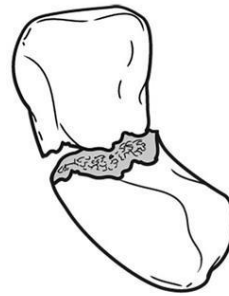
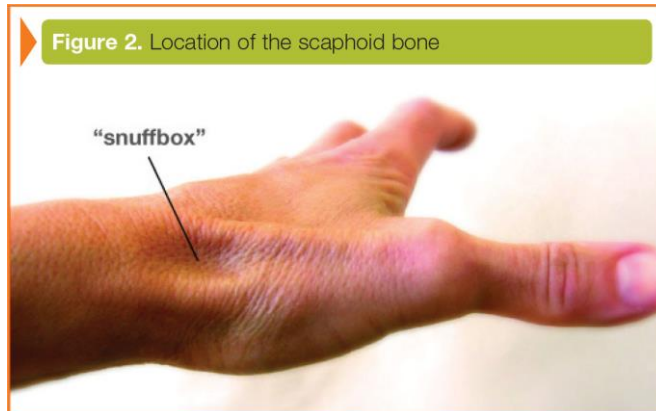
Fracture of the Scaphoid

- * **Incidence** : A rare fracture , usually occurs in young adults .
- * **Aetiology** : Fall on outstretched hand .
- * **Pathology** :
 - The fracture usually affect the waist (middle 1/3) of the bone .
 - **Blood supply to scaphoid** : Blood, which is essential for healing, is supplied from the distal end of the scaphoid, and runs backwards towards the wrist. The proximal end of the scaphoid therefore has a poor blood supply and a fracture can easily cut it off preventing healing.



- * **Complications** :
 - 1- Avascular necrosis
 - 2- Delayed union and non-union .
 - 3- Osteoarthritis & stiffness of wrist joint .
- * **Clinical picture** :
 - 1- After fall on outstretched hand , pain occurs in the wrist region but the function of the wrist is not markedly affected .

- 2- Tenderness over the scaphoid in the anatomical snuff box .
- 3- Little or no swelling in the wrist .
- 4- The condition is usually missed & wrongly diagnosed as sprain wrist especially x-ray may be negative at the time of injury .



* **Investigation :**

- **X-ray** may not be informative immediately after the injury and the fracture may appear only after 2 weeks .
- Immediate early diagnosis by **bone scan and MRI** .

* **Treatment :**

- If a scaphoid fracture is suspected, a scaphoid plaster cast is applied for 2 weeks followed by re-x-ray .
- **If diagnosis is established :**
 - **Undisplaced stable fracture** : fixation in below elbow thumb cast or thumb wrist brace for 8 weeks → union in 90% of uncomplicated fractures .
 - **Displaced unstable fracture** : Open reduction and internal fixation by wires or screw .

- **Avascular necrosis and non-union** : Open reduction and internal fixation with bone graft to prevent degenerative osteoarthritis .



External Fixation by thumb wrist braces

Below elbow thumb cast



Postoperative plain left wrist PA with ulnar deviation and lateral radiographs show internal fixation with K-wires at



Internal fixation by wires

Internal fixation by screw