

**Fractures and  
dislocations  
around the elbow in  
adults**

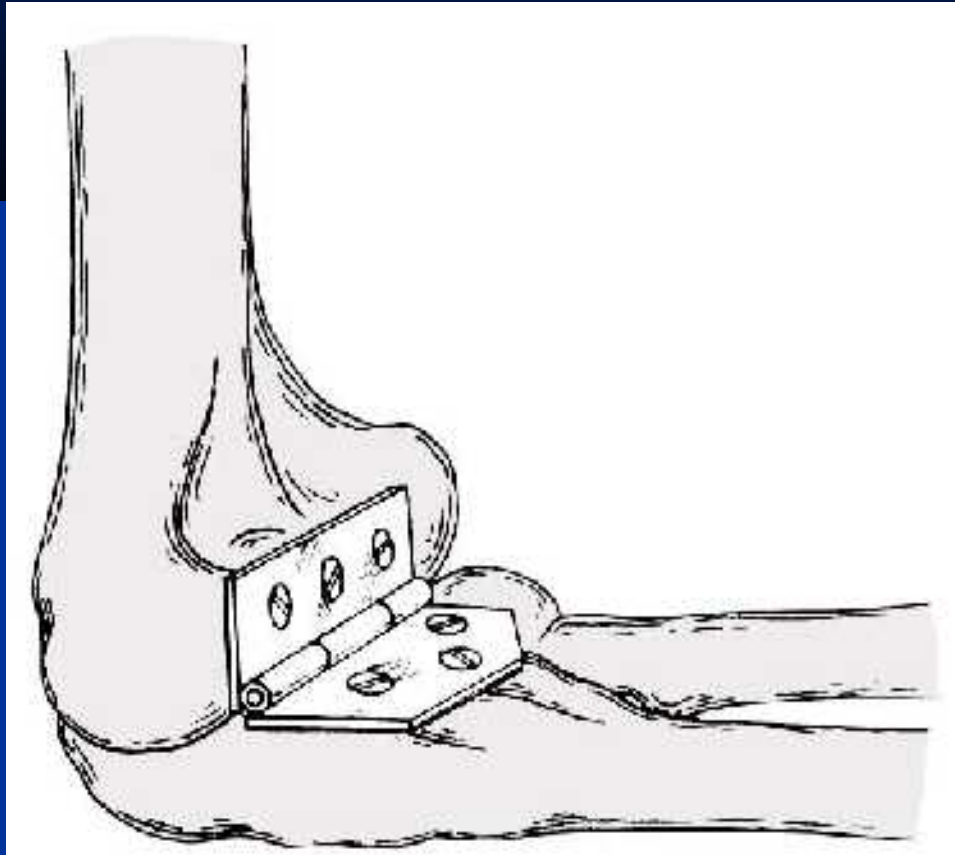
# Anatomy

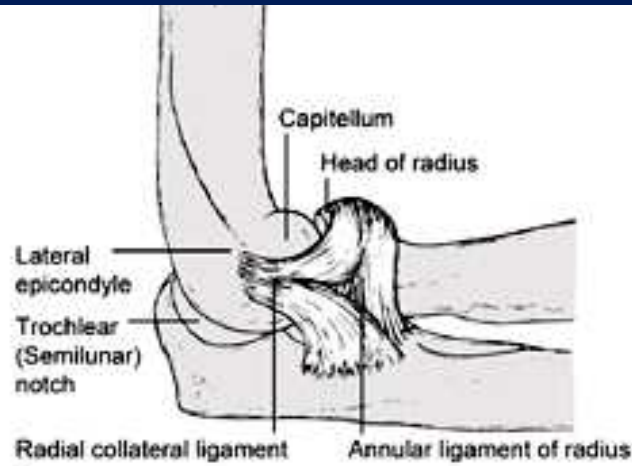
- The elbow joint is a complex hinge occur b/n trochlea and capitulum of humerus and trochlear notch of ulna and radial head

**Movement:** flex 135 ext 0-5 .

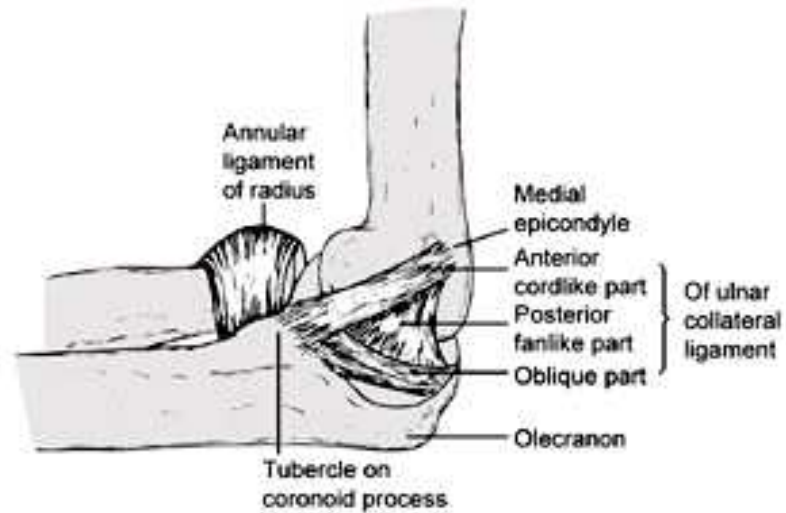
Appear in slight valgus {carrying angle} m  
5deg/ f10-15.

**Stability** : depend on shape of joint collateral ligaments, capsule & muscles around it .





A

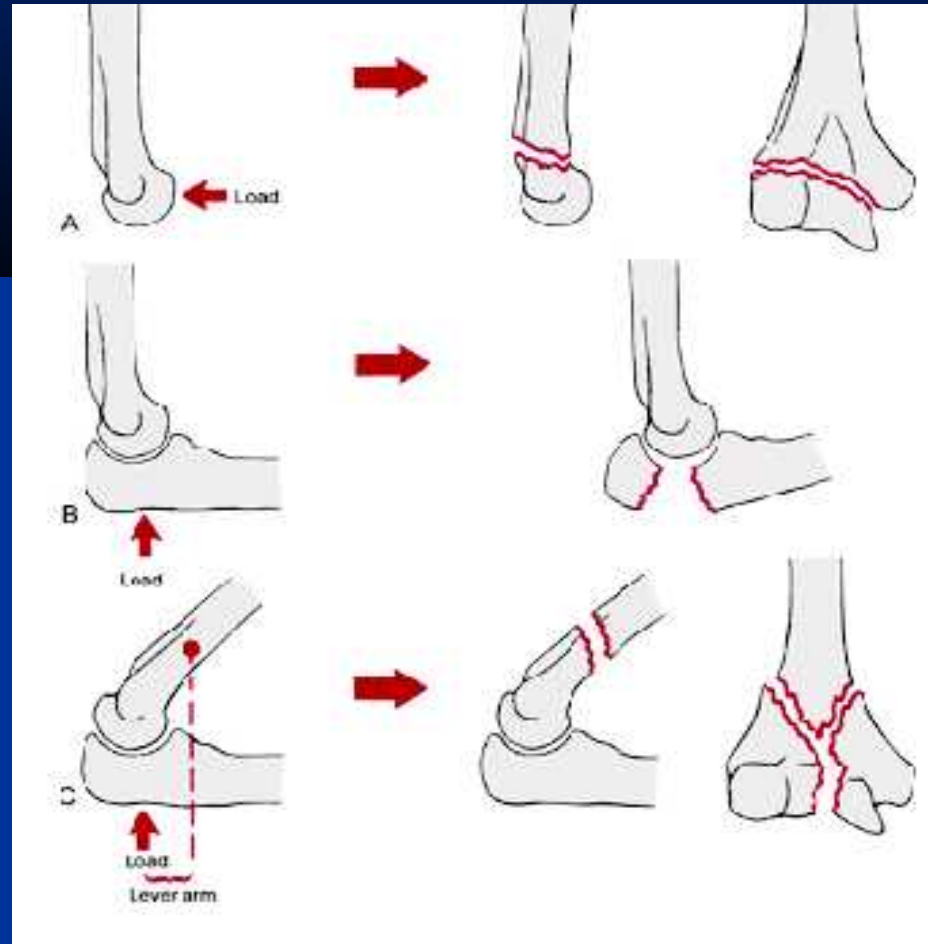


B

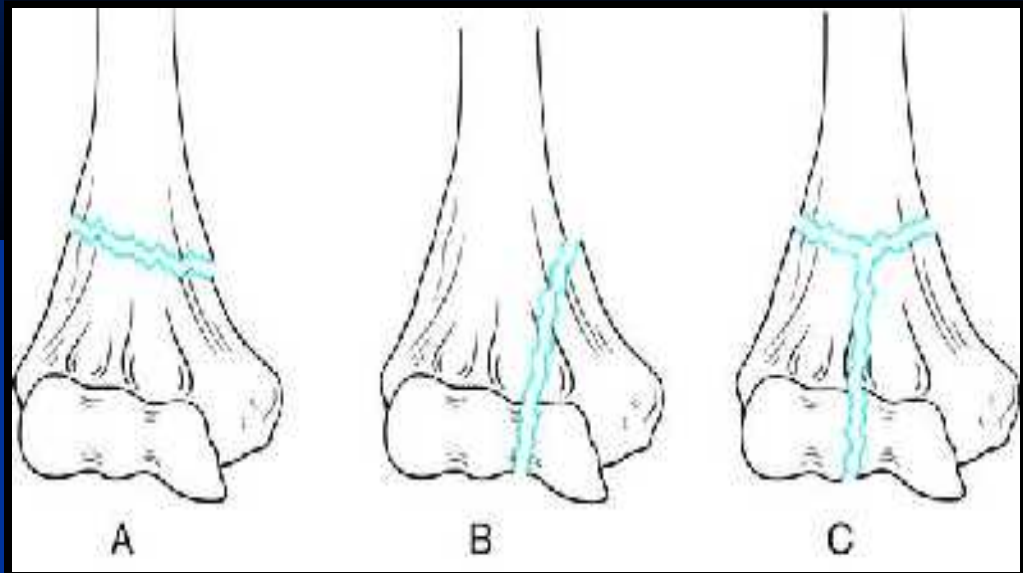
# Fractures of distal humerus

- **Mech.of injury:** -high energy except in osteoporotic.  
-falling on flexed elbow > 90 degree.
- **classification [ A O ] :** divided into:
  - **type A:** extraarticular
  - **typeB:** intraarticular unicondylar frct .[one condyle sheared off and the still in contact with the shaft.
  - **typeC:** intraarticular bicondylar [no one in contact with the shaft] . has subgroups:- **simpleT or Y**
    - **extraarticular comminution**
    - **intraarticular comminution**

# Mechanism of injury of distal humerus#



# classification [ A O ] of distal humerus#



# other classification of distal humerus#

## ■ Some classified them into :

- Supracondylar # .

- Intracondylar # .

- transcondylar #

- Chondyles[med.and lat.]#

- Articular surface[capitulum and trochlea]#

-Epicondyles #



# Diagnosis of distal humerus#

- **C.P**: pain , swelling etc.....

Careful neurovascular assessment :

(**median & ulnar n. brachial a.**)

- **x-ray** : APV & LAT.V

gentle traction x-ray help in: -

- accurate Dx

- classification

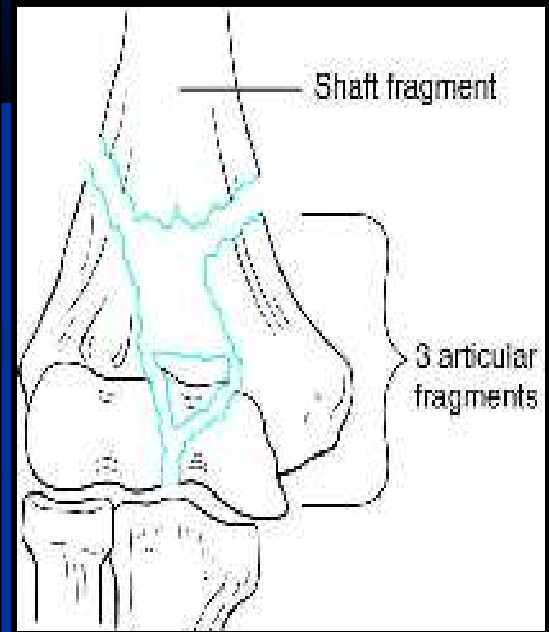
- pre-op. planning

- **C. T**

## X-ray APV



## Gentle traction x-ray



# Treatment of distal humerus#

**I. Conservative:** -(rare) for **undisplaced #**.  
-p.o.p in 90 flexion for **6-8 w** .  
-weekly x-ray

**II. Surgical** is the treatment of choice. :  
because fracture ***usually unstable***

**III. Alternative:**

# Treatment of distal humerus#

- **III.Alternative:** indicated for:
  - 1.severely commin.# .
  - 2. severely soft tissue damage.
  - 3.Patient bad condition.
  - 4.lack of expertise & facilities.
  - 5. severely osteoporotic(contraversed).

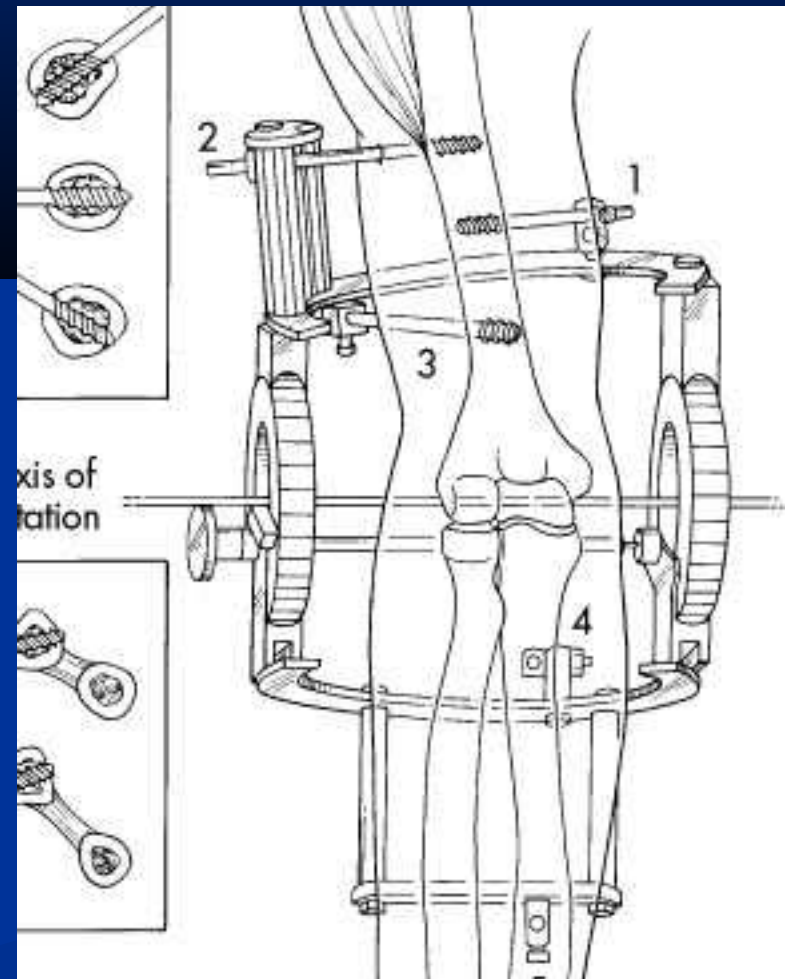
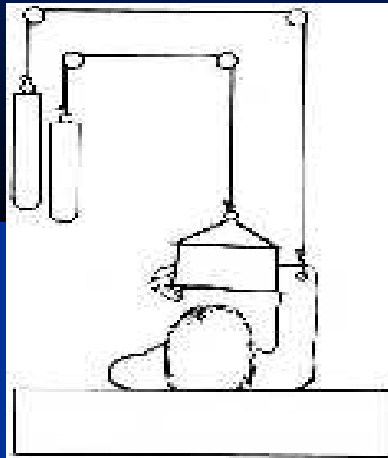
# III. Alternative treatment

## Types :

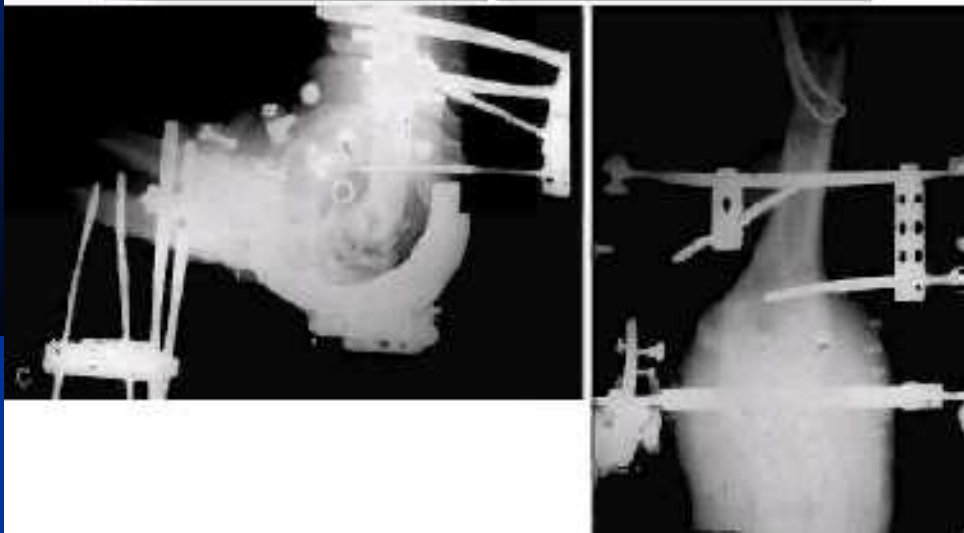
- 1. bag of bones:** arm held in a collar & cuff or p.o.p flexion > 90. active motion encouraged if pat. well exercise continue after # healed.  
we get motion ranged : (45—90).
2. Olecnon traction.
3. Ilizarof ext. fix. (hinged type).
4. Total elbow arthroplasty. (elderly & less active pat)

Olecnon traction.

Ilizarof ext. fix. (hinged )



## Ilizarov ext. fix. (hinged )



## Total elbow arthroplasty



# Surgical treatment

■ It include:

- **pre operative planning:-**

- careful reading of x-ray C.T

- prepare for the worst before op.

- **internal fixation:**

\* it should be **early**(24-48h)except open #,  
**accurate & rigid** to give good stability &  
**permit early motion**



# Follow int.fixation

- O.R.I.F depend on the type of fracture:

- **1. Clsed #:**

.Uncomm#:screws,K.W(crossed or tension band).

.Commin#:contoured plate(single or double).

It is the **best** ———→ **strong stability.**

- **2. Open #:** acc.to **Gastilo:**

-GI&II- ----- O.R.I.F early.

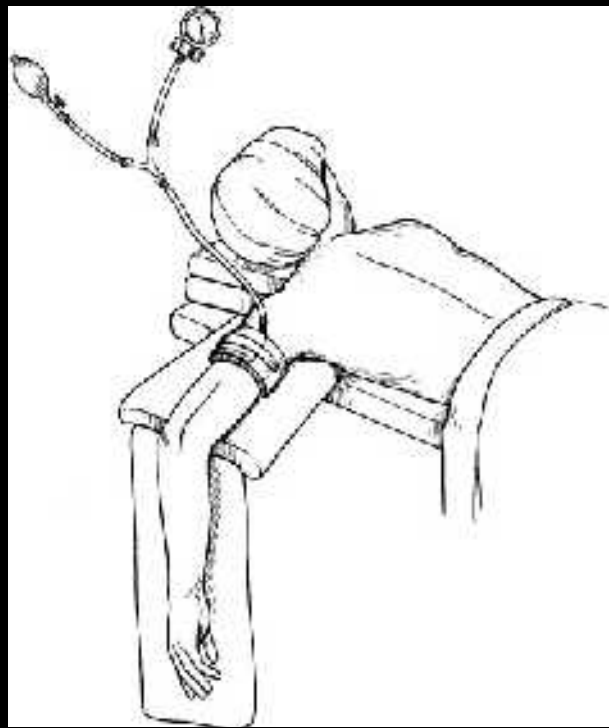
-GIII----- dibridment .&delay O.R.I.F

# Follow int.fixation

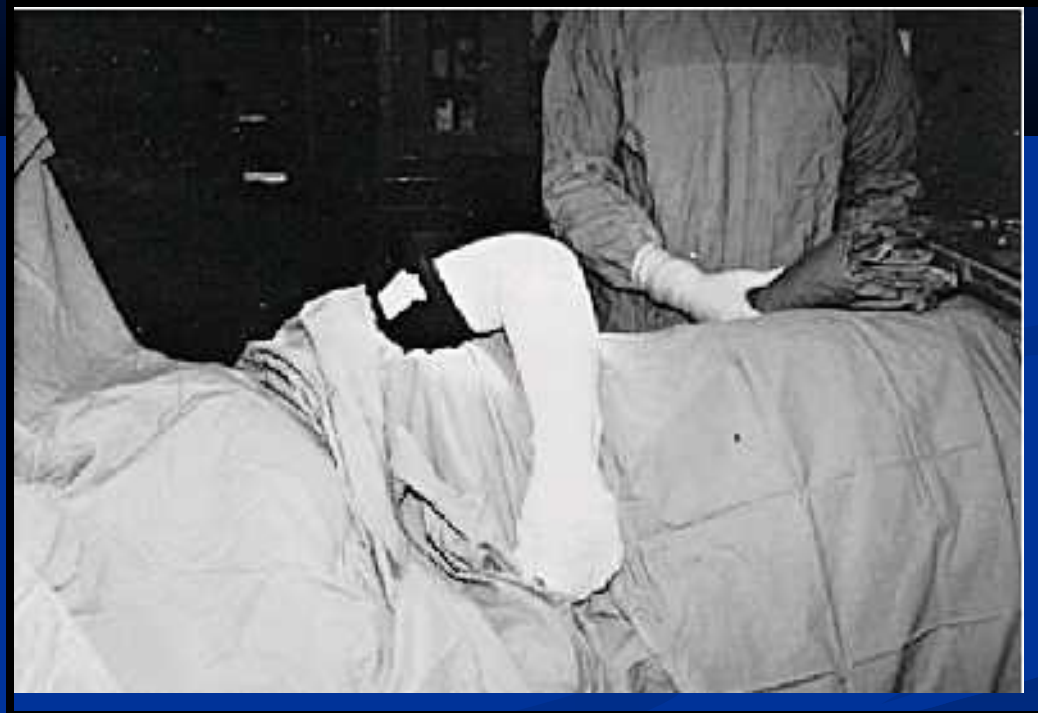
## ■ **Technique:**

- **position:** prone, lateral. (help for bone graft)  
supine (in multitraumatic pat.)
- **incision:** posterior 5cm distal olecranon up to 10—  
12cm above.
- isolate ulner n.
- **Approach**
  - Campbell
  - Transolecranon.
  - The medial triceps-elevating exposure for  
elbow arthroplasty

# Prone position



# lateral position

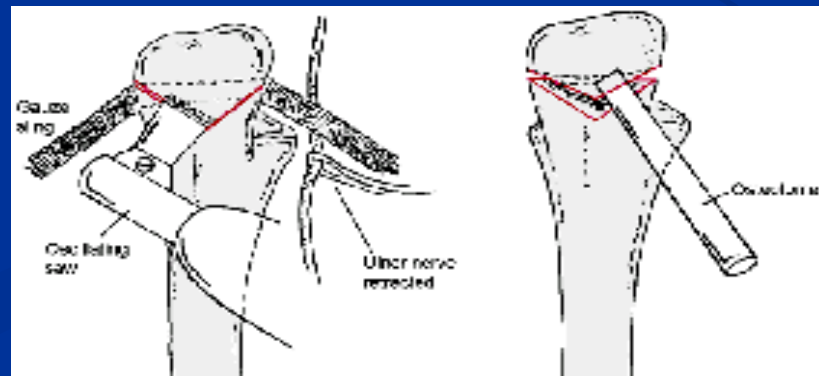
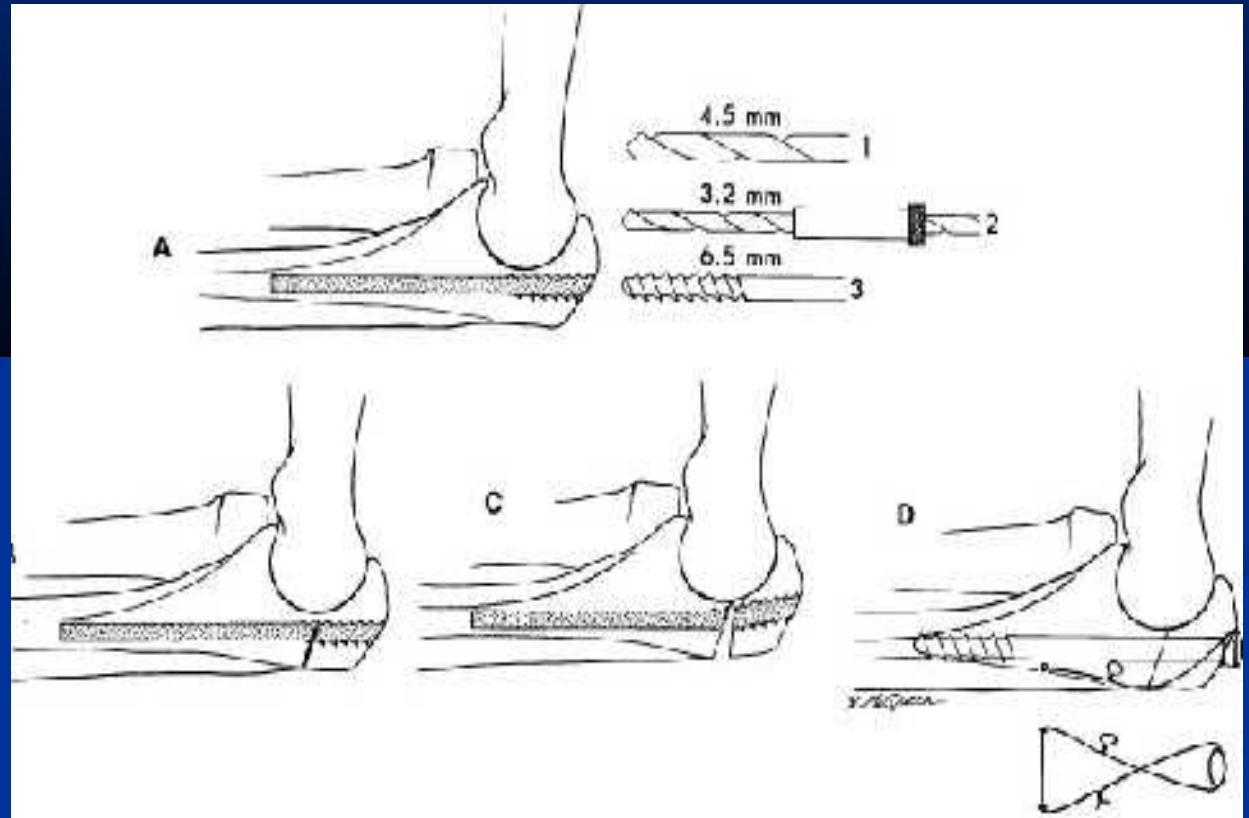
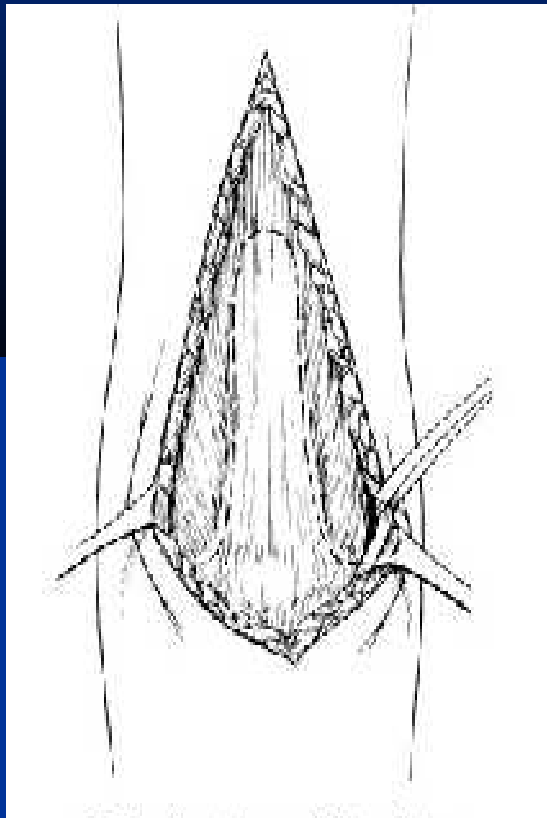


# Approaches of intercondylar #

- **I. Campbell app. advantages:**
- 1- it is the only soft tissue approach to the elbow that expose all the articular surfaces of the joint,  
2-after the ulnar nerve has been isolated no large vessels or nerves lie in the area of the incision.
- **II Transolecranon app.** that provides an even better exposure of the articular surface but does not give exposure as far proximally as the Campbell app.  
- **disadvantage:** non union transolecranon #

# Campbell App.

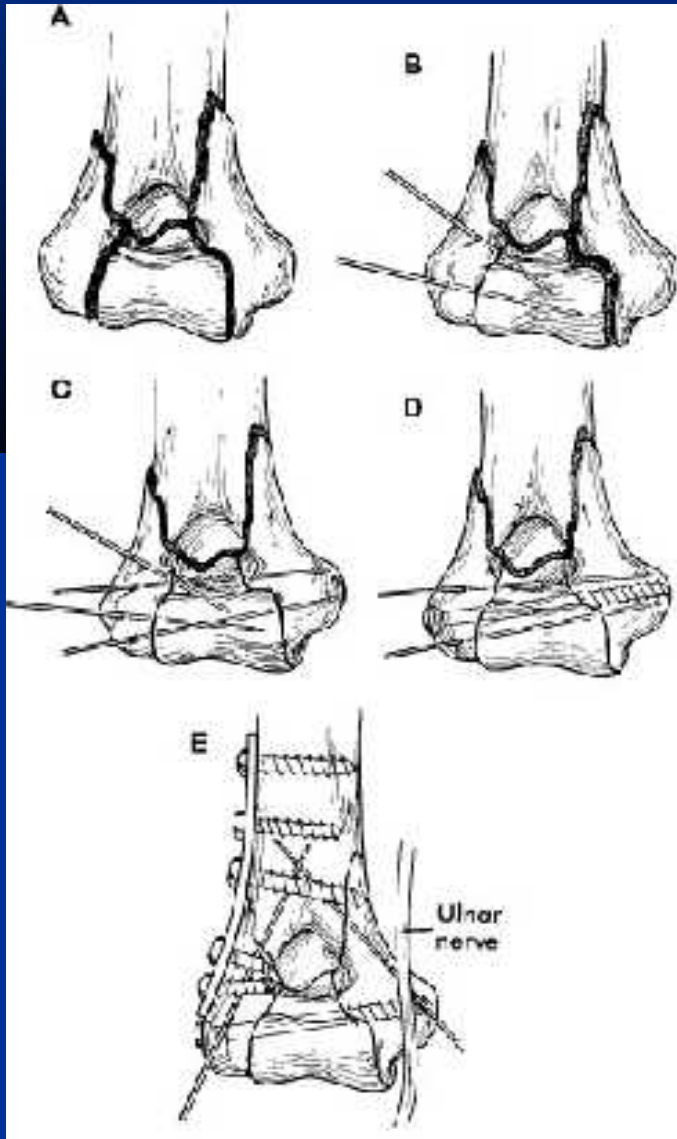
# Transolecranon APP




# Follow int.fixation

## ■ Steps of reduction of intercondylar # :-

1. **Reduction & fix. Of condyles :**
2. **Reduction & fix. Of epicondylar ridge :**  
to the proximal fragment. (it form a buttress to which condyle later attached)
3. **Reduction & fix. Of reassembled condyles:** to metaphysis with : screws, K.W or plates.

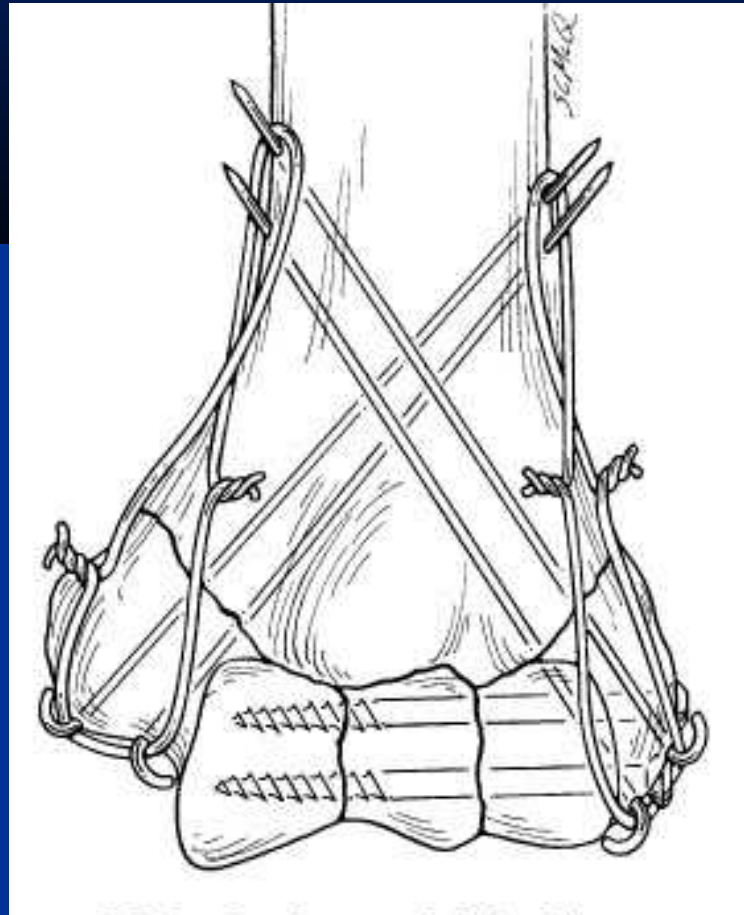


# Follow int.fixation

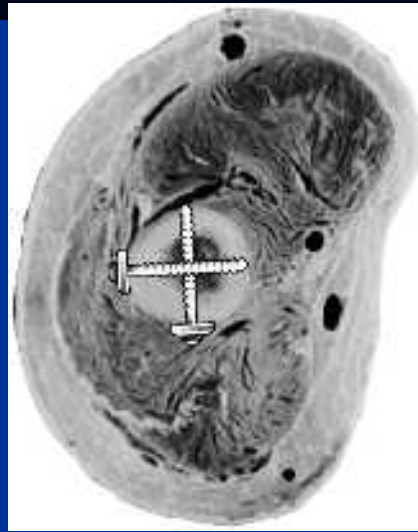
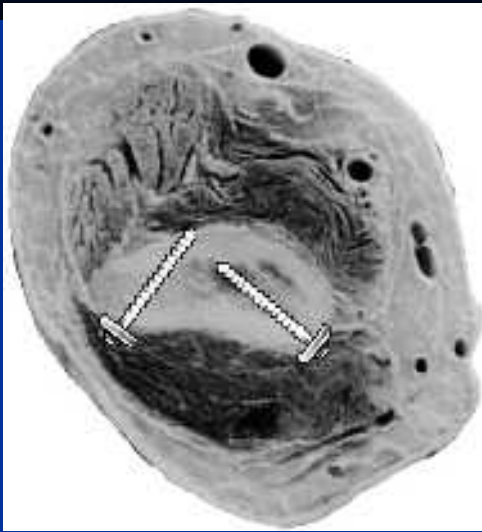
- **Screws:** if #line not extend far proximally.
- **K.W:** if #line extend more proximally.
- Contoured plates(single or double) or Y shape:
  - 1/3 tubular p. in the medial edge of med.pillar.
  -  **Reconstructive** p. in post. Aspect of lat.pillar.
  - **Good stability.**



# Tension band wire



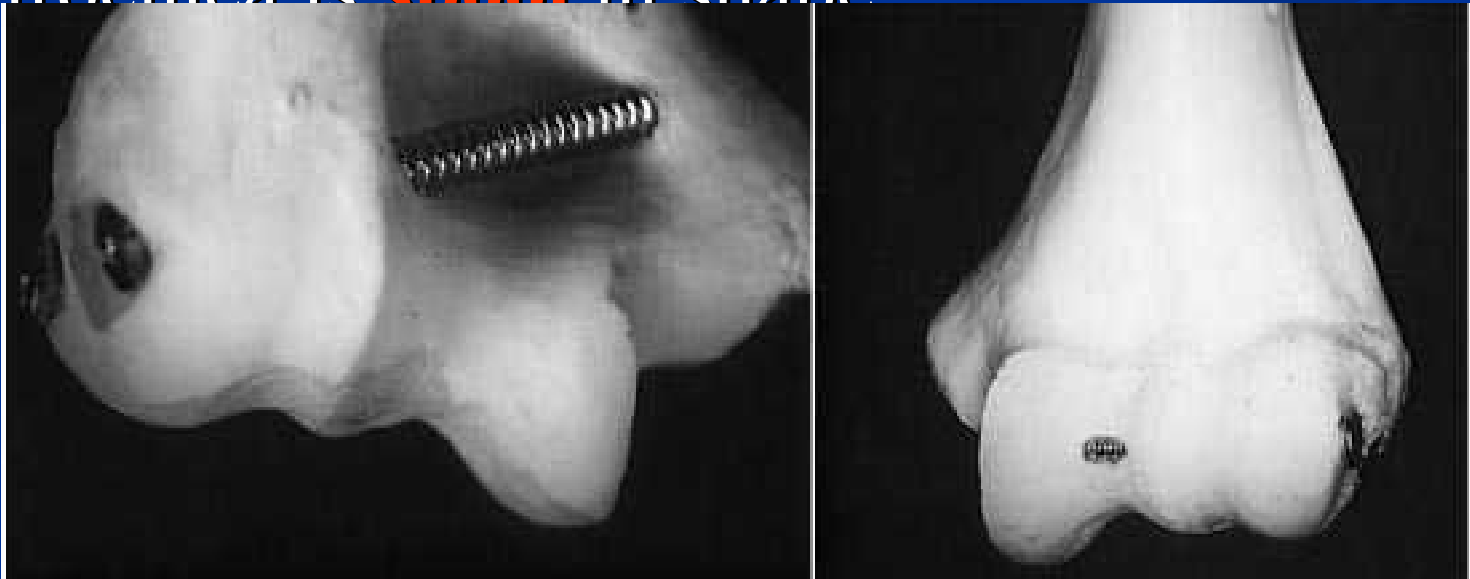
# Position of plates in distal humerus#




- **caution:** not to encourage screw in olecranon or

coronoid fossae or penetrate **trochlear surface.**

trochlea is **spool** in shape.



# After treatment

- Light post. Splint.
- When wound healing is satisfactory 7—10 
  - Remove p.o.p periodically & gentle active exercise started.
- after 3 w p.o.p removed and the arm is supported by a sling with active motion as pain permit
- vigorous motion contraindicated

# Transchondylar #

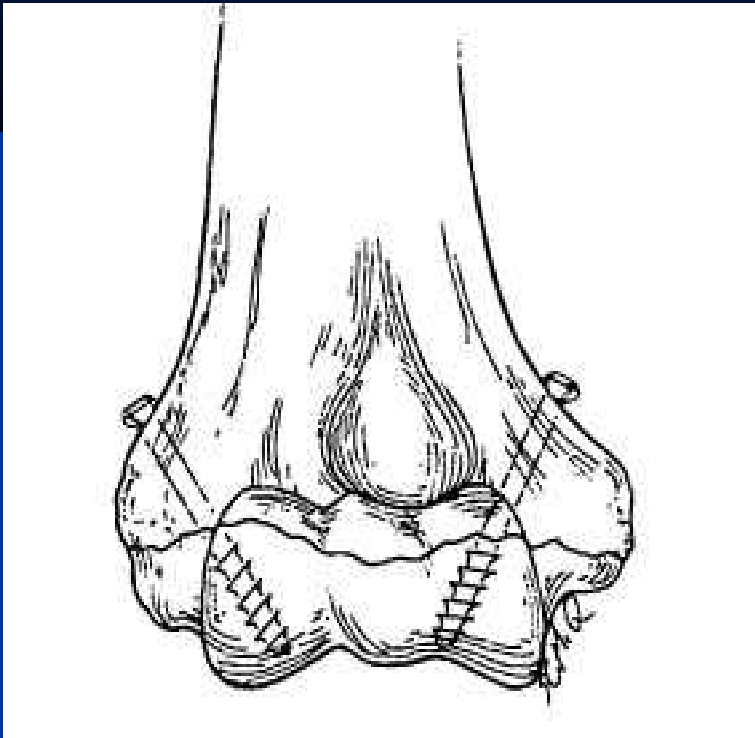
often is grouped with suprachond#. but **requires special considerations** b/s usually **extends to articular surface** . **Quite unstable** .  
unite **slowly** if treated conservatively .

-so treated with **percutaneous pins** , **lag screw** (through small incision without opening the frac.), or **canulated** screw .

if Was intraarticular and not fixed properly can be complicated by **avascular necrosis** .

-**Displaced #**----- O.R.I.F.

**Undisplaced transcond#**



**A vascular necrosis**




# Displaced transcondylar #



# Side swipe fracture

- occur in **arm protruded from window** of car and struck with other car .
- fracture **always open** . Vary from **GI ---- GIII**
- the **most combination** of this fracture consist of:
  - \* **open distal 1/3 # of olecranon .**
  - \* **anterior dislocation of radial head & distal fragment of ulna .**
  - \* **comminuted distal humerus fracture .**
- &other



- **Treated by** : reduction of dislocation , **O.R. I.**  
**F .** of olecranon # & **ext. fix.** To stabilize the  
all complex.
- **Primary goal**: care of open wound  
& restoration of elbow joint.
- Always complicated by infection, non union  
severe myositis ossificans  **arthroplasty**

# Complication of intercondylar # of distal humerus#

## I. Early:

neurovascular injury.

## II. Late :

- Failure of fixation.
- Non union & malunion.
- Non union of olecranon osteotomy.
- Infection.
- Nerve palsy.
- Hetrotopic ossification.

**Failure of fixation.**

**Nonunion**

**Heterotopic  
ossification**



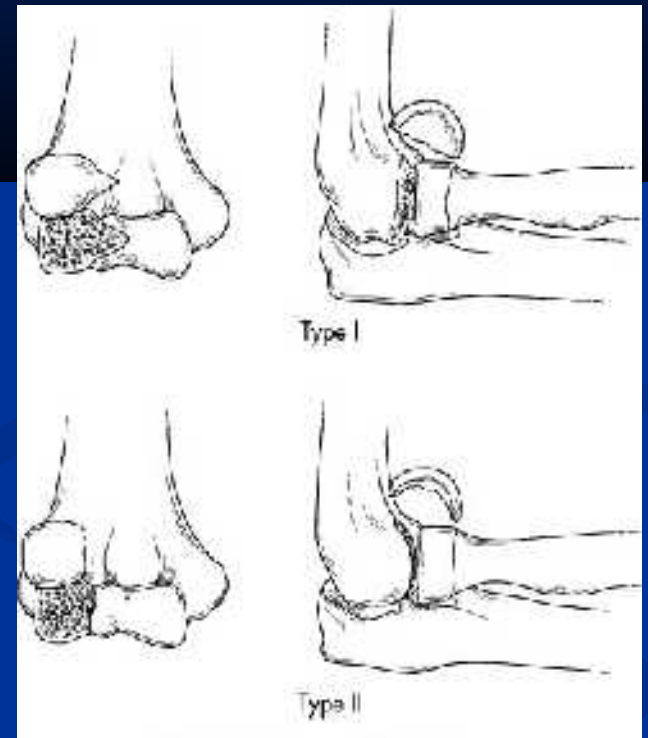
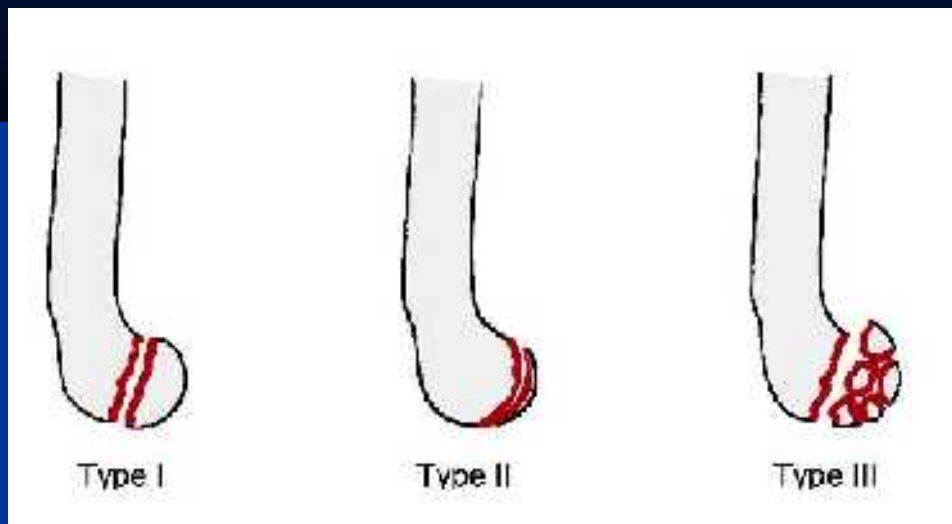
# Fracture of capitulum

- **Mech. Of injury:** F.O.S.H---- head of radius impacted to capitulum  $\xrightarrow{\quad}\xrightarrow{\quad}$ fracture

## classification:

- **type I:** large fragment of bone and articular surface (**involve trochlea**) are fractured.
- **type II:** small shell of bone and articular surface (**not involve trochlia**).
- **type III:** comminuted #.

# Classification of capitulum Fracture



# Fracture of capitulum

- **Diagnosis:-**
- x-ray :lateral view (diagnostic). & A.P.V
- **Deff. diag.:** from # of radial head but the later rarely to displaced anteriorly (so any # fragment ant.to lat. Condyle is capitulum fragment till prove otherwise.)
- C.T scan
- **Treatment:** ( through lat. Approach)
  - Type I :** O.R.I. F with **small AO** screw or **Herbert's** screw ( from post. to ant.)
  - Type II&III:** excision .
- After treatment:** like intercondylar # .

# Fracture of capitulum

Lat.V

APV



# Treatment of capitulum Fracture

- Screw countersunked posteriorly.
- Not damage articular surface anteriorly.






# Epicondylar fractures

- Med.& Lat. Epic. # are **rare** in adult.
- **Mech. Of injury:** direct blow.
- **Treatment:**
  - lat. Epic.** - Usually conservative :p.o.p for 3w. followed by supportive motion.
  - Med Epic.** - Undisplaced: p.o.p.
    - displaced > **1cm**:O.R.I.F.
  - if med.epi. displaced to joint in: (rare in adult).
    - 1.close Red:vulgus of elbow, arm supination&ext. of wrist.
    - 2.open Red.

# Olecranon fractures

- **Mech. Of inj.**  **direct**: blow on elbow.  
**indirect**: falling on partially flexed elbow with indirect force generated by triceps \_\_\_\_\_ avulsion.

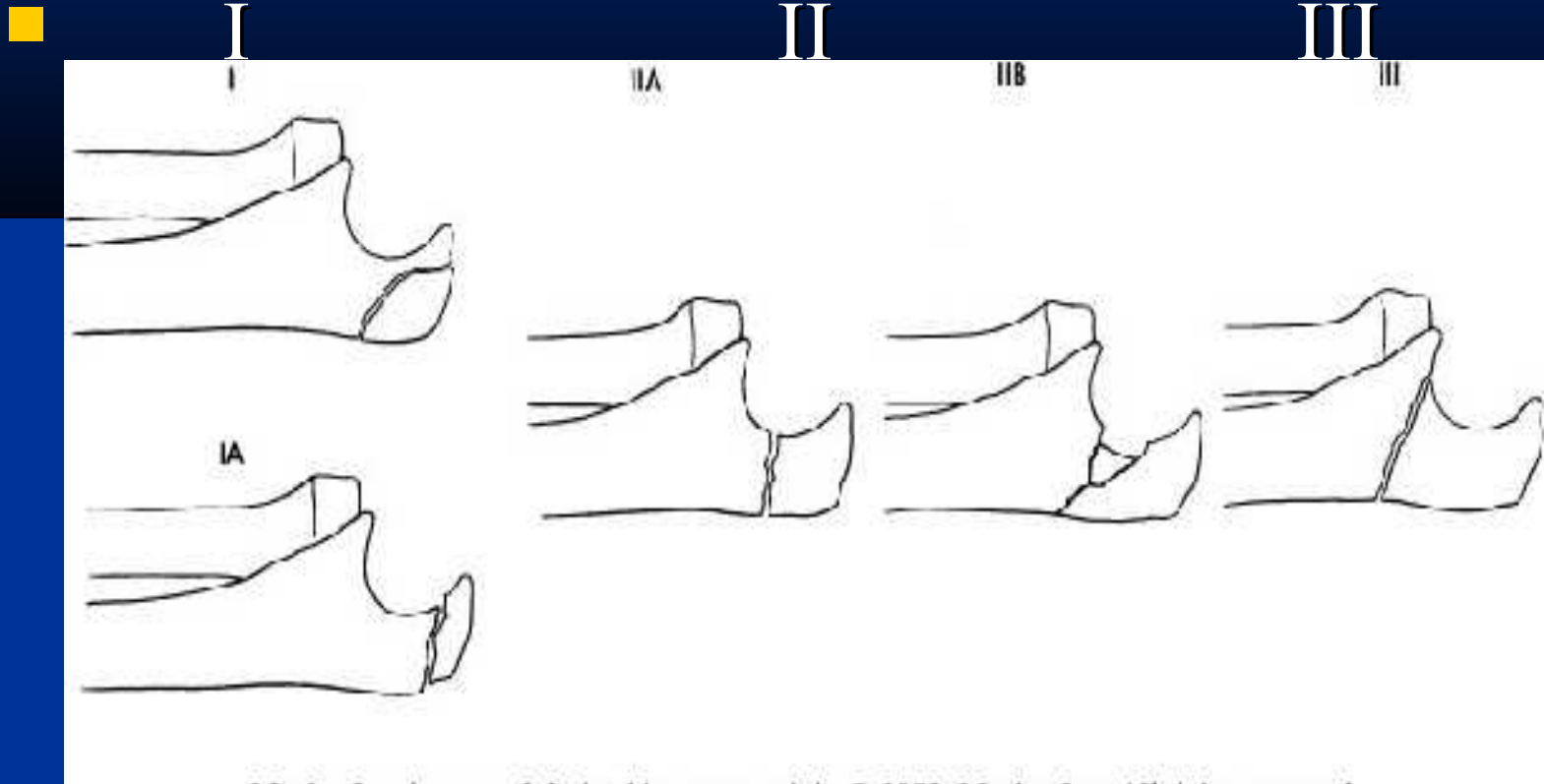
## **classification:**

**type I** :# of proximal 1/3.

**type II** :# of middle 1/3 .

**type III** :#of distal 1/3.it may be associated with ant. displacement of radius.

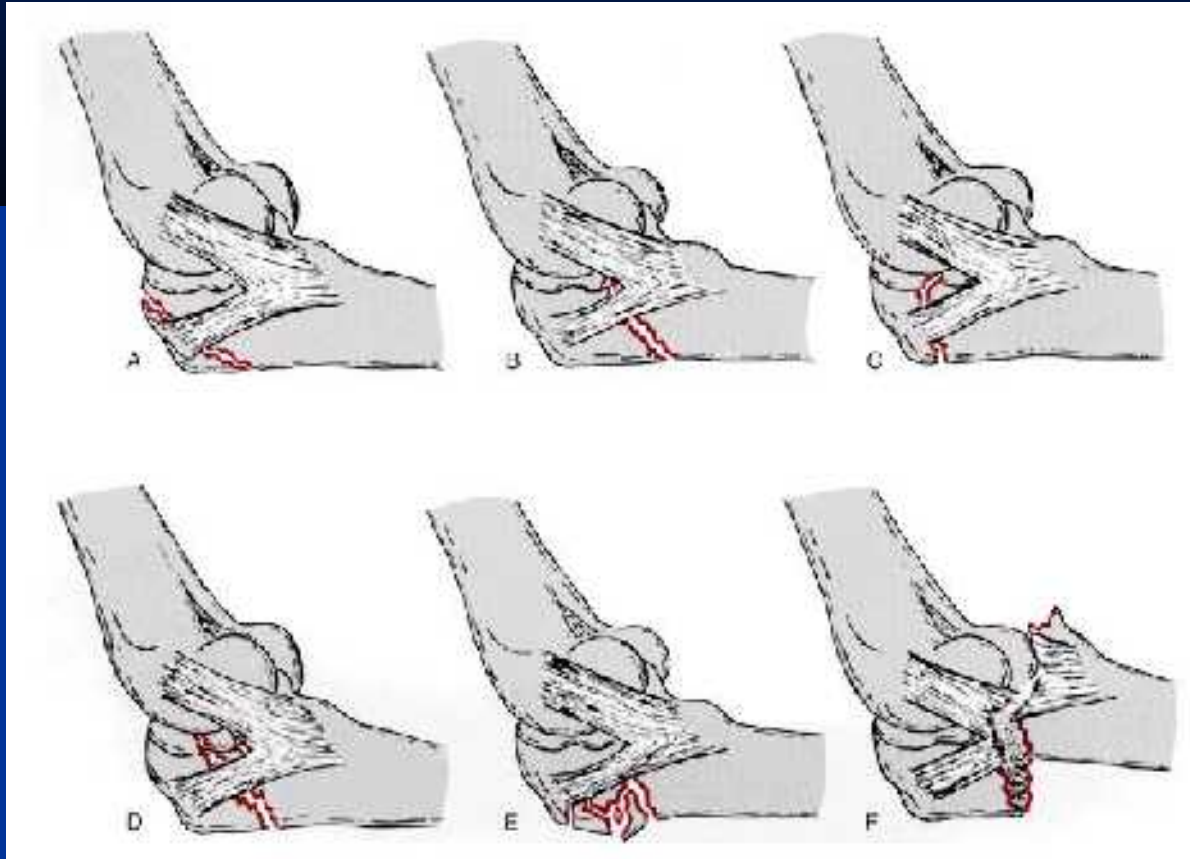
# Classification of Olecranon fractures



# Follow olecranon fracture

- **Other classification:** [Colton] according to:  
displacement and the anatomy of the fracture, thus  
give guidance as to the appropriate type of fixation :
- I. Nondisplaced and stable
- II. Displaced fractures
  - - Avulsion fractures
  - - oblique fractures .
  - - Transverse fractures
  - - Isolated comminuted fractures
  - - Fracture/dislocations

# classification of olecranon fracture [Colton]



# Treatment of olecranon fracture

## ■ I. Nondisplaced and Stable:

1. if the fractures displacement  $< 2$  mm.

2. exhibit no change in position with gentle flexion to 90 degrees or with extension against gravity .

-treated by: p.o.p in 90 degrees of flexion for 3 to 4 w -followed by protected range of motion.

-avoiding flexion past 90 degrees until bone healing is complete radiographically usually around 6 to 8 weeks.

-In the elderly patient , motion may be initiated earlier than 3 weeks if the patient can tolerate it.

-Control x-Ray after 5-7d.

# Nondisplaced and Stable



# Treatment of olecranon fracture

## ■ **II. Displaced Fractures:**

O.R.I.F is the treatment of choice.

## ■ **The goals of treatment are:**

1. Maintain power of elbow extension.
2. Restore congruity of the articular surface.
3. Restore stability of the elbow.
4. Prevent stiffness of the joint.
5. Allow the patient to do early motion



# Follow olecranon fracture

- 1. Avulsion #:** -tension band wire. (T.BW)  
- if fragment small--- excision .

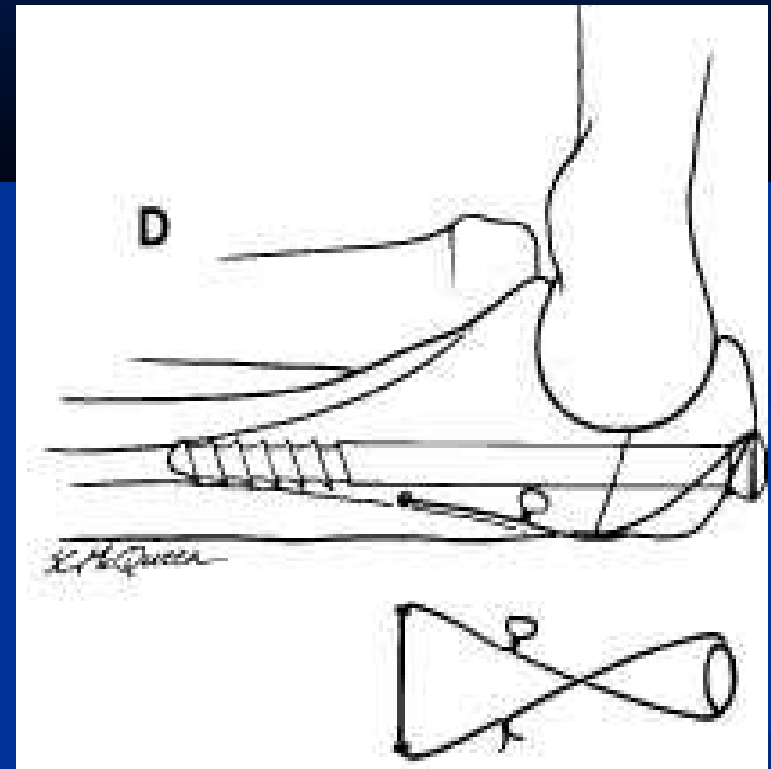
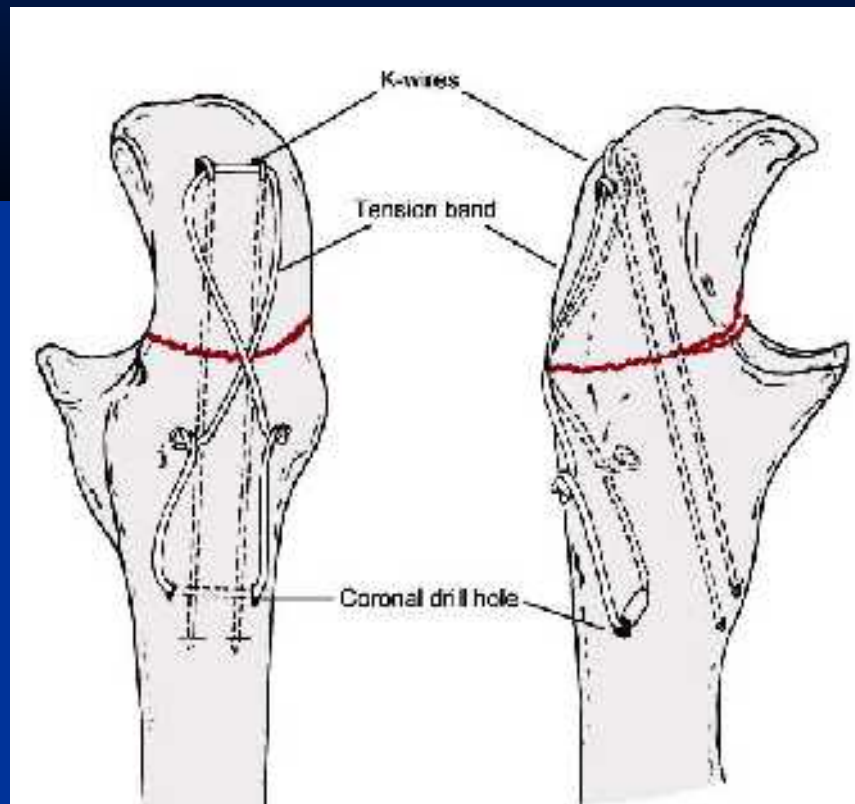
## 2. Transverse #:

- a. **Without comminution:** tension band wire is suitable  
- if fragment is **big**----- cancellous screw 6.5mm  
-if fragment is **small** --- K.W.
- b. **with comminution:** contoured plate with or without bone graft (T.B.W cause compression at # site & narrowing of trochlear notch.)

# Avulsion #: small fragment



# Transverse # without comminution



# Follow olecranon fracture

## ■ 3. Oblique #:

a. **without comminution** ∴ (T.B.W may displace#)

1. plate : **reconstructive** (thick), **1/3 tubular** (fatigue) or contoured limited contact dynamic compression **LCDC**

it permit greater angulation of screws & has low profile.

2. some indicate T.B.W with Interfragmentary screw.

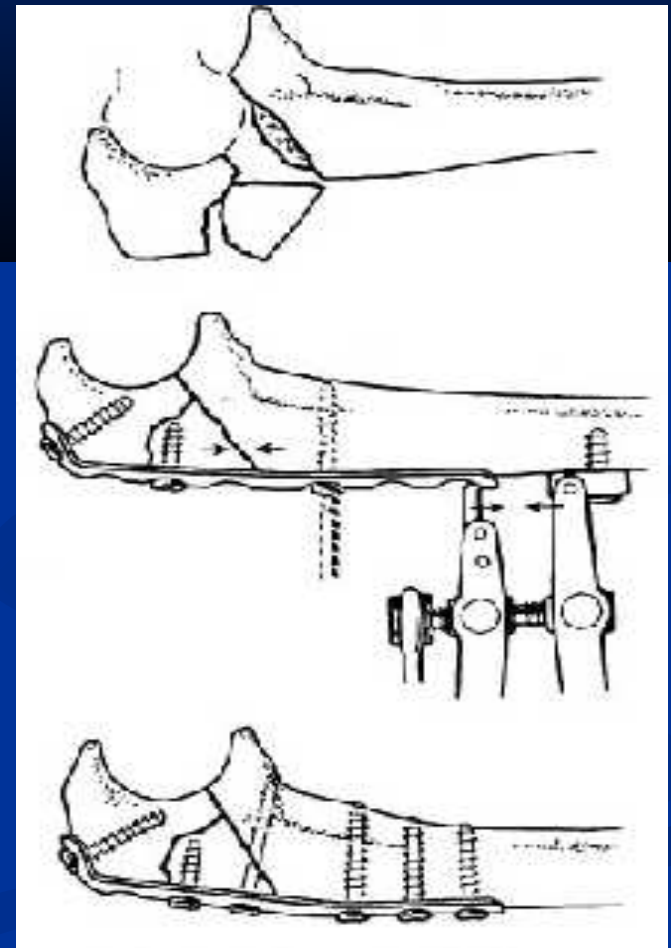
b. **with comminution**: plate with bone graft.

# Oblique # without comminu.

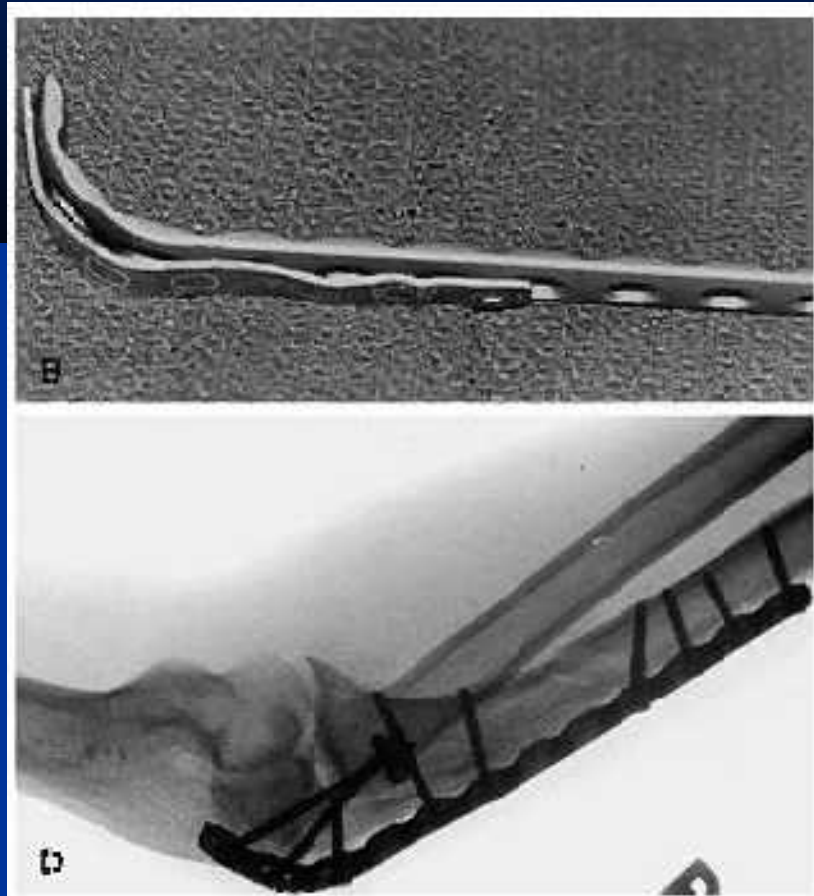
T.B.W with Interfragmentary screw

# Oblique # with

comminution



contoured limited contact dynamic  
compression plate **LCDC**



- **4. Isolated comminuted** results from direct trauma. There are multiple fracture planes, & crushing of many fragments.

-may be associated with fractures of **the distal end of the humerus**, the **radial & ulnar shafts**, and the **radial head**.

-If **no association** with previous  **excision.**

& not in distal 1/3 of olecranon

-if **association** occur (excision unsuitable)---  
**combination of plate & tension band wire.**

# Excision of proximal fragment:

-used only if there is proximal# & the remnant distal part form stable base for trochlea.

## Advantages:

1. The possibility of non union is eliminated.
2. The possibility of traumatic artheritis is menimiz due to irregular articular surface.

## Indication:

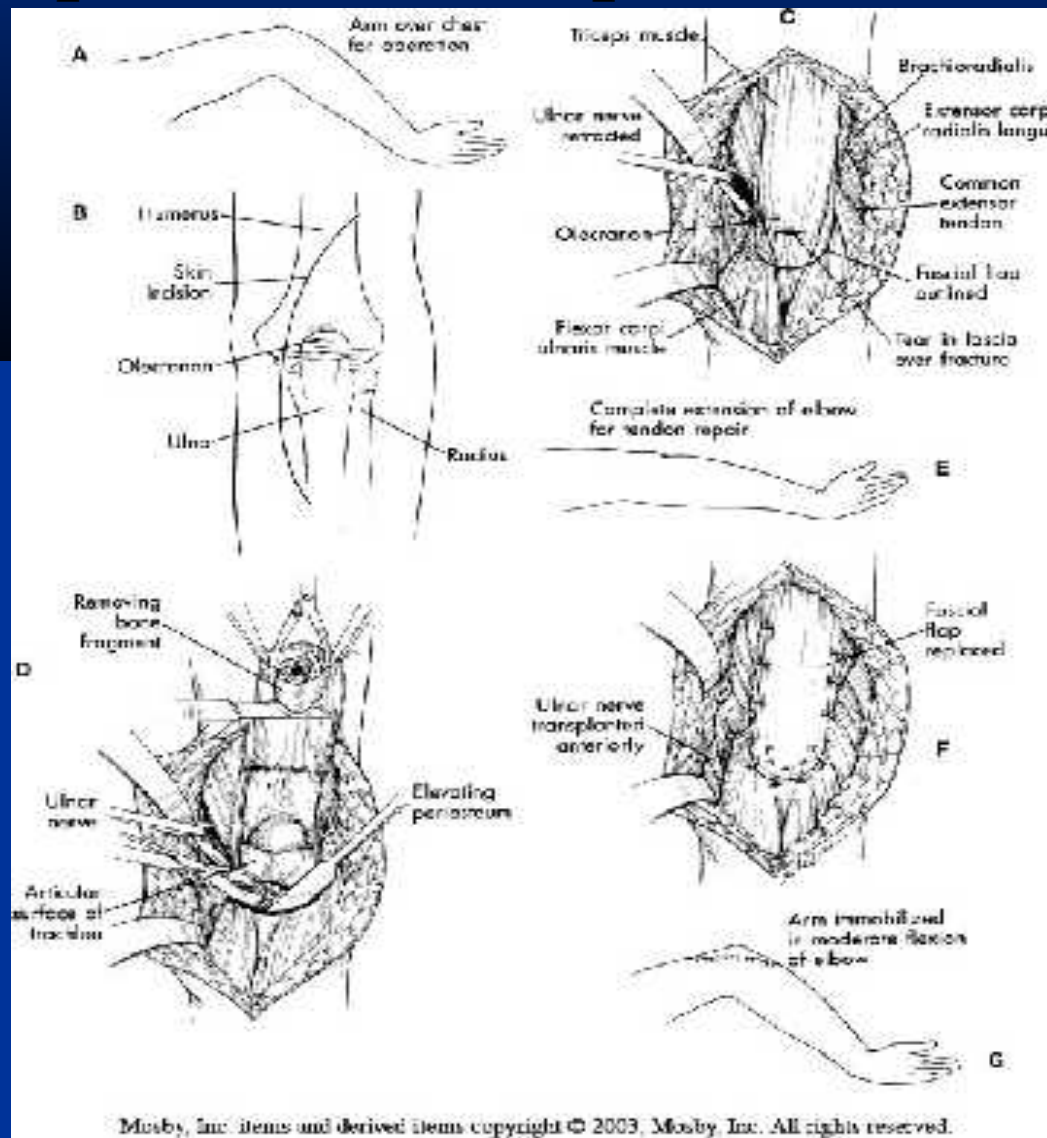
severely comminuted fractures in which open reduction and internal fixation are not Possible.

- non articular #.
- Non union .
- after failed O.R.I.F .
- when reduction is delayed 10—14d.
- in type III open# or if local soft tissue damaged .

**Contraindication:** in distal 1/3 olecranon#  joint instbility



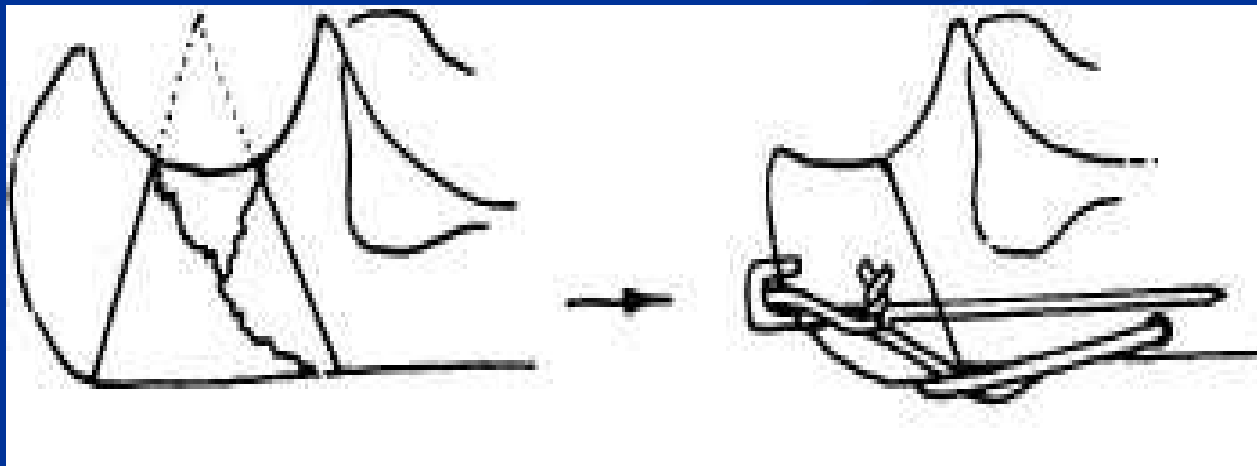
# Technique excision of proximal fragment



## After excision of proximal fragment

- p.o.p in flexion **70 deg.** For **3w.**
- gentle motion when wound heal permit 7—10d.
- avoid** forceful movement (ext. or flex.) for **3** month.

- **Note** : up to **80%** olecranon can be excised safely.
- If **mid portion** of olecranon is very comminuted while the proximal 1/3 intact ,excision of comminuted area as wedge& reconstitute a large olecranon notch then fixed with plate or tension band wire.



# Follow olecranon fracture

## ■ 5. Fracture-Dislocation

- Fracture-dislocations present a challenging problem because of the combination of **severe bone and soft tissue damage**
- . ORIF with **restoration of alignment and stability of the ulna** is the goal . This can be achieved by
  - **intramedullary wires** or a **long screw** to ulnar canal.
- . Often **plate** is required in spite of such soft tissue damage .
  - Primary excision** of the olecranon# must be **carefully considered**. ----- joint instability

# Treatment of olecranon fracture

Type	Treatment Method
Nondisplaced	LAC 90 degrees × 2 weeks with early active ROM
Displaced	
Avulsion	Tension band/lag screw
Transverse	Tension band/lag screw
Transverse with comminution	Plate fixation/bone graft
Oblique	Lag screw/plate fixation
Oblique with comminution	Plate fixation/bone graft
Comminuted	Excision/combination plate and tension band
Fracture/dislocation	Wires/lag screw/plate

---

LAC, long-arm cast; ROM, range of motion.

# After treatment of olecranon fracture

- P.o.p at 90degree for 3—4w.
- When wound heal permit, (7-10) gentle exercise.
- Periodic removing of p.o.p.
- Maximal function not return before 6—12m.

# Complication of olecranon fracture

the most common complication are:

-nonunion.

-Limitation of

motion (esp. extension).

-Subcutaneous

pain due to fixation devices.

# Coronoid fracture

It indicate severe trauma to elbow.

**Mech. of inj.** - Struck of trochlea in coronoid.  
-avulsion (less common).

## Classification:

type I: simple avulsion of tip.

type II: involve <50%.

type III :involve >50%.

## Treatment:

type I&II: heavy suture to the proximal of ulna.

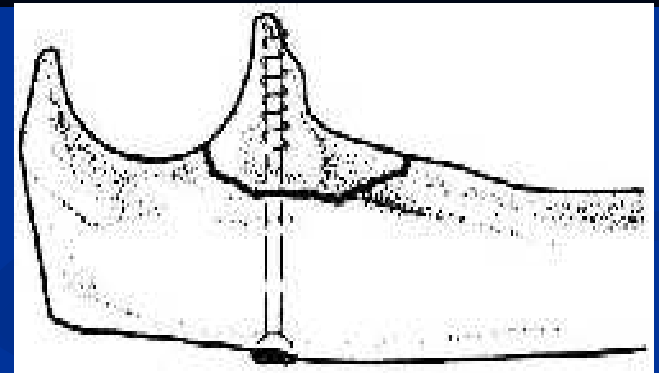
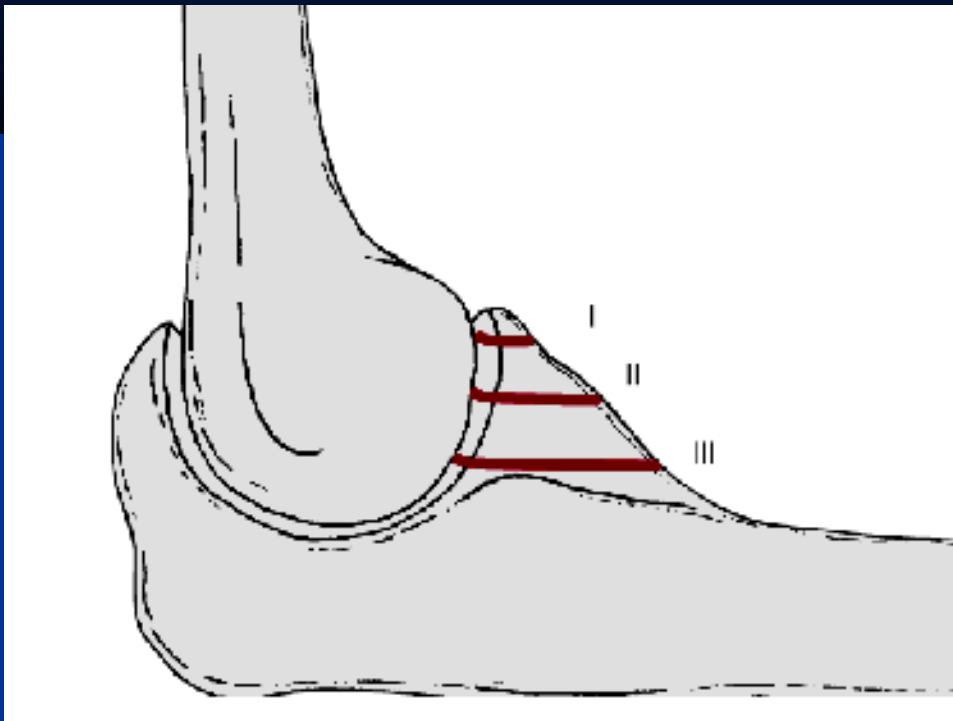
type III :I.F with screw.



# Coronoid fracture

## Classification

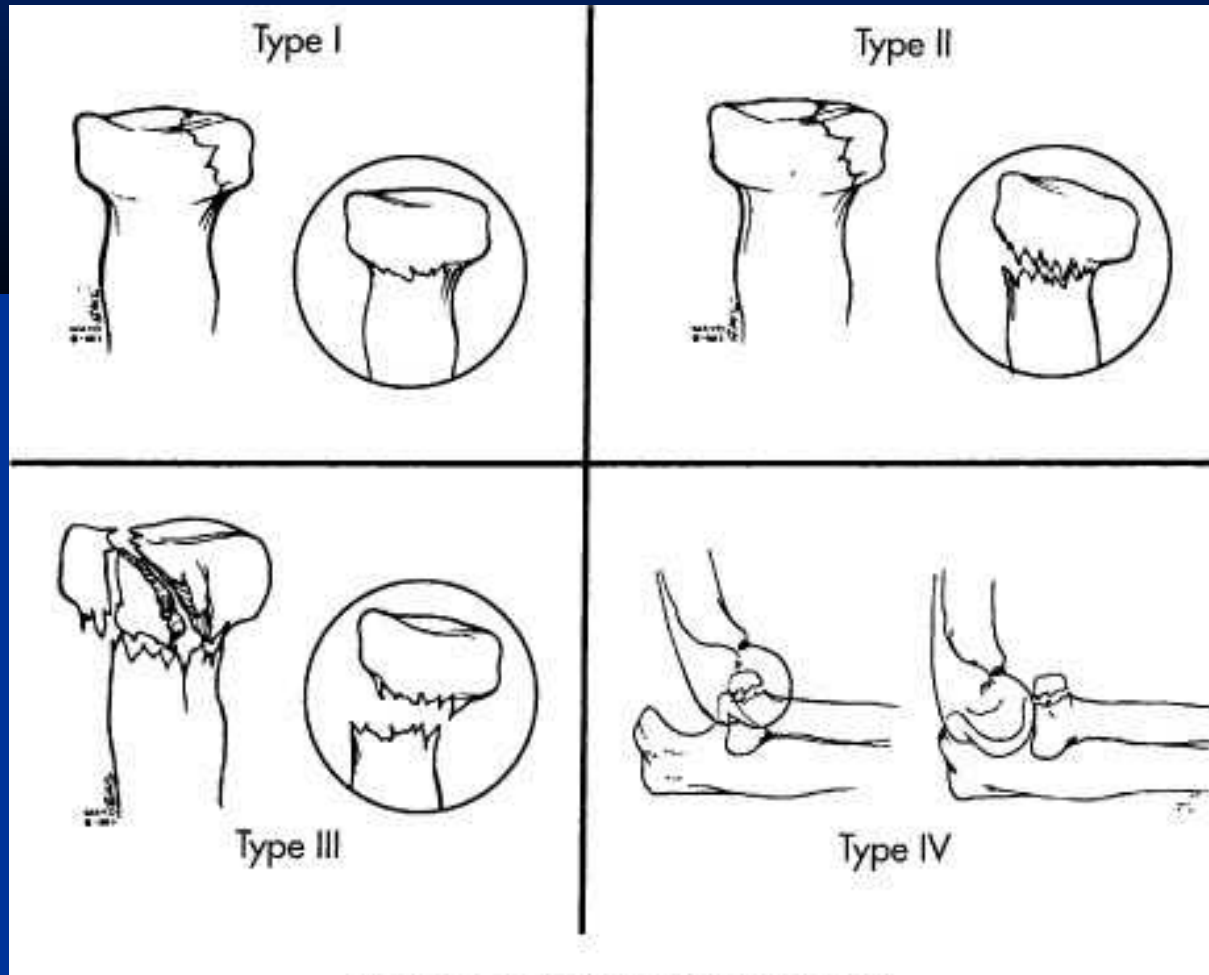
## Treatment



# Fracture of radial head

- It is common in adult.
- **Mech.of inj.** :F.O.S.H while arm **pronated**, head impacted in capitulum.
- **Classification**: of radial head: Mason
  - type I: undisplaced.
  - type II: displaced.
  - typeIII: Comminuted.
  - type IV:# associated with post. Elbow dislocation & coroniod #.

# Classification: of radial head: Mason



# Fracture of radial head

## ■ Treatment:

I. **conservative**: for :

-type I.

-type II : - if # in  $< 1/3$  of head circum.

-in outer part.

- or get 70% of pronation & supination.

# Fracture of radial head

2. **surgical** [Excision of radial head] is the treatment of choice.

## Indication:

- a. type III#
- b. If head become oval in shape.
- c. if  $>1/3$  of head circumflex involved.
- d. .fracture lie in the inner side.
- e. those with loss fragments in the joint.
- f. neck# with enough angulation that interfere with rotation.

# Excision of radial head

## ■ Technique:

- excision should be early 24—48h.
- incision: 5cm below radial head up to lat. condyle.
- pass b/n E.C.U&E.D or E.C.U&anconeus.
- excision: transverse just proximal biceptal tuber.
- anular lig should be excised. & debris removed

**After treatment:** p.o.p in 90 deg. for 1w then converted to sling till 3w. Within this interval start gentle active motion.

# Site of excision of radial head



- **Note:** if# segment is **large, isolated& uncomminuted** fixed with :  
mini O.A, Herbert or Accutrac screw.





## # of radial head & neck associated with elbow dislocation & coronoid #(type IV):

- 1 - If coronoid#undisp.----- excision early.
- 2- If coronoid#disp. but not commin-----  
O.R.I.F of coronoid #&excision of head at the same time.
- 3 - If coronoid# was commin. &difficult to fix it wait 3-6m till# healed then excision.  
In this time some indicate radial prosthesis to maintain joint stability.

# Fracture of radial neck

- Radial neck **classified** same as# of head.
- treatment:
  - conservative**: undisp. or minimally displaced.
  - surgical**: excision of head for severely displaced.
    - if joint unstable ----- small T plate.
    - or small cortical screw in oblique # .

small T plate.



small cortical screw  
in oblique #



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# Radial head & neck # with dislocation of distal radio ulnar j. (**Essex-Lopresti** fracture dislocation).

**Mech. Of inj.:** F.O.S.H cause disruption of distal radio ulnar j & tearing of interosseus memb. --- radial migration

**Diagnosis:** pain at the wrist associated with displaced radial head or neck #.

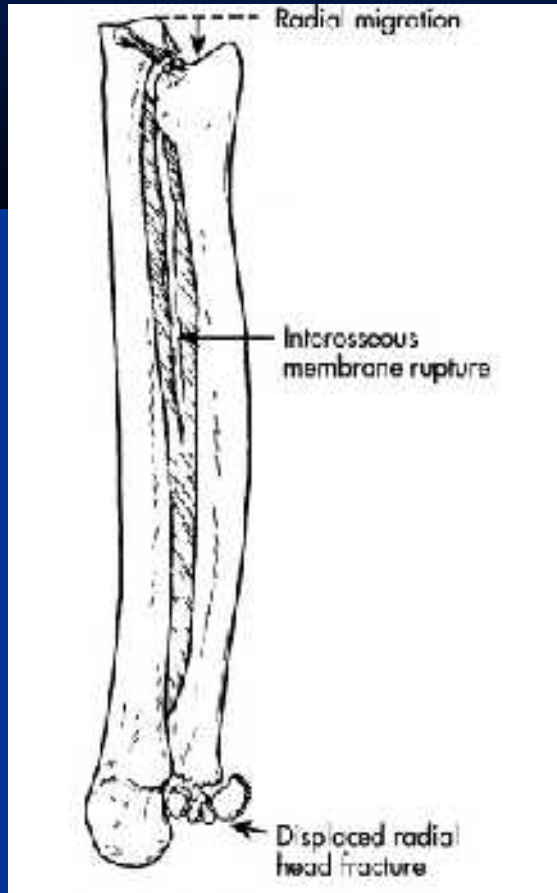
it should be early .once migration has occurred ,late reconstructive is unsatisfactory.

**Treatment :** O.R.I.F of proximal radial #+pinning of distal R.U.J

In supination. pin removed after 3—6 w.

if # irreducible--- radial head arthroplasty.

# Essex-Lopresti fracture dislocation



# Dislocation of elbow joint

- Form 20% of joint dislocation (after shoulder & finger)
- classification: posterior [most common 80%]
  - ant. - med. - lat. - divergent. [rare].

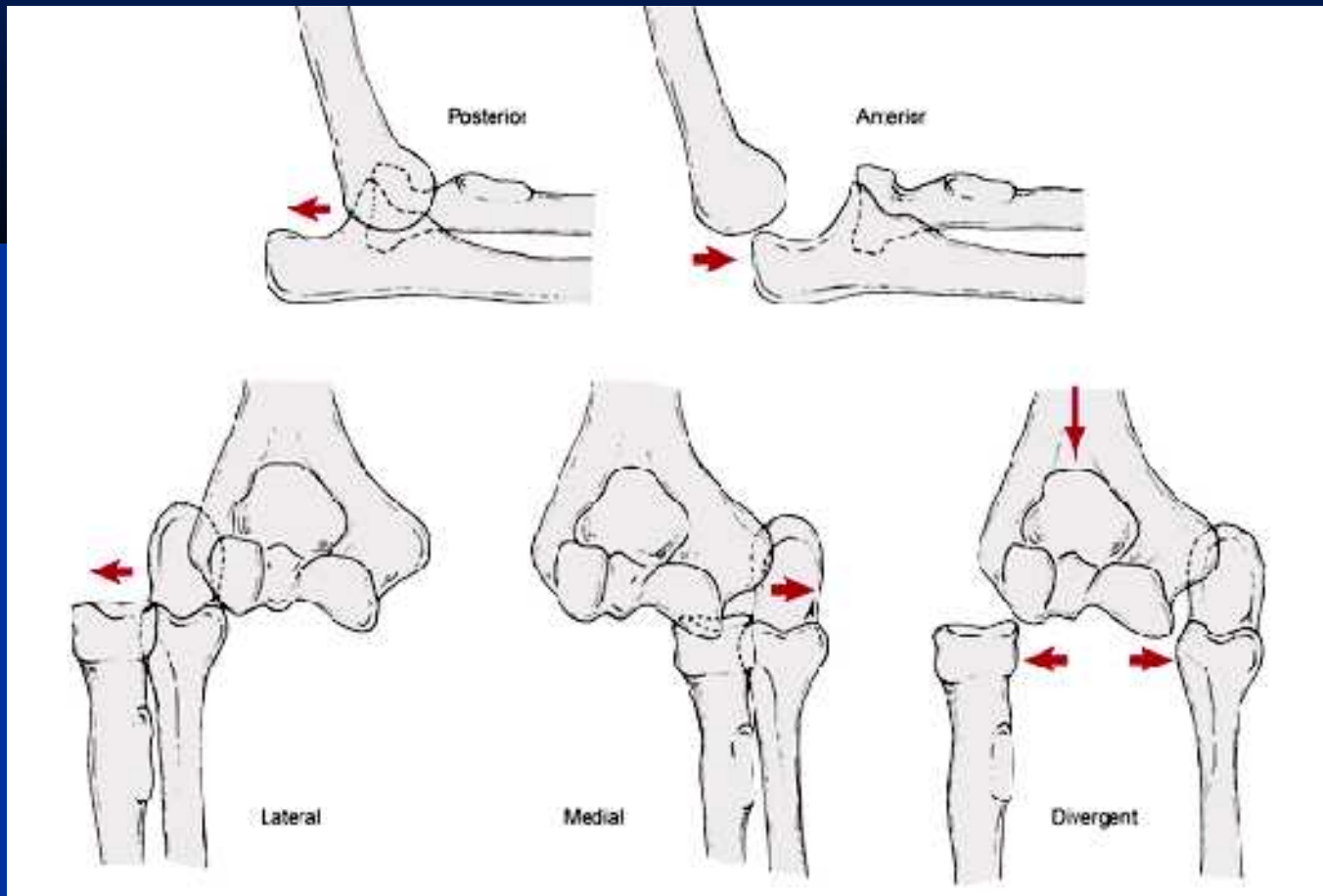
## **posterior or post.lat. dislocation :**

**mech of inj. :** FOOSH while elbow extended.

**Diagnosis:** -C.P it may ass. with neurovascular inj  
(median & ulnar n. & brachial a.)

- X—Ray.

# classification elbow Dislocation



# posterior elbow dislocation





# Treatment

## of posterior dislocation:

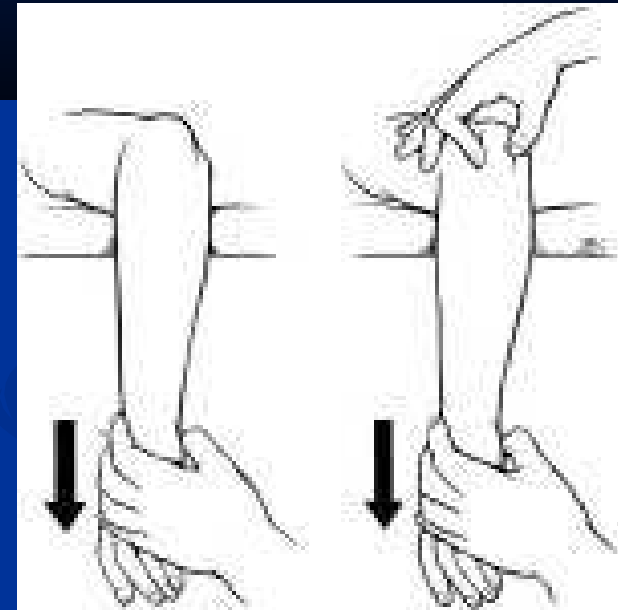
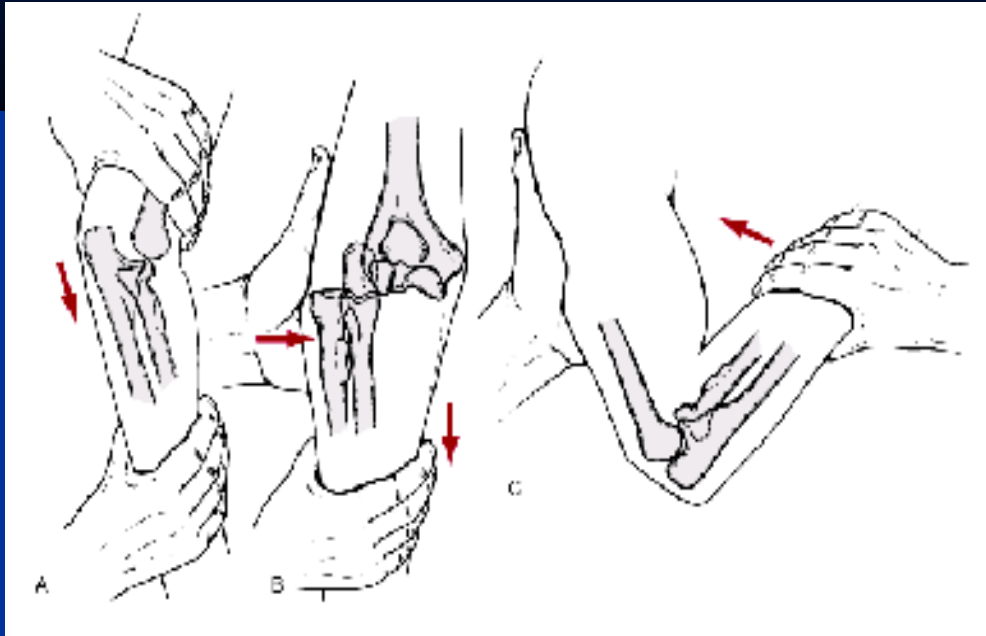
### I. Un complicated:

- close reduction: traction & counter traction of slightly flexed elbow, correction of lateral displacement. & olecranon Pressure.
- traction with **hyperext.** to unlock olecranon. from distal humerus.
  - dangers** is **entrapment of median n.** & trauma to brachialis.
- reduction **in prone** position if no assistant .

# Reduction

in prone position

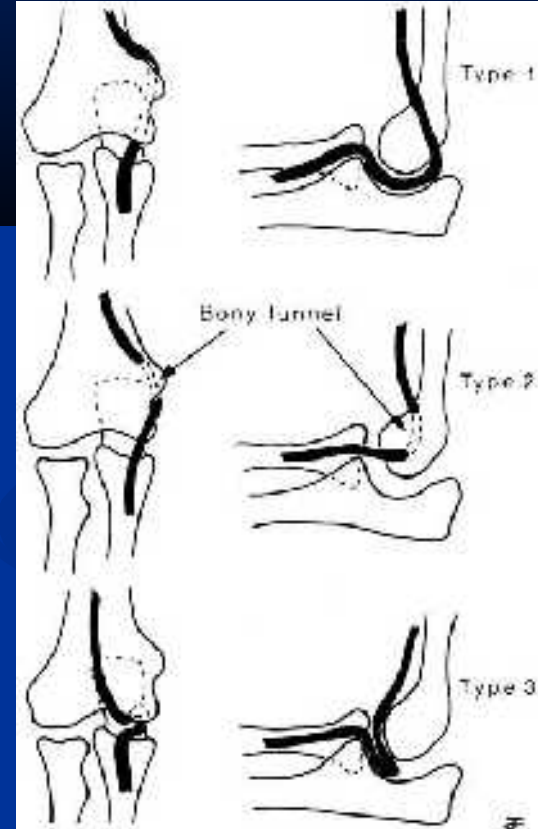
# Reduction in supine position



# Lock of olecranon in distal humerus



# Entrapment of median n



# Treatment

## of posterior dislocation:

- **II. Complicated:** associated with :
  - 1 -coronoid#      2 - radial head #.
  - 3 -olecranon #      4 -medial epicondylar# .
- 1.Dislocation with coronoid #:treated as before.
- 2. Dislocation with radial head #:
  - a.** we try to preserve radial head especially if associated with coronoid# or medial lig.- by O.R. I.F.
  - b.** if# irreducible:-\*stitch of med. lig.& pronater mass& p.o.p for 3-4w then excision.
    - \*- or early excision &immobilization for 3-4w.  
but if the joint unstable ---  
temporal arthroplasty .

# Dislocation of elbow +radial head# + displaced coronoid# treated improperly with early excision of radial head &no coronoid I.F

- Dislocation of elbow  
+radial head#  
displaced coronoid#



+

improper  
treatment



after 5days

# Complication of Dislocation of elbow joint

1. **Stiffness & post traumatic arthritis .**
2. **Neurovascular injury.**
3. **Heterotopic calcification .**(severe inj. long immobilization, aggressive passive motion) .

**treatment:- NSAID & Radiotherapy but ineffective.**

-Resection of calcification but delayed till  
12 month.

-Early resection is contra indicated.

-passive motion also avoided.

## 4. Recurrent instability due to:

a. weak collat. Lig.

b. residual articular defect  
in trochlea or trochlear notch

c. ununited coronoid#

d. unhealed ant. Capsule.

- **Treatment:** b/s the cause not clear, so number of surgical procedures was tried :
  1. Block of tibial bone put on coronoid.
  2. Transfere of biceps tendon to coronoid.
  3. Creation of cruciating lig. from triceps & biceps .
  4. Collateral lig. Reconstruction.



***THE END***

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- هذه المحاضرة هي من سلسلة محاضرات تم إعدادها و تقديمها من قبل الأطباء المقيمين في شعبة الجراحة العظمية في مشفى دمشق, تحت إشراف د. بشار مير علي.
- الموقع غير مسؤول عن الأخطاء الواردة في هذه المحاضرة.

•This lecture is one of a series of lectures were prepared and presented by residents in the department of orthopedics in Damascus hospital, under the supervision of Dr. Bashar Mirali.

•This site is not responsible of any mistake may exist in this lecture.