PLEASE CLICK ON THE FOLLOWING LINK TO WATCH THE LECTURE ONLINE:-

https://www.youtube.com/watch?v=BLTkPPmNpeo&list=PLuBRb5B7fa_fRRpcuUO-I1JFGuAGVF9Qy&index=3

Elbow instability made easy

Dr. Ghandi Abbadi (MD)

MRCSEd

Hand and Upper Limb Surgeon

Orthopedic Specialist

Outlines

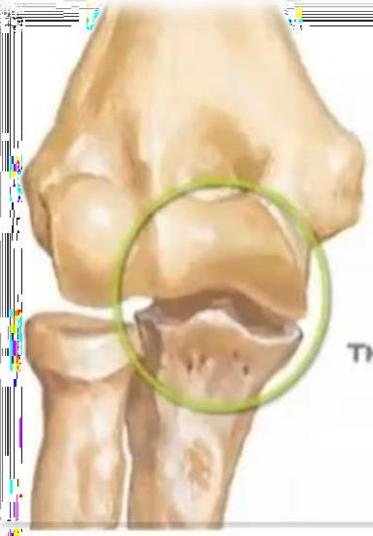
- Definitions
- Elbow function
- Anatomy
- ER
- Mechanism
- Diagnosis
- Treatment Guidelines
- Surgical Notes

Elbow Instability

- Elbow instability refers to rupture or stretching out of one of the main ligaments that keeps the elbow from dislocating or subluxing ("partial dislocation").
- This may occur following:
  - trauma
  - repetitive stress and strain to the ligament.
- Often, instability is not obvious to the patient but rather manifests as pain or a decrease in athletic performance (such as loss of pitch speed and endurance in a throwing athlete).
- Rarely, patients are able to actually pop the elbow out of joint and have had a history of dislocating the elbow in the past.

DEFINITIONS

- Stable
- Elbow

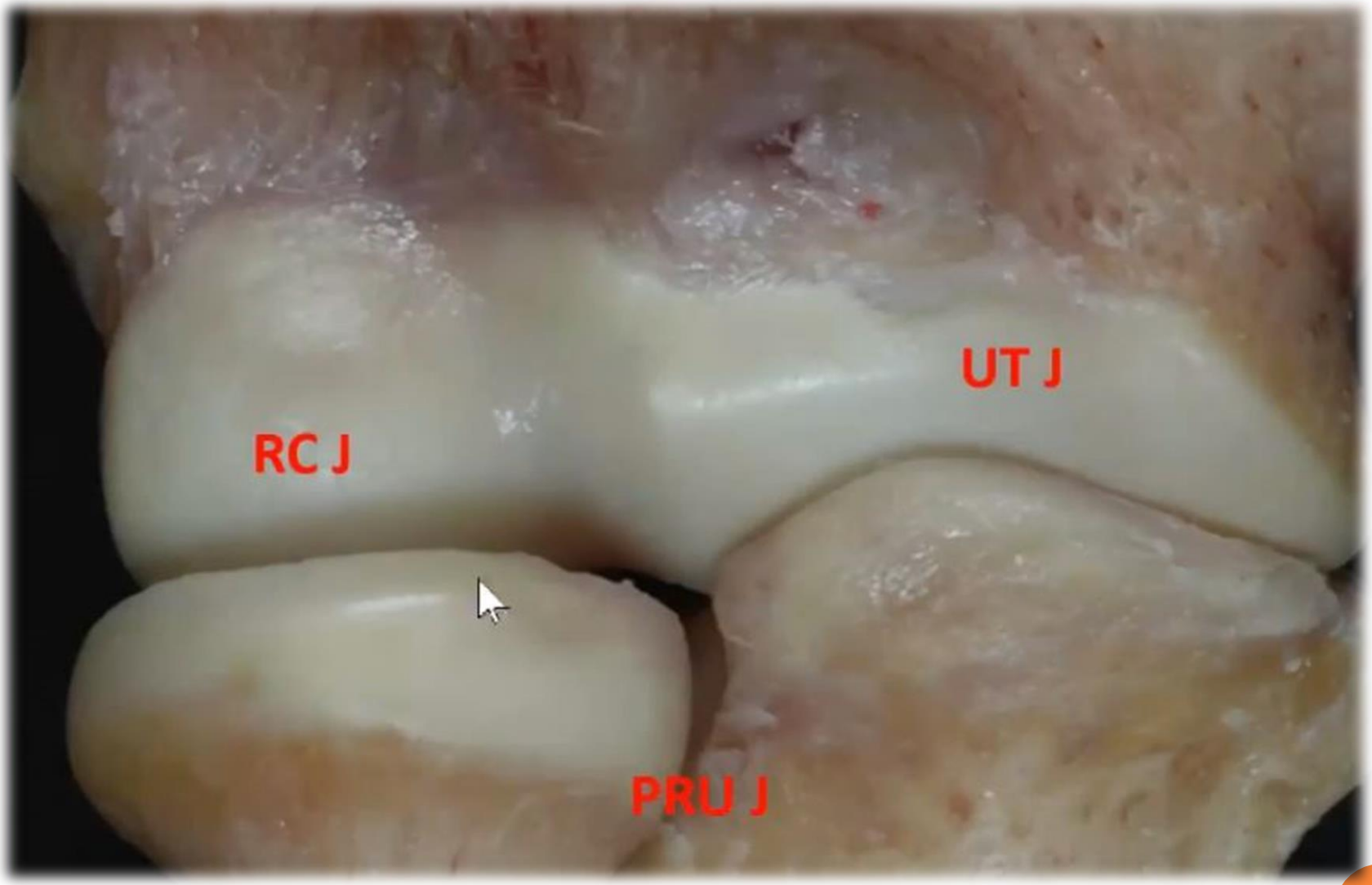


THE ULNOTROCHLEAR JOIN

THE RADIOCAPITELLOR JOINT

PROXIMAL RADIOULNAR JOINT

Elbow=3 articulations

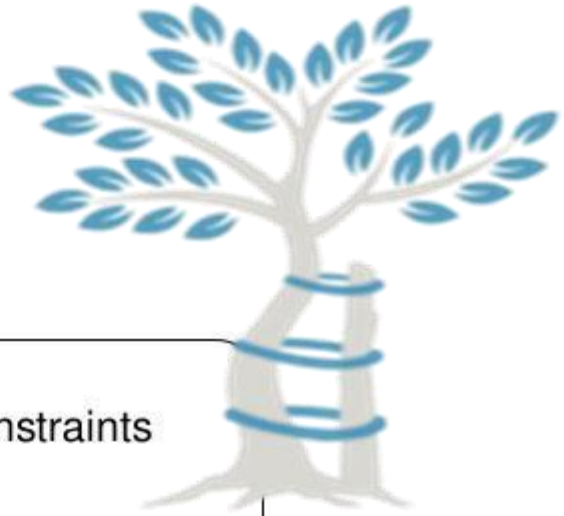

UT J
RC J
PRU J

Function of Elbow

- The elbow exhibits an elegant balance between:
  - marked **Stability**
  - large **Mobility**

- **Placing Hand in space** with the shoulder and the hand, with extreme importance in approximating and furthering the hand to body center
- provide stable axis for **forearm rotation**
- **Weight-bearing joint** in patients using crutches

Elbow Stabilizers



- Stability of the elbow - static and dynamic constraints

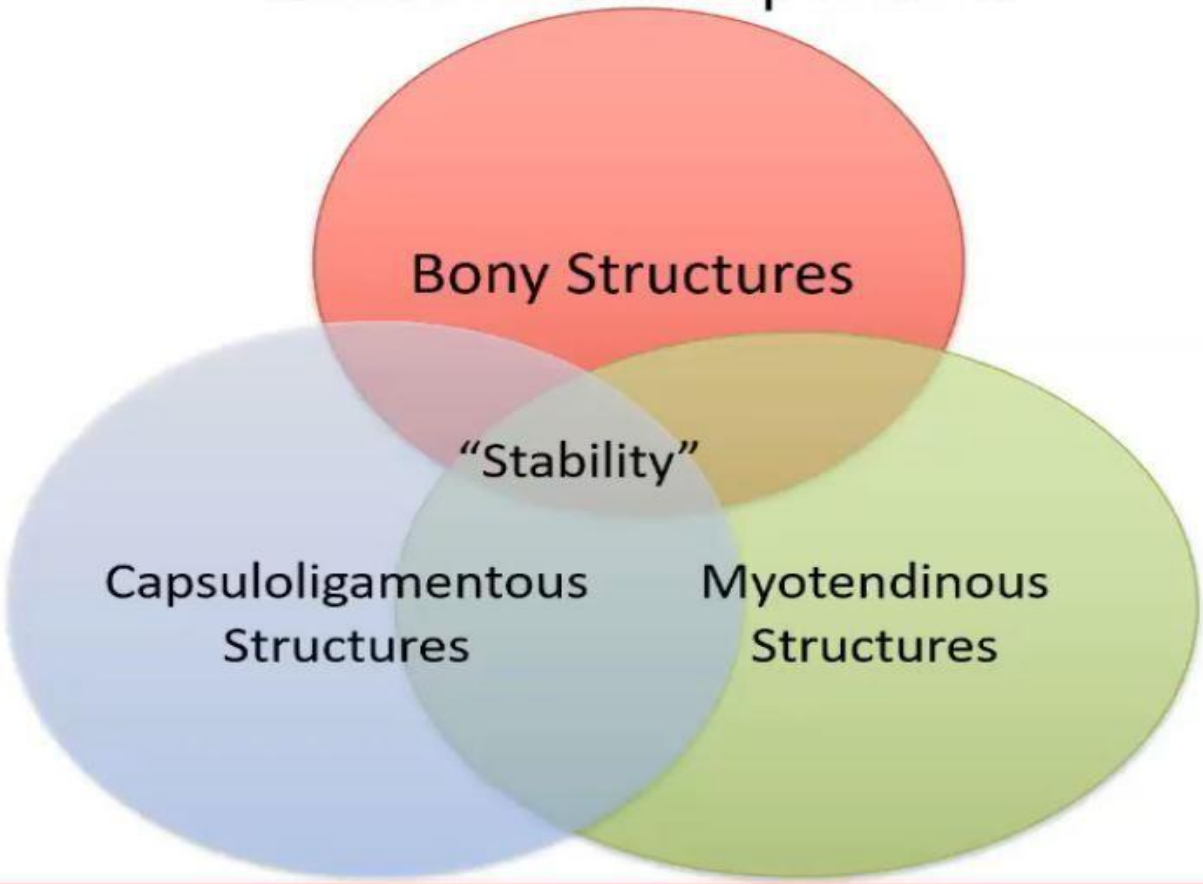
- **3 primary static constraints**
- Ulnohumeral articulation,
- the anterior bundle of the MCL
- the lateral collateral ligament (LCL) complex

- **4 Secondary constraints**
- Radiocapitellar articulation,
- the common flexor tendon,
- the common extensor tendon,
- the capsule.

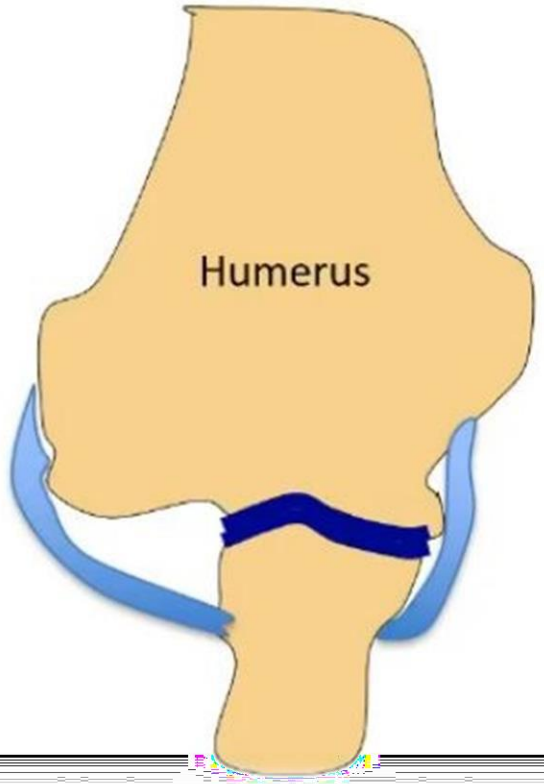
- **Dynamic stabilizers** - Muscles that cross the elbow joint

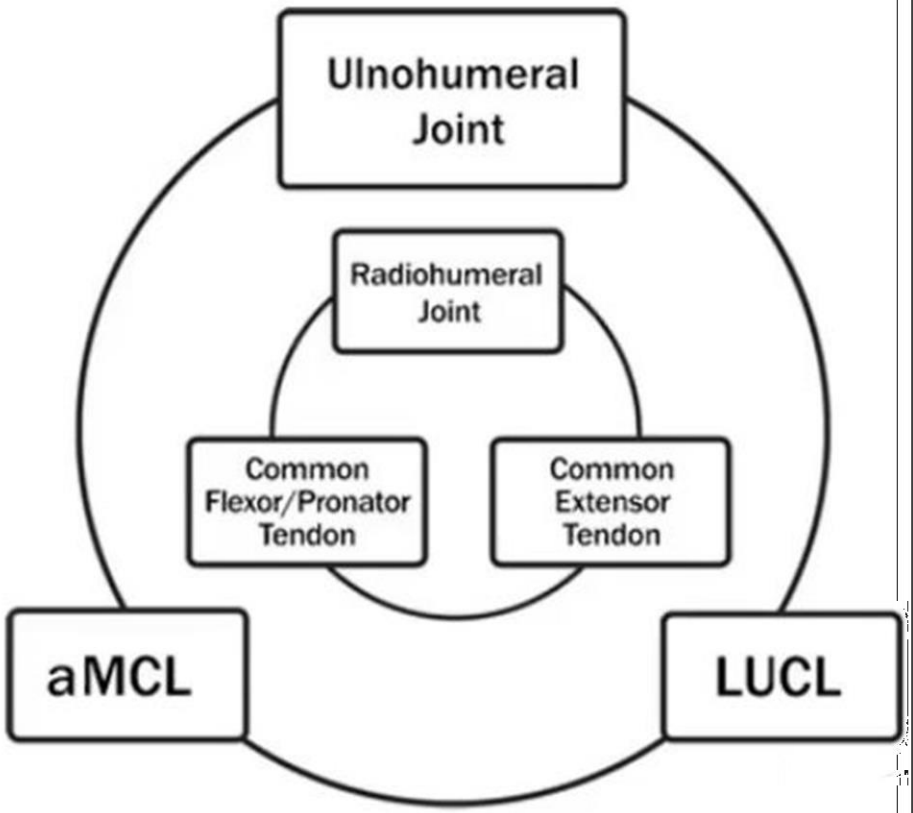
Elbow Joint Stability →high

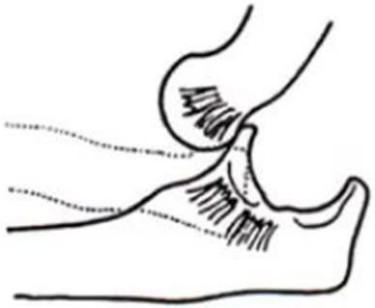
Interaction 3 components



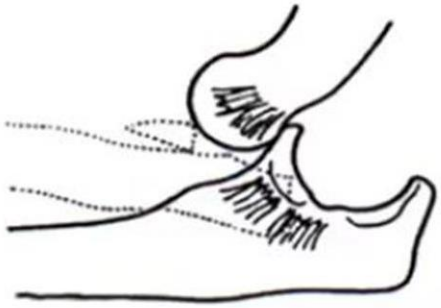
- Coordinated interaction between osteoarticular & soft-tissue constraints



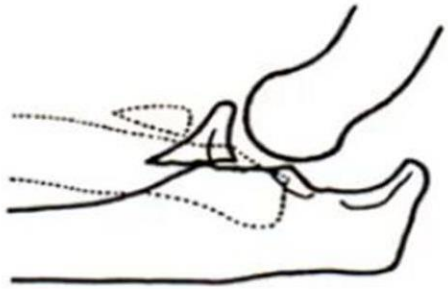




Dislocation



Dislocation
+
Radial head fracture



Dislocation
+
Radial head fracture
+
Coronoid fracture

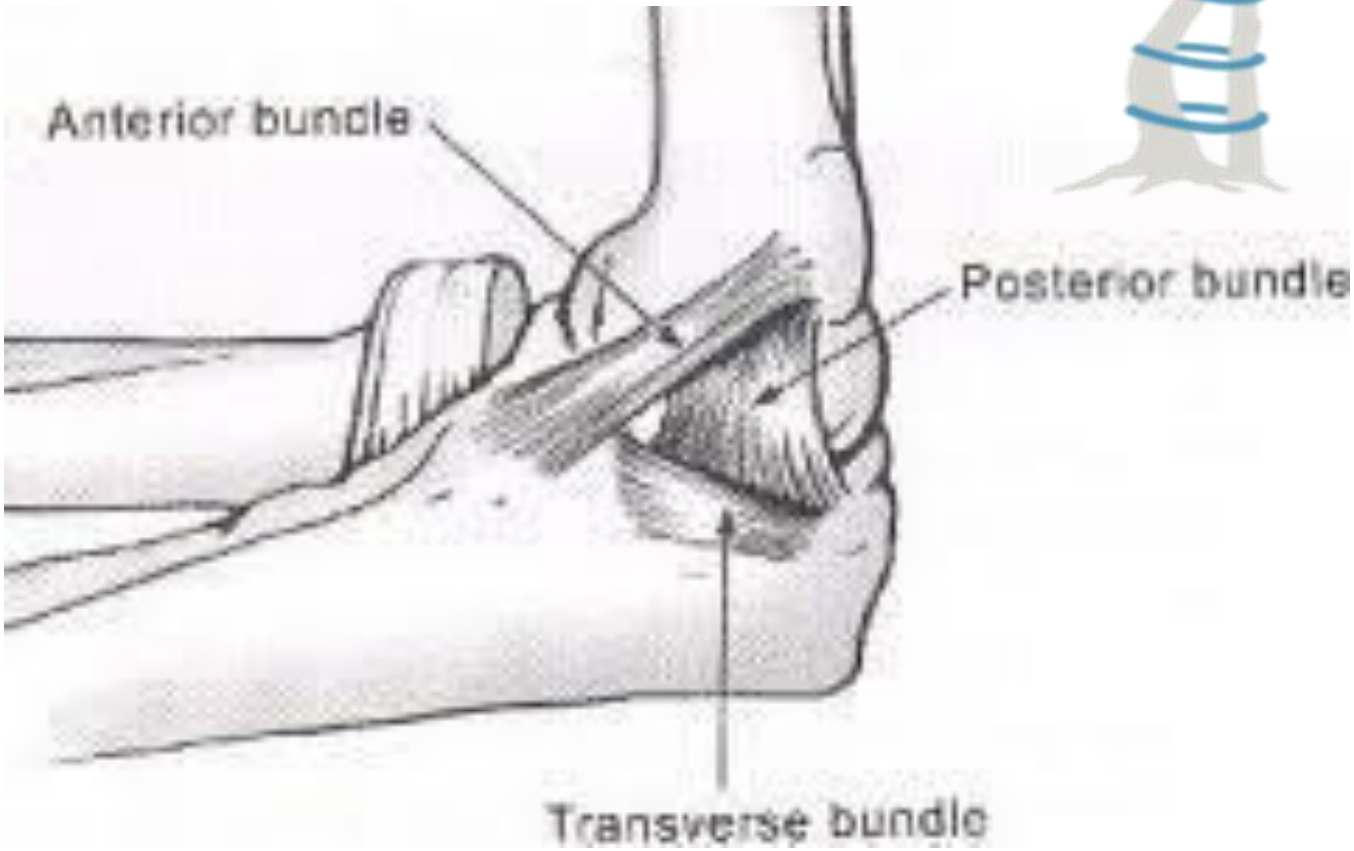
Stable

Unstable

Very unstable

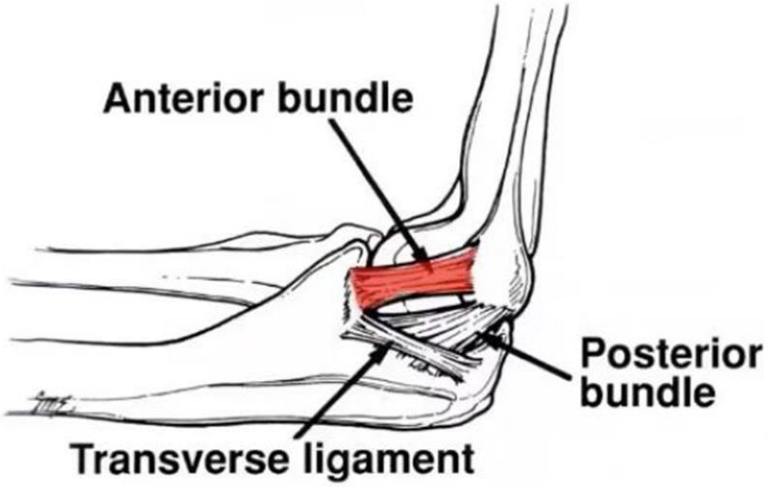
ANATOMY

MCL



MCL

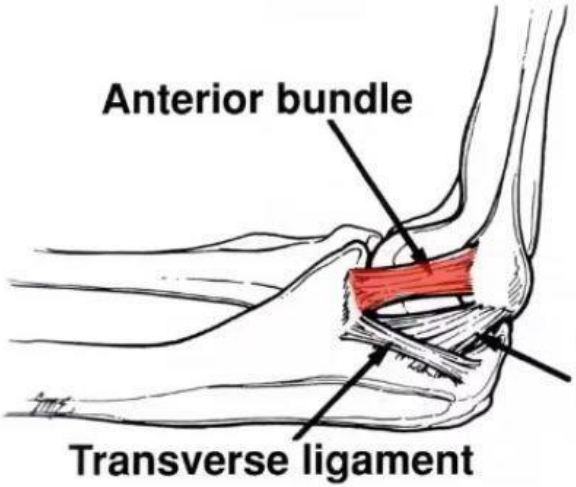
Anterior bundle MCL = primary stabilizer resisting **valgus stress**



Medial Epicondyle → Antero medial facet of coronoid

MCL

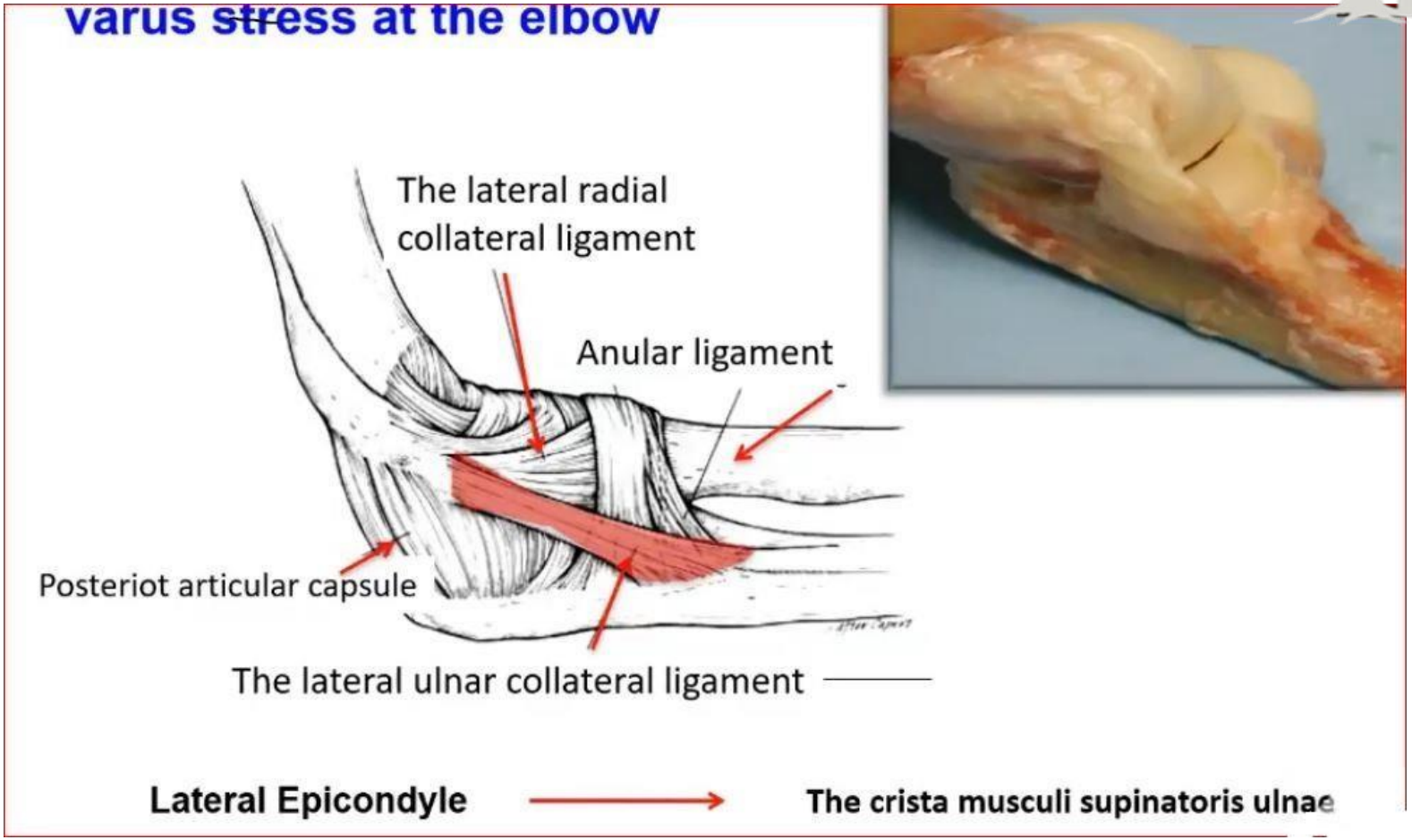
Anterior bundle MCL = primary stabilizer resisting **valgus stress**



Medial Epicondyle → Antero medial facet of coronoid

Lateral Ulnar Collateral Ligament LUCL

Primary stabilizer to



How to Approach

- Hx
- P.E
- Investigations
- Treatment

HISTORY

- Age
- CC
- Duration
- Mechanism
- Dislocation? reduction?
- LOC
- Eye Witnessed
- Occupation, sport?
- Comorbidities, medications
- Hx of dislocations

P.E

- ATLS
- Other injuries, wrist, shoulder
- N/V
- Look
- Feel
- Move
- Special tests

INVESTIGATIONS

- XRAYS
- CT
- MRI ??

What to see in X-ray& CT

- Alignment.
- Congruity HU, RC.
- Symmetry.
- Fractures of:
  - Radial head.
  - Coronoid.
  - Olecranon.
  - Avulsion in medial or literal condyle s.

STRESS TESTS

REDUCTION

Pathophysiology of most elbow injuries

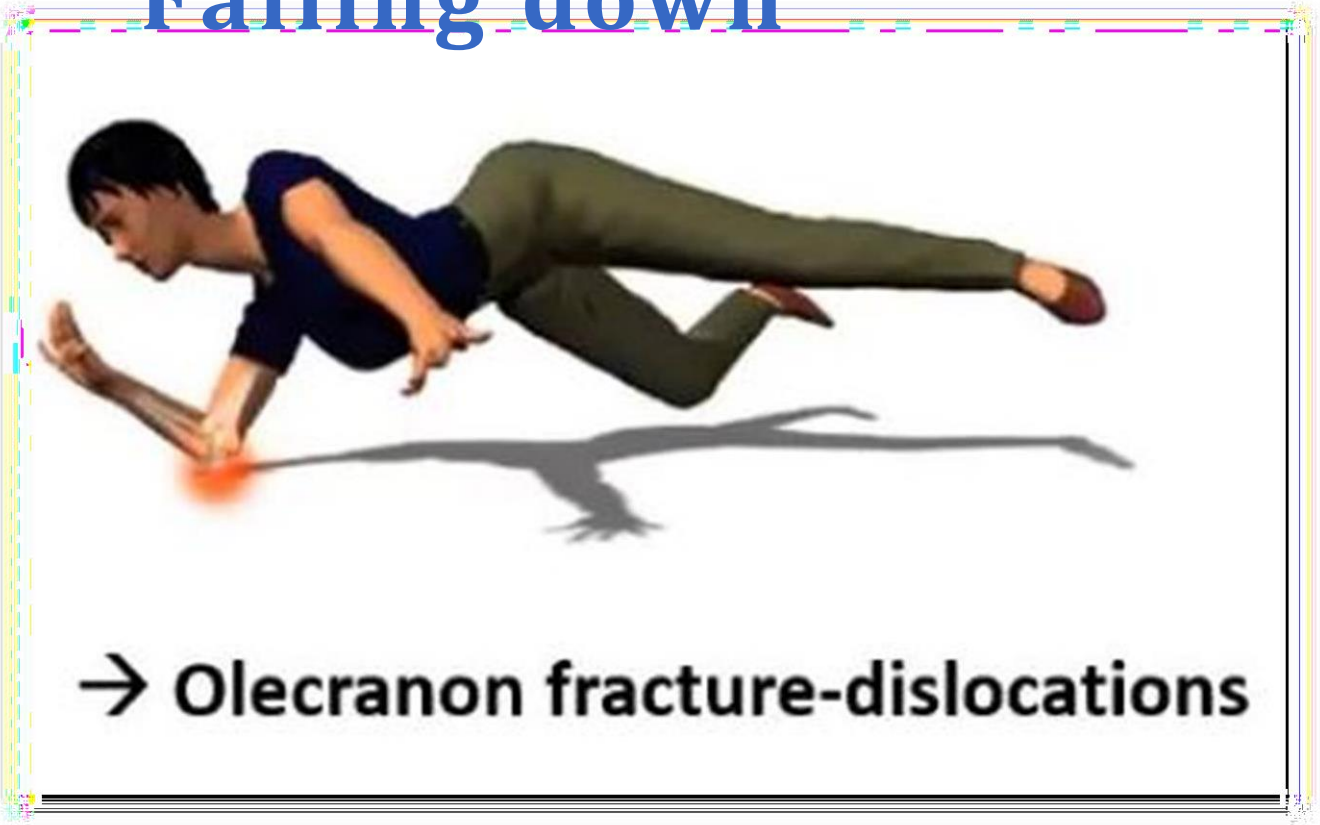
Pathophysiology of most elbow injuries

Direct Trauma
Fall on Elbow

Fall on the outstretched hand
Indirect Trauma

Direct Trauma

Falling down



→ Olecranon fracture-dislocations

Pathophysiology of most elbow injuries

Indirect Trauma

FOOSH

Pathophysiology

Fall on the outstretched hand

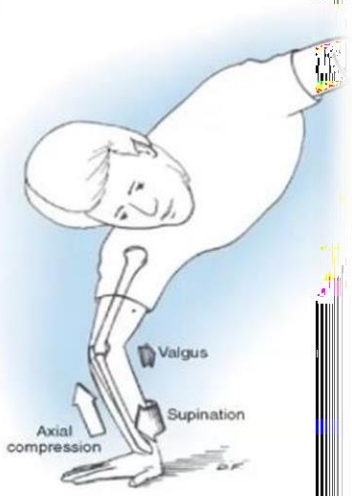
Axial loading
Usually **Shoulder abducted**
Low energy

Forced flexion:

> **Supination (external rotation) + Valgus = PLRI**

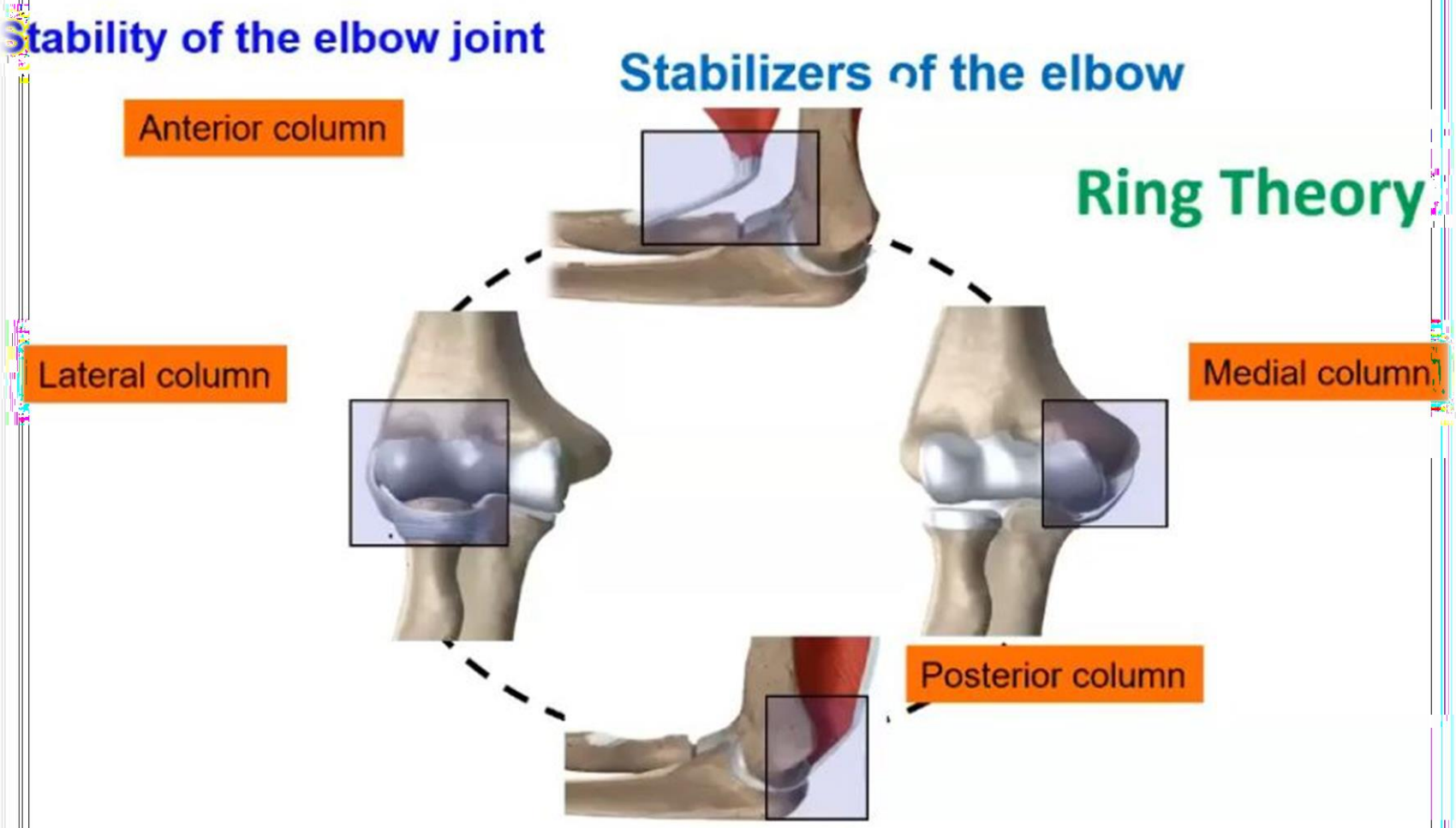
OR

> **Pronation (internal rotation) + Varus** (less common) **= PMVRI**



VIDEOS

Stability of the elbow joint



Stability of the elbow joint

Stabilizers of the elbow

Ring Theory

Anterior column

1. Coronoid process
2. Anterior aspect of capsule
3. Brachialis muscle

Lateral column

Medial column

Posterior column

1. Olecranon process
2. Posterior aspect of capsule
3. Triceps muscle

Stability of the elbow joint

Stabilizers of the elbow

Ring Theory

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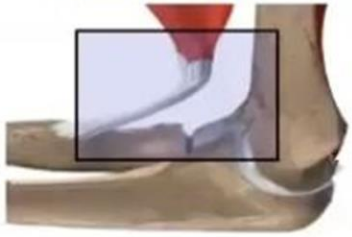


Lateral column

Radial head
Capitellum
Lateral coll. lig. complex

Medial column

Medial coll. lig.
Coronoid process
Trochlea

Posterior column

Olecranon process
Posterior aspect of capsule
Triceps muscle

Patterns/ Spetrum of traumatic elbow instability

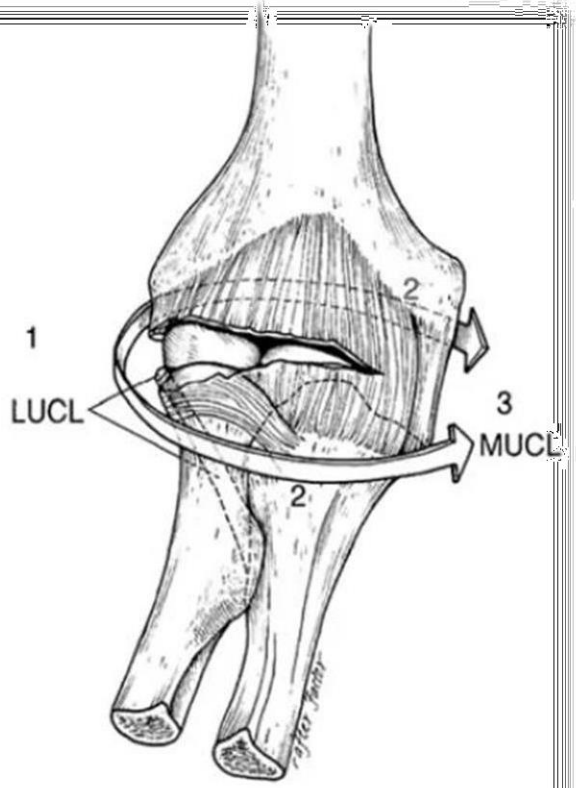
A- **Simple Dislocations** (no fractures)

B- Instability + Fractures

Simple Dislocations

(no fractures)

- In most elbow dislocations, both the MCL and LCL are avulsed from the epicondyles
- Possible for the elbow to dislocate with the MCL intact

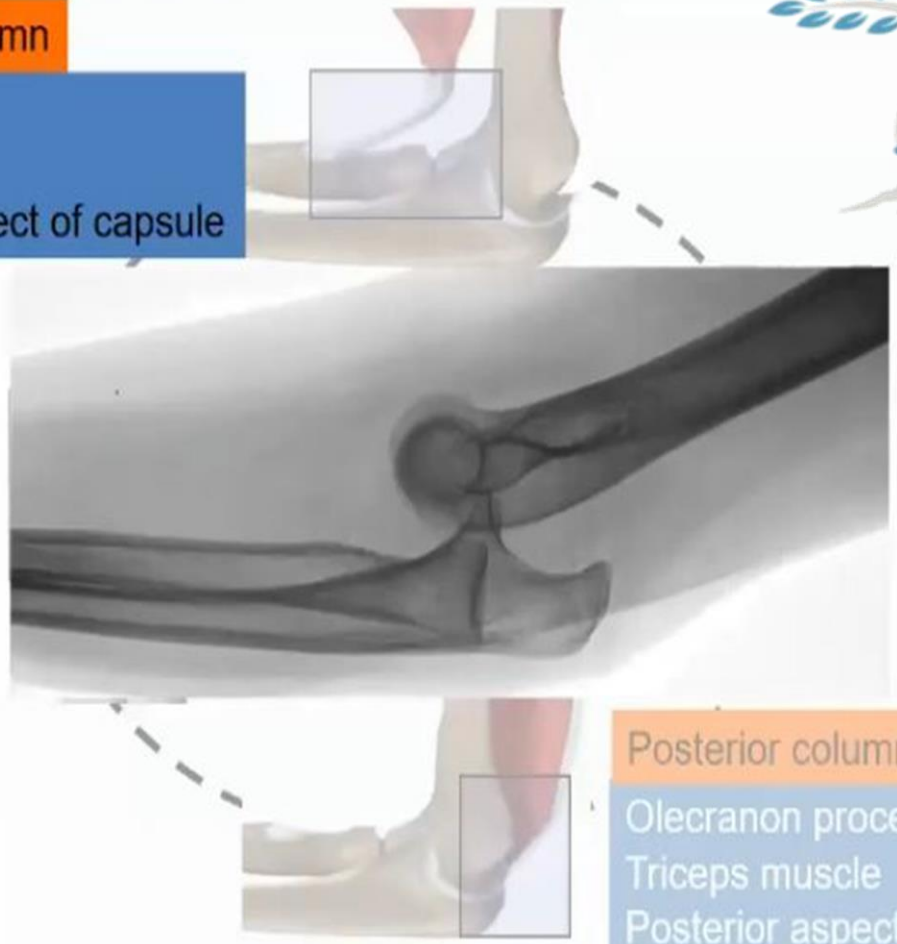


O'Driscoll's ring of instability

Stabilizers of the elbow

Anterior column

Anterior aspect of capsule



Lateral column

Lateral coll. lig. complex

Medial column

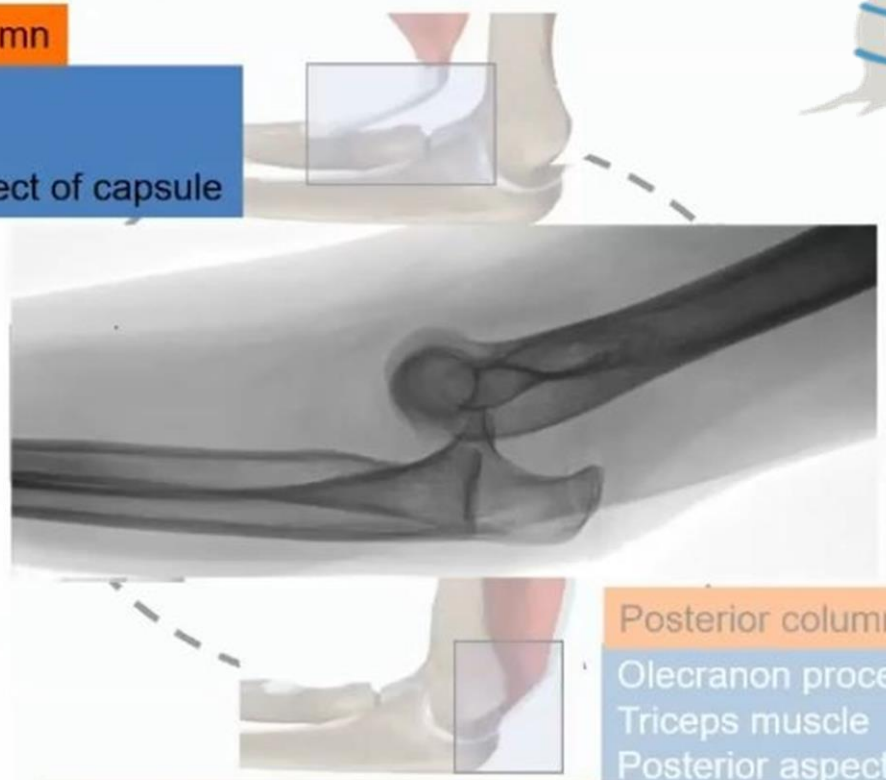
Medial coll. lig.

Posterior column

Olecranon process
Triceps muscle
Posterior aspect of capsule

Multiple column soft tissue injury with dislocation

Stabilizers of the elbow



Multiple column soft tissue injury with dislocation

Pure Dislocation

Simple Dislocations

(no fractures)

- After reduction, simple elbow dislocation is treated with:
  - Brief (less than 2 weeks) immobilization
  - Followed by active mobilization and self-assisted stretching

Patterns/ Spetrum of traumatic elbow instability

A- **Simple Dislocations** (no fractures)

B- Instability + Fractures

1. **Fracture with instability**: PMVRI (subluxation)
2. **Fractures Olecranon & Dislocation of Radius**:

   Anterior or Posterior (**Fracture-Disruption**)
3. **Fractures Dislocations** PLRI

Patterns of traumatic elbow instability

1. **Fracture with instability**: PMVRI (subluxation)

Varus posteromedial rotational instability

Patterns of traumatic elbow instability

2. Fractures Olecranon & Dislocation of Radius:

(Fracture-Disruption)

Varus posteromedial rotational instability

Olecranon fracture-dislocation

Patterns of traumatic elbow instability

3. Fractures Dislocations PLRI

Dislocation

With # radial head only

radial head + Coronoid
= (terrible triad)

Patterns of traumatic elbow instability

Varus posteromedial rotational instability

Olecranon fracture-dislocation

Anterior

Posterior

Dislocation

With # radial head on

radial head + Coronoid
= (terrible triad)

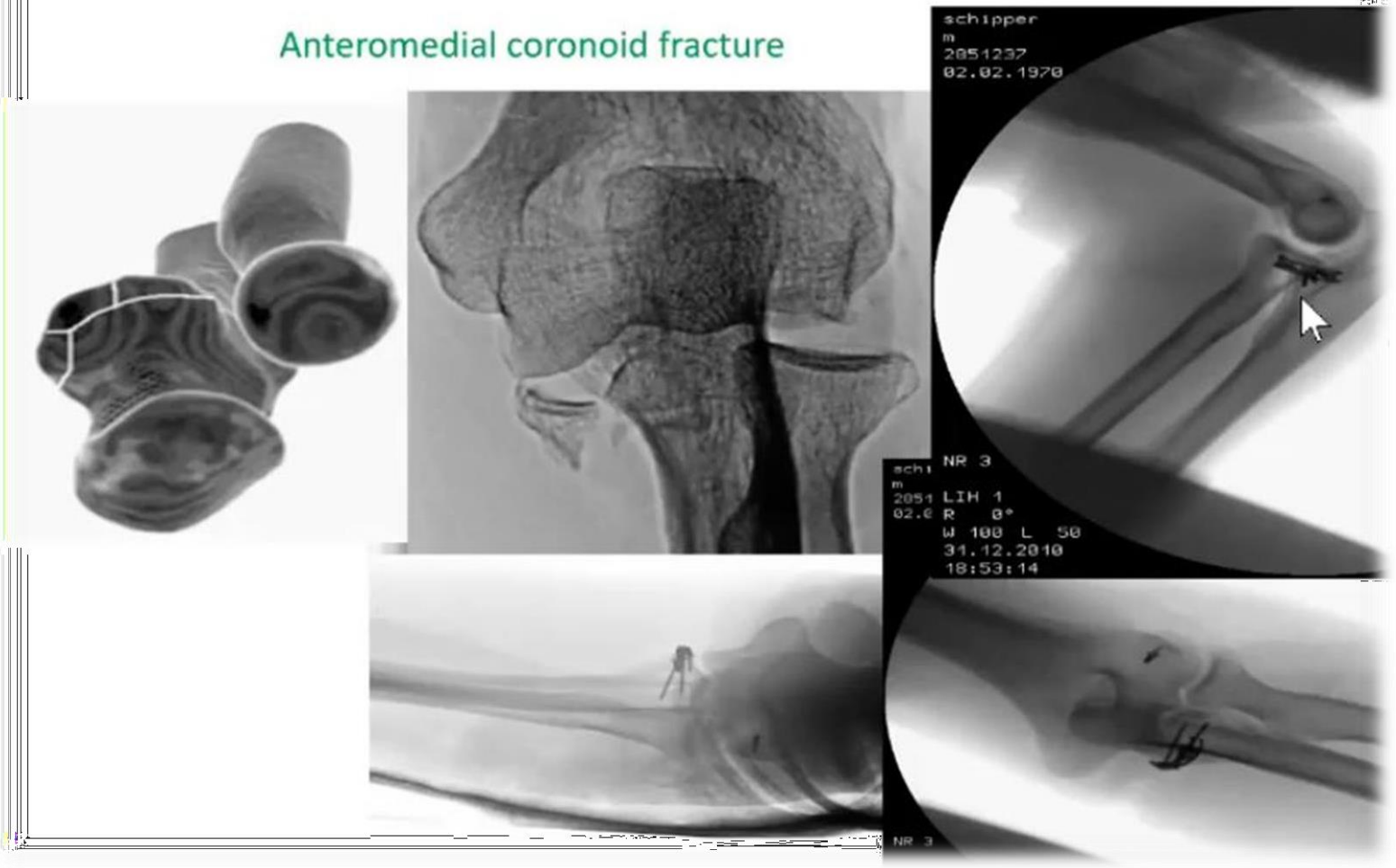
1. Fracture with instability: PMVRI (subluxatio

Posteromedial varus rotational instability

=Anteromedial coronoid fracture

Posteromedial varus rotational instability pattern injury

Anteromedial coronoid fracture



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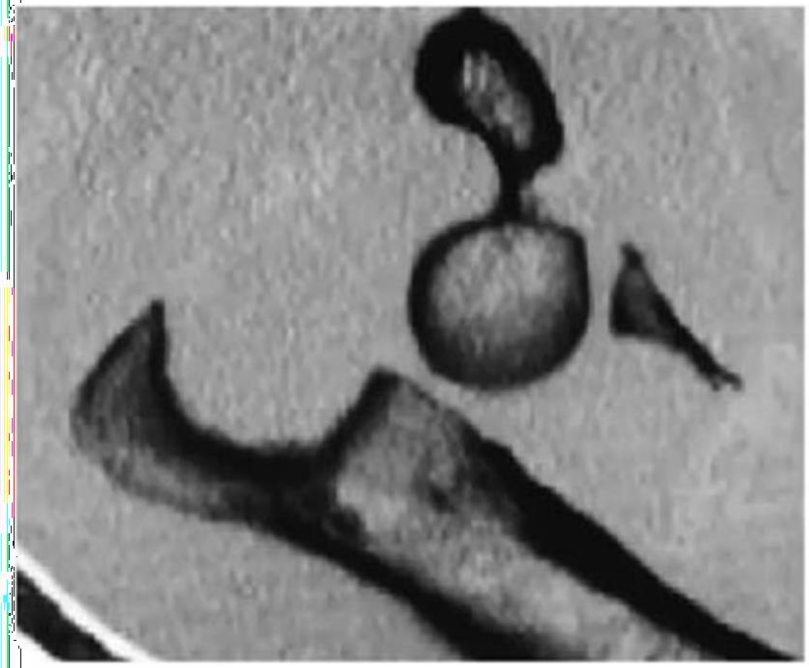
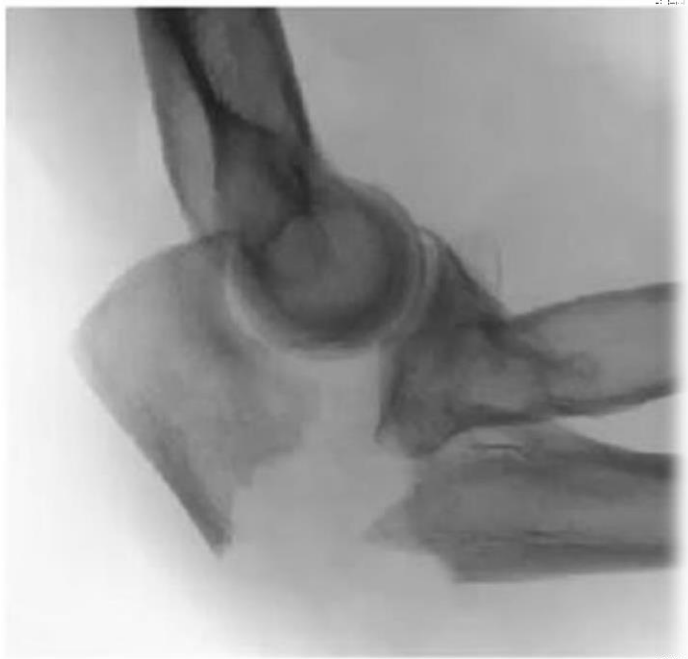
Dislocation vs disruption

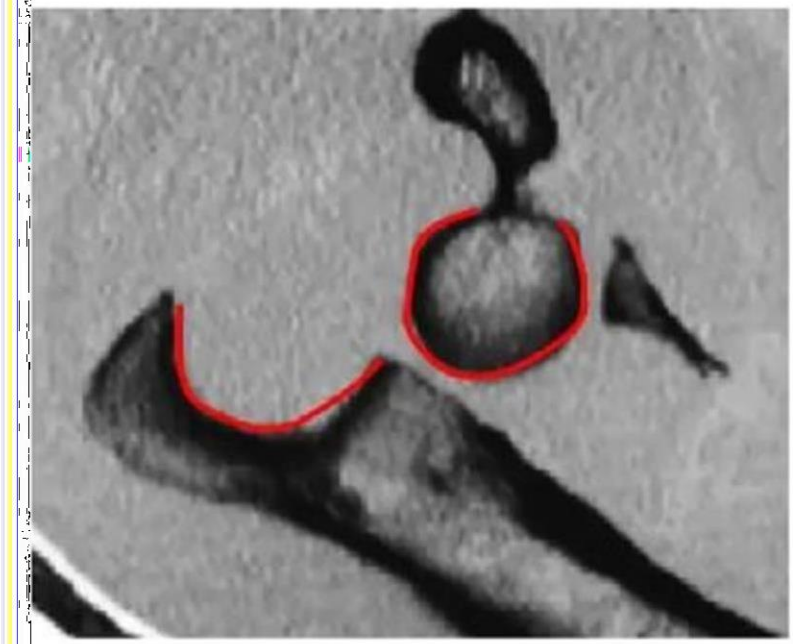


Dislocation



Disruption

Dislocation vs disruption



Dislocation

Disruption

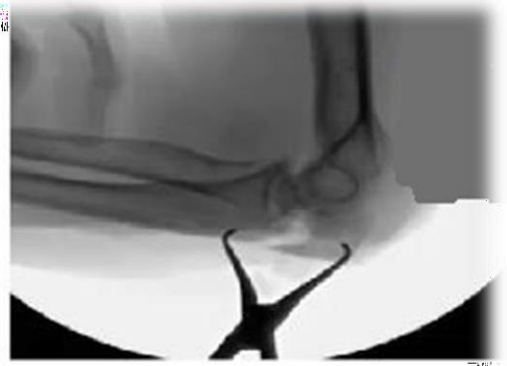
Trans-Olecranon Fx-dislocation

Trans-olecranon Fx-dislocation

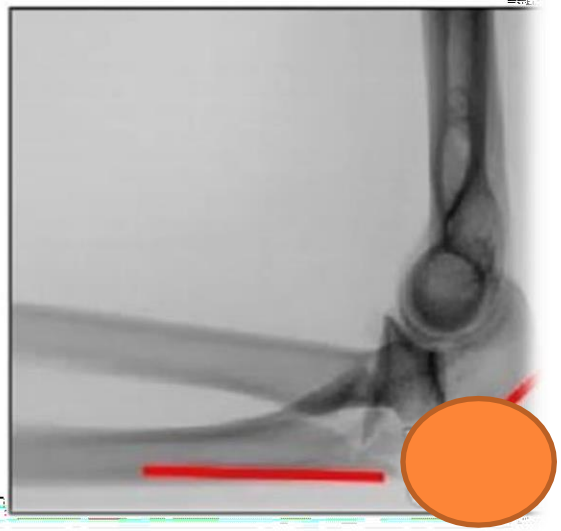
- Humerus driven through the ulna
- PRUJ intact!
  - coronoid and ligaments intact
- Ulna and radius go
  - Anterior

Trans-Olecranon Vs Monteggia

Both Require Anatomic Restoration Of Ulna



- **Trans-olecranon**:
  - Restoration of the **trochlear notch to coronoid** indirectly reduces dislocation via ligamentotaxis
- **Monteggia**:
  - Axial alignment of the **diaphysis** long plate



The " Terrible Triad"

The "Terrible Triad"

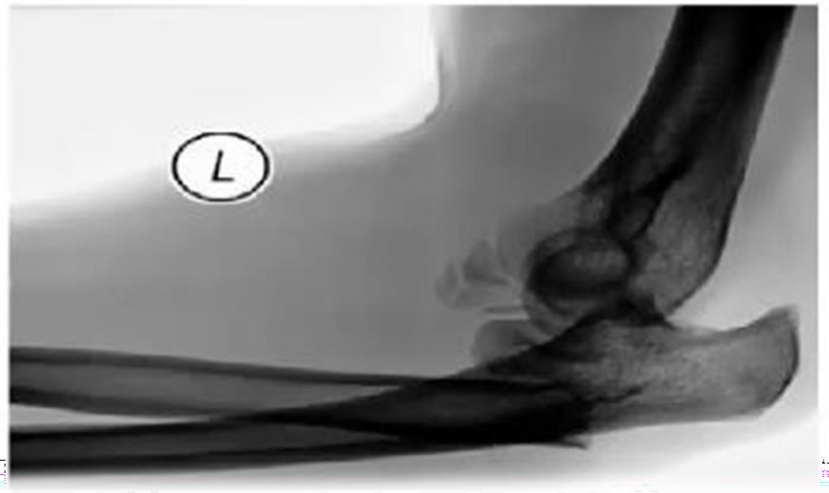
Historically ***"terrible"*** outcomes

Chronic instability, arthrosis and pain

Josefsson et al., COOR 1989
Ring et al., JBJS 2002

The "Terrible Triad"

Fracture dislocation Elbow with Radial Head & coronoid Fracture
= Multiple Stabilizers of the elbow
= Terrible Triad



Fracture dislocation Elbow with Radial Head Fracture
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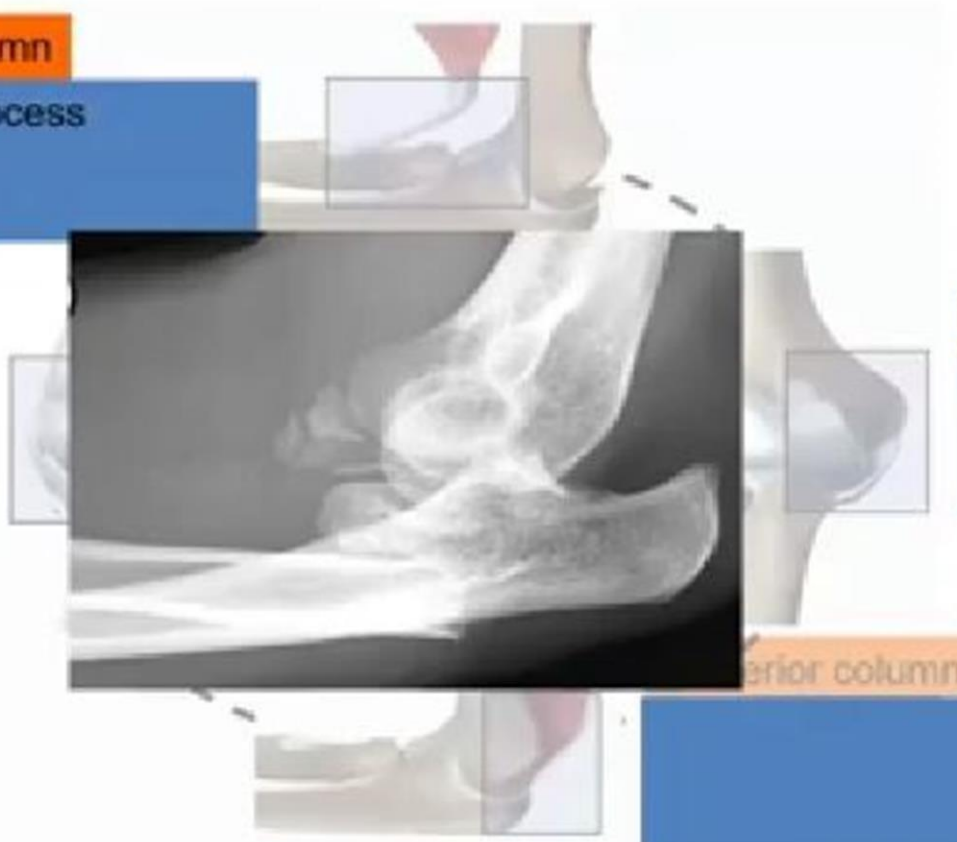
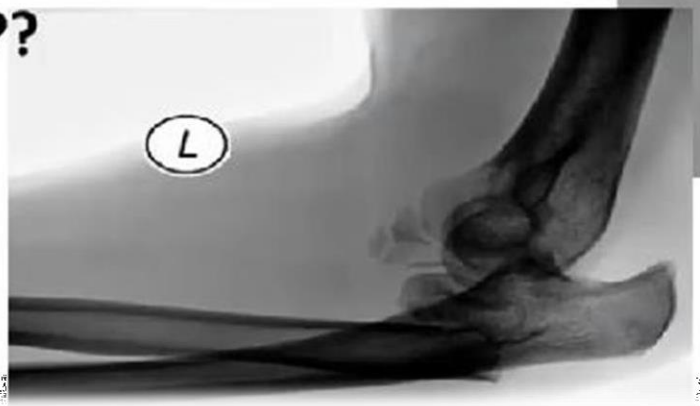


Multiple column fracture dislocation=terrible triad

1. (Small) coronoid fracture avulsion
2. Radial head fracture
3. Rupture of the lateral collateral complex
4. MCL rupture??



Terrible Triad Treatment Algorithm

- Coronoid : fix or repair
- Radial Head : fix or replace
- LCL : repair or reconstruct
- If still unstable : MCL
- If still unstable: Ex. Fix

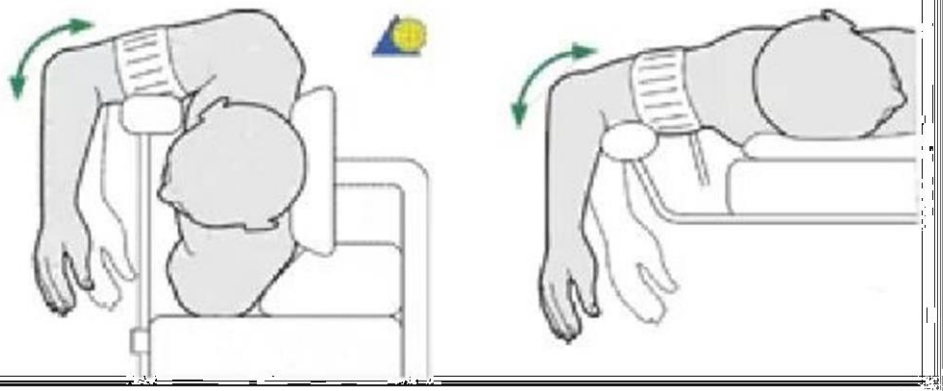

Terrible triad injury
Fluoroscopic examination
Lateral approach excise or retract radial head
Able to fix coronoid
Unable to fix coronoid
Fix or replace radial head and repair LCL
Fix or replace radial head and repair LCL
Elbow stable
Elbow unstable
Medial approach fix coronoid and repair MCL
Medial approach repair MCL
Elbow stable
Elbow unstable
Elbow unstable
Elbow stable
Apply external fixator
Apply external fixator

Approach choices

1- Two incisions

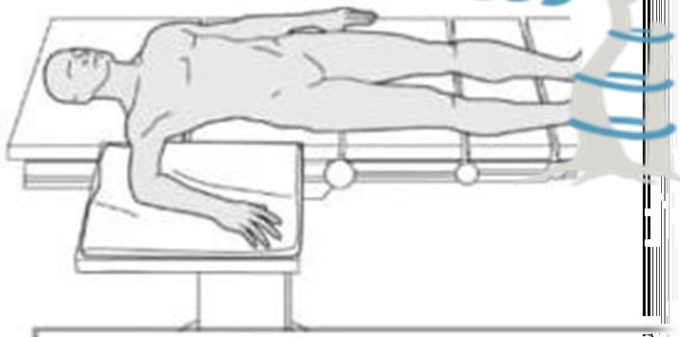
2- Extensile posterior approach

- Lateral decubitus
- Prone



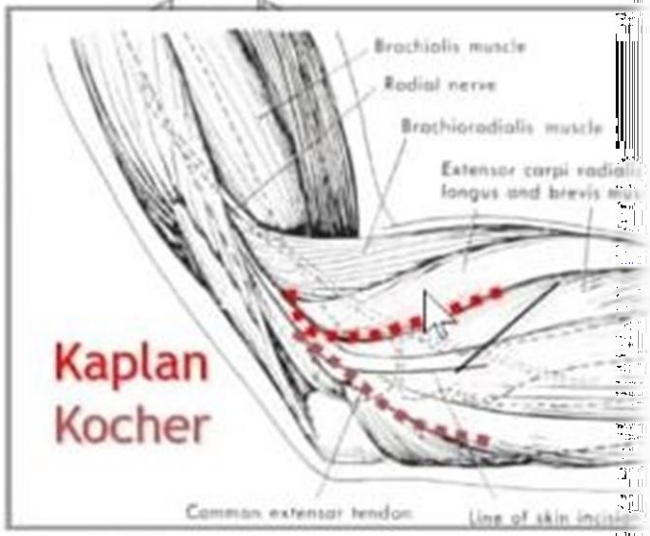
Lateral Approach

Approach choices



1- Two incisions

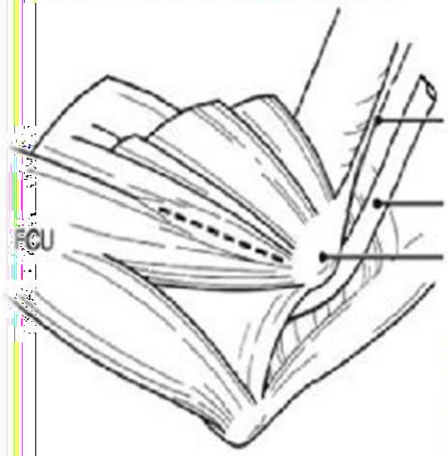
- **Lateral**
  - Kocher
  - Kaplan
- +/- **Medial**
  - “over the top” Hotchkiss
  - flexor carpi ulnaris Splitting



2- Extensile posterior approach

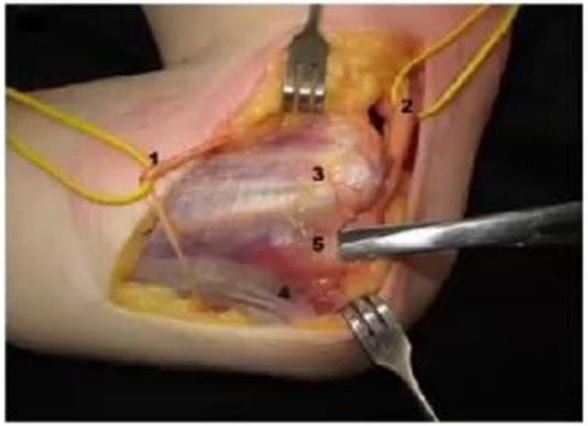
Over the top

(Small Coronoid)



Elevation of entire flexor pronator mass

(Large Coronoid)

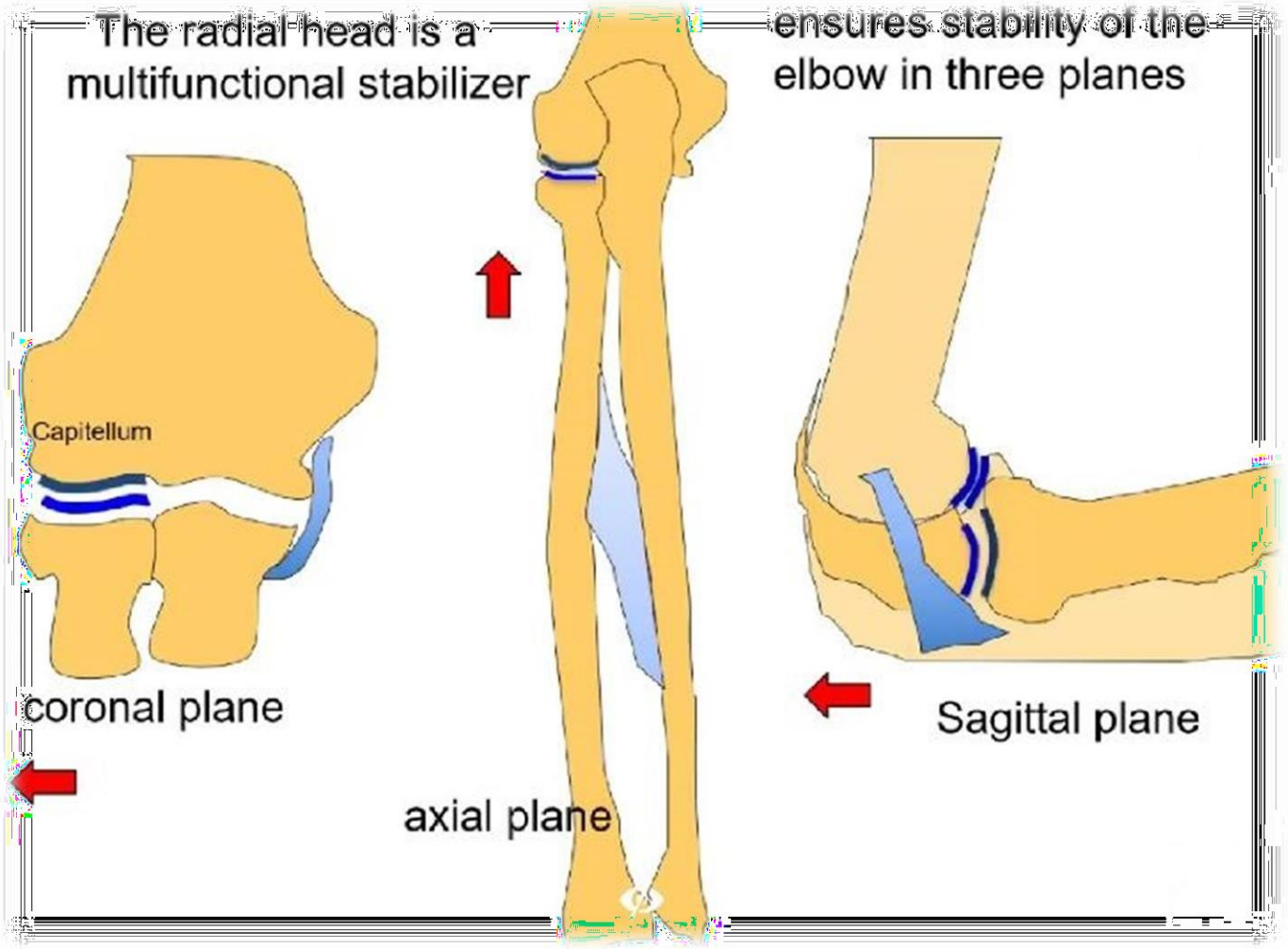


FCU splitting

(Medium Coronoid)

Radial Head Fracture

Radial Head Function



Radial Head fractures

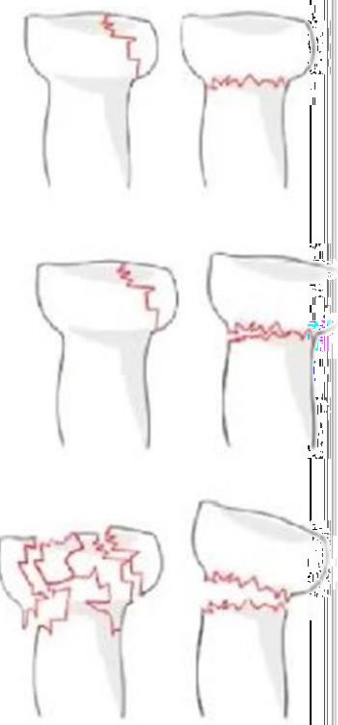
No Mechanical Block

Radial head fractures

1- **Nondisplaced** simple fractures (Mason type I) <2mm
   – Surgical **fixation unnecessary**

2- **Displaced/depressed** fractures (Mason type II)
   – **ORIF** fixation required

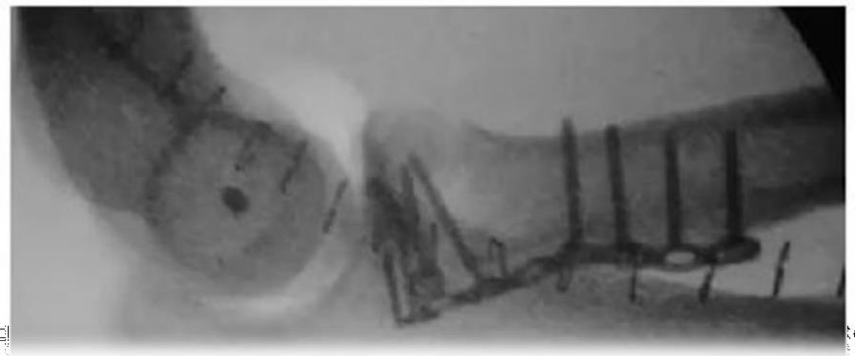
3- **Multifragmentary fractures** (Mason type III)
   =Not reconstructible comminuted Head or Neck
   – **Arthroplasty**
   – Excision (rare)



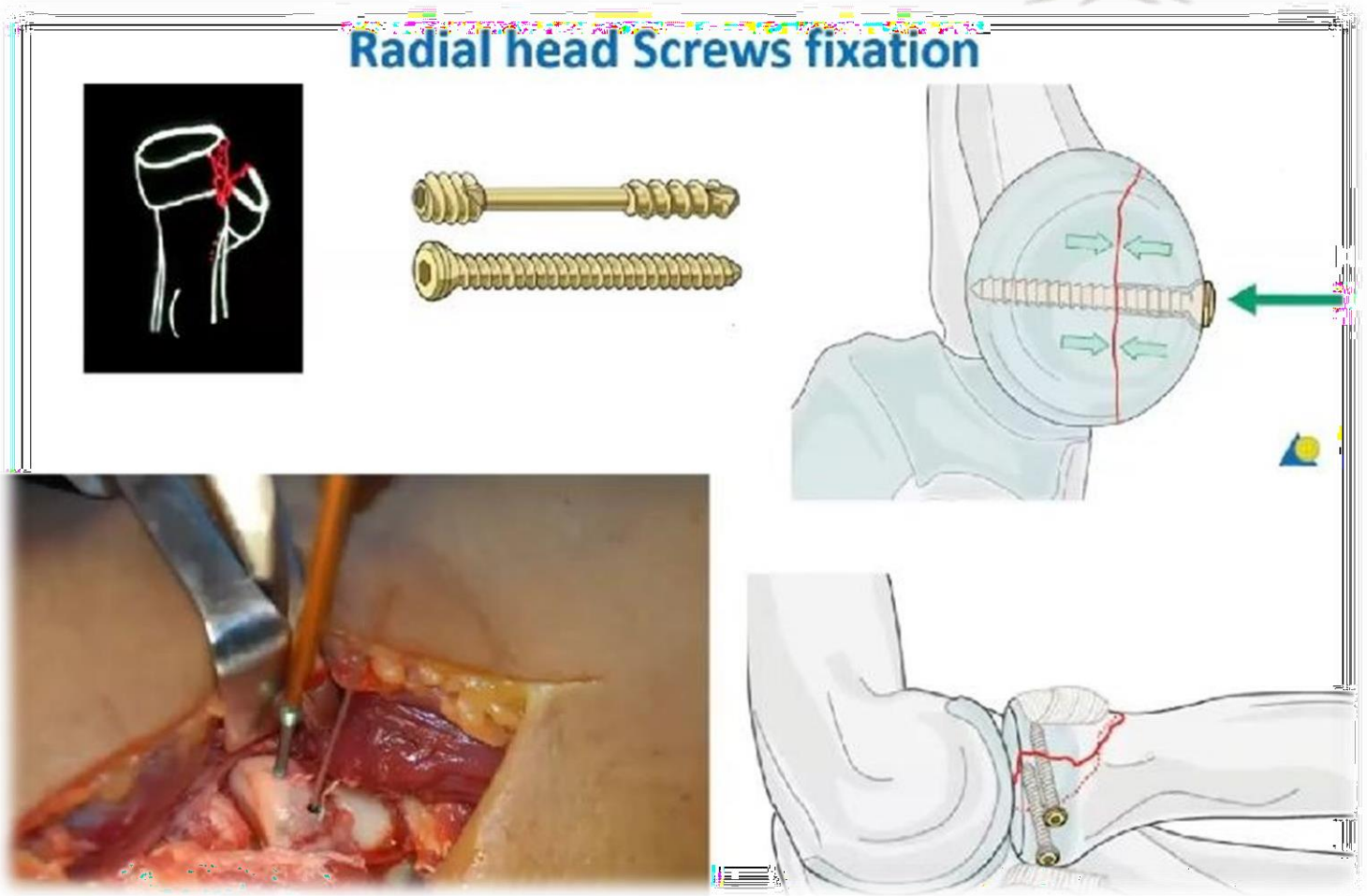
Radial Head-ORIF

Radial Head - **ORIF**

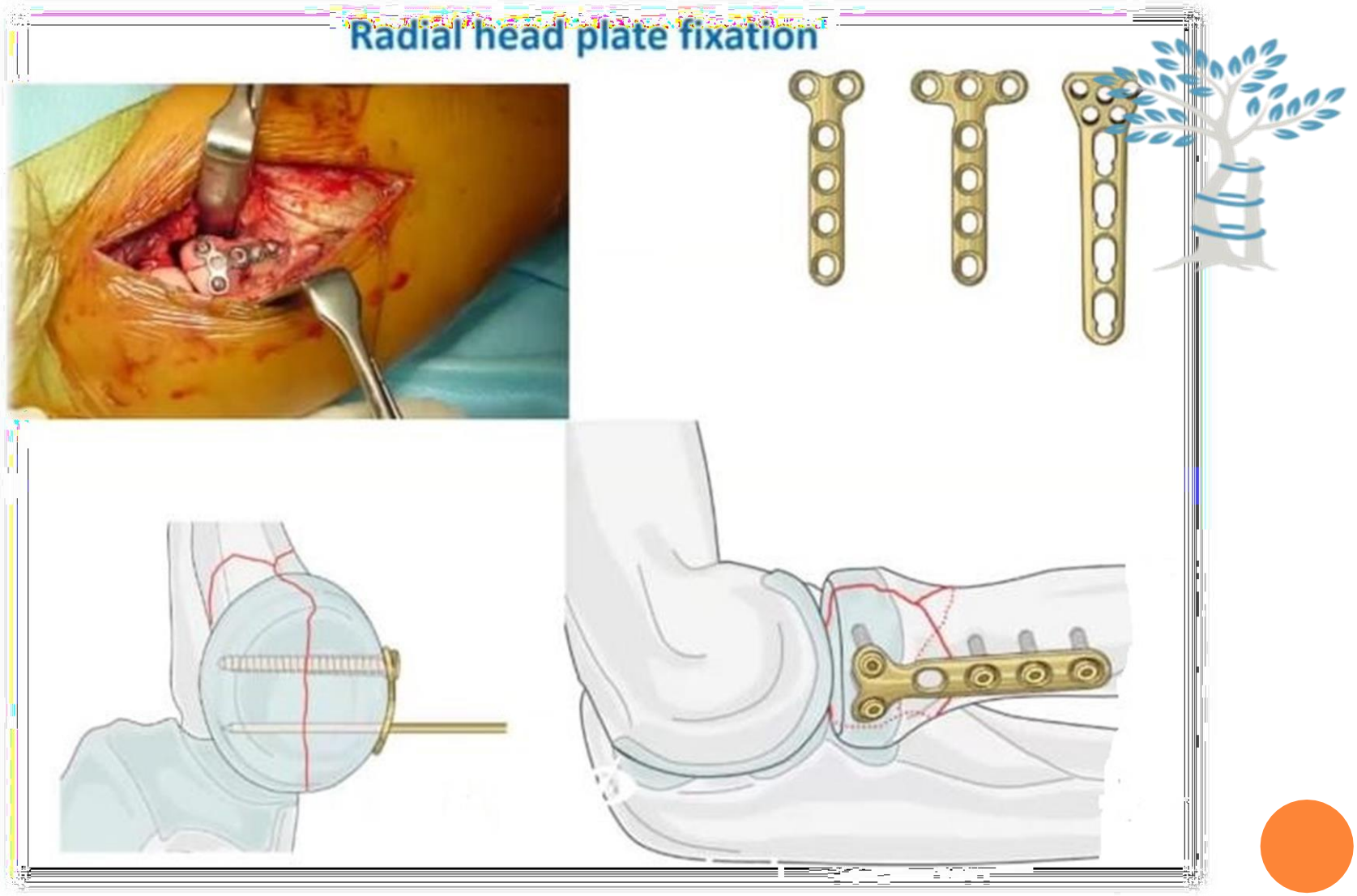
- **Screw fixation**
  - -Multiple screws into head
  - -Low profile to avoid impingeme
- **Plate** contoured/ Precontoured



Radial Head Screws fixation



Radial head plate fixation

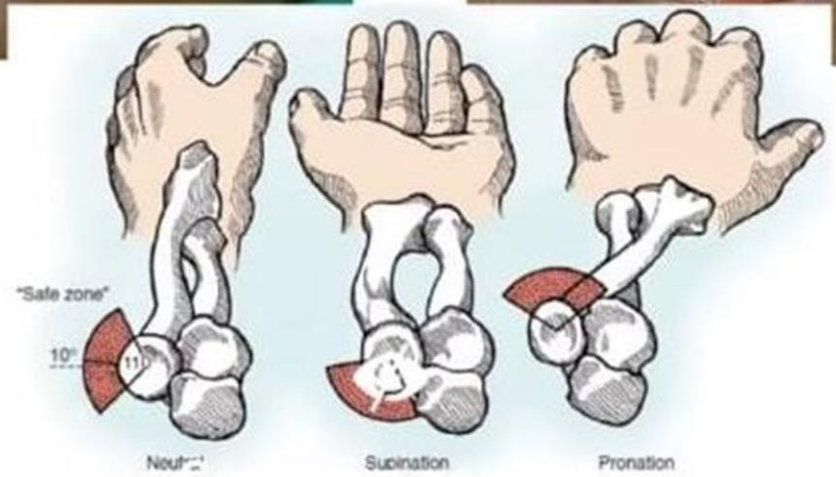


Safe Zone

Avoid impingement- place plates in **safe zone**

supination

pronation



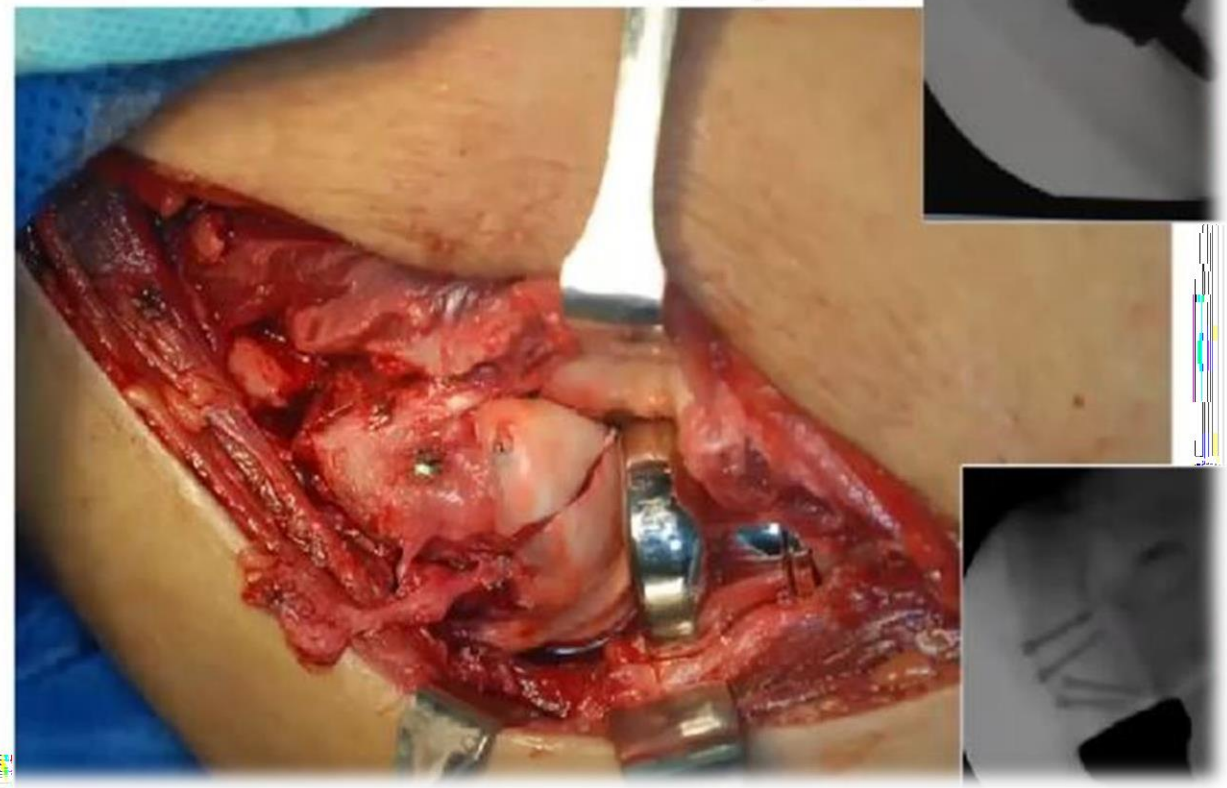
EXISION OF RADIAL HEAD

Excision of radial head

- If small fragment less than 25% and blocking motion
- If entire head is comminuted and all ligaments are intact
  - No axial instability
  - No post instability
  - No valgus instability

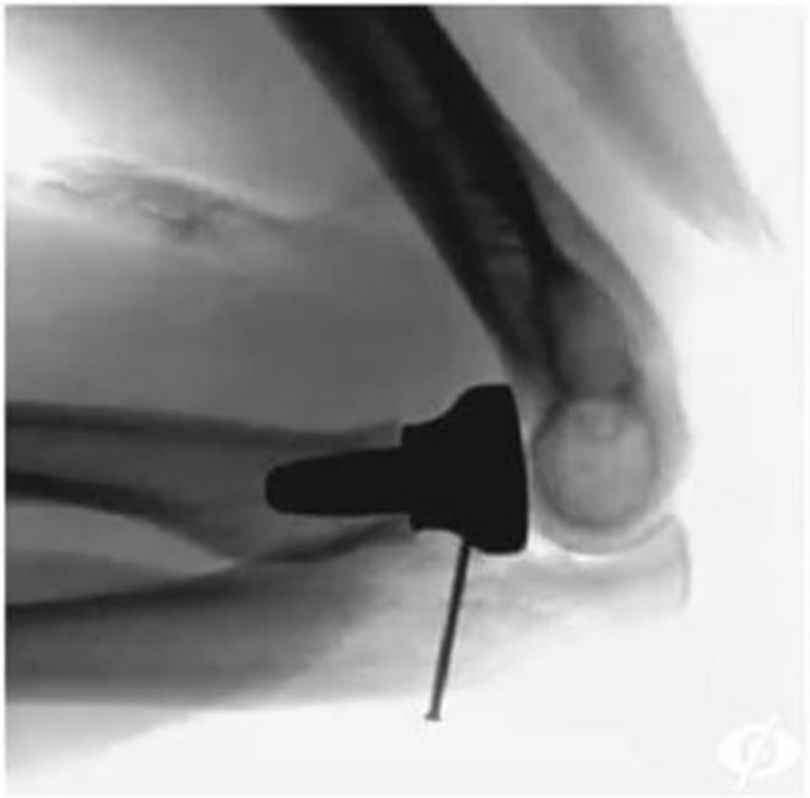
Does not apply with associated injuries

Radial Head Replacement



The “terrible triad”

Tighten and secure LCL in pronation



pronation

supination

Coronoid process

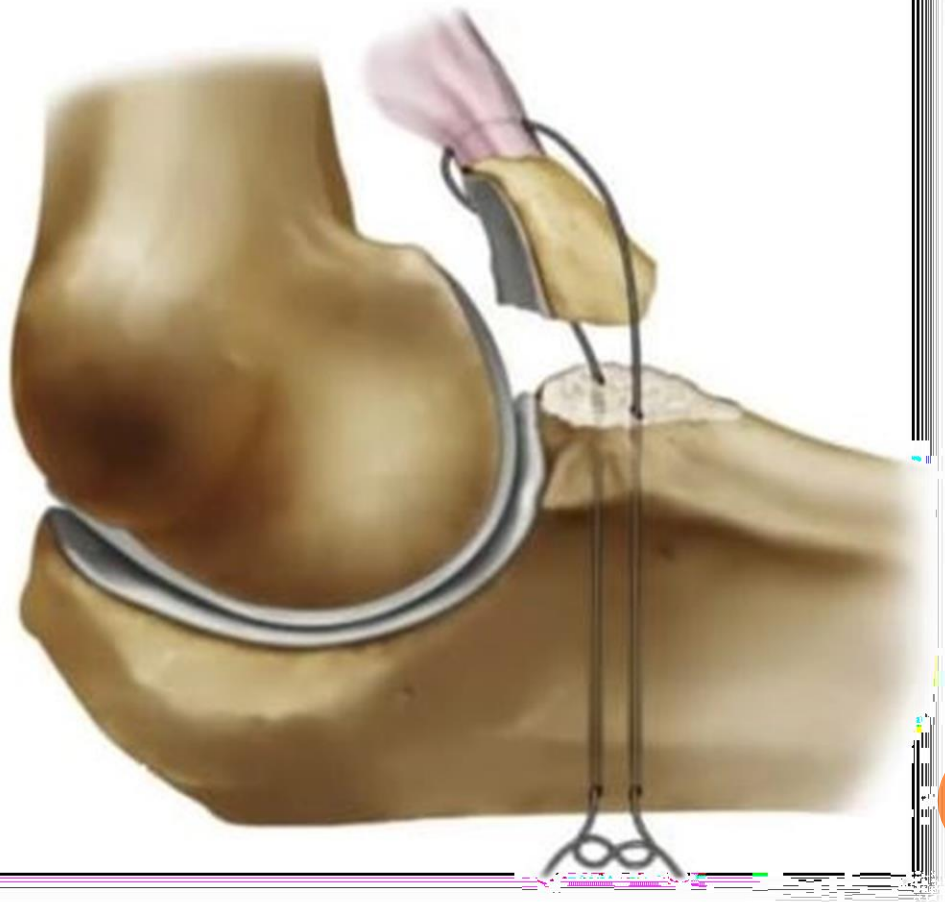
I Transverse > posterolateral fracture dislocation

II Anteromedial facet > anteromedial fracture dislocation

III Basilar > transolecranon fracture dislocation

O'Driscoll 1993

Type 1: tip fractures—suture repair

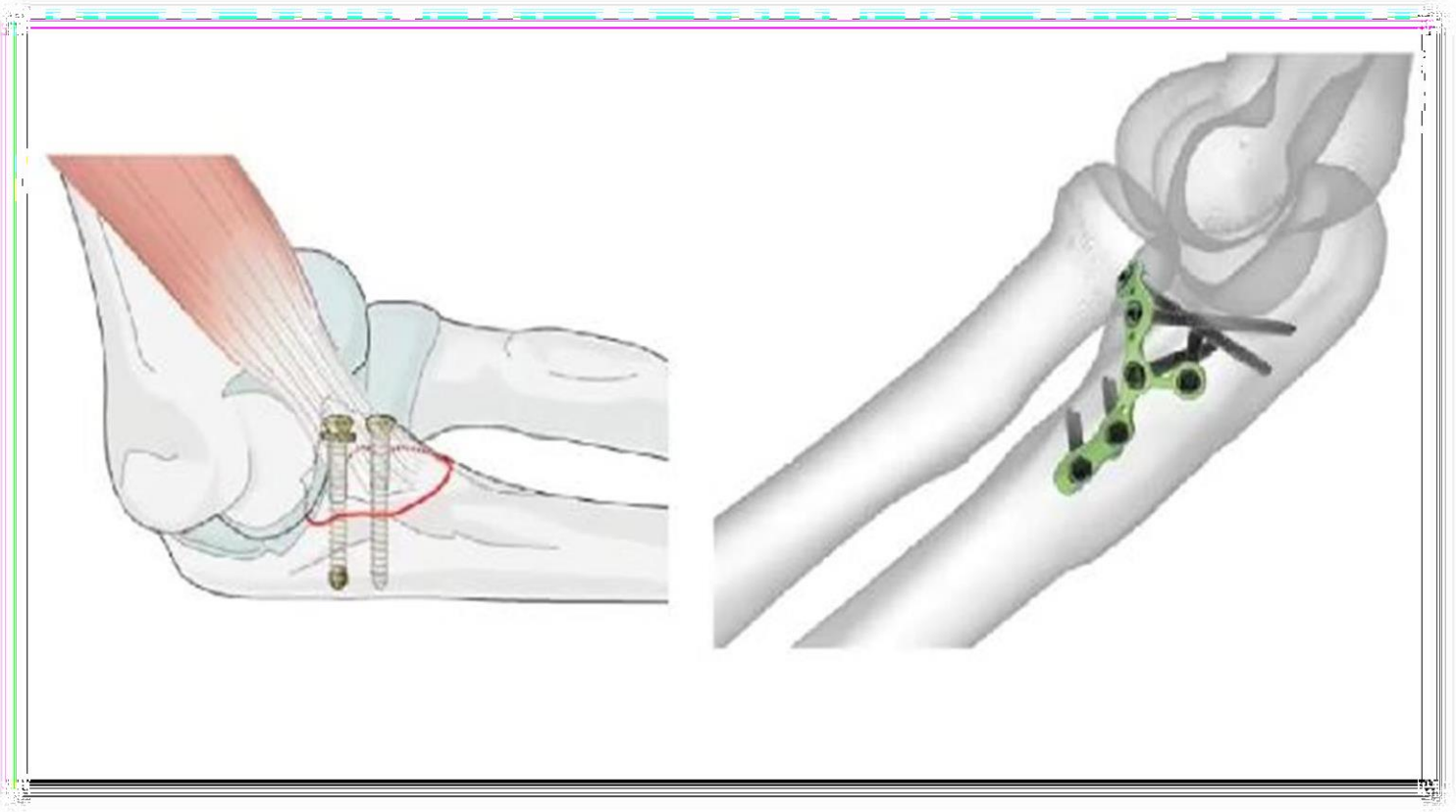


Type II

- Anteromedial coronoid fracture
- Posteromedial varus instability


2851237
02.02.1970
Radiologie
6
NR 3
LIH 1
R 0°
W 100 L 50
31.12.2010
18:52:40
BONE
MAG 0
kV 49
mA 2.4
cGy cm2
16.7
min 0:35
2851237
02.02.1970
Radiologie
7
NR 3
LIH 1
R 0°
W 100 L 50
31.12.2010
BONE
MAG 0
kV 49
mA 2.4
cGy cm2
16.7

Type III



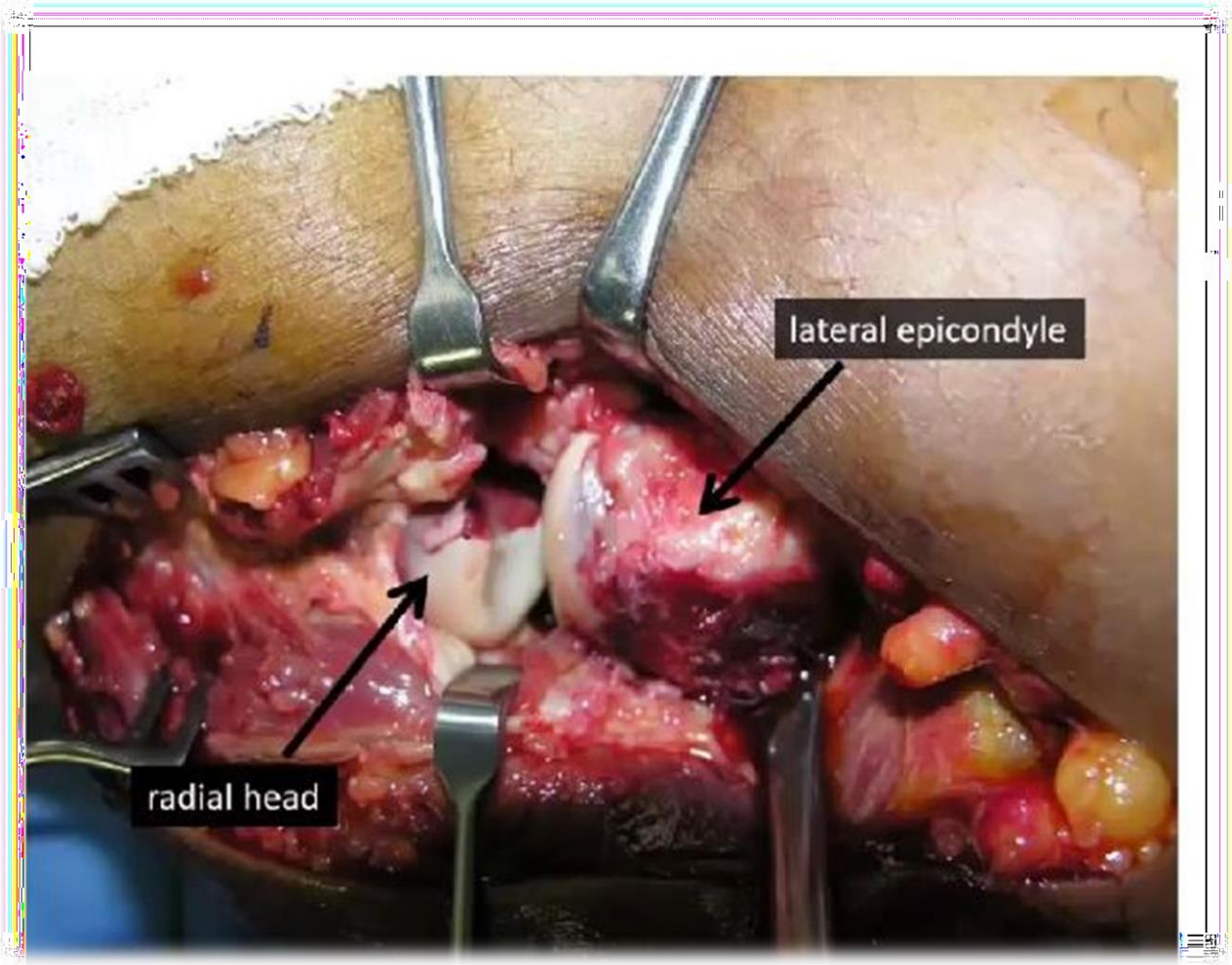
Non operative in anteromedial coronoid

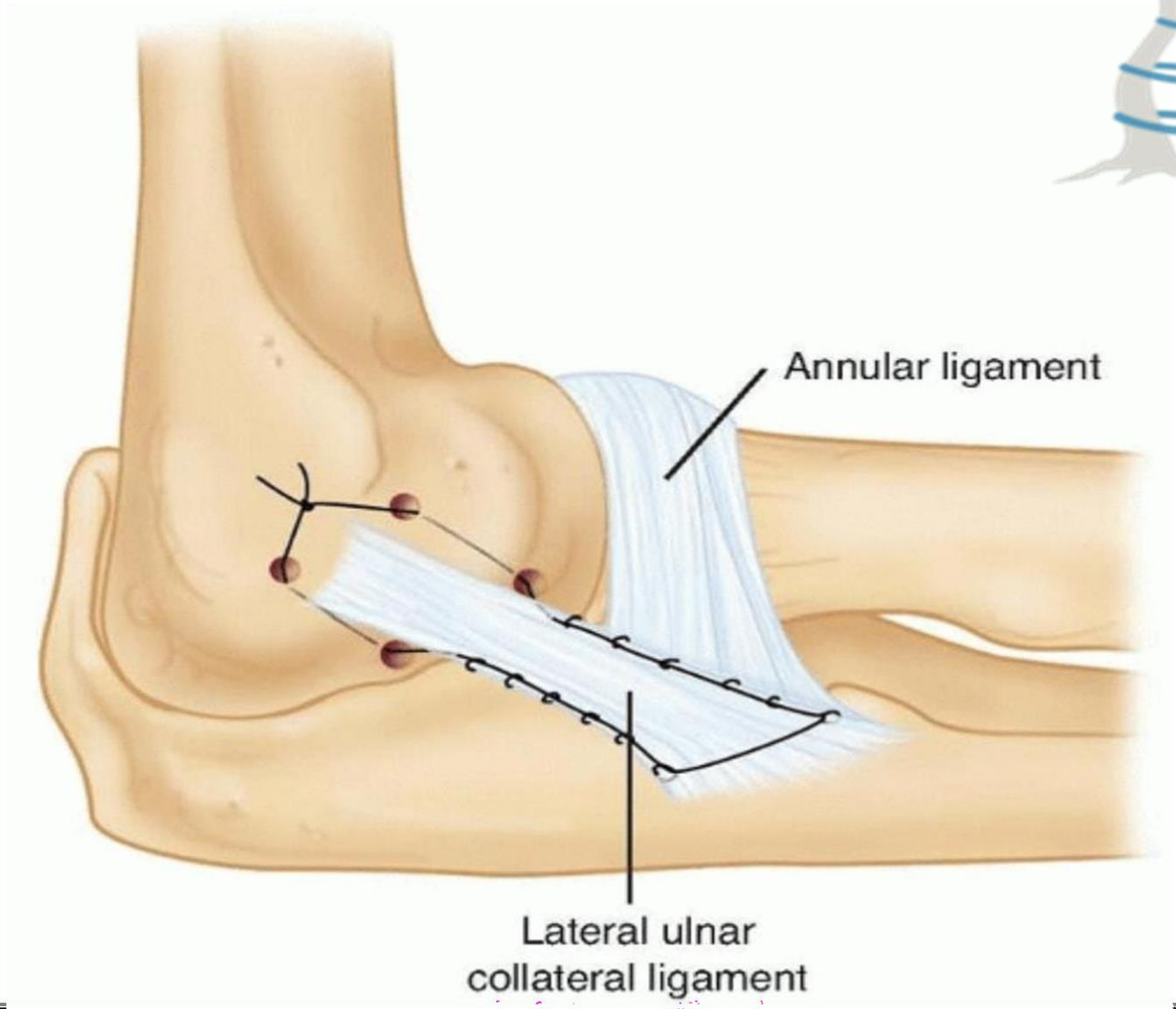
(1)minimally displaced or undisplaced smaller subtype 2 fractures, especially those ≤5 mm

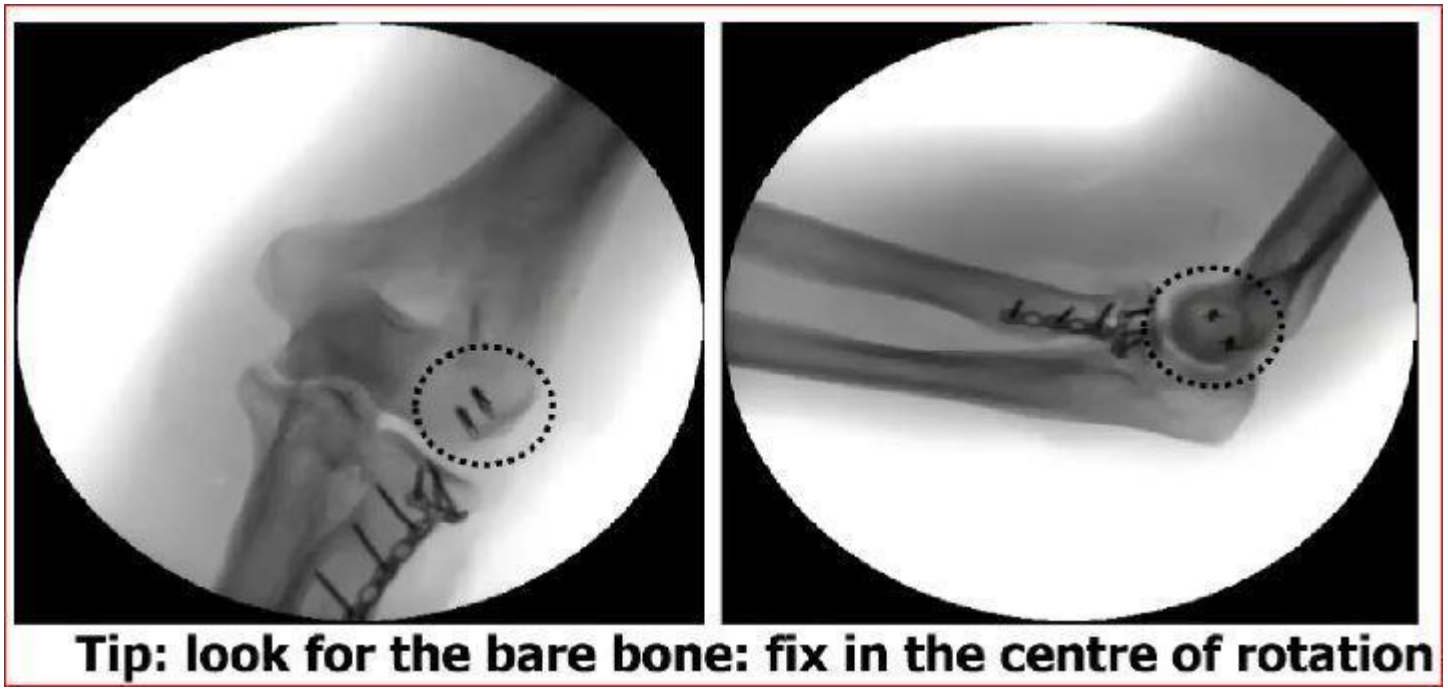
(2) a concentric elbow joint

(3)a stable range of motion to a minimum of 30° of extension.

L U C L

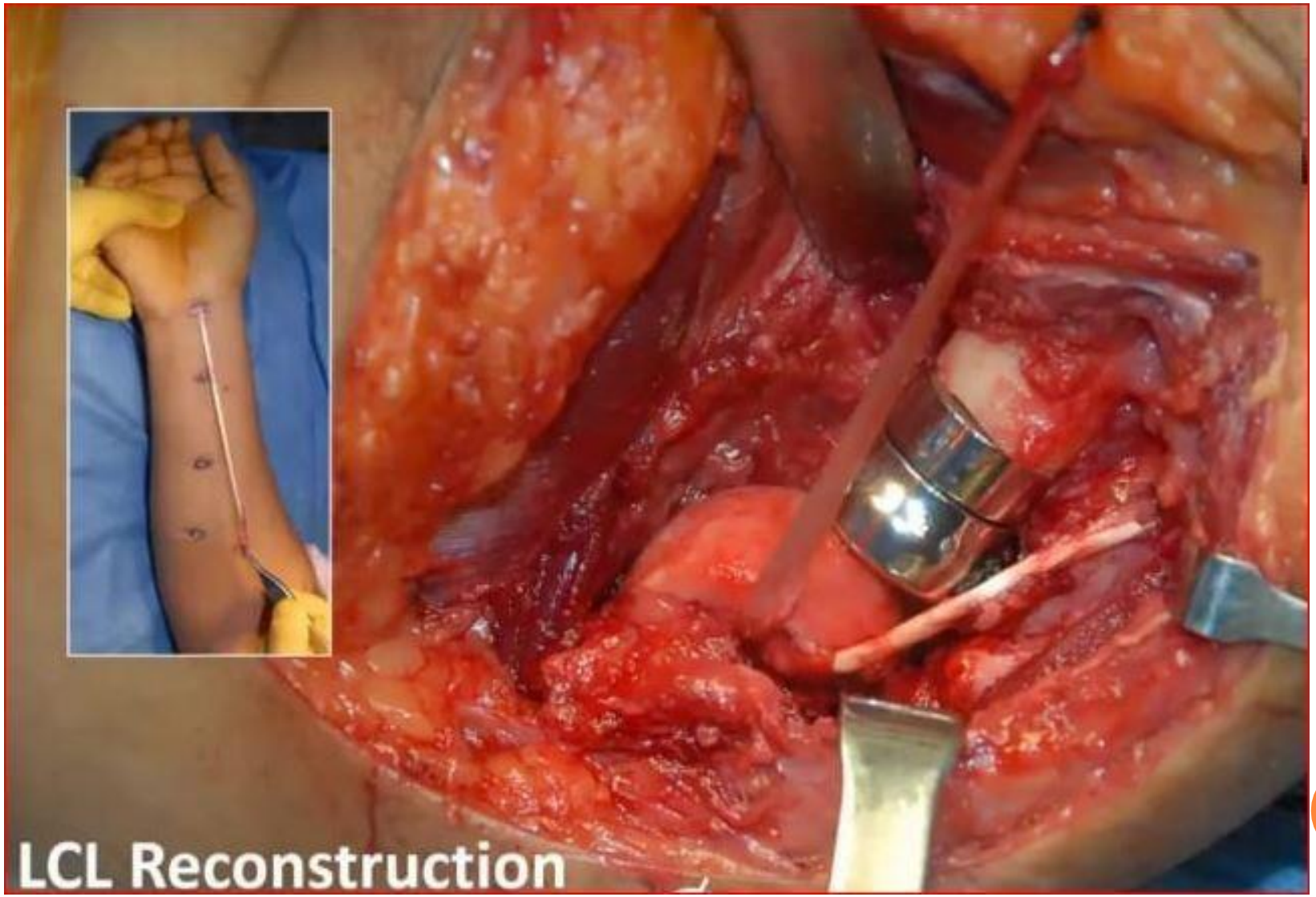

lateral epicondyle
radial head


Annular ligament
Lateral ulnar
collateral ligament

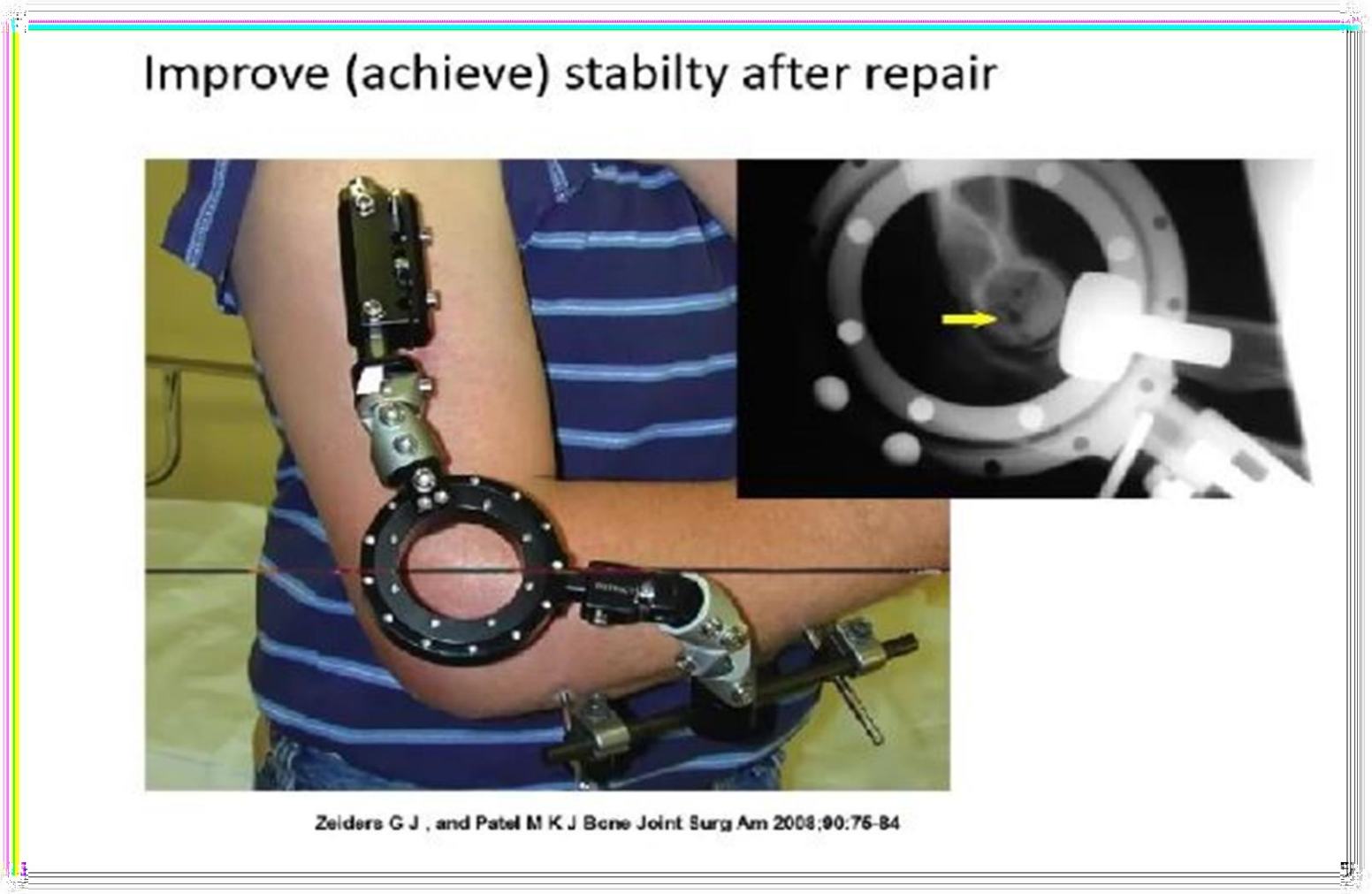


Tip: look for the bare bone: fix in the centre of rotation

LCL Reconstruction



Improve (achieve) stability after repair



Early ROM

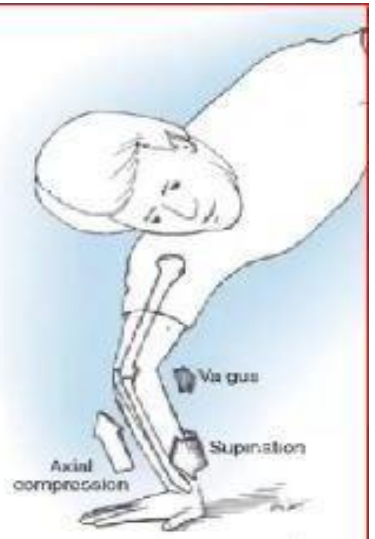
- First, get stable, rigid fixation!
- Then, **allow early active elbow flexion and supination**!
  - Biceps is pulling on radius, brachialis on ulna (Duckworth 2014).

PATHOPHYSIOLOGY

Pathophysiology

Fall on the outstretched hand

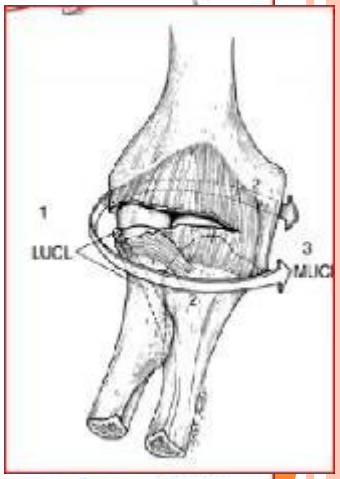
> **Supination (external rotation) + Valgus**
= PLRI



A- **Simple Dislocations** (no fractures)

B- Instability + Fractures

1. **Fracture with instability**: PMVRI (subluxation)
2. **Fractures Olecranon & Dislocation of Radius**: Anterior or Posterior (**Fracture-Disruption**)
3. **Fractures Dislocations** PLRI



- LCL+ Anterior capsule+ Radial head
- LCL+ coronoid fracture+ Radial head **= Terrible triad**

PATHOPHYSIOLOGY

Pathophysiology

Fall on the outstretched hand

> **Pronation (internal rotation) + Varus**
(less common) = **PMVRI**

LCL rupture

B- Instability + Fractures

1. **Fracture with instability**: PMVRI (subluxation)

2. Fractures Olecra
Posterior (Fracture-Disrupt

3. Fractures Disl