

DISTAL HUMERUS

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Distal Humerus

Adults

✓ Extraarticular-

- Epicondyle avulsion #
- Supracondylar Humerus #

• Children

✓ Intraarticular-

- Intercondylar Humerus #

Distal Humerus

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Children

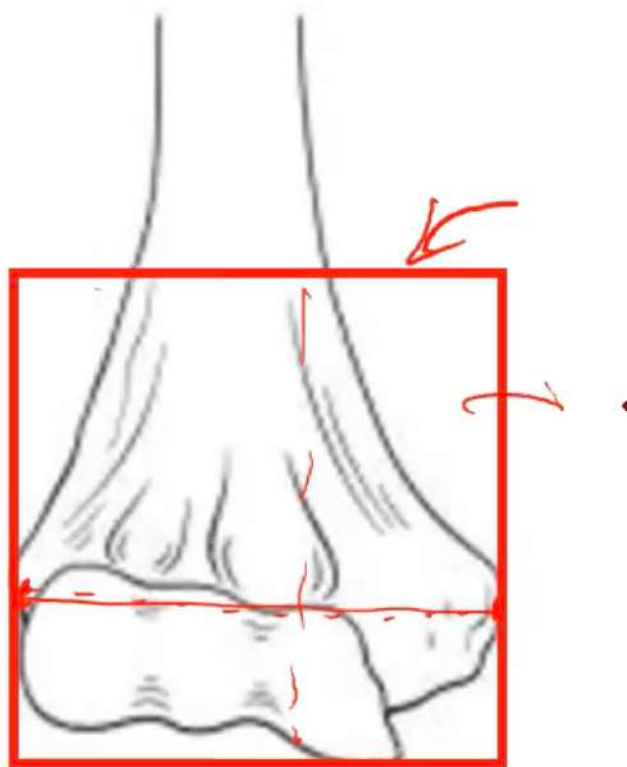
A. Supracondylar Humerus # (3-10 yrs)

B. Lateral condyle Physis # (5-7 yrs)

C. Medial Condyle Physis # (8-12 yrs)

D. T shaped distal humerus # (Adolescents)

Distal Humerus # in Adults



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

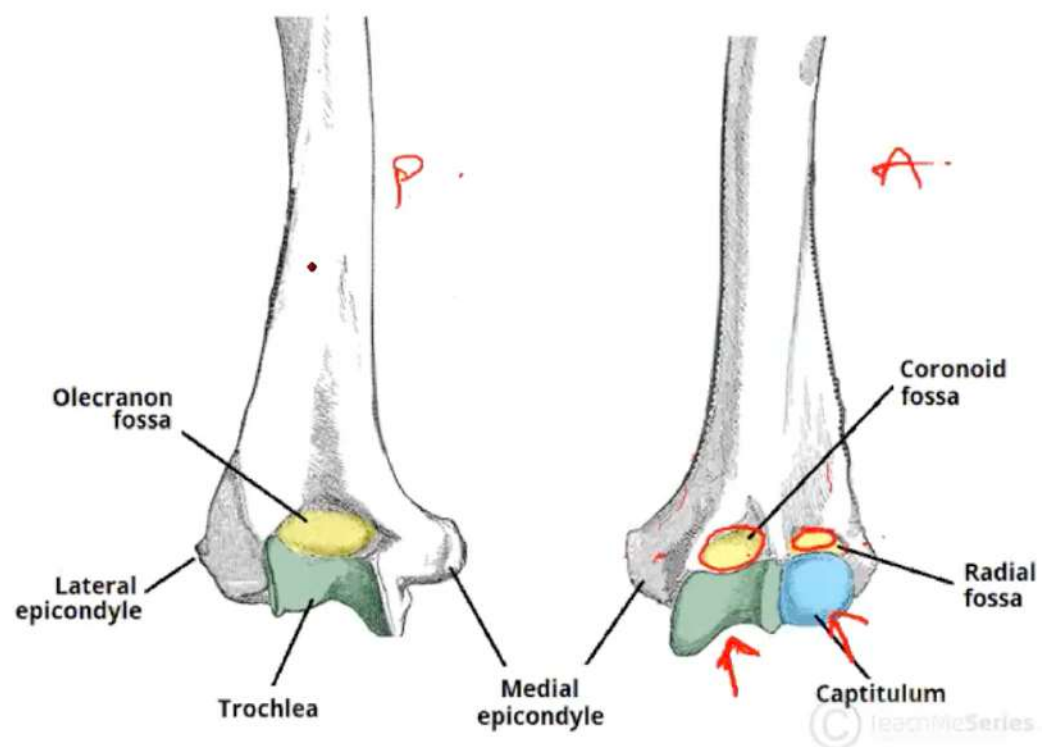
Distal Humerus



Younger males-
High energy trauma ✓

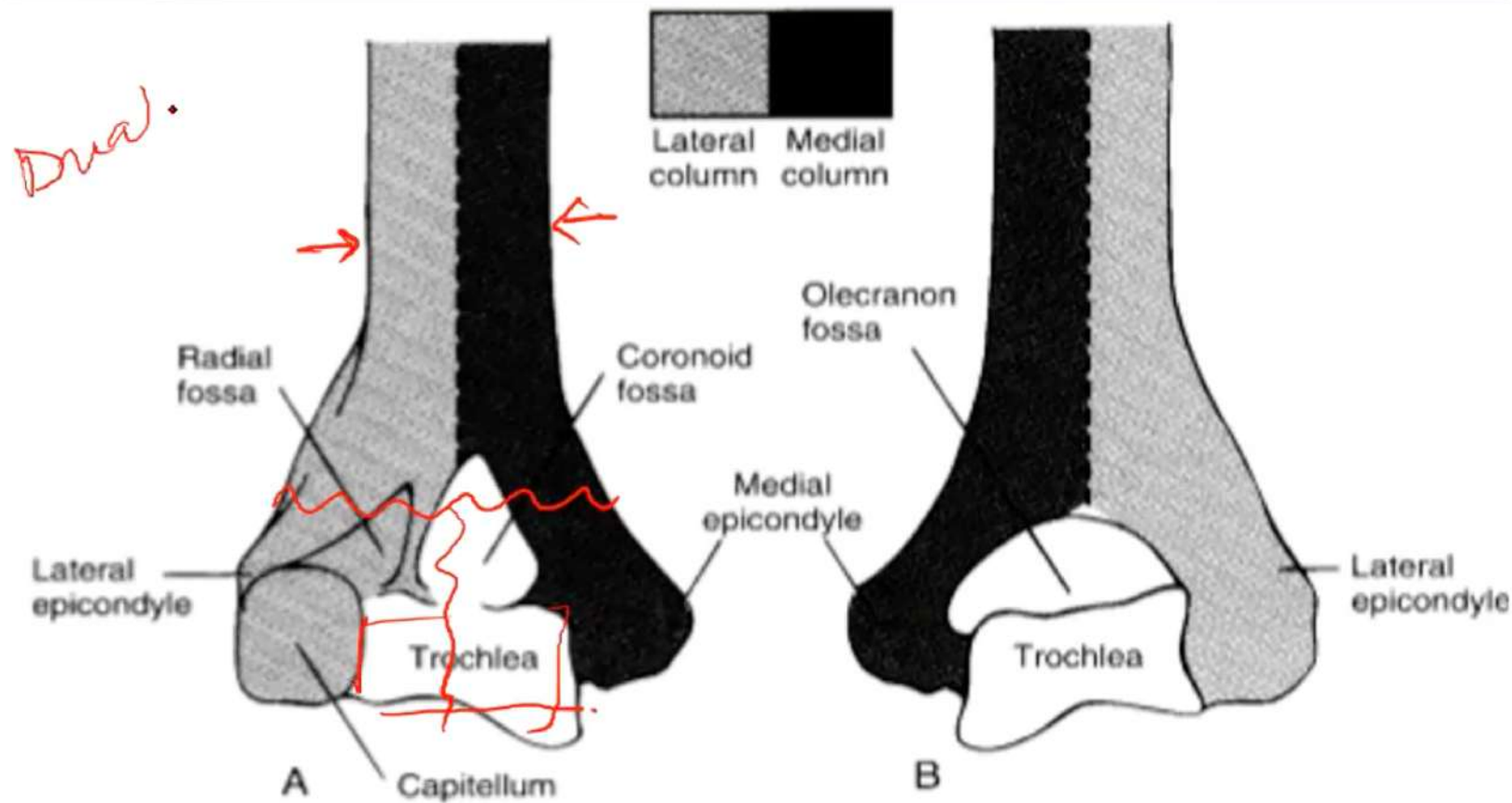
Older females –
Low energy trauma
(Osteoporotic)

Anatomy



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

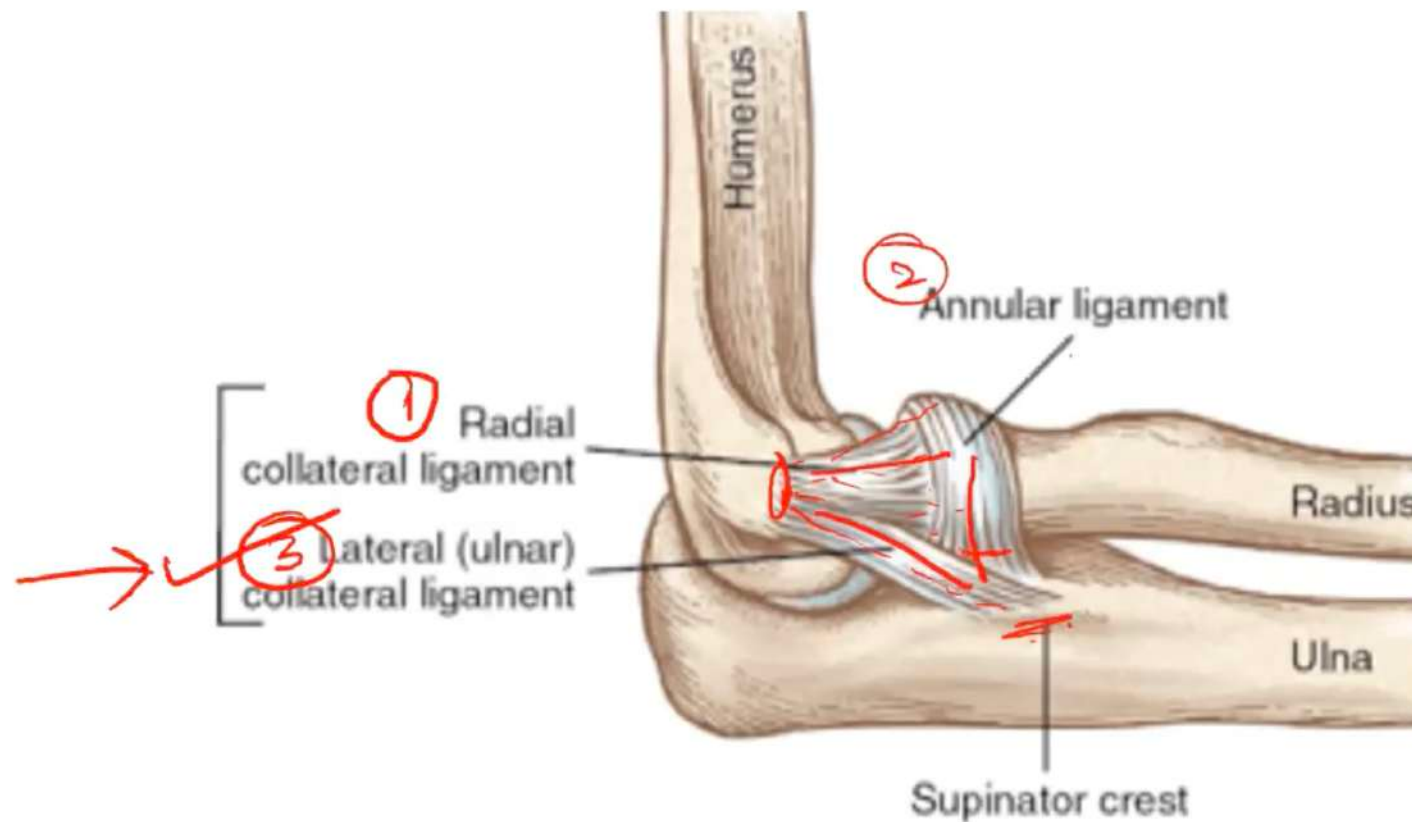
The column concept



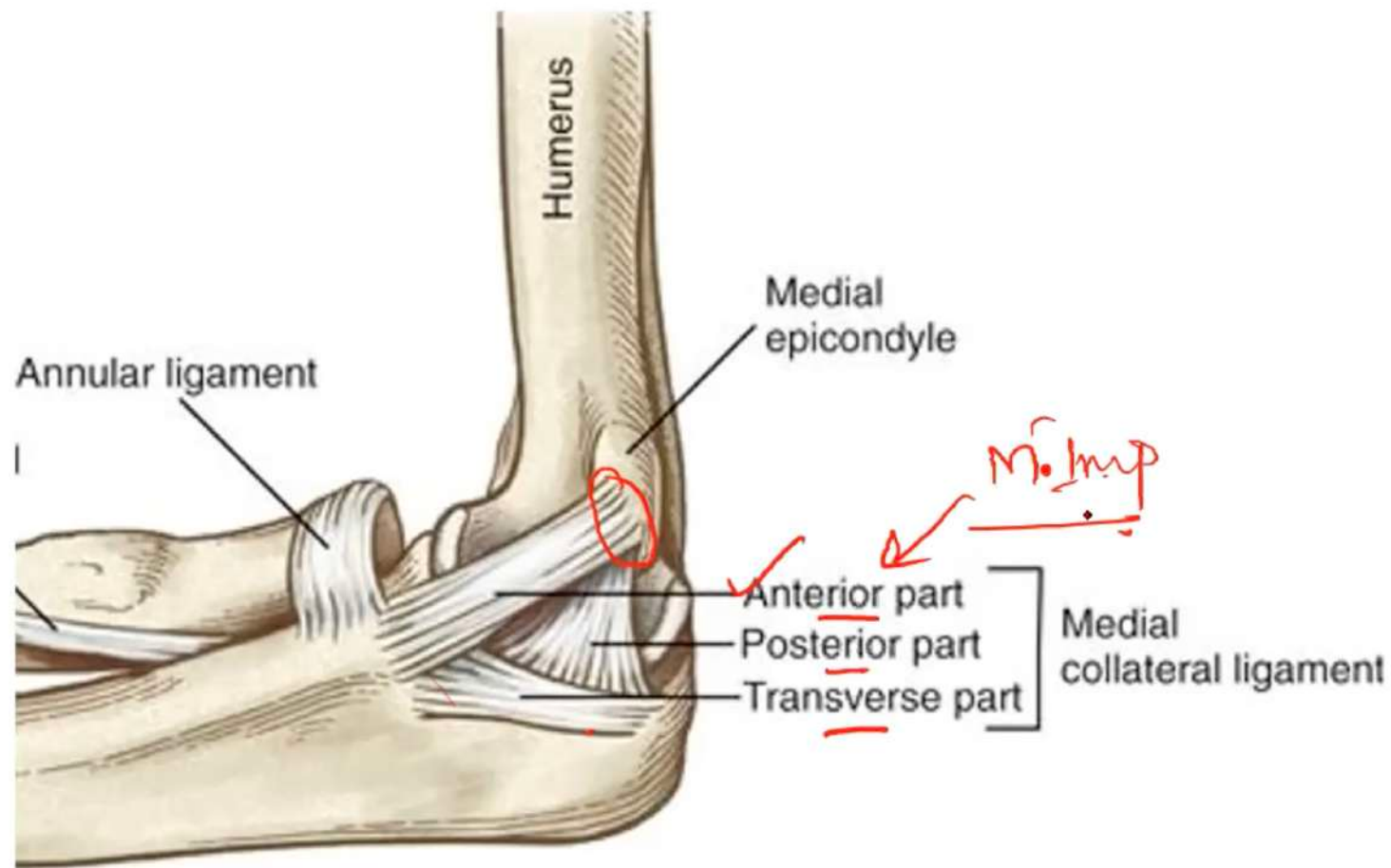
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Lateral Collateral ligament complex

LCL

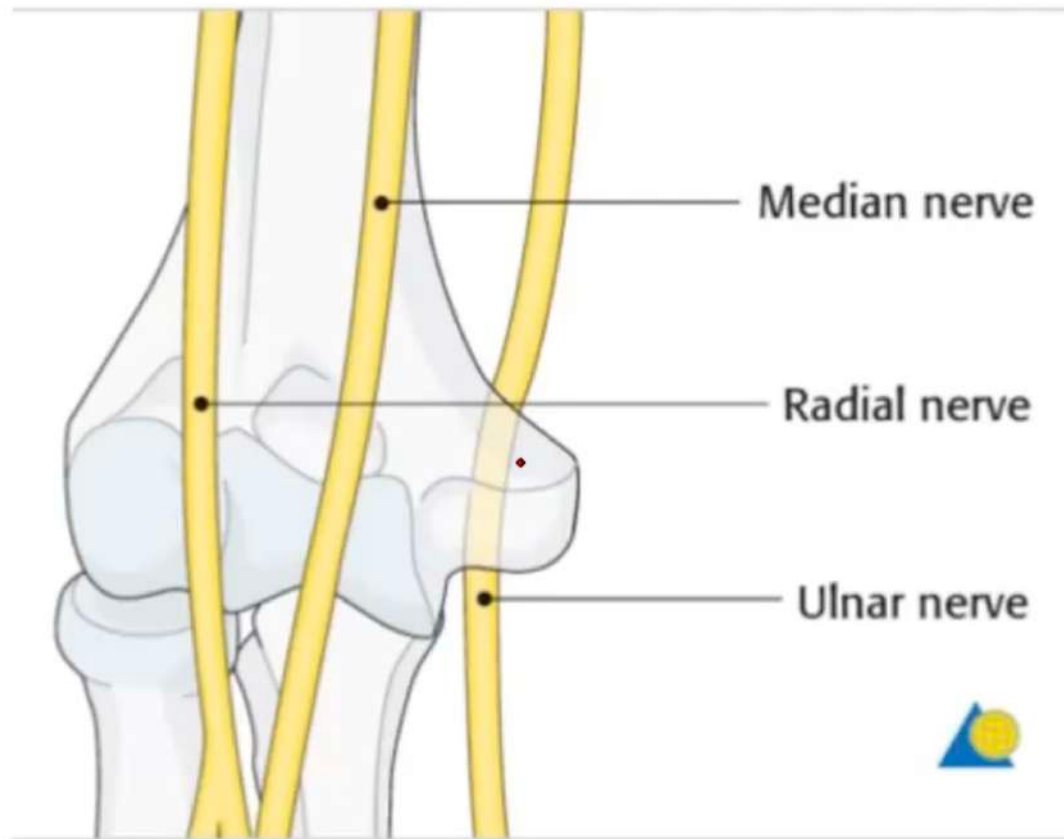


Medial Collateral ligament complex



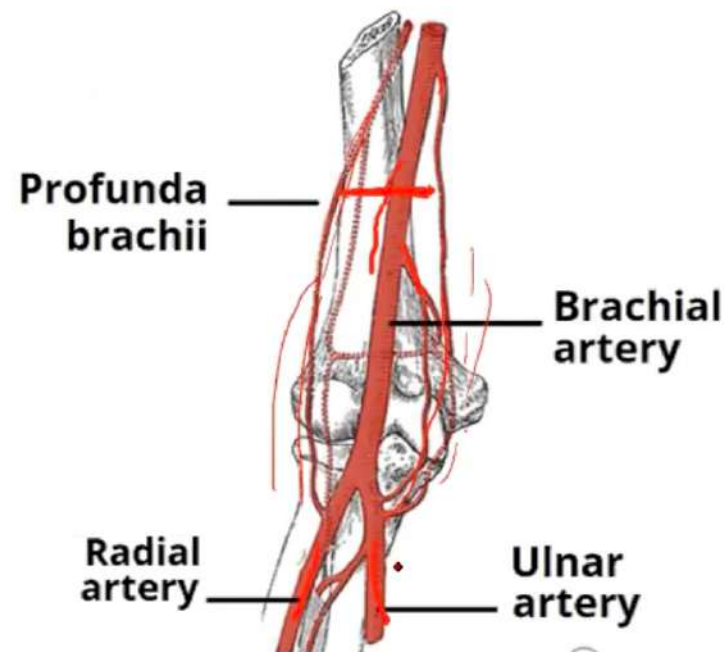
DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

Nerves around distal humerus



Blood supply

- Have good blood supply / Rich collateral circulation
- Problems with healing and osteonecrosis are very rare



Clinical presentation

- Pain, swelling, ecchymosis, crepitus, tenderness.....

1. Check for skin condition, blisters, puncture wounds

2. ~~Neurological examination is must~~

3. ~~Vascular examination~~

4. ~~Check for compartment syndrome.~~

operative
Rx.

Imaging

- Xray-
- ~~AP~~ and Lateral view of elbow



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

- CT with 3D recon
- Indications:
 1. Decision making for deciding approach,
 2. Comminution at articular surface
 3. Decision between ORIF vs replacement



Classification

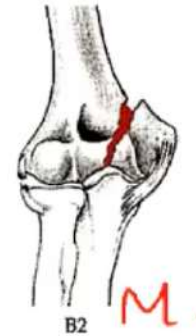
- AO classification-
- A- Extraarticular

13



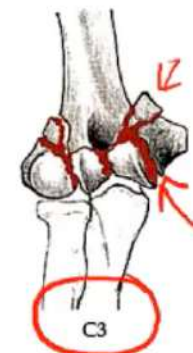
- B- Partial articular

Single column.



- C- Complete articular

T



DISTAL HUMERUS FRACTURES: DR ANURAG T.

Mehne and Matta

- Intraarticular-

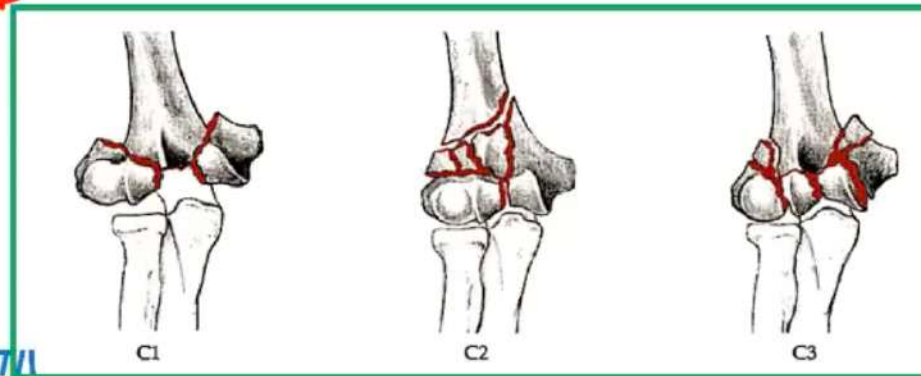
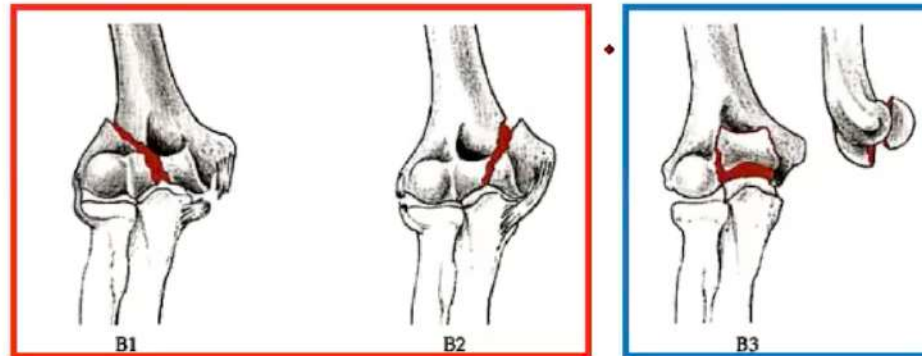
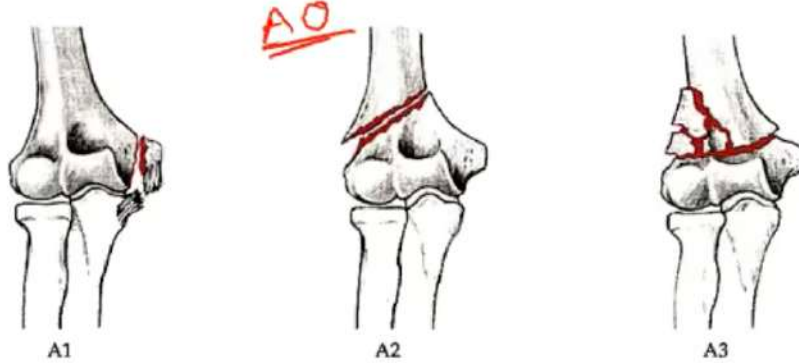
Single column

Two column

Articular surface

- Extraarticular Intracapsular

- Extracapsular



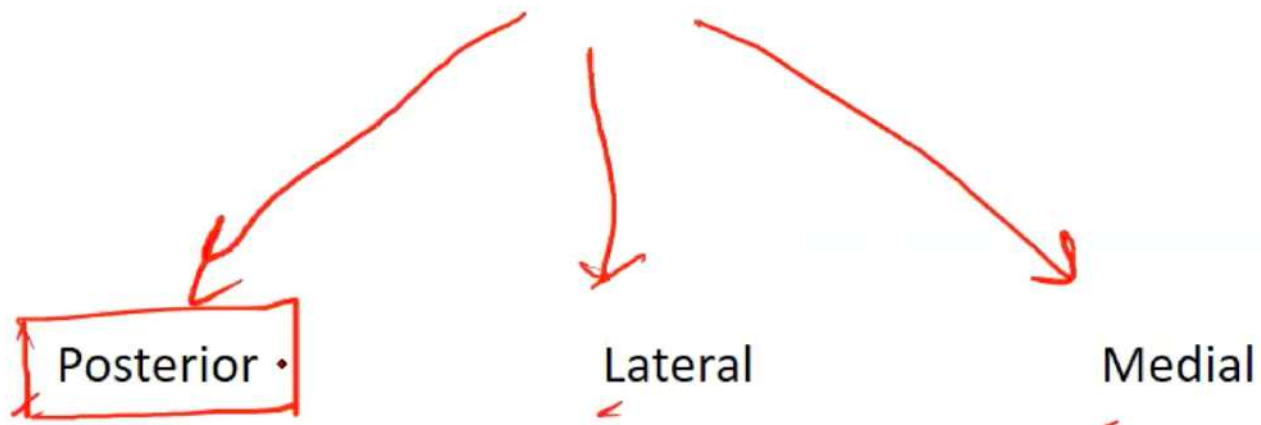
Management

- ✓ Non operative- No Role
 - Indications rare
 - ✓ Undisplaced #
 - ✓ Very high surgical risk
- slab/cast
 → Traction
 → immobilization
 ↓
 "Stiffness"
- ↓
- ✓ Operative-
 - ✓ "ORIF with plate is Gold Standard"
 - ✓ Total elbow arthroplasty
 - ✓ Hemiarthroplasty

ORIF with plate

- Aim of surgery-
- ✓ Anatomic rigid fixation
- ✓ Early mobilization (< 3 weeks) → "Stiffness"

• Which approach ??



Approaches- Posterior

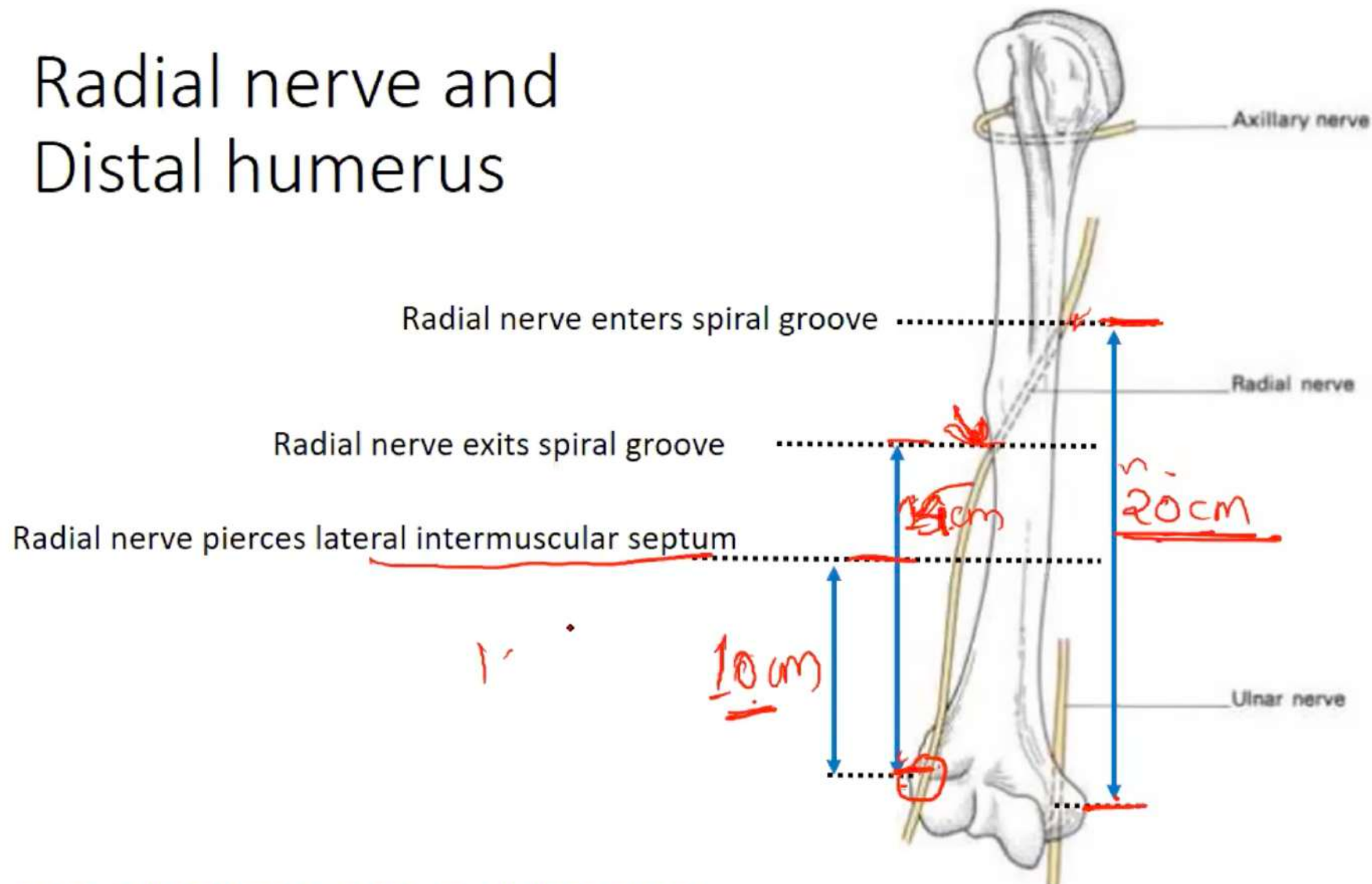
① Olecranon osteotomy (M-C.)

② Paratricipital (Triceps sparing/ Triceps On)
Lateral Paraolecranon

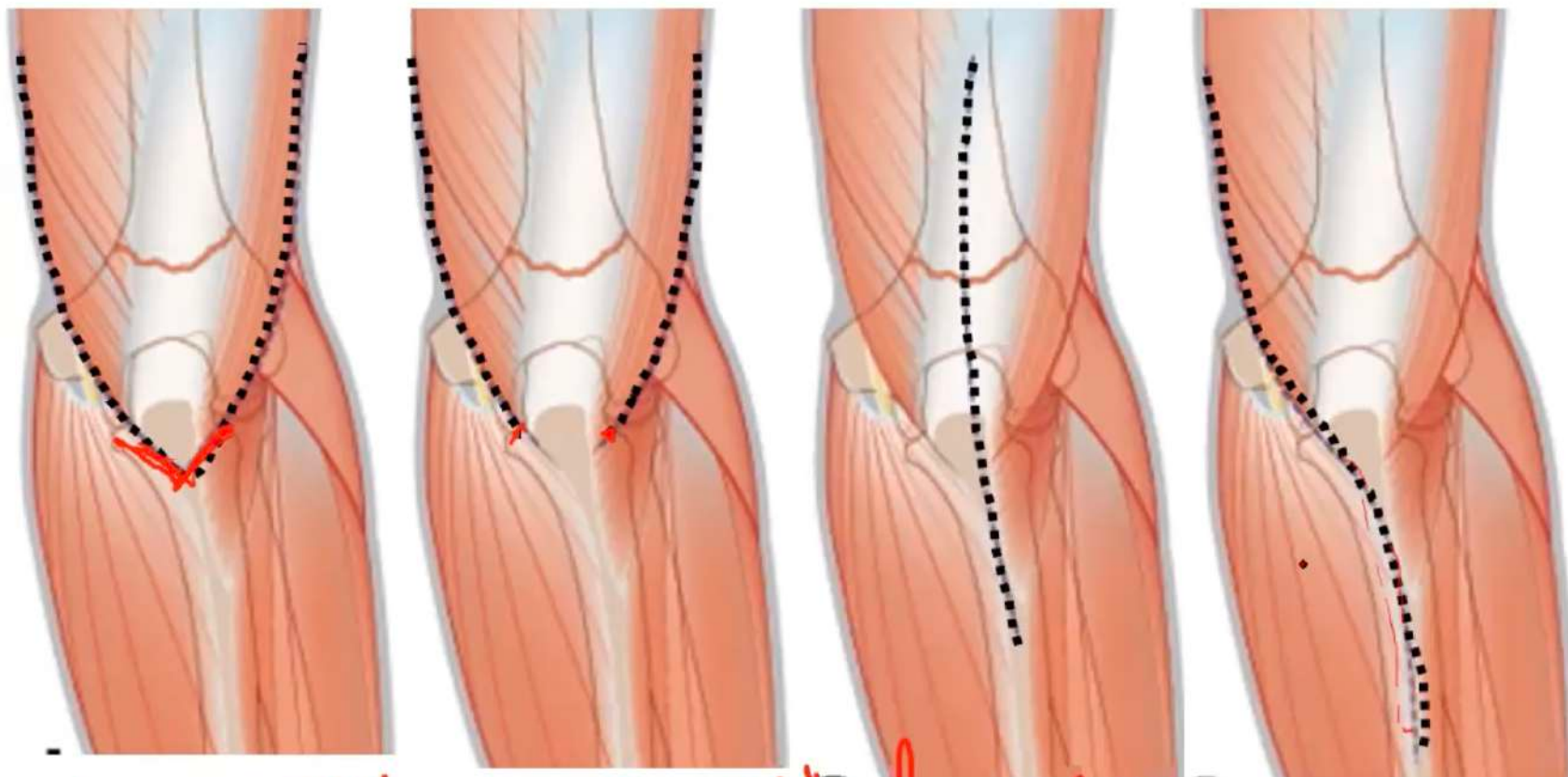
③ Triceps Detaching - Triceps Splitting
Triceps Reflecting/Triceps Reflecting Anconeus Pedicle (TRAP)
Triceps Tongue

- ✓ Ulnar nerve must be identified and protected in posterior app
- ✓ If approach extended proximally, radial nerve must be identified and protected

Radial nerve and Distal humerus



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

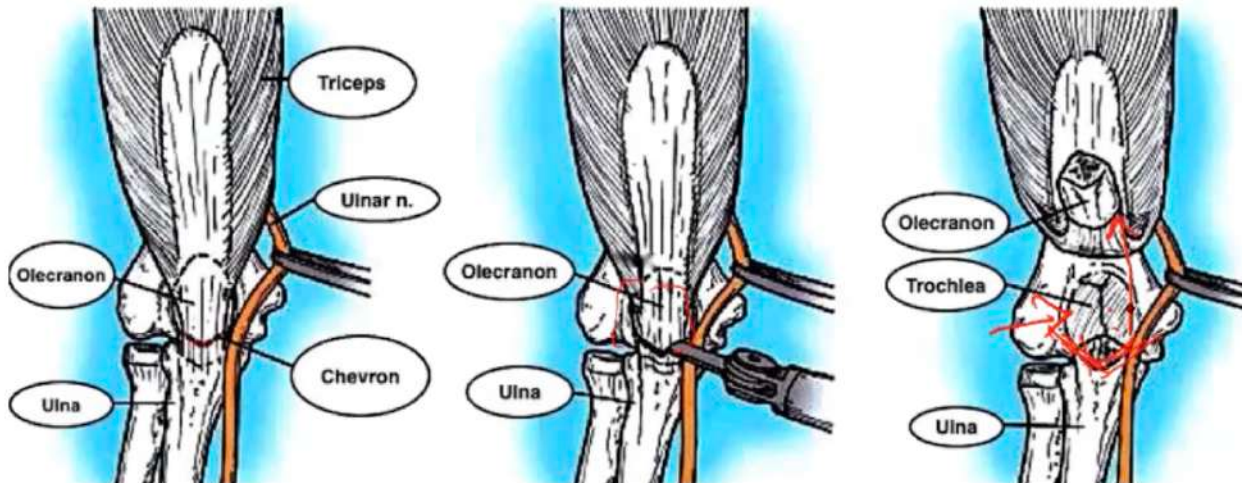


olecranon
osteotomy

Paratricipital. splitting - Reflecting.

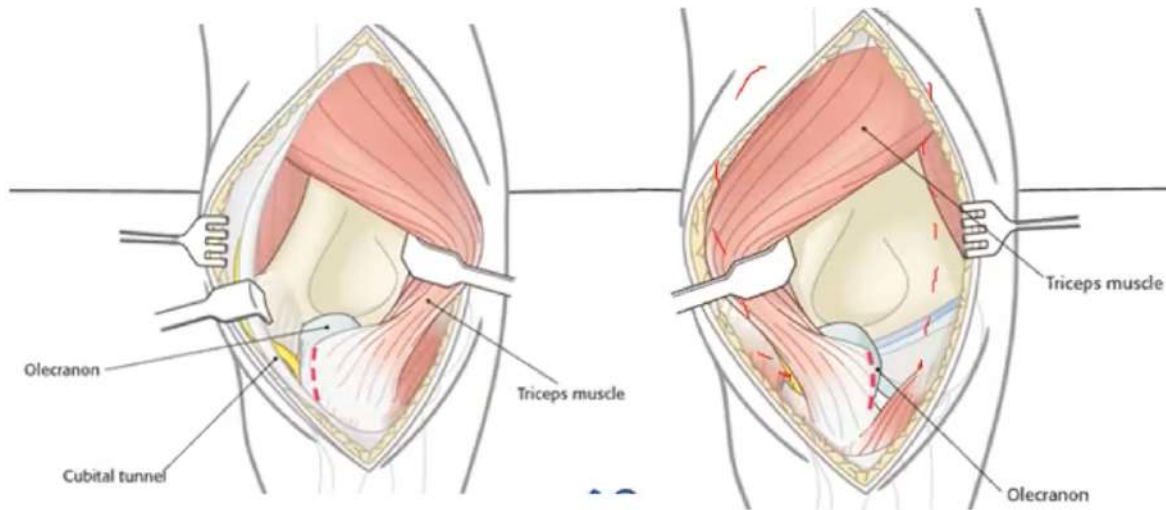
DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

Olecranon osteotomy



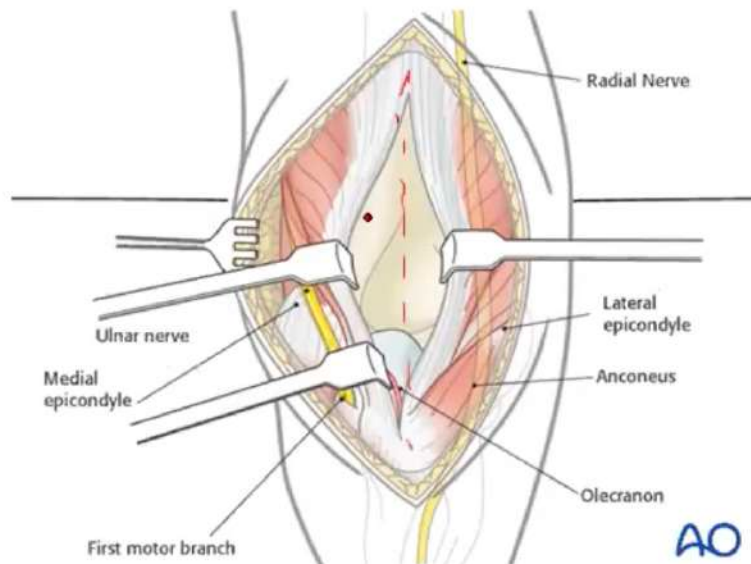
- Best visualization of articular surface
- Disadv: ~~Olecranon~~ Non union
~~Hardware~~ prominence
- Avoid, if conversion to TEA required
- Intraarticular Olecranon osteotomy 1-2cm distal to tip, V shaped.
- Fixed with TBW, Screw or plate

Paratricipital approach



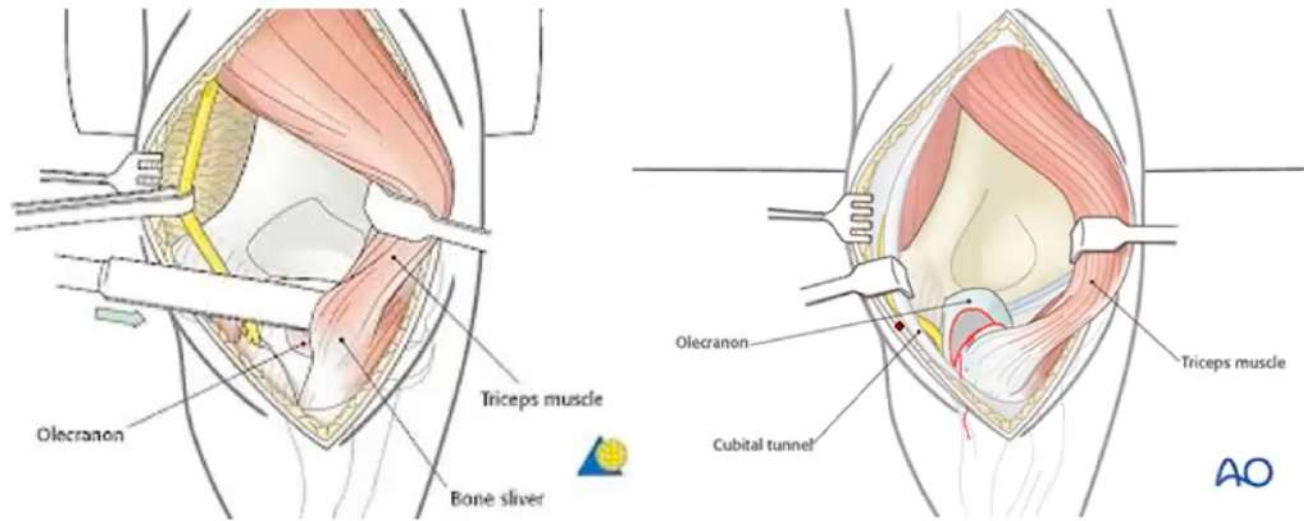
- Two surgical windows
- Avoids extensor mechanism disruption
- Limited articular surface visualization

Triceps splitting approach

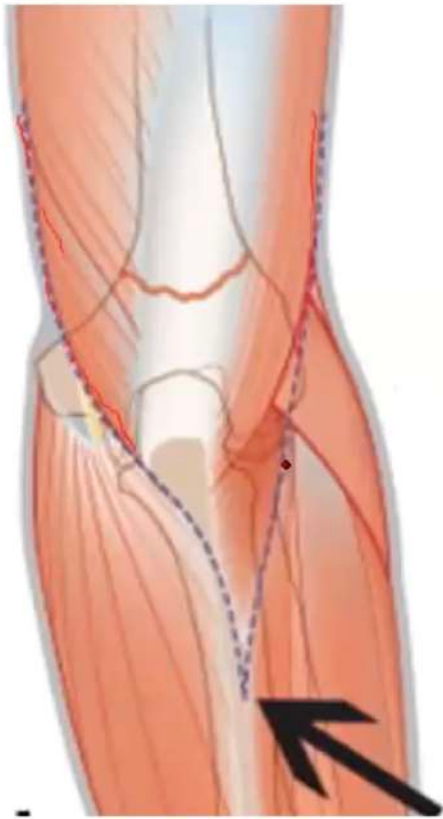


- Avoids extensor mechanism disruption
- Limited articular surface visualization

Triceps Reflecting approach

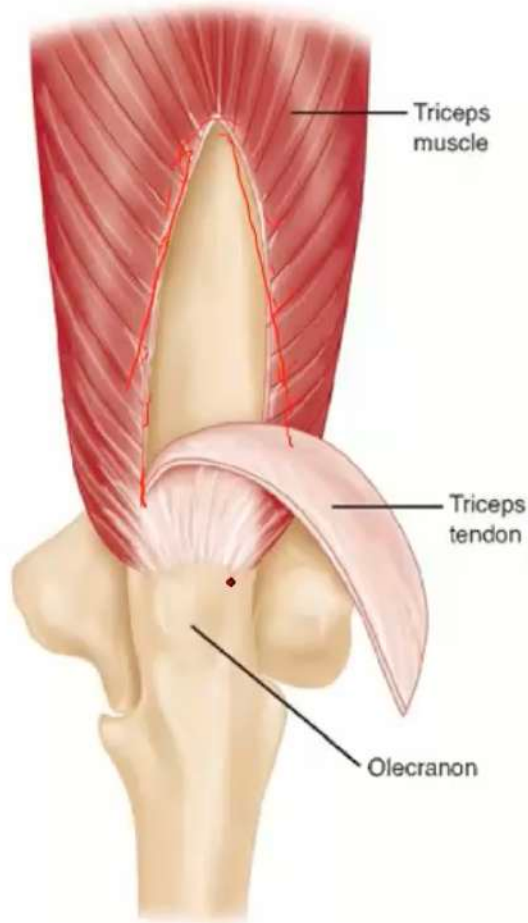


Triceps Reflecting Anconeus Pedicle approach (TRAP)



- Anconeus blood supply is preserved

Triceps Tongue approach (Van Gorder)



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

- 70 year old female patient, with intraarticular distal humerus # with severe comminution. Which approach will you not prefer?

→ T. E. A.

- A. Olecranon osteotomy. — C.S.

- B. Triceps detaching
- C. Triceps splitting
- C. Paratricipital approach

Reduction tips

- ~~✓~~ Anatomical reduction of articular surface is must
- ~~✓~~ Avoid Trochlea shortening → Use fully threaded screws in comminution
- Avoid screws in olecranon fossa → Impingement and decreased ROM

Reduction tips

- ~~✓~~ Anatomical reduction of articular surface is must
- ~~✓~~ Avoid Trochlea shortening → Use fully threaded screws in comminution
- Avoid screws in olecranon fossa → Impingement and decreased ROM

??

- Number of plates?



- Configuration of plates?

- Implant choice?

- Period of immobilization?

- Which configuration of plates is biomechanically superior?
- A. Orthogonal (90-90) — 78%.
- B. Parallel (180) — 22%.
- C. Single plate
- D. All are equal

Parallel loaded



Implant choice

- Distal humerus anatomic countoured plates *locking*
- Distal humerus extraarticular LCP
- Reconstruction plates

$\frac{1}{3}$
 $\frac{1}{4}$] x -



Period of immobilization

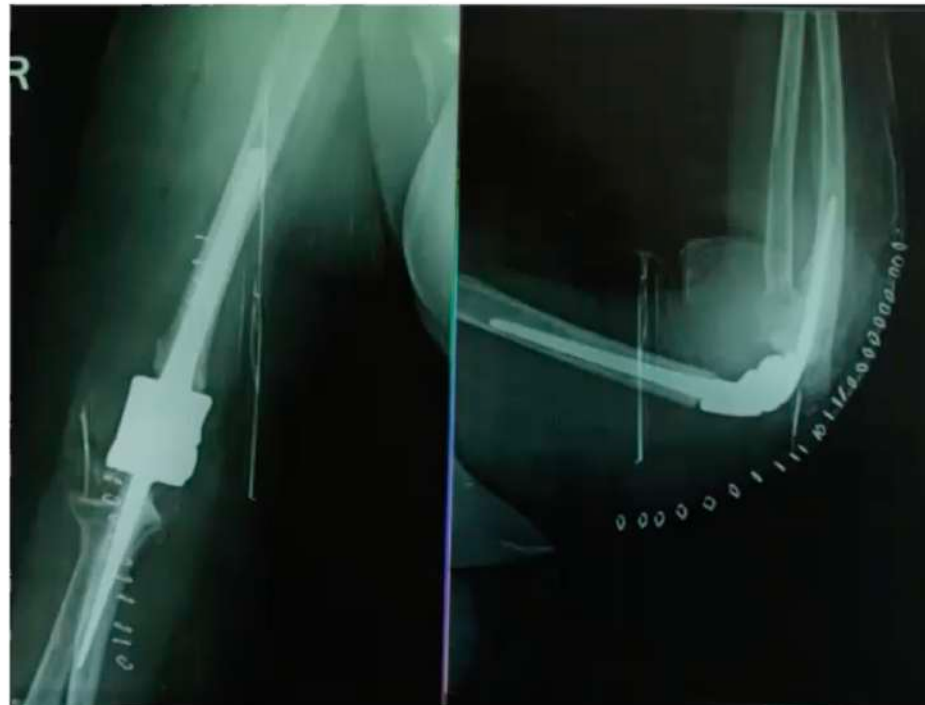
o X
< 3 weeks.

Total elbow arthroplasty

- Indications-

70yr.

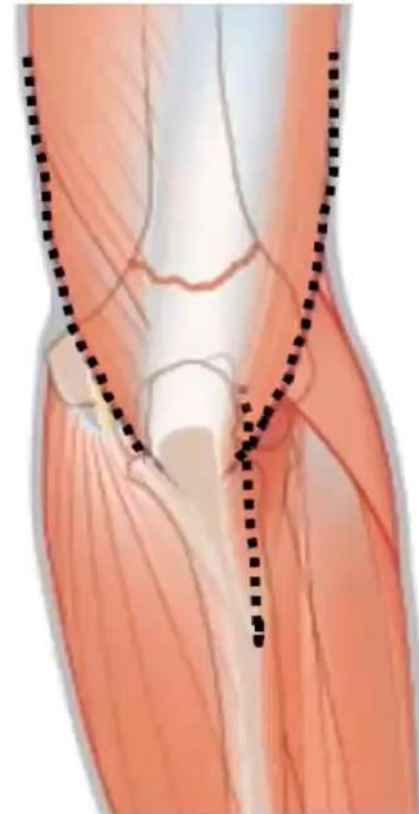
- ✓ Elderly patients with severe osteopenia and articular comminution (Non reconstructible)
-
- ✓ Preexisting arthritis of elbow



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

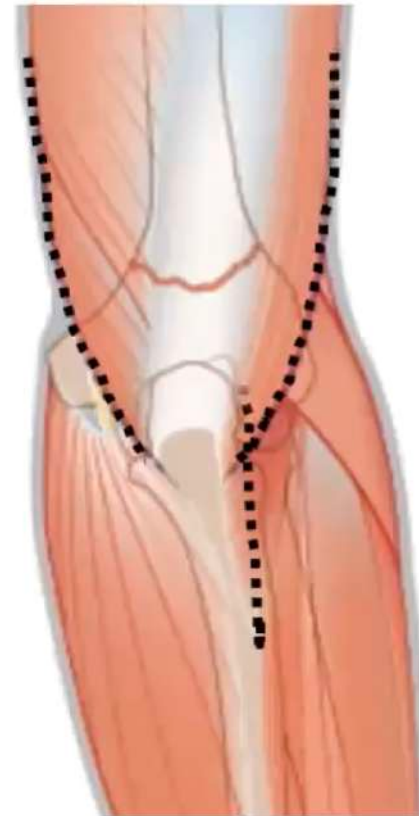
ORIF →

- Approach for TEA-
- Any but not Olecranon osteotomy ✓
- Preferred – lateral paraolecranon
(modified Paratricipital)



ORIF →

- Approach for TEA-
- Any but not Olecranon osteotomy ✓
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(modified Paratricipital)



Capitulum # (Rare).



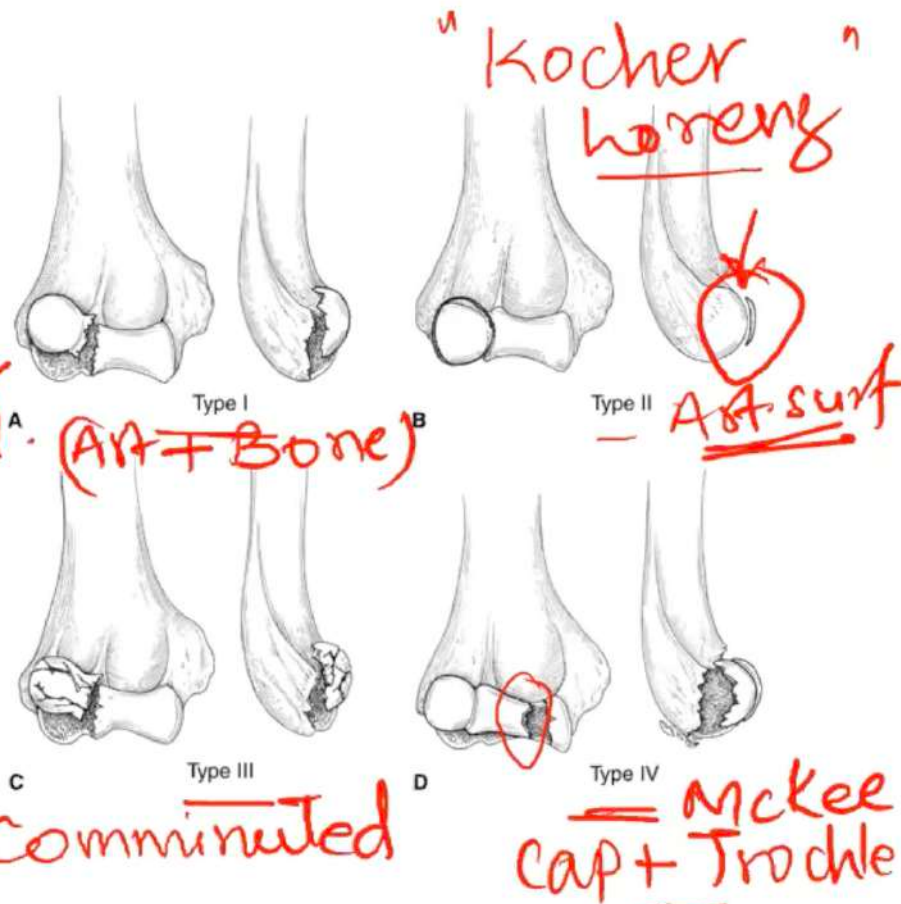
- Classification →

- Treatment- ORIF.

- Technique of Reduction

Extension, Supination and Varus

- Screws Direction – ✓ A. Posterior to Anterior
B. Anterior to Posterior??



Hahn
Steinthal (Art + Bone)

Lateral condylar physis Injury

- What structures lateral condyle forms ??

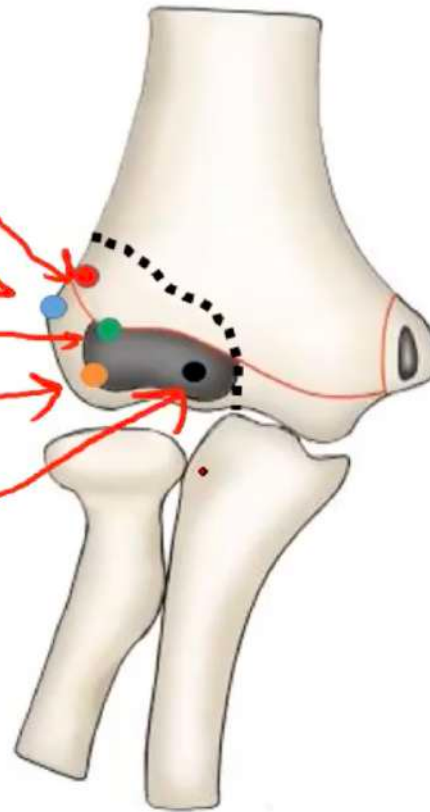
Metaphysis

Lateral epicondyle

Lateral condylar Physis

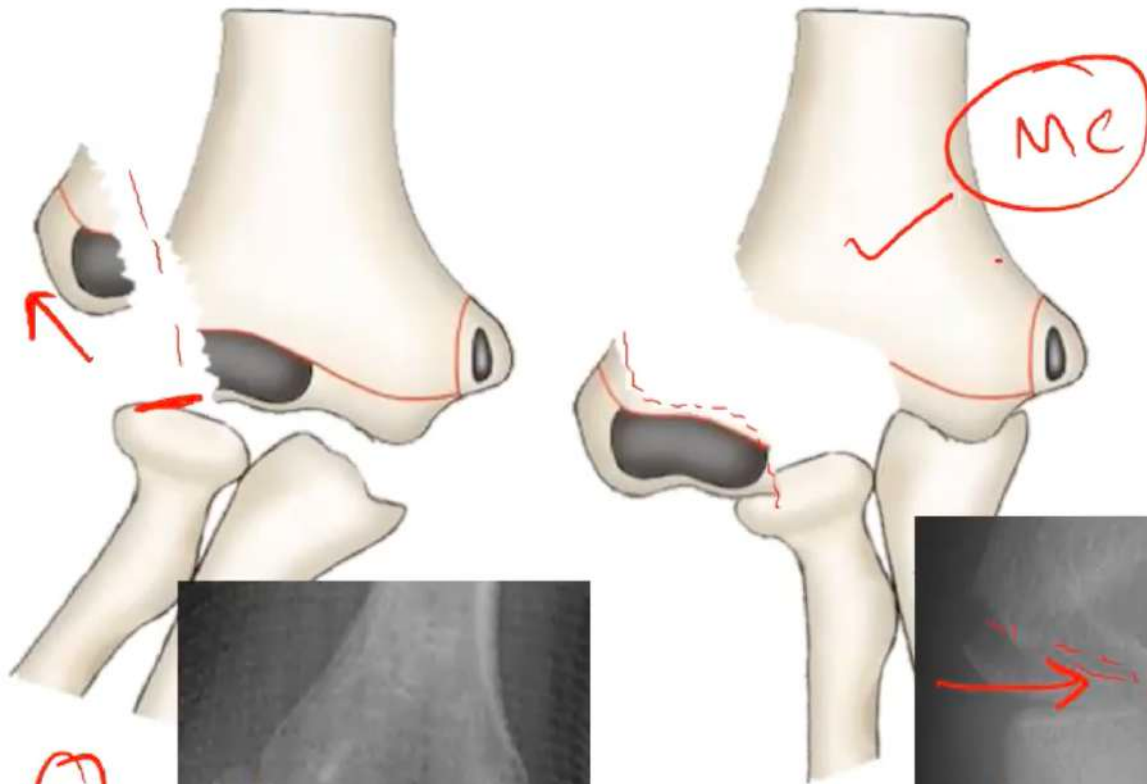
Capitellum

Portion of trochlea



Classification — Mech. of Injury.

MILCH. ST
↓



PWM
2
S-H-



DISTAL HUMERUS FRACTURES. DR ANURAG TIWARI

X-ray

- What is your Diagnosis?
- A. Lateral condyle humerus #
- B. Elbow dislocation
- C. Supracondylar humerus #
- D. None of the above



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

X-ray

- What is your Diagnosis?
- A. Lateral condyle humerus # ~~X~~
- B. Elbow dislocation
- ~~C~~. Supracondylar humerus #
- D. None of the above

Infants
✓ Transphyseal
d-h. separation (1-3)



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

Distal Humerus Physis separation

DeLee Classification



1-24M



✓ I
(1-2)



II
(1-2)



(8A)
III (2-3)

Treatment

- Non operative-

If # is undisplaced. ($< 2\text{mm}$)

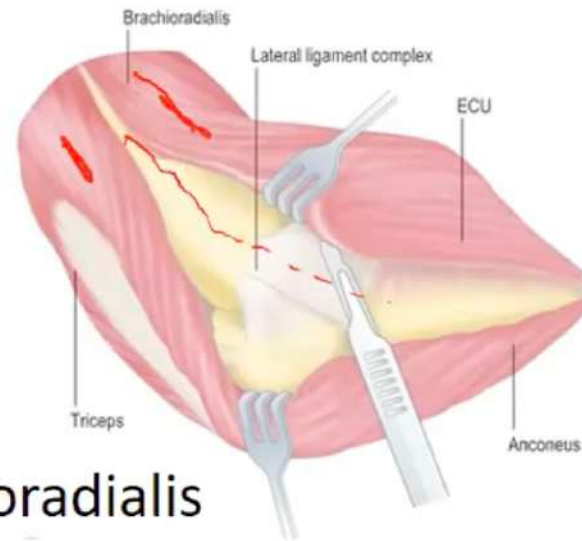
→ Cast / slab.

- Operative

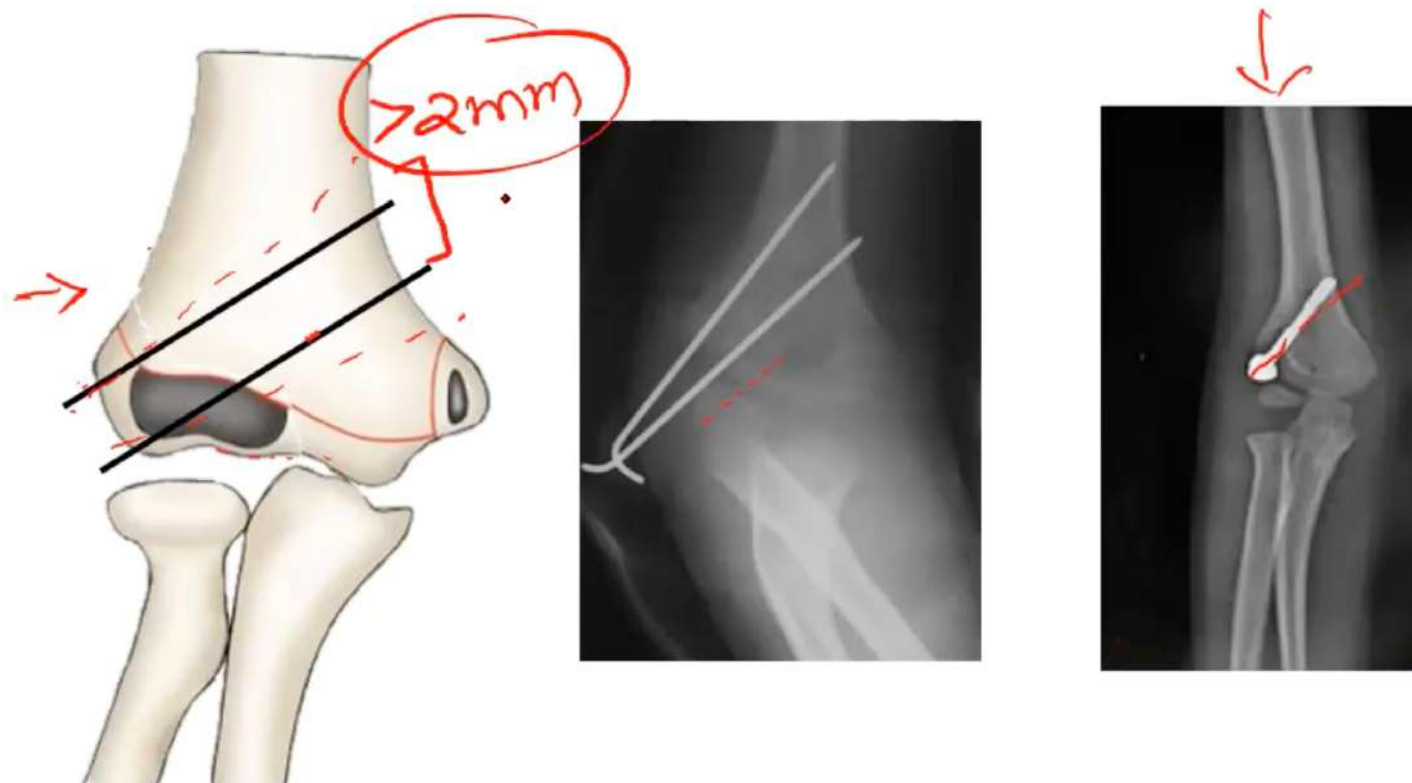
If displacement $> 2\text{mm}$

→ ORIF

✓ (# of necessity) speed.



- ORIF
- Kocher's approach
- Plane – Triceps and Brachioradialis
- Don't dissect over posterior surface to prevent osteonecrosis
- Obtain anatomical articular reduction
- Fix with atleast 2 k wires parallel or divergent fashion



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

??

- K wire or screw
- Number of k wires
- Configuration of k wires
- K wire- Buried inside skin or left outside skin??

Complications

- Most common complication of united # lateral condyle humerus in 8 year old child?

↓
Vasc. ↑
growth.

- ✗ A. Cubitus Valgus — 43%.
- B. Cubitus Rectus
- ✓ C. Cubitus varus
- D. Elbow hyperextension

Complications

- Non union ✓

- 5-10 yr
- 2 yr

- Cubitus Valgus

(20-25 yrs)

- Tardy Ulnar nerve palsy

slow →
friction neuritis

Causes of non union



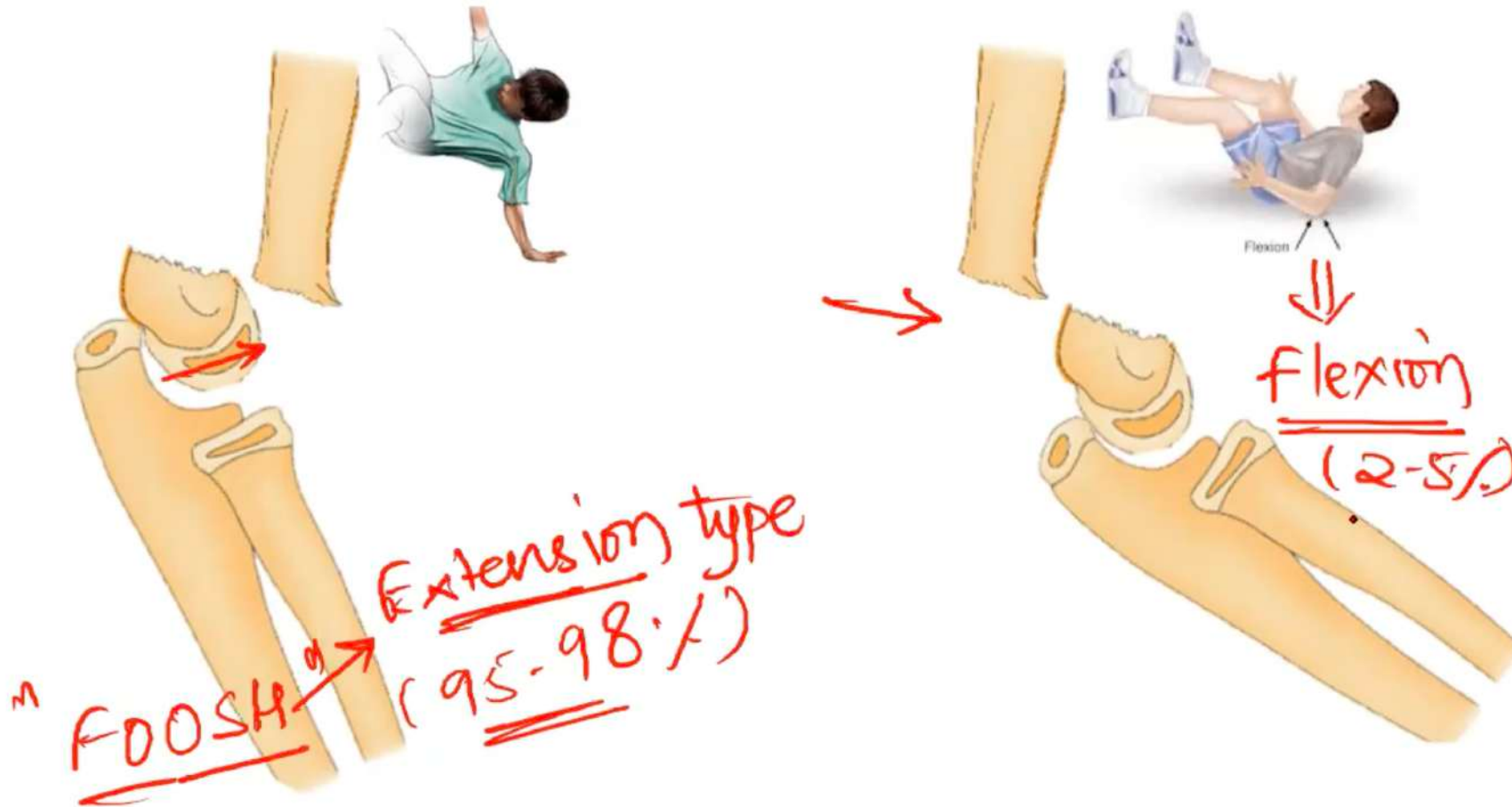
1 Intraarticular #-
synovial fluid dilutes hematoma

2 Constant pull (distraction) by
extensor muscle mass

3 Fragment gets rotated 180 degree → articular cartilage
facing metaphysis → No bone to bone contact

Supracondylar Humerus # in Child

Mechanism of injury and Types

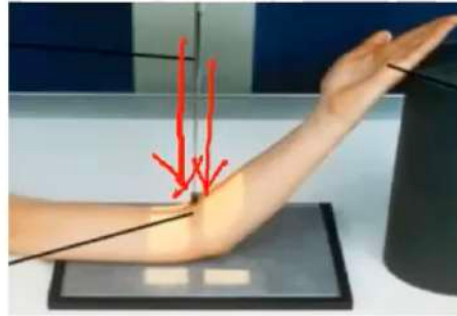


Clinical presentation

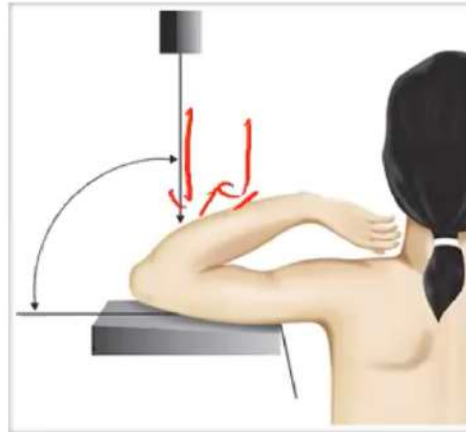
- Pain, swelling, ecchymosis, tenderness
- ✓ Compartment syndrome
- ✓ Distal neurological examination – Median nerve, Radial nerve
- ✓ Vascular injury- Radial pulse.

X ray

- True AP view



- AP Jones view

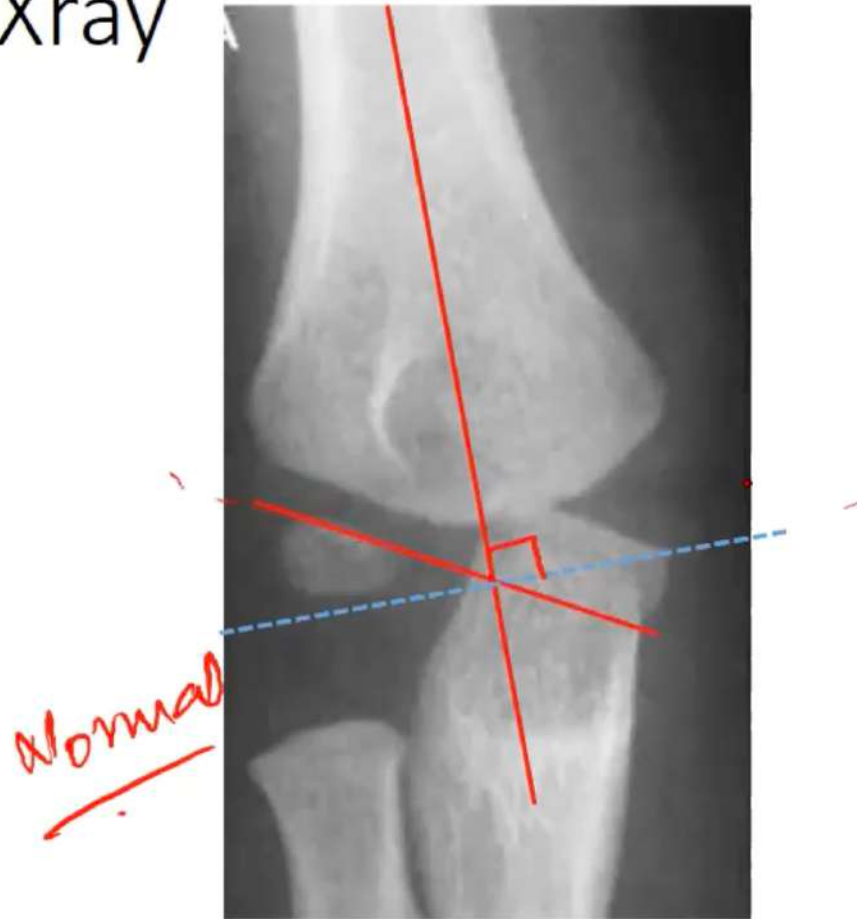


- True Lateral view



Xray

Baumann's angle



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

Gartland Classification →



1



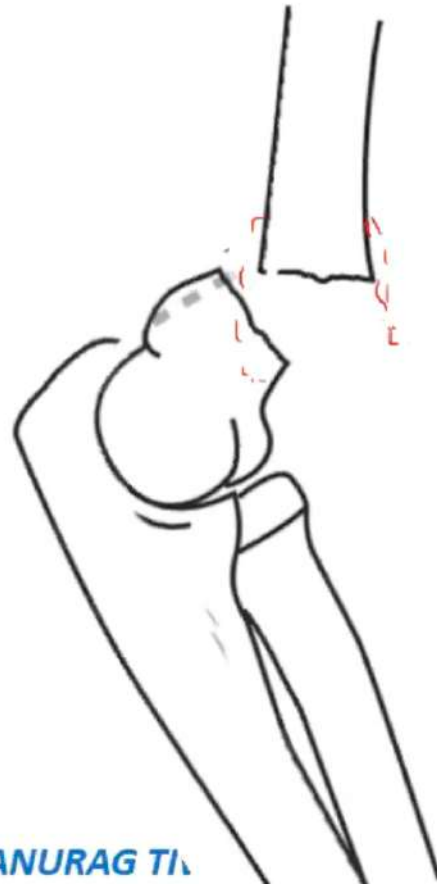
2



3

✓ Type IV – Complete periosteal disruption

- Diagnosed while examining under image intensifier



- Type IV- Complete periosteal disruption with # displaces in flexion and extension
- ✓ Medial comminution type- Medial column comminuted/ collapse → decrease in Baumanns angle.

↓
↓
~~op~~ operative

- Structures injured in Posteromedial displacement

- A. Median nerve 33%
- B. Brachial artery
- C. Both of the above — SD
- D. Radial nerve



Prox. fragment. Rad. n.

- Structures injured in Posterolateral displacement

✓ Prox → medially
 PL → Med. nerve
 Brachial
 PM → Radial nerve.

Management

- Type I-

Non op



Compartment



c'

- Type II-

- Type III-

CRIF & knife



(OR)

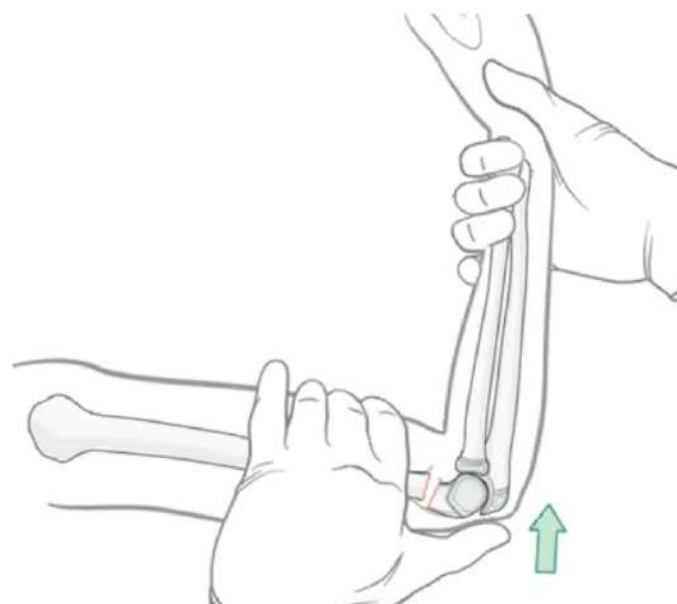
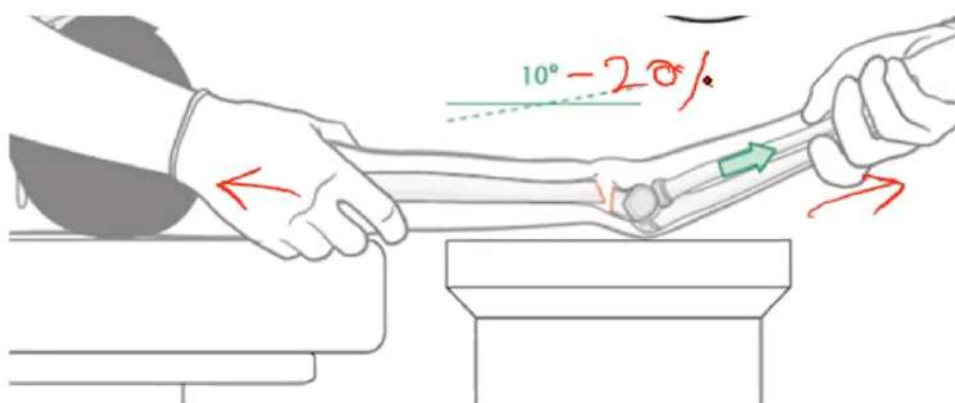


Technique of Close reduction



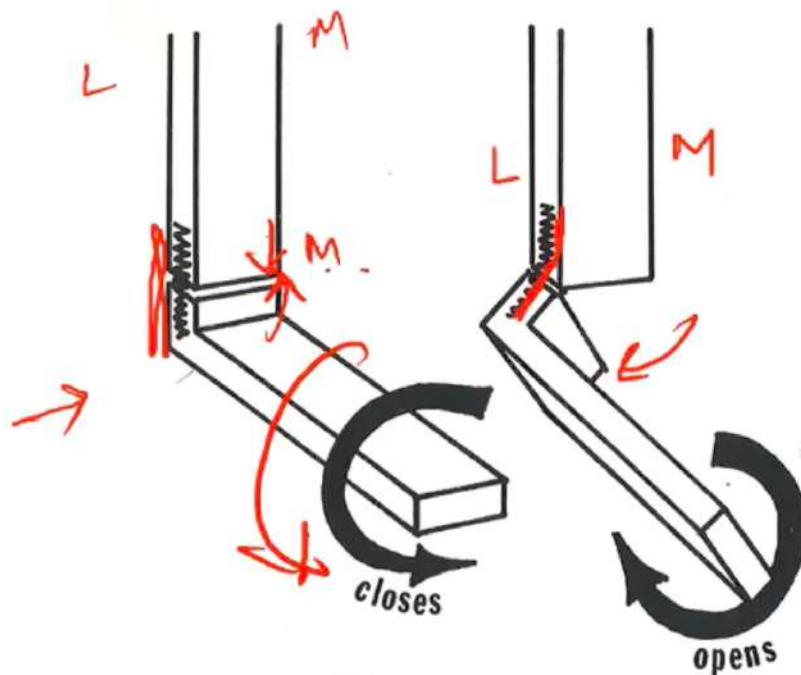
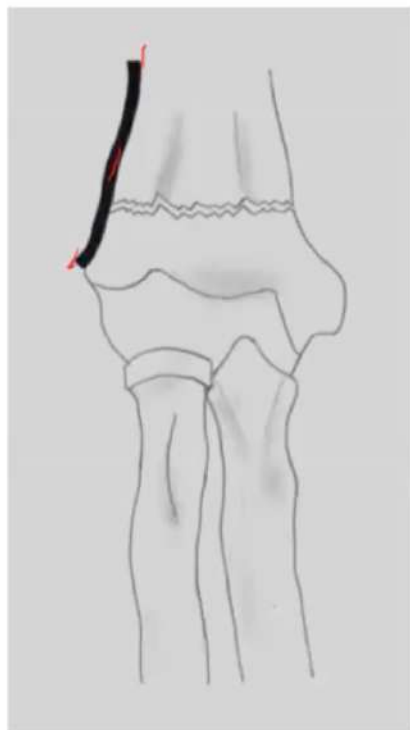
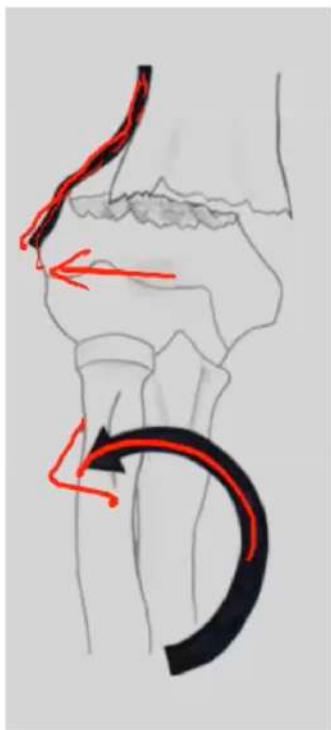
- While reducing this fracture, which movement will help in reduction?
- A. Pronation of forearm — 80%.
- B. Supination of forearm — 20%.
- C. Abduction at shoulder
- D. Adduction at shoulder

Technique of CR



DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

Supination or Pronation??



✓ L →
✓ M →

Supination
Pronation

Technique of Close reduction



PL → Sup.

- While reducing this fracture, which movement will help in reduction?
- A. Pronation of forearm — 80%.
- B. Supination of forearm — 20%.
- C. Abduction at shoulder
- D. Adduction at shoulder

Acceptable reduction-

- AP view- Baumann's angle > 10 degree
- Lateral view- Anterior Humeral line passing through capitellum
- Oblique views- well reduced medial and lateral columns

??

- Number of K wires?
- Configuration??
- Period of immobilization?

Configuration ?



Two lateral pins



Crossed pins – one lateral and one medial



Two lateral and one medial pin

- ✓ Maximum separation of pins at # site
- ✓ Medial pin- Beware of ulnar nerve injury

Incision -
↓ flex elbow

DISTAL HUMERUS FRACTURES: DR ANURAG TIWARI

??

- Number of K wires?

2/3 - s/c H - 3wks - out
4CH - 6wks - in.

- Configuration??

infection

- Period of immobilization?

3wks
Controversial
K wire left out (in.) → migration

ORIF

- Indications-
- Open #
- Irreducible #
- Unacceptable close reduction
- Vascular injuries
- Nerve entrapment during close reduction
- Approach- Anterior approach for extension type
Posterior approach for flexion type

*Post percutaneous
insert*

Why??

Pulseless Hand

Perfusion of Hand

Pink

White

Reduce the # by placing elbow flexion < 45 degrees

Wait for 5-10 minutes

Pulse reappears

Pulseless but Pink

Pulseless white

CR + pinning

Observe

Angio & Explore the artery

Artery in continuity, but spasm +

Thrombus +

Transection

Observe

Thrombectomy

Repair +/- vein graft