IBRA International Bone Research Association

IBRA
Terrible Triad of the Elbow
&
Ligament Reconstruction

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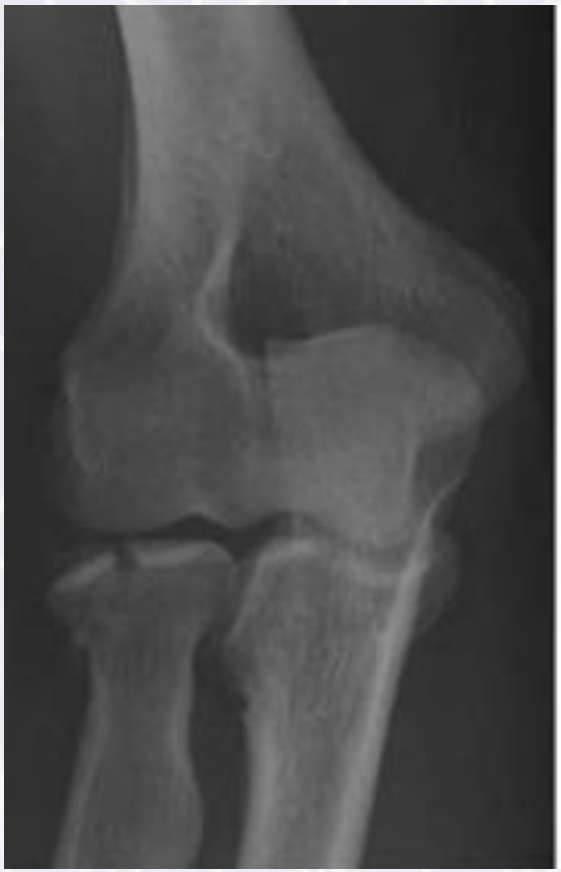
What is it?

- Elbow Dislocation
- Radial Head Fracture
- Coronoid Fracture

Emergent/Urgent Reduction

- Better for cartilage
- Better for soft tissues
- Delineate full spectrum of injury



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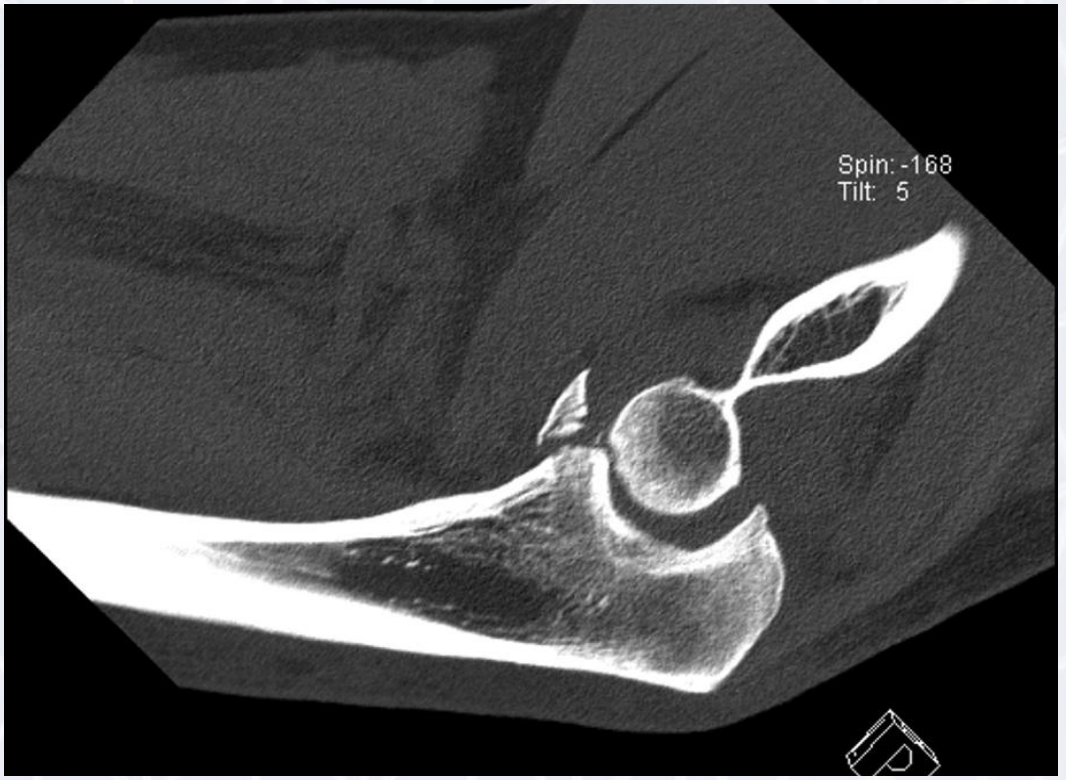
Emergent/Urgent Reduction

- Plain x-rays
- CT Scan
- Definitive treatment in light of day and usual staff



Anatomy - The Radial Head

- Important anterior and valgus stabilizer of the elbow
- Also contributes to longitudinal stability

Radial Head Anatomy

- Not quite a circle
- Articulates with the capitellum and the proximal ulna at lesser sigmoid notch
- A portion of the rim, laterally in neutral position so called “safe zone”, devoid of hyaline cartilage

Anatomy - The Coronoid

- Important anterior and varus stabilizer of the elbow
- Tip, Body, Anterolateral facet, and Anteromedial facet.
- Sublime tubercle
- Supinator Crest

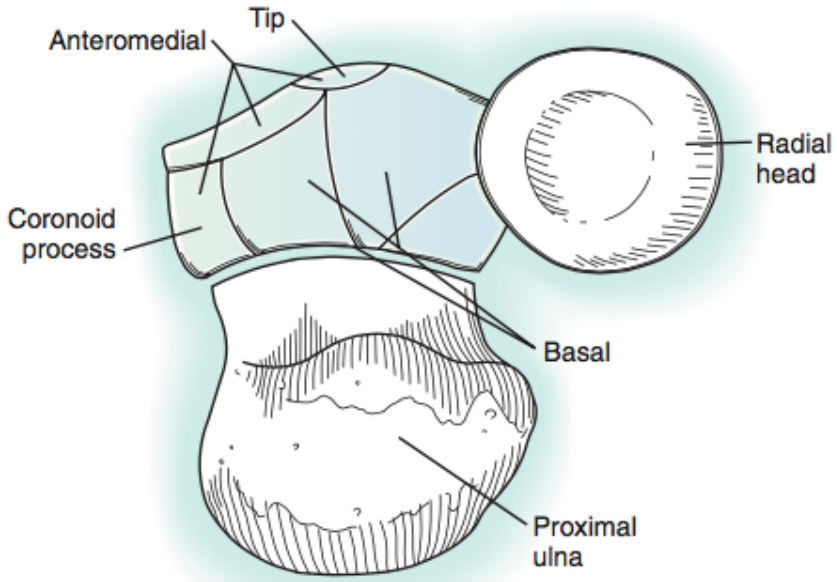
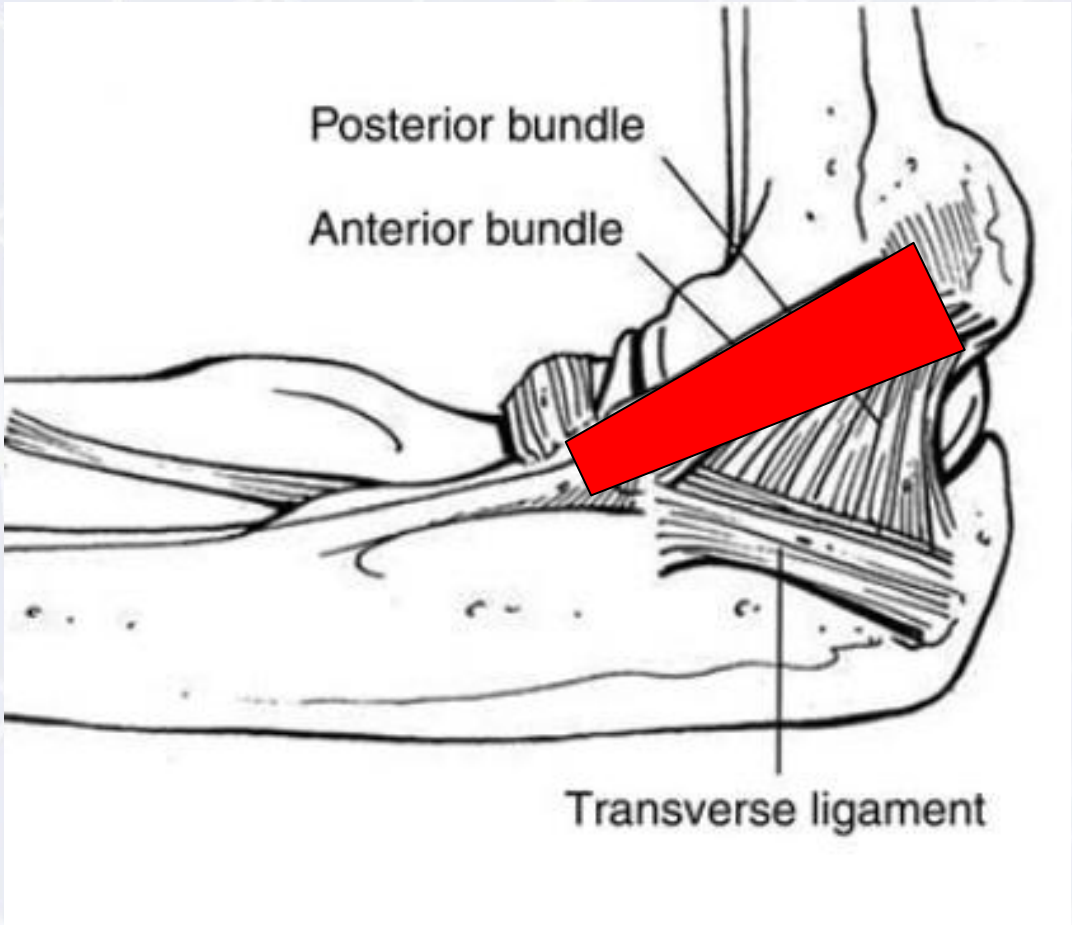


Figure 24.6 Coronoid fracture classification as described in O'Driscoll and colleagues.[79] *Tip fractures* have two subtypes: Subtype 1 involves ≤2 mm of coronoid height, and subtype 2 involves >2 mm of coronoid height. *Anteromedial fractures* have three subtypes: Subtype 1 involves the anteromedial rim, subtype 2 involves the anteromedial rim and tip, and subtype 3 involves the anteromedial rim and sublime tubercle. *Basal fractures* have two subtypes: Subtype 1 involves the coronoid body, indicated by at least 50% of the height of the coronoid, and subtype 2 is associated with olecranon fractures.

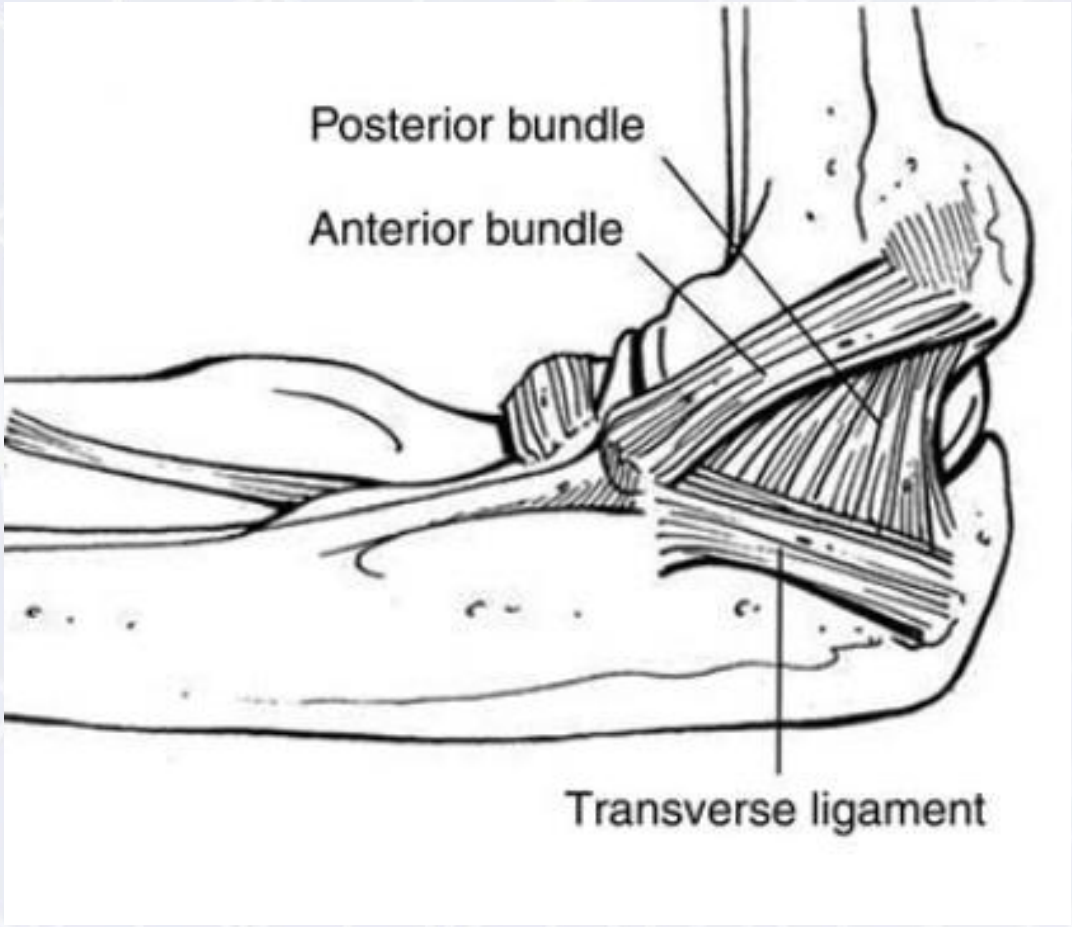
Anatomy - MCL

- Anterior Bundle
  - AA and PA?
- From anteroinferior medial epicondyle to sublime tubercle
- Important stabiliser to valgus and posteromedial instability



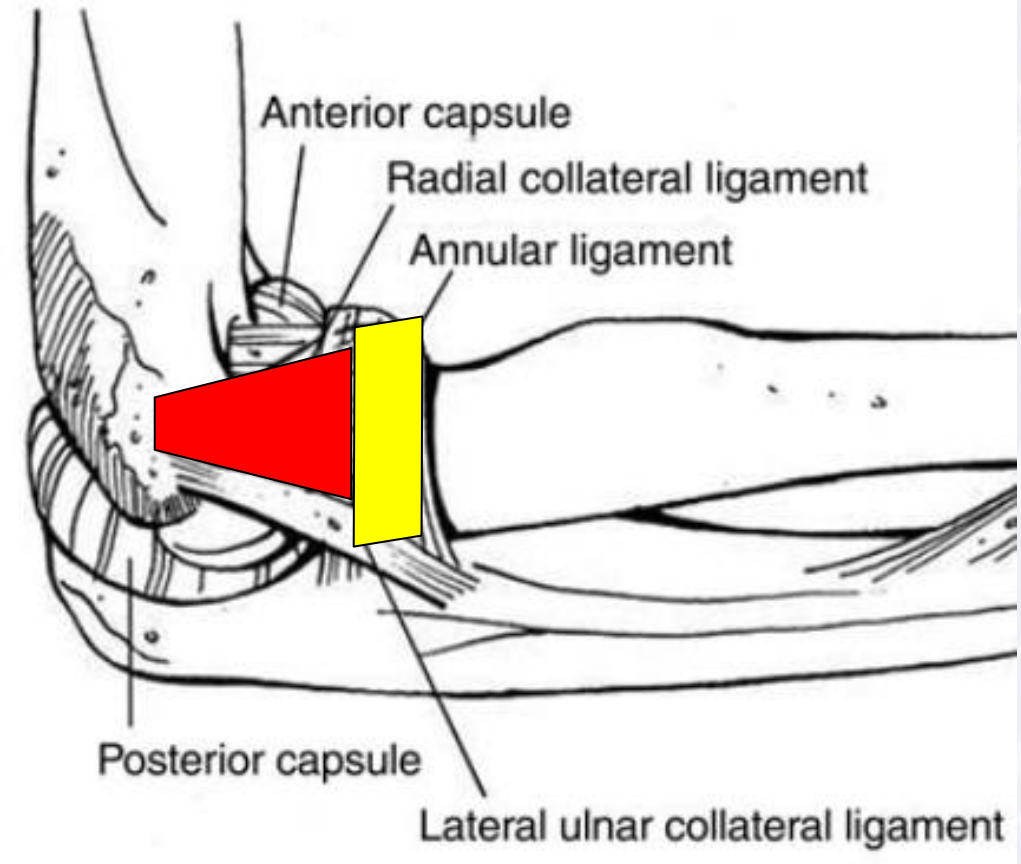
MCL

- Transverse
- Posterior Bundle



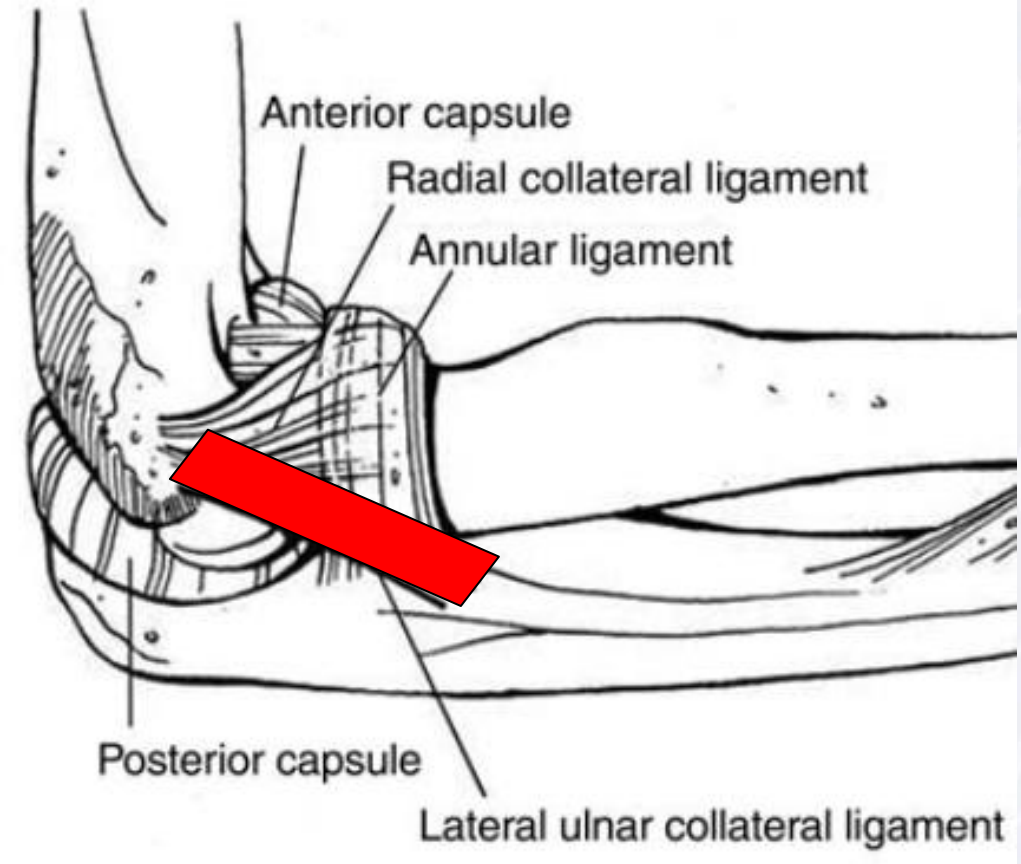
Anatomy - LCL

- Radial Collateral Ligament
  - Lateral epicondyle to blend with annular ligament
- Annular Ligament
  - Anterior and posterior sigmoid notch



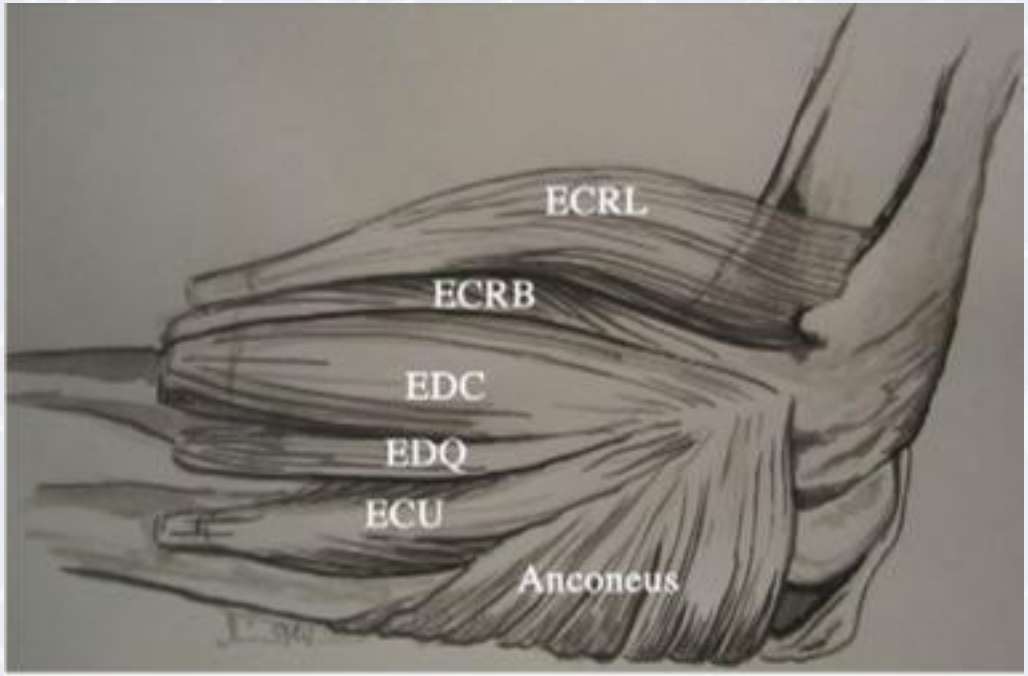
LCL

- Lateral Ulnar Collateral Ligament (LUCL)
  - From isometric point on lateral epicondyle to supinator crest
- Important Restraint to Varus and posterolateral rotatory instability (PLRI)



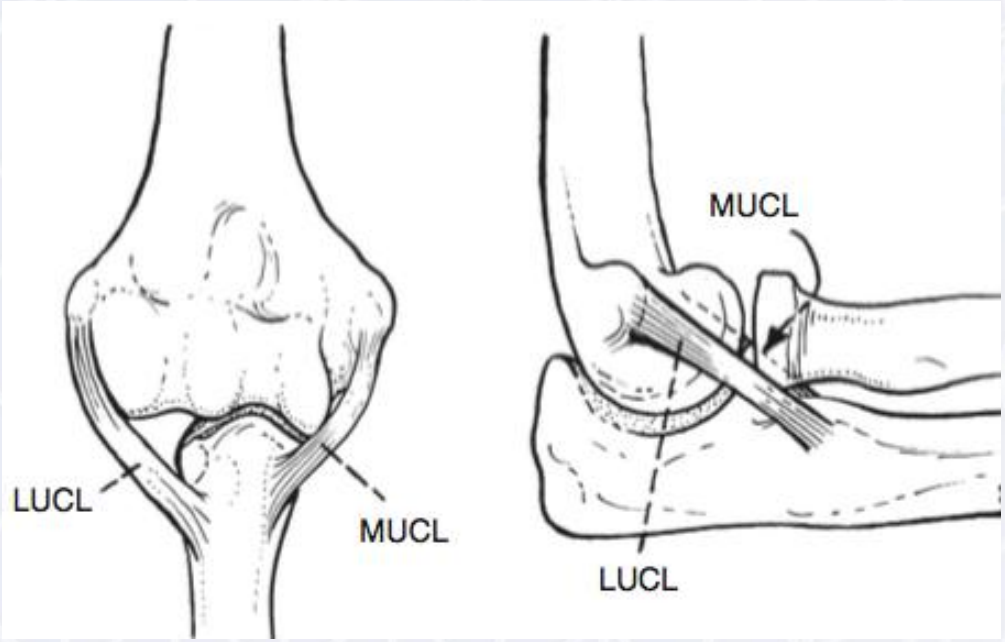
Dynamic Stabilisers

- Flexor Pronator Mass
  - Valgus restraint
- Common Extensor Origin
  - Varus restraint



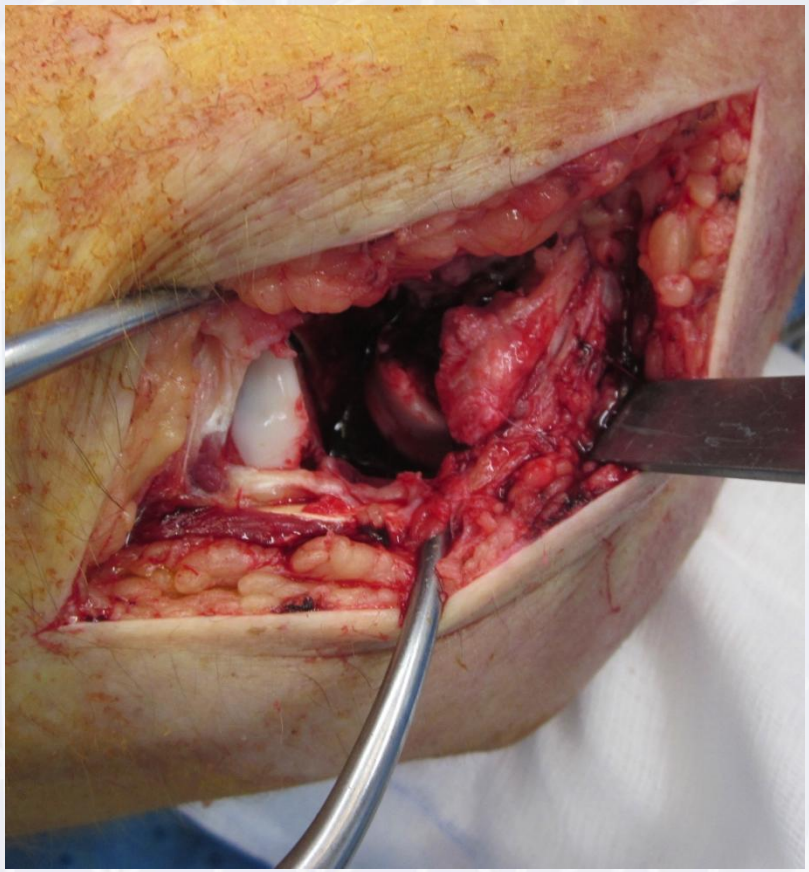
Primary Restraints

- Ulnohumeral articulation
  - Coronoid Esp >30 degs flexion
- MCL
- LCL



Secondary Restraints

- Radial Head (MCL)
  - Both radial head and MCL required for normal stability
- Joint Capsule
- Flexor pronator and common extensor muscles

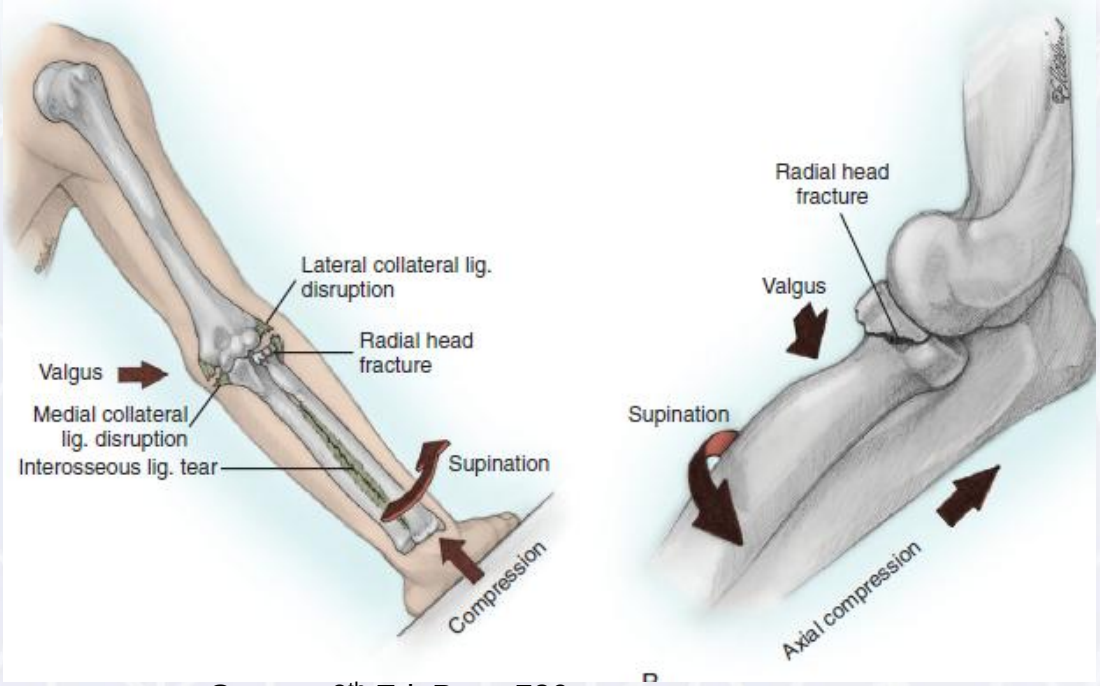


Mechanism of Injury

- Axial load + valgus load and rotatory moment
- Anterior capsule tears and levering of ulna out of articulation

Failure of Structures

- MCL failure
- Tension and failure of lateral ligamentous structures
- Radial Head fracture
- Coronoid fracture



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SYMPOSIUM: TRAUMATIC ELBOW INSTABILITY AND ITS SEQUELAE

Can We Treat Select Terrible Triad Injuries Nonoperatively?

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12 patients

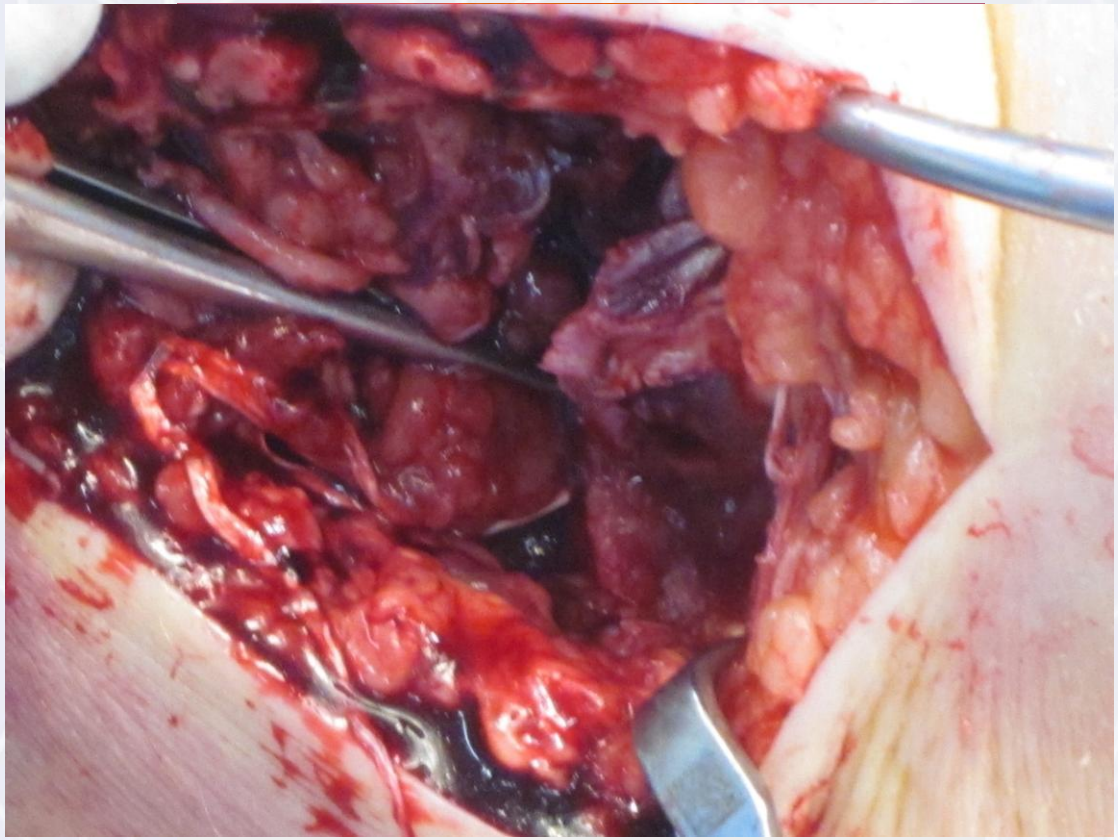
- a concentric joint reduction
- radial head fracture that does not cause a mechanical block to rotation
- smaller coronoid fracture
- stable arc of motion to a minimum of 30° of extension to allow active motion within the first 10 days

Approach

- Lateral
  - Kocher
  - Direct Lateral
- Medial
  - ECU split
  - Over the top
- Universal Posterior

Lateral Approach

- Lateral
  - Kocher
  - Direct Lateral
- Advantages
  - Easy, familiar
  - May only need 1 approach anyway
- Disadvantages
  - May need medial approach as well



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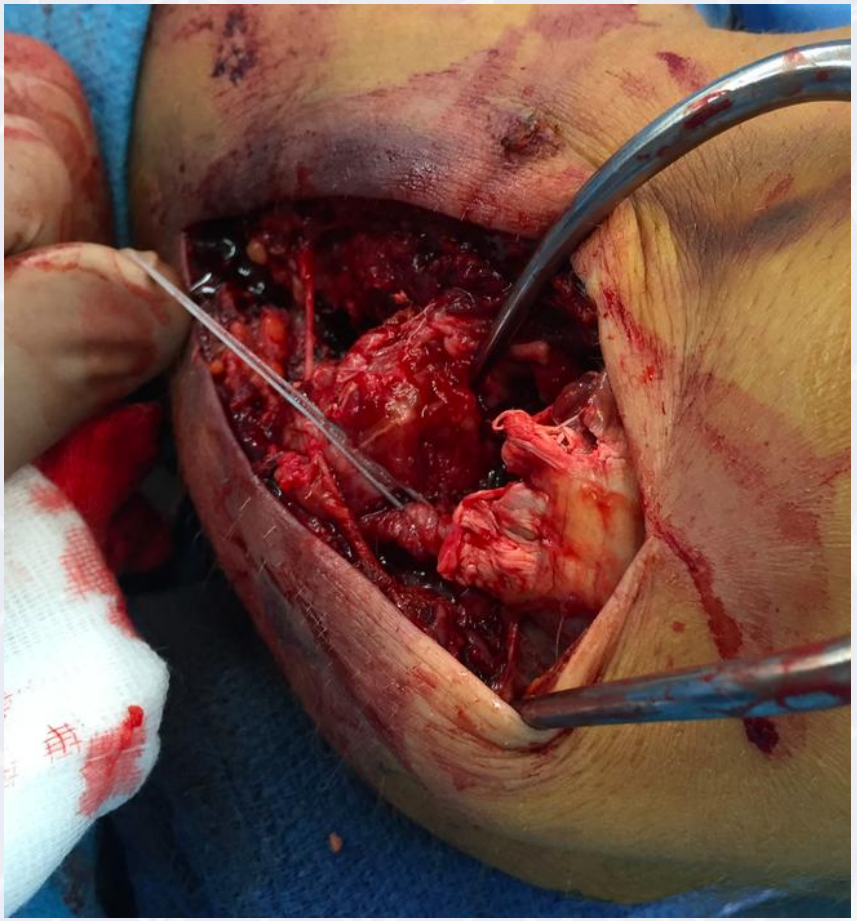
Medial Approach

- Medial
  - Through floor of cubital tunnel
  - Direct medial
  - Over the top



Radial Head - What Am I Thinking?

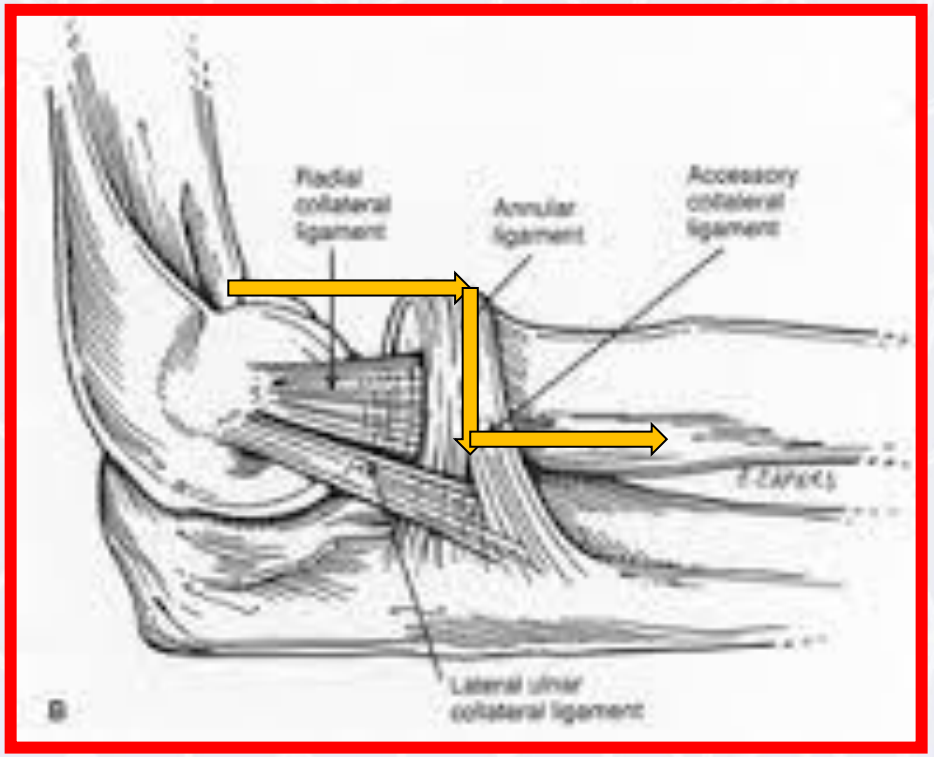
- Is the joint any good
- Are there other injuries
  - Radial neck
  - Capitellar injury
  - Other

What Am I Thinking?

- **Is it fixable?**
- **LASTLY but of course not least!**
- **WHAT IS THE PATIENT LIKE?**

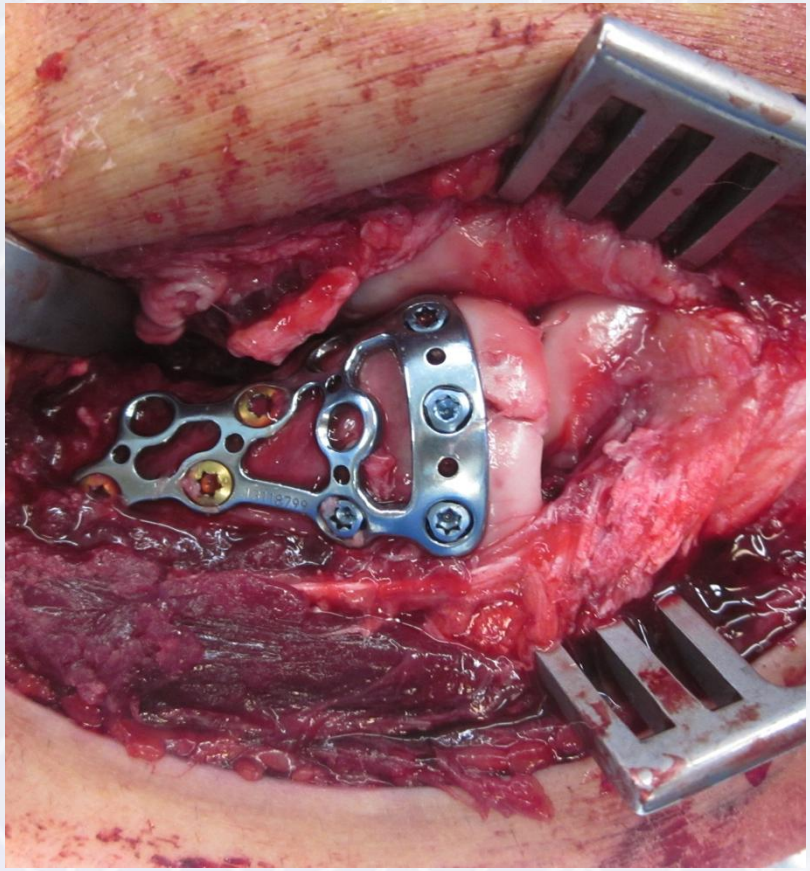
ORIF with radial neck involvement

- **Step cut annular ligament (if not ripped to shreds)**
- **Identify lateral ligament complex to repair**



ORIF if you can

- Be aware of “safe zone”
- Step cut annular ligament (if not ripped to shreds)
- This allows closure afterwards if desired

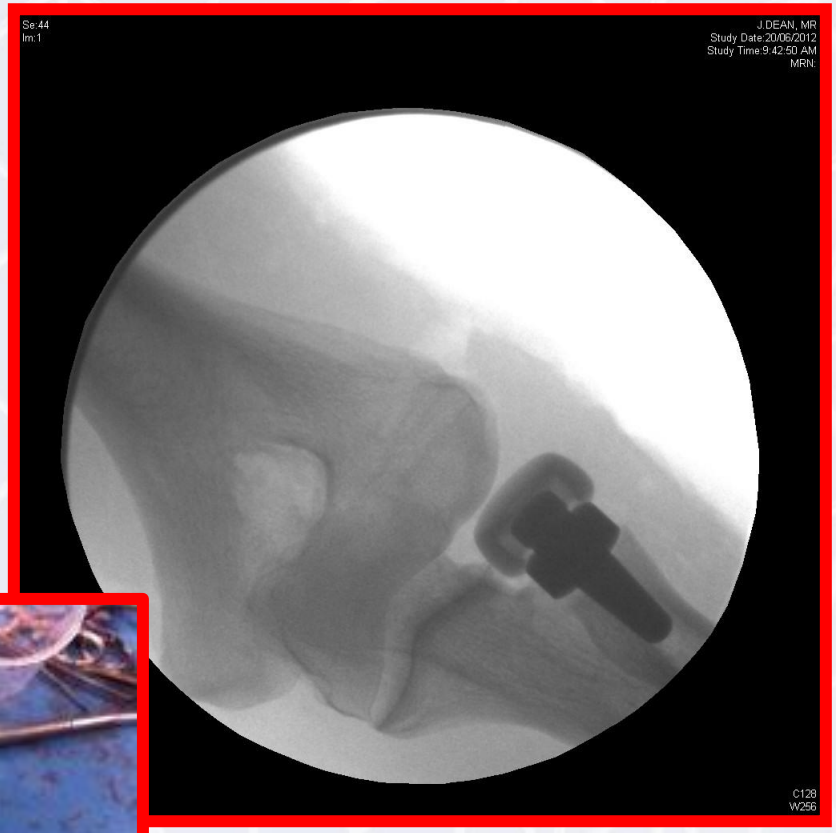


Mason III/IV Comminuted/Smashed

- ORIF/Replace
- Use a metal prosthesis
- If young I consider a pyrocarbon implant

Comminuted/Smashed

- Make sure you don't overstuff
- Measure head to get size
- Move immediately post op



Coronoid Fixation

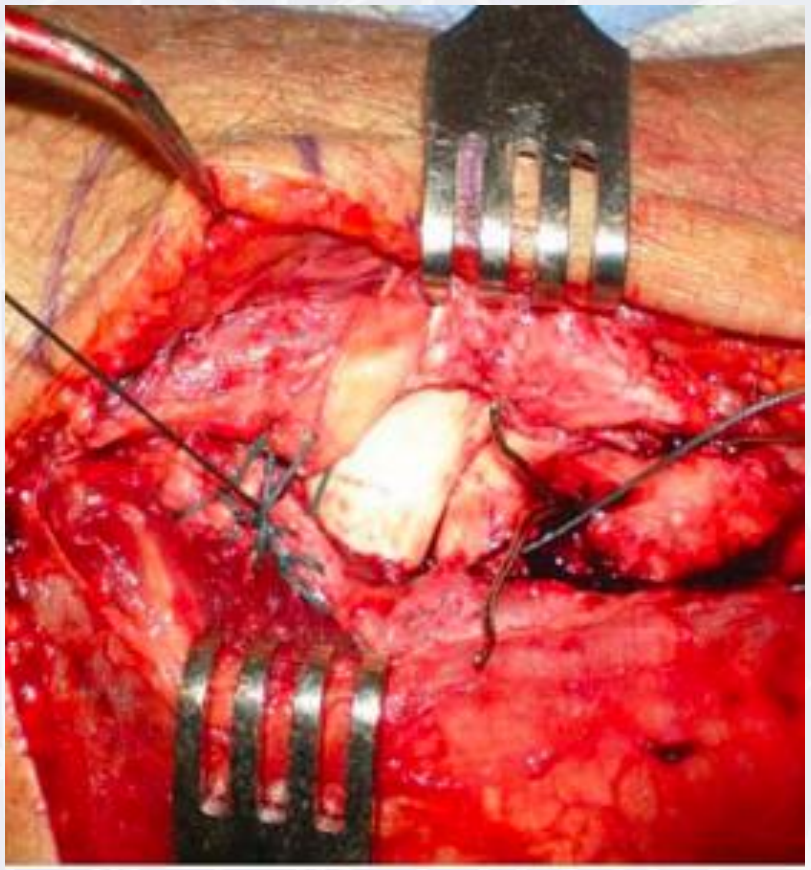
- Fix from lateral side if access adequate
- If not from medially
- Small fragments, repair anterior capsule

Coronoid Fixation

- Larger fragments internal fixation, can buttress plate from anteriorly
- Retrograde screw, use ACL guide

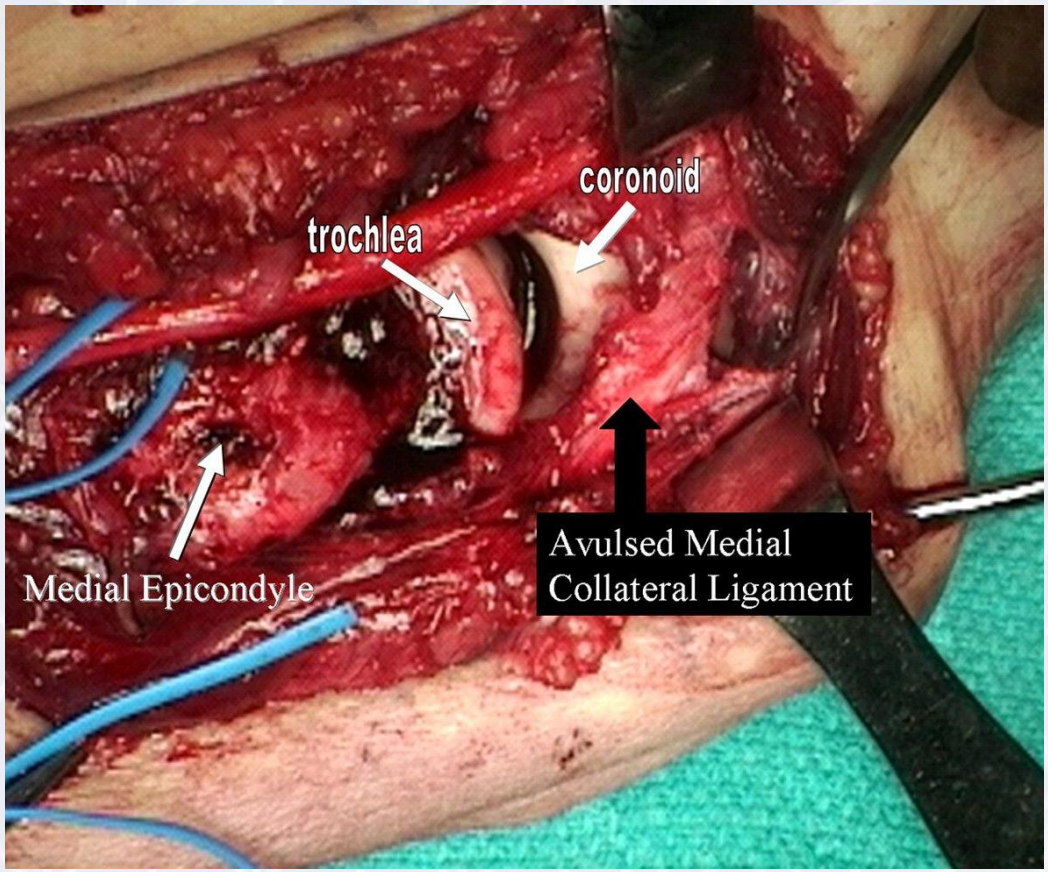
Lateral Ligament Complex Repair

- Suture anchor
- Bone tunnels
- If MCL competent then repair in pronation, if MCL lax then in supination



MCL Repair

- If elbow remains unstable after radial head, coronoid and LCL stabilised then repair MCL
- Suture anchor or tunnels
- Beware the ulna nerve



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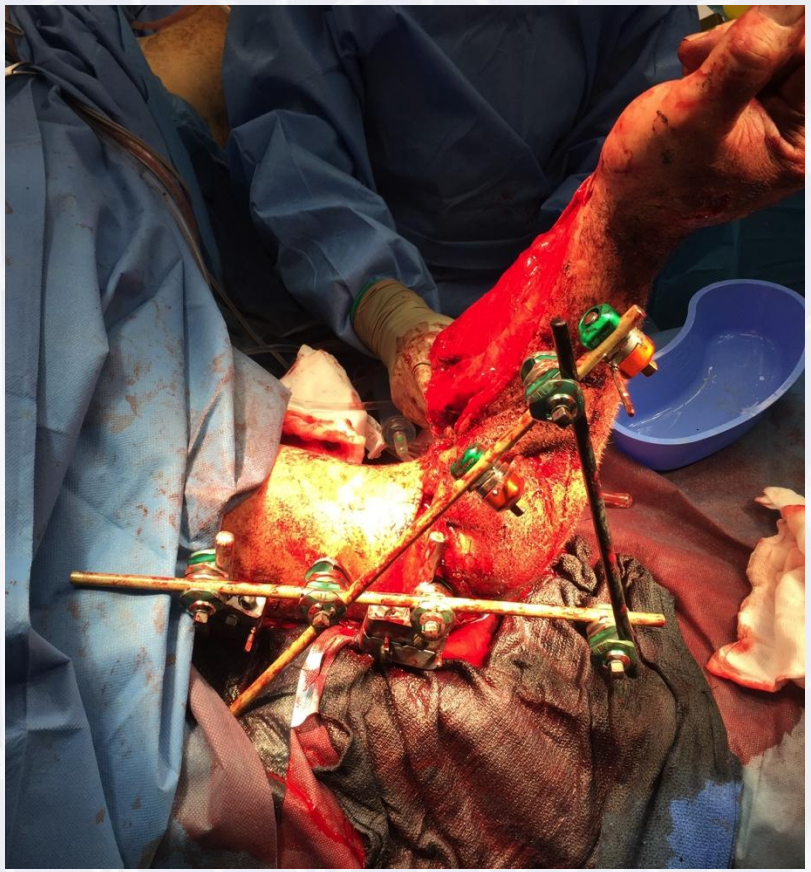
Ex-Fix

- Static
  - Leave at 90 degs and for 3 weeks
- Dynamic
  - Can start immediate motion, technically more demanding



Summary

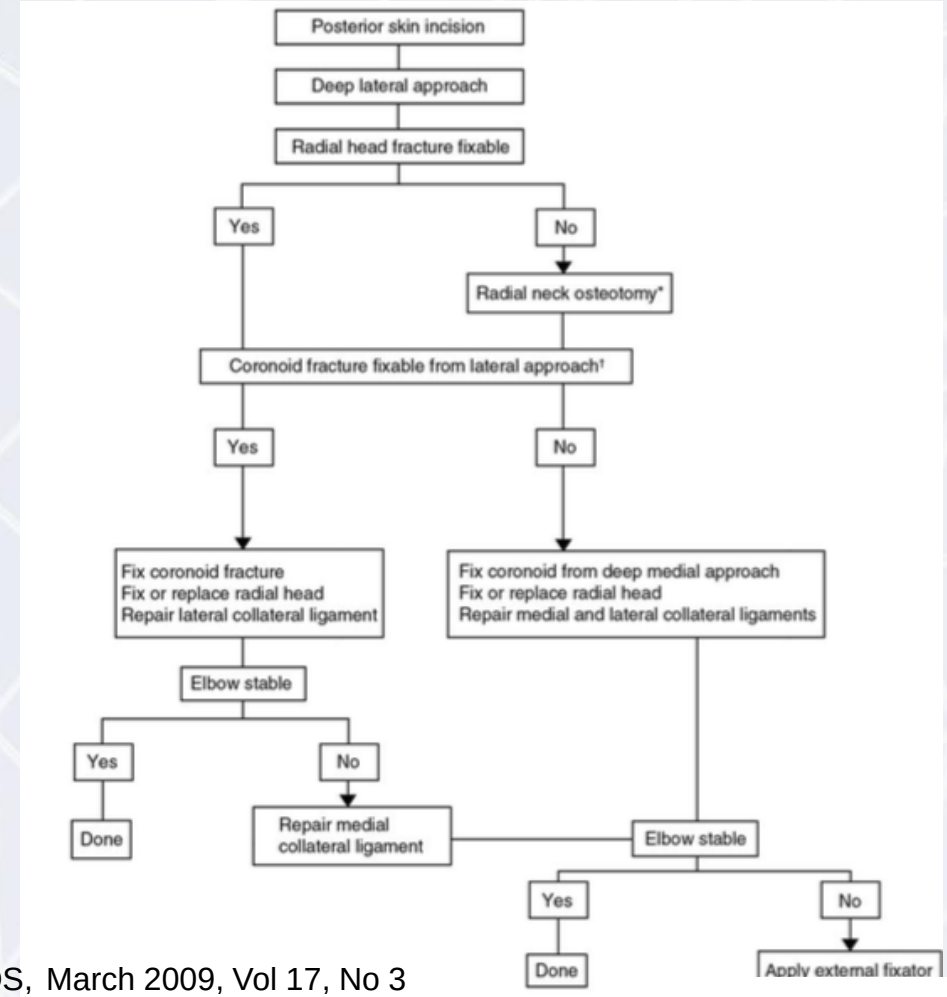
- Recognise injury
- Reduce joint
- Adequate imaging to organise plan of attack
- Choose approach

Summary

- Assess radial head
- Fix or replace?
- Fix coronoid from lateral
- If unable do medial approach

Summary

- Repair LCL
- Assess stability
- Fix MCL if unstable
- Assess stability
  - Ex fix



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Late Instability

- In patients with a “simple” dislocation late instability can occur but is uncommon
- Can be lateral, medial or both

Lateral Instability

- Pain
- Locking, clicking or snapping
- Worse w supination, extension and valgus force

Lateral Instability

- Commonly known as PLRI = Posterolateral Rotatory Instability

- Get subluxation of the radial head in extension and supination

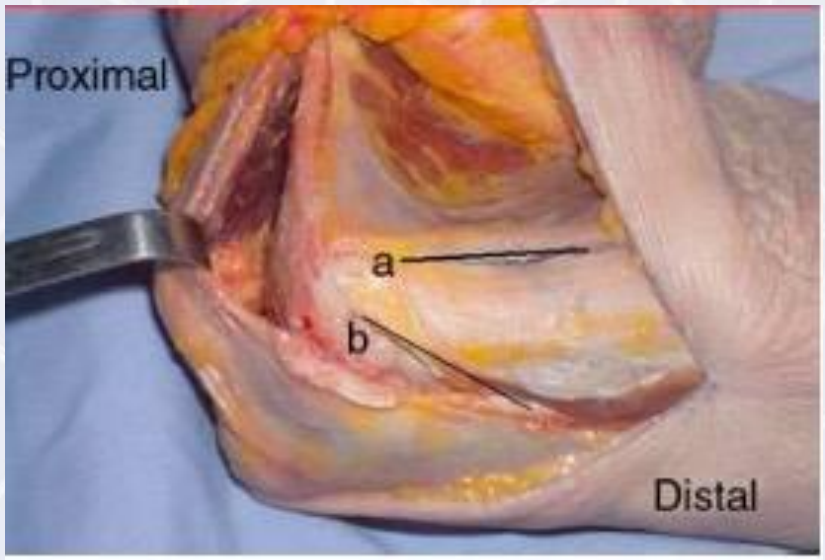
Lateral Instability

- Also push up and chair apprehension test
- Feeling of instability

- Stage 1 - subluxation of the elbow in a posterolateral direction.
- Stage 2 is subluxation of the elbow joint in which the coronoid is perched beneath the trochlea.
- Stage 3 is complete dislocation of the coronoid resting posterior to the trochlea:
- Stage 3a including a tear of posterior band of the MCL
- Stage 3b including a tear of the anterior and posterior band of the MCL

LCL/LUCL Reconstruction

- Palmaris Graft
- Lateral approach to elbow



Lateral view of a right elbow demonstrating the relative location of the Kaplan approach (line a) and of the Kocher approach (line b).

LCL/LUCL Reconstruction

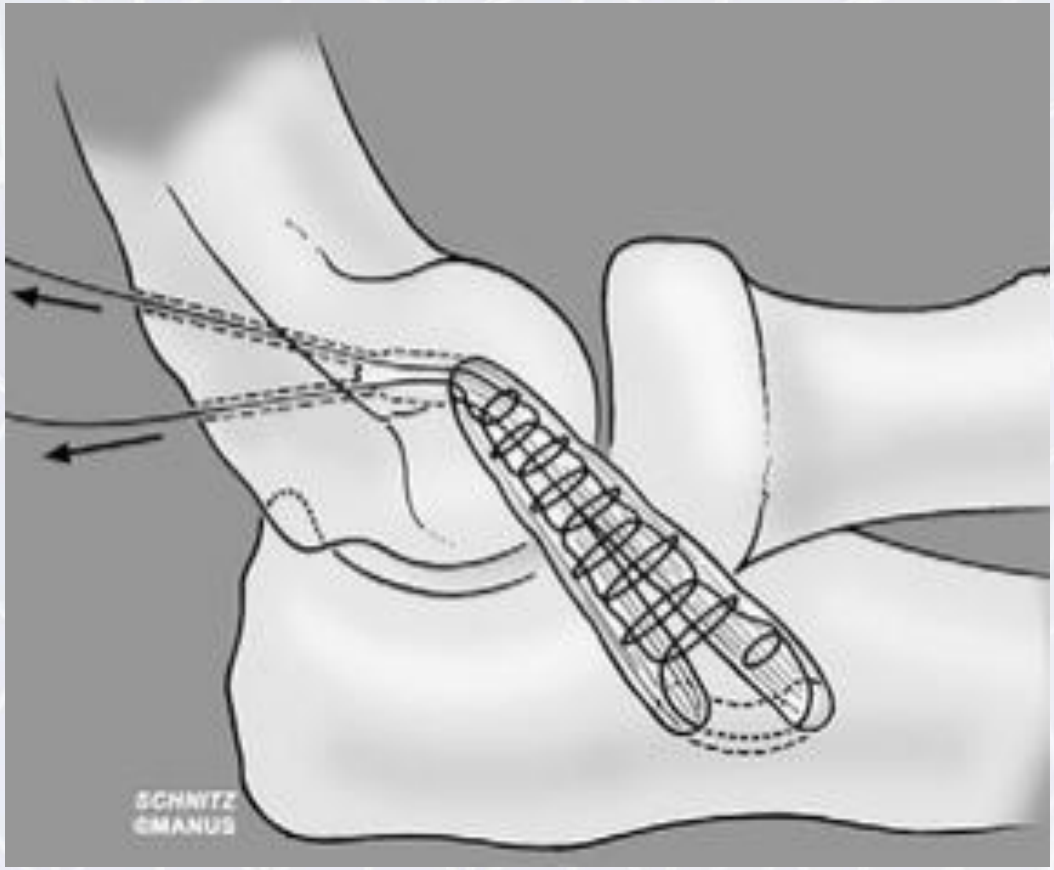
- Expose the capitellum
- Define isometric point
- Drill hole so that posterior edge of hole is at isometric point
- Then 2 smaller suture holes

LCL/LUCL Reconstruction

- Distal insertion is on supinator crest
- Begins at proximal margin radial head, distally for 2cm

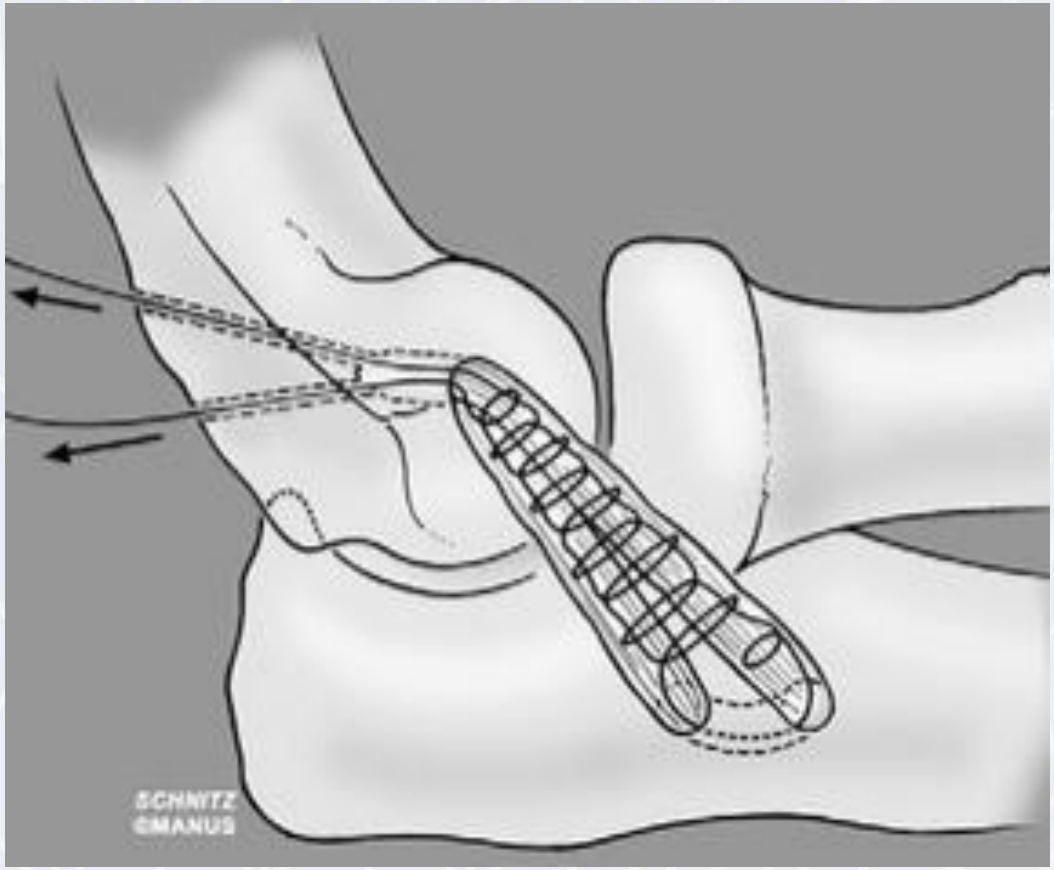
LCL/LUCL Reconstruction

- Pass graft through the ulna
- Repair native ligament, capsule and extensor origin
- Pass sutures through tunnels



Post Op

- Start motion at 7-10 days
- Avoid shoulder abduction
- No supination in full extension until 6 weeks
- May pronate/supinate in flexion

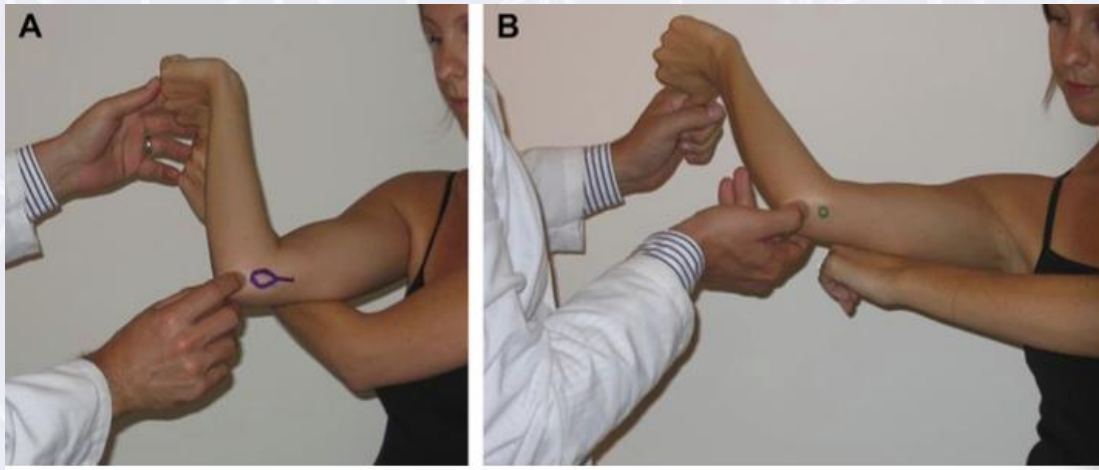


Medial Instability - Examination

- Palpate ligament in 30 degs flexion
- This unlocks the olecranon and therefore reliance on MCL
- Tenderness over sublime tubercle

Examination
Milking Manoeuvre

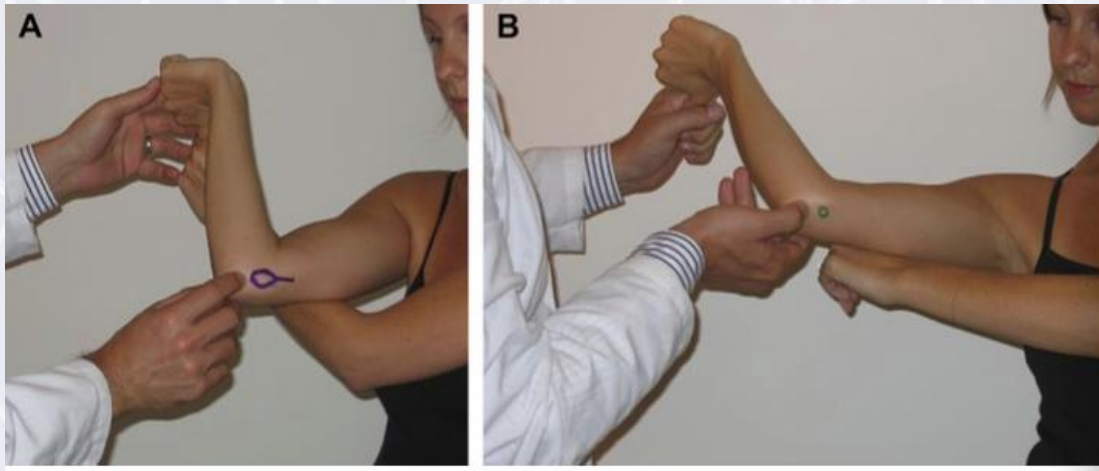
- Support elbow with contralateral forearm and then grasp thumb
- As patient pulls thumb apples valgus force



Hand Clin 24 (2008) 53–67

Examination
Valgus Stress Test

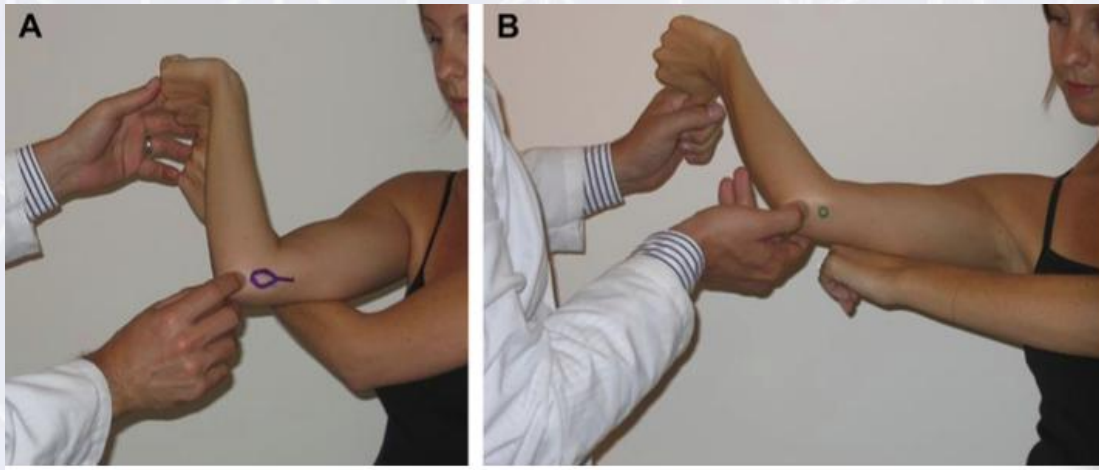
- Abduct shoulder to 90 degs and max ER shoulder
- Valgus stress then applied



Hand Clin 24 (2008) 53–67

Examination
Moving Valgus Stress Test

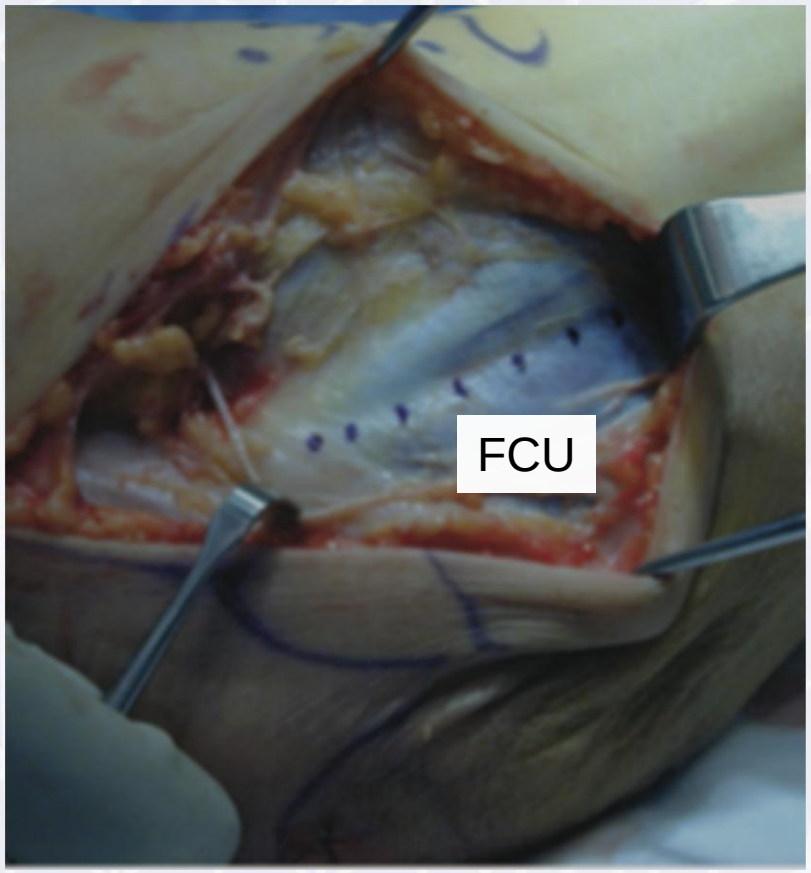
- Same as valgus stress test but then move elbow
- Pain between 70-120 degs suggests MCL injury



Hand Clin 24 (2008) 53–67

MCL Incompetent Reconstruction

- "Tommy John" Procedure
- Muscle split through posterior 1/3 of flexor/pronator mass
- Protect the ulna nerve

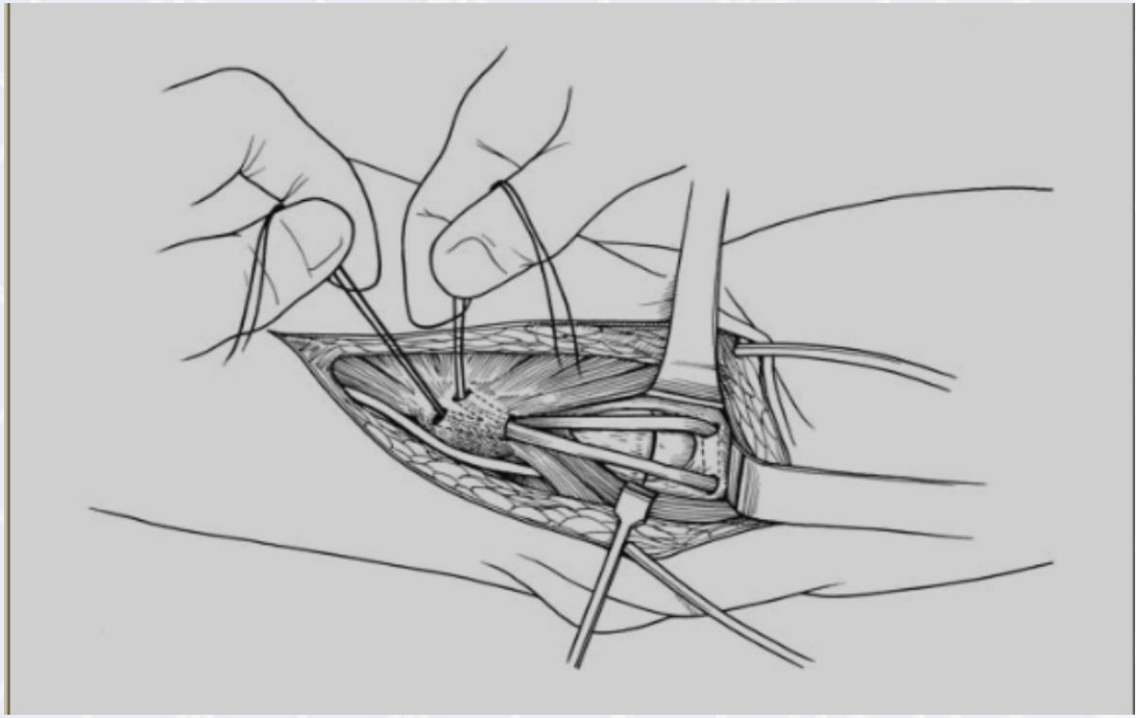


Reconstruction

- Expose sublime tubercle & 4-5mm posterior to drill tunnel (3mm) anterior and posterior to tubercle
- Keep a 2cm bone bridge

Reconstruction

- Humeral exposure along line of UCL
- Drill 4mm tunnel with blind end
- Drill 2 smaller holes (use K-wire) 1cm apart to connect to 4mm hole

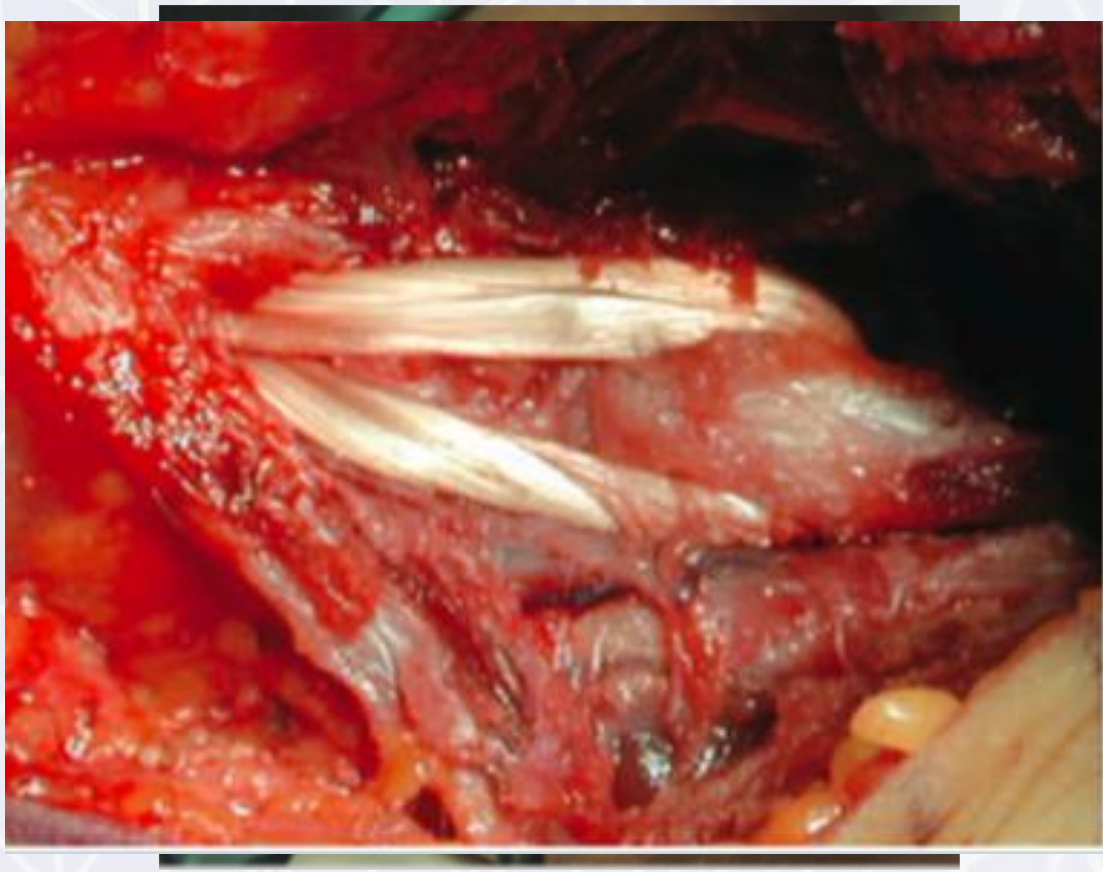


MCL Reconstruction

- Usually Palmaris graft
- Pass graft from anterior to posterior
- Pass posterior limb of graft into humeral tunnel

MCL Reconstruction

- The estimate length needed to be in tunnel without bottoming out
- Cycle the elbow for creep
- Tension in 30 degs and tie over bone bridge



Post Op

- Rest 1 week
- Then motion 30 – 90 degs flexion for 2 weeks
- Week 3-5, 15-105 degs flexion
- 6 weeks full motion

THANK YOU