AAOS/AAPA 2022
JUNE 25TH, 2022

The Elbow: Funny Bone or Tiger Country

MATTHEW D. BELTON, MD

UNIVERSITY OF COLORADO SOM

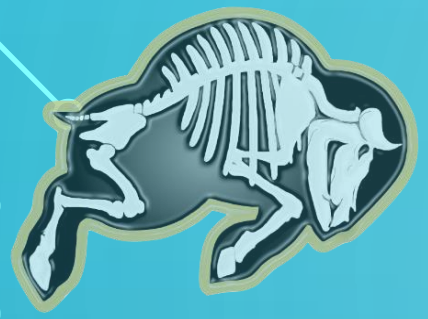
ASSISTANT PROFESSOR,

DEPARTMENT OF ORTHOPEDIC SURGERY

SECTION OF HAND, WRIST AND ELBOW SURGERY

DISCLOSURES

- Non-Declaration Statement: I have no relevant relationships with ineligible companies to disclose within the past 24 months. (Note: Ineligible companies are defined as those whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.)



LEARNING OBJECTIVES

At the conclusion of this session, participants should be able to:

At the conclusion of this session, participants should be able to:

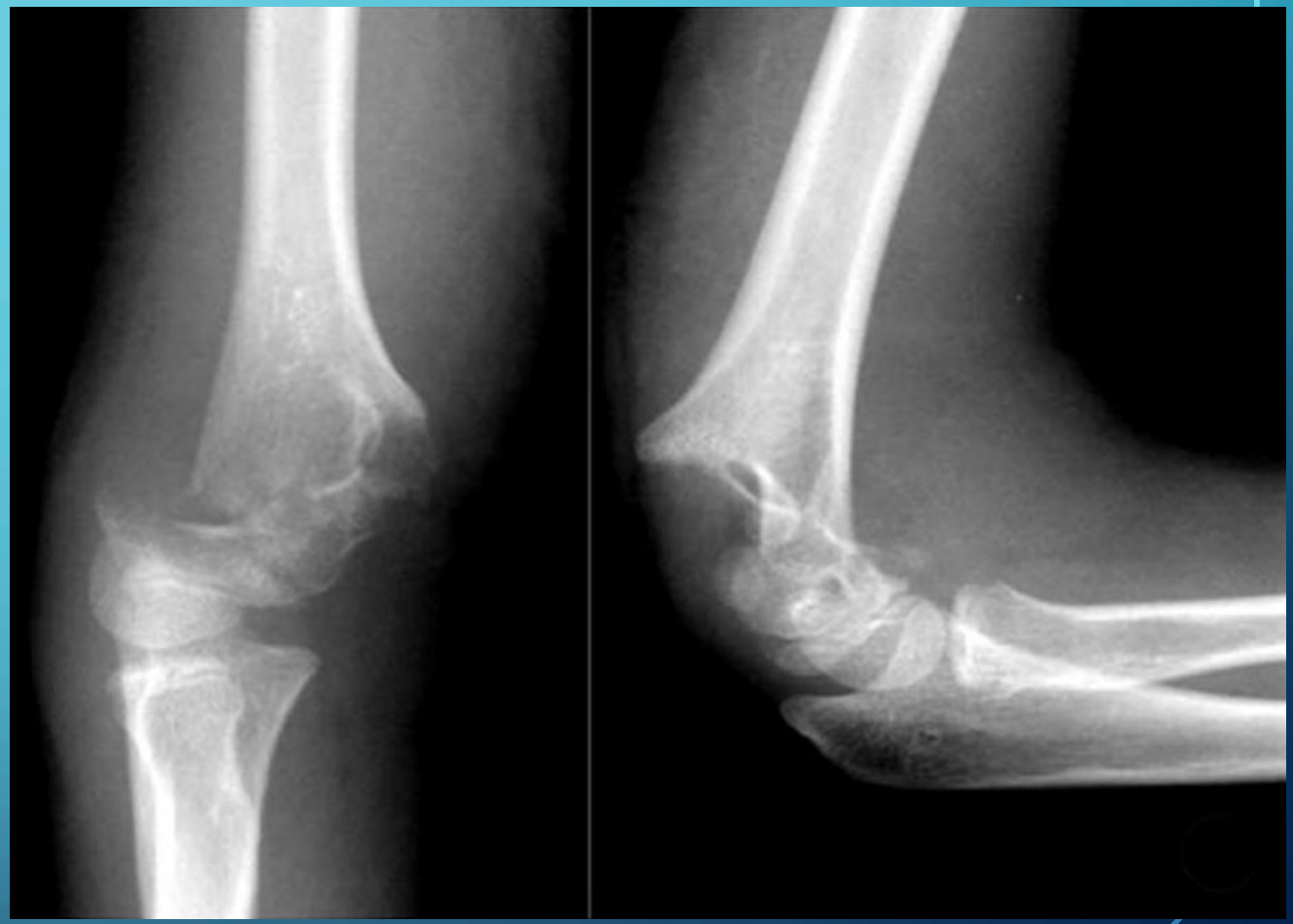
- Recognize important elbow anatomy with physical exam tips and tricks
- Identify and treat the most common elbow injuries including identifying/escalating emergent elbow injuries
- Illustrate a basic understanding of radiographic principles regarding elbow series
- Describe general brace, cast, sling and splint principles for initial stabilization

"Fight for the things that you care about. But do it in a way that will lead others to join you."

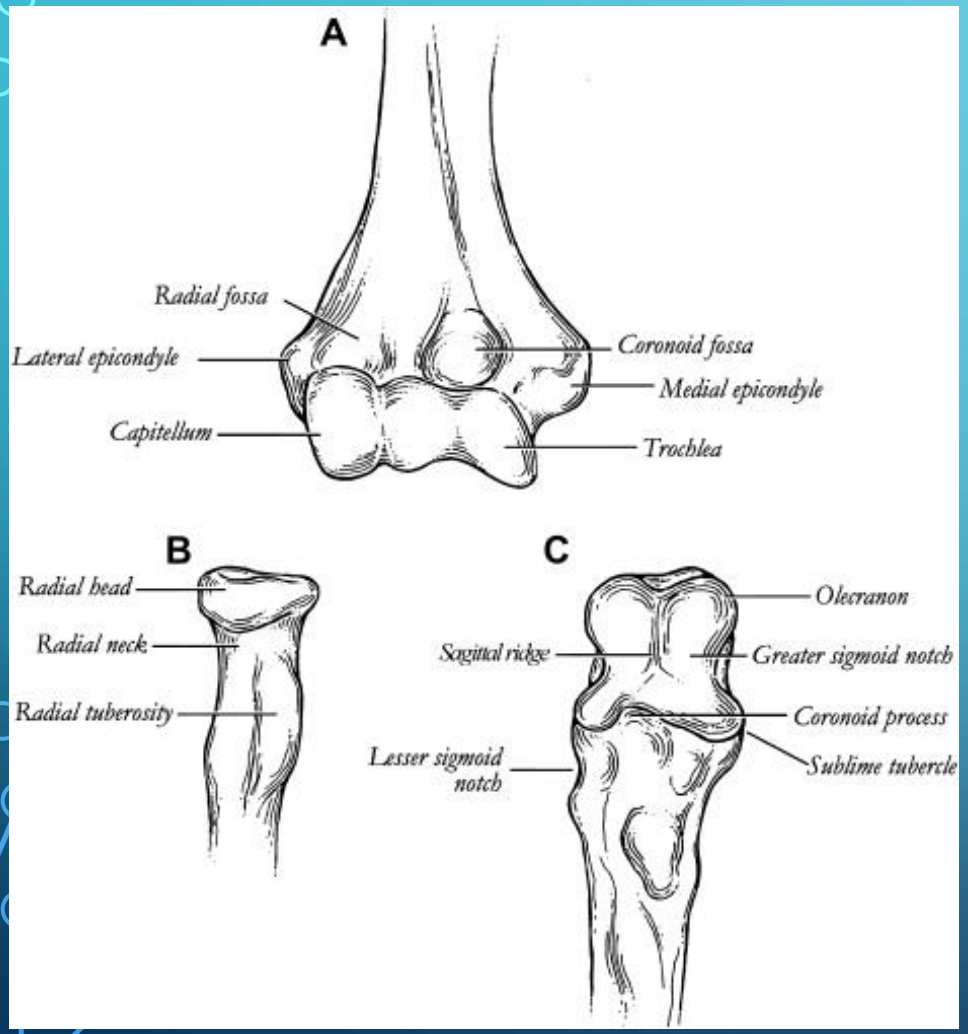
- RBG

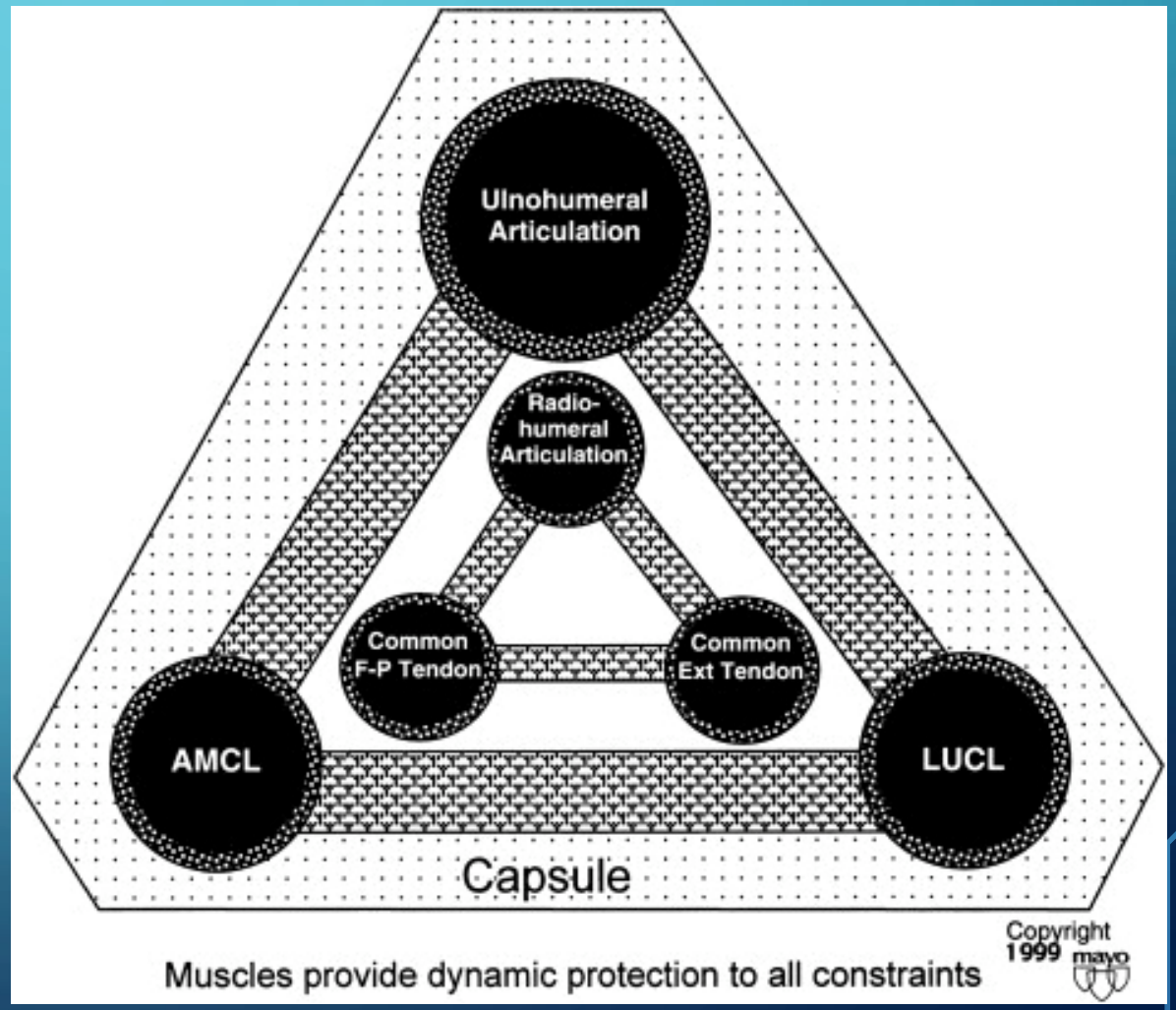
QUICK CASE:

- 6F, falls from monkey bars. Elbow swelling and pain. Radiographs obtained.
- 1) Reduce fracture and splint
- 2) Perform a full complete neurovasc exam
- 3) Long arm cast
- 4) CT Stat!
- 5) Call nearest Peds Surgeon immediately
- 6) Is that a fracture or her growth plates?



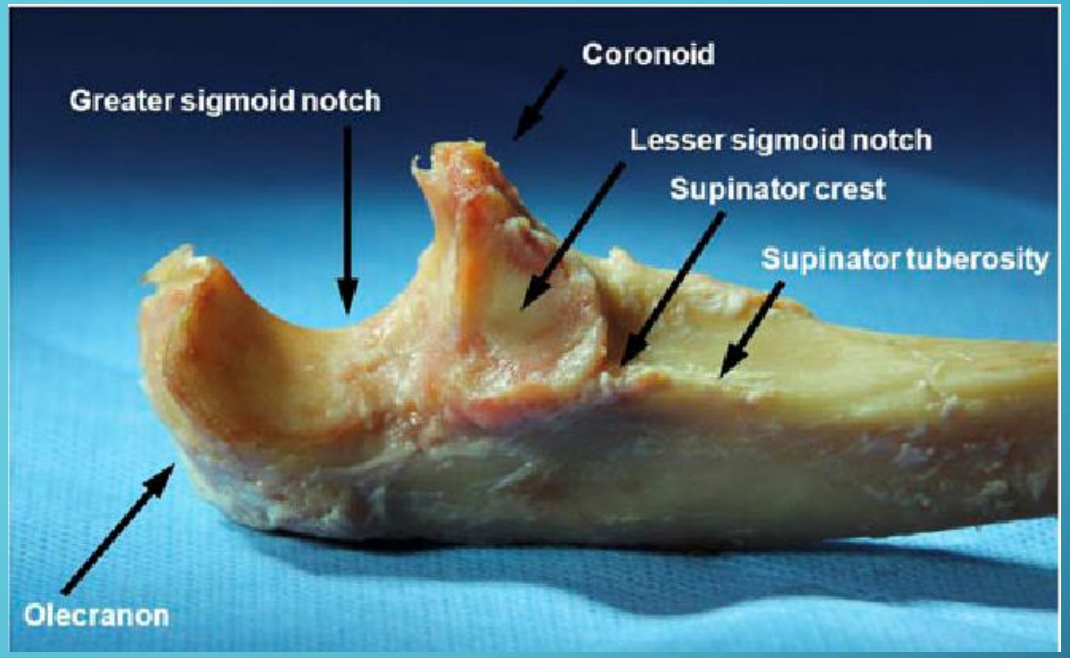
THE ELBOW

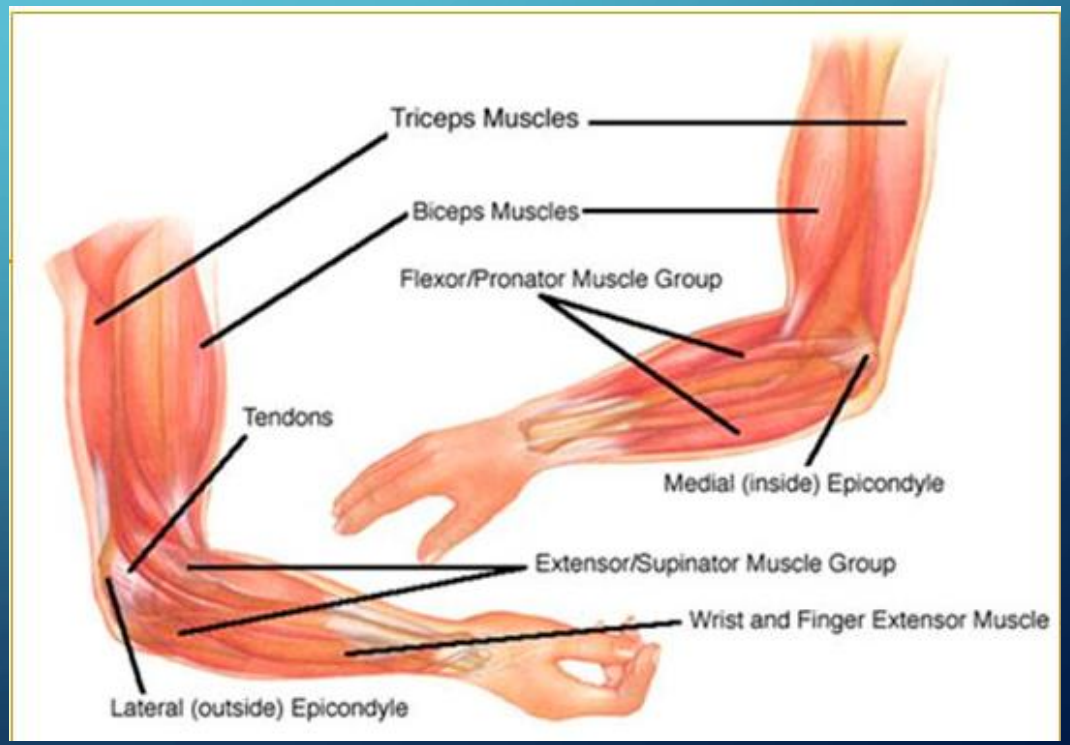

A
Radial fossa
Lateral epicondyle
Capitellum
Coronoid fossa
Medial epicondyle
Trochlea
B
Radial head
Radial neck
Radial tuberosity
C
Olecranon
Sagittal ridge
Greater sigmoid notch
Coronoid process
Lesser sigmoid notch
Sublime tubercle


Ulnohumeral Articulation
Radio-humeral Articulation
Common F-P Tendon
Common Ext Tendon
AMCL
LUCL
Capsule
Copyright 1999 mayo
Muscles provide dynamic protection to all constraints

OSTEOLOGY: PROXIMAL ULNA

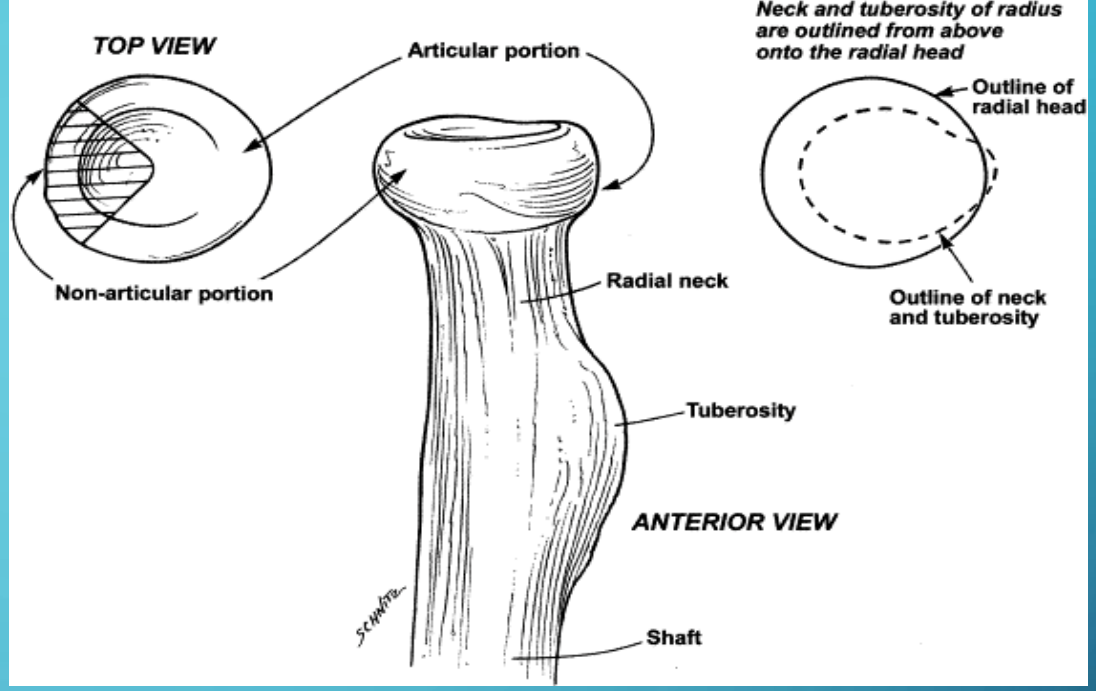
- Three Articulations: Trochleoginglomoid
  - Radiocapitellar/Ulnohumeral/PRUJ
  - Hinged (Ginglymoid): Flexion/Extension
  - Radial (Trochoid): Pronation/Supination
- Proximal Ulna: Olecranon/Coronoid
- Muscular Anatomy:
  - Anterior: Biceps Brachii, Brachialis, Brachioradialis
  - Posterior Triceps, Anconeus
  - Lateral: Common Extensor Mass
  - Medial: Common Pronator Mass

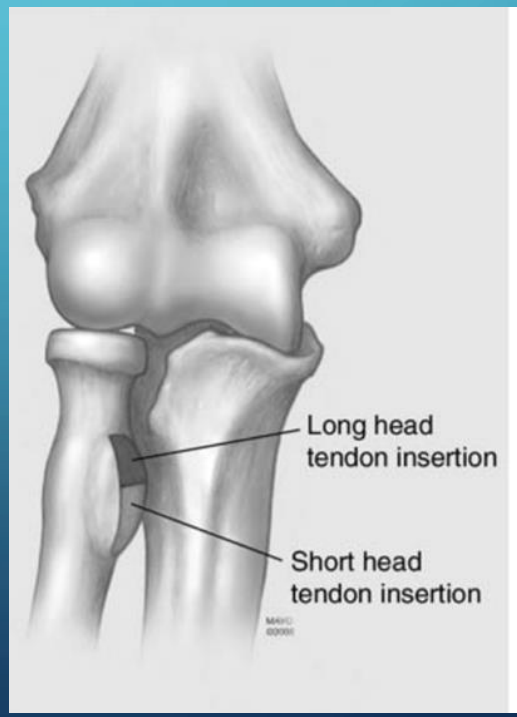


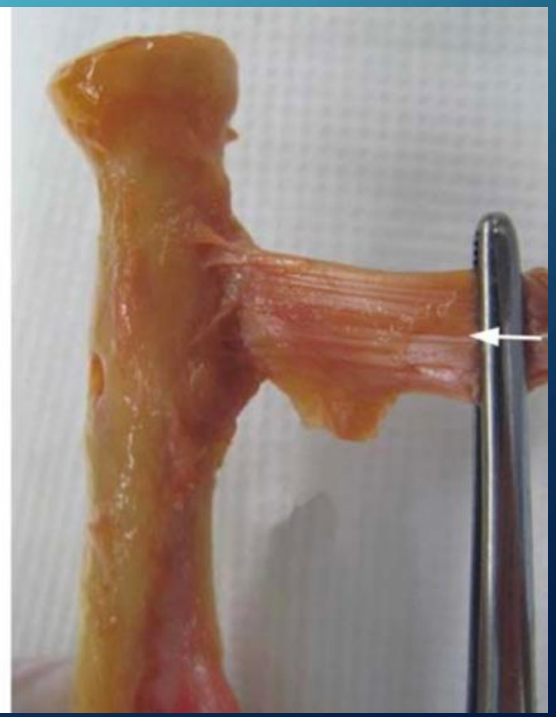


OSTEOLOGY: RADIUS

- Secondary Stabilizer: Valgus Stress
- Articular cartilage: 280 degrees arc
- Inconsistent elliptical shape
- Distal biceps insertion at radial tuberosity
  - Strong Supinator
  - Moderate elbow Flexion

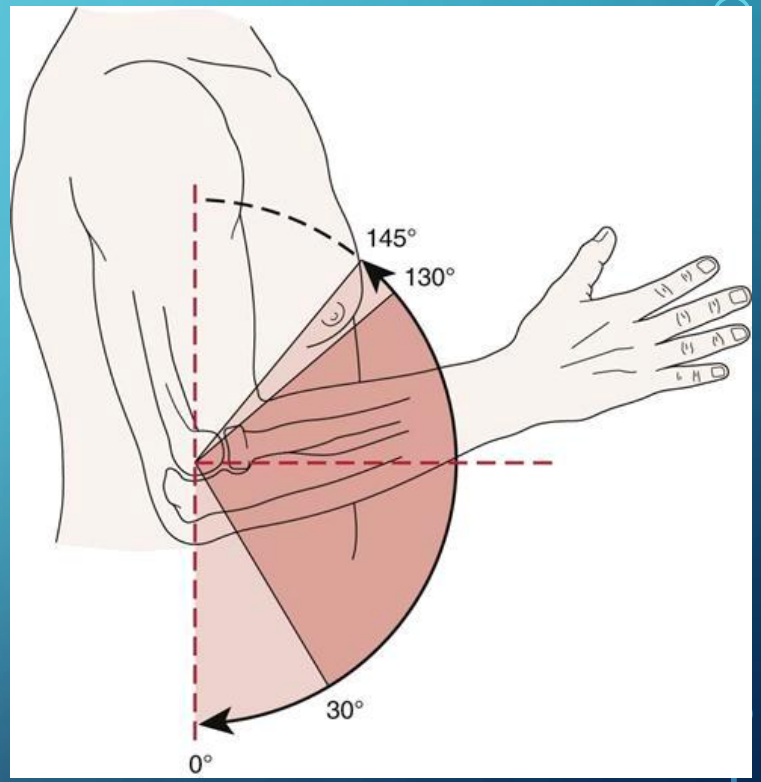


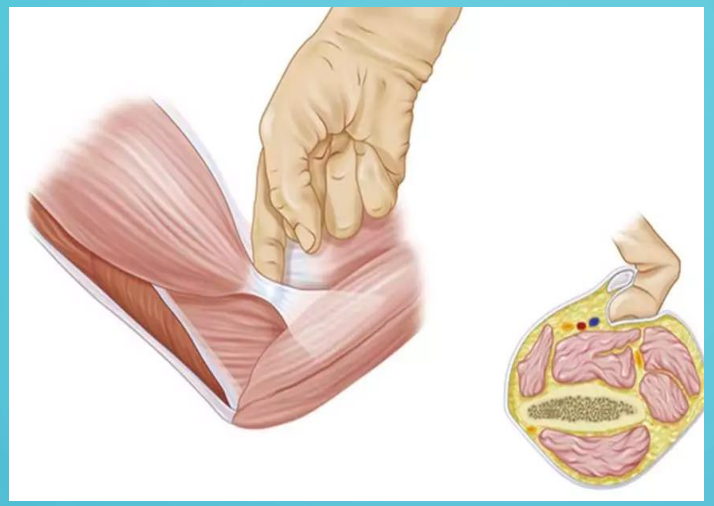




PHYSICAL EXAM

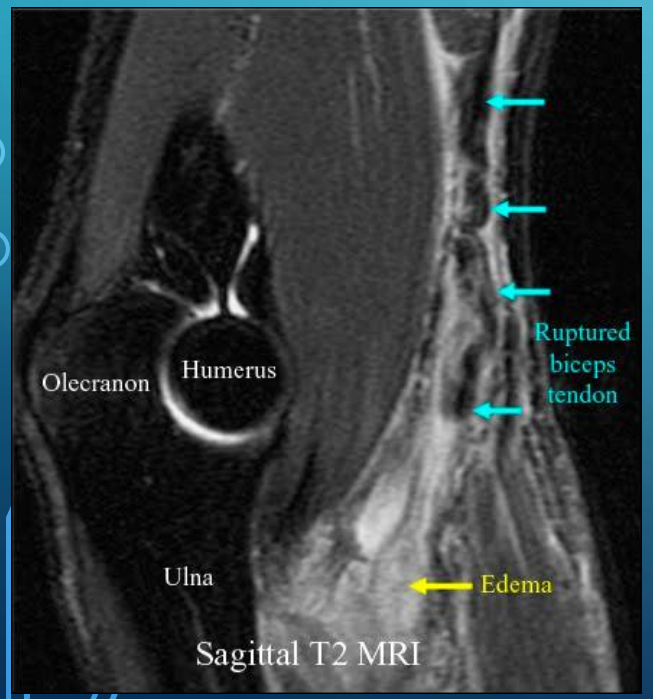
- Deformity
- Active and Passive ROM
  - F/E: 0-150, P/S: 90-90
  - Functional: 30-130, 50/50
- Stability to varus/valgus stress 0/30 degrees
- Crepitus/Mechanical signs
- Ecchymosis patterns
- Neurovascular status distally
- Special Exam Maneuvers:
  - Hook test
  - Resisted Wrist extension

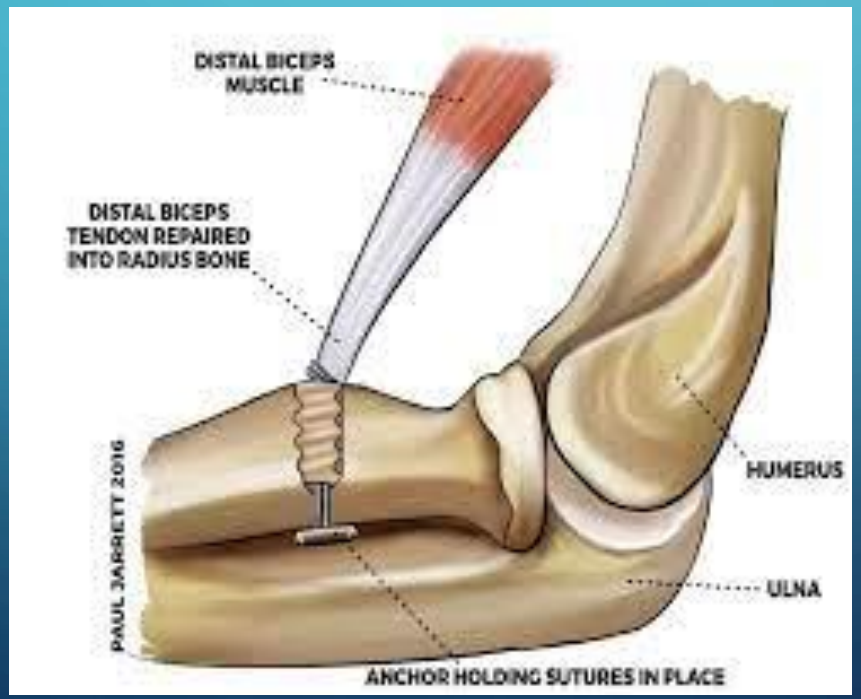


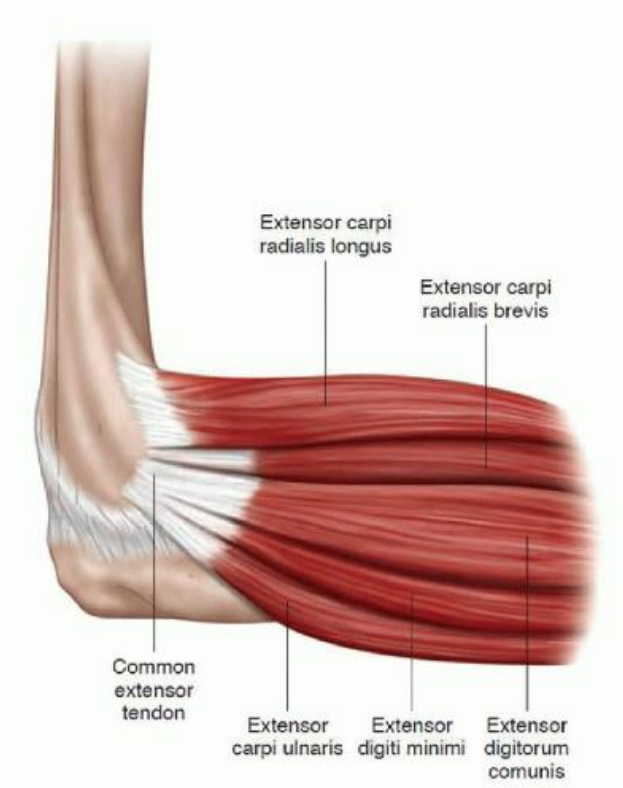


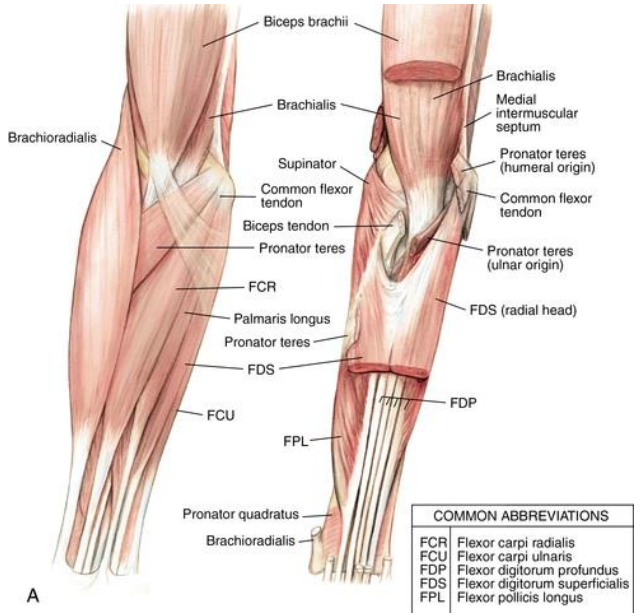
COMMON CLINICAL SCENARIO #1: DISTAL BICEPS RUPTURE

- 40M, moving a pool table, felt a pop and weird "slithering" sensation
- Ecchymosis at antecubital fossa
- + Popeye Deformity
- Weakness in supination/flexion
- Hook test, positive
- Advanced imaging:
  - MRI without contrast
- Discussion of surgical vs. non-surgical management
  - Non-Surgical:
    - Loss of supination (50%)
    - Flexion (30%)
    - Deformity
  - Surgery:
    - Long recovery ~ 3 months
    - Intra-op Risks: LABCN, PIN







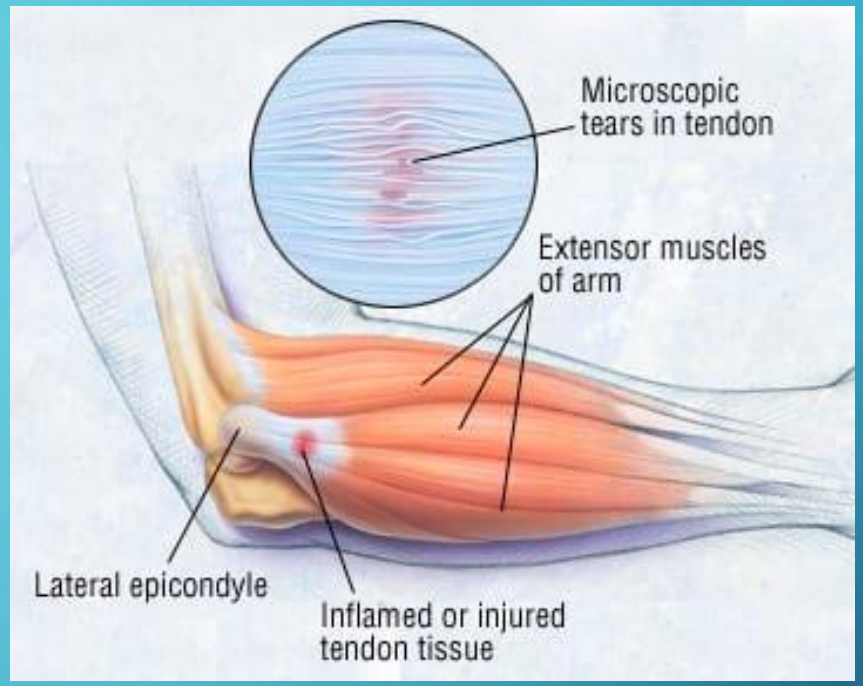


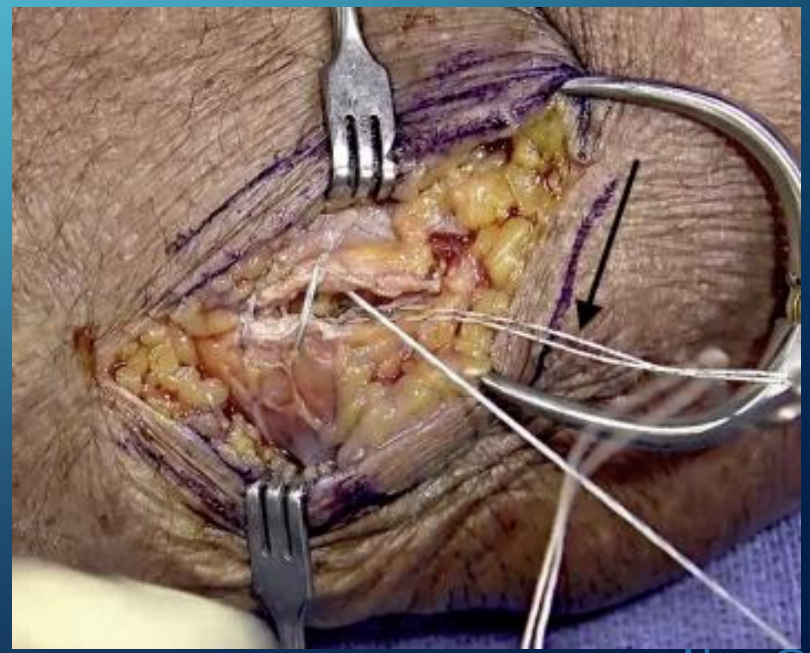
DYNAMIC STABILIZERS MEDIAL/LATERAL EPICONDYLES

- Medial Epicondyle:
  - Flexor/Pronator Mass
    - Forearm motion (Pronator Teres)
    - Extrinsic tendons to wrist/hand
      - FCR/PL/FCU/FDS
- Lateral Epicondyle:
  - Common Extensor Origin
    - Mobile wad + EDC + ECU+ Anconeus

COMMON CLINICAL SCENARIO #2: LATERAL EPICONDYLITIS

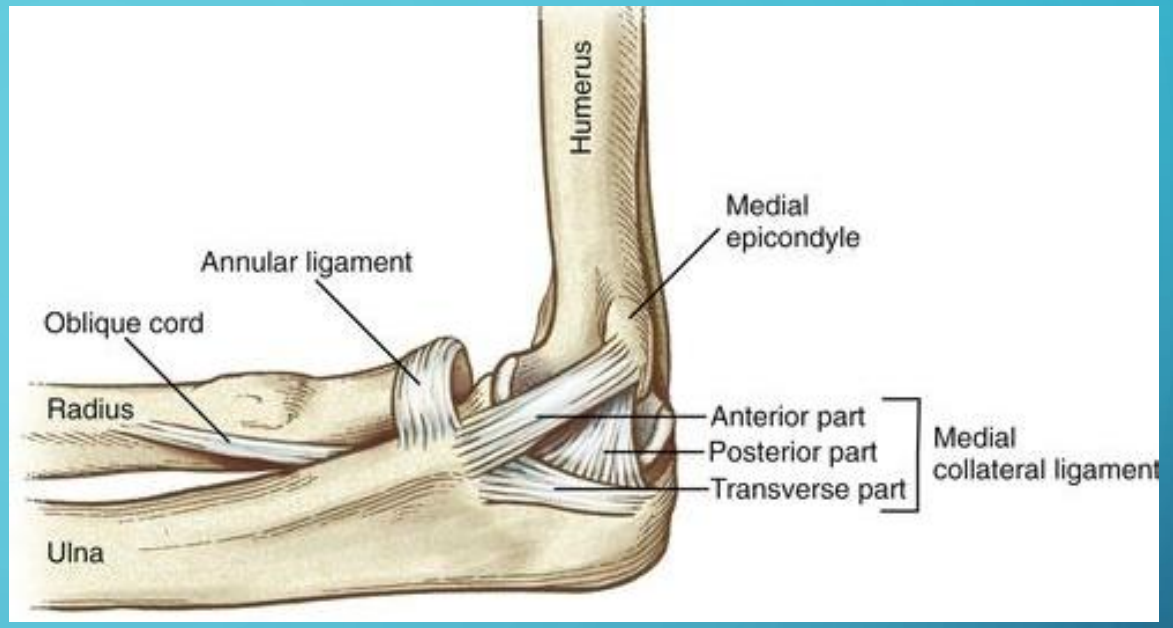
- Case: 36F, persistent pain lateral elbow for 6 months
  - No inciting event
- PE:
  - TTP Lateral epicondyle
  - Positive resisted wrist extension/supination
  - +/- Tinel distal to Lat Ep
- XR: elbow series
  - Clinical exam important, MRI often not necessary
- Treatment:
  - Conservative Tx > 90 %
    - Braces (Counterforce bracing/Night wrist extension splint.
    - Physical therapy (iontophoresis, dry needling, ESWT)
    - NSAIDS
    - Injections (CS/Botox/PRP)
  - Surgical: when all else fails
    - ECRB Debridement/reattachment

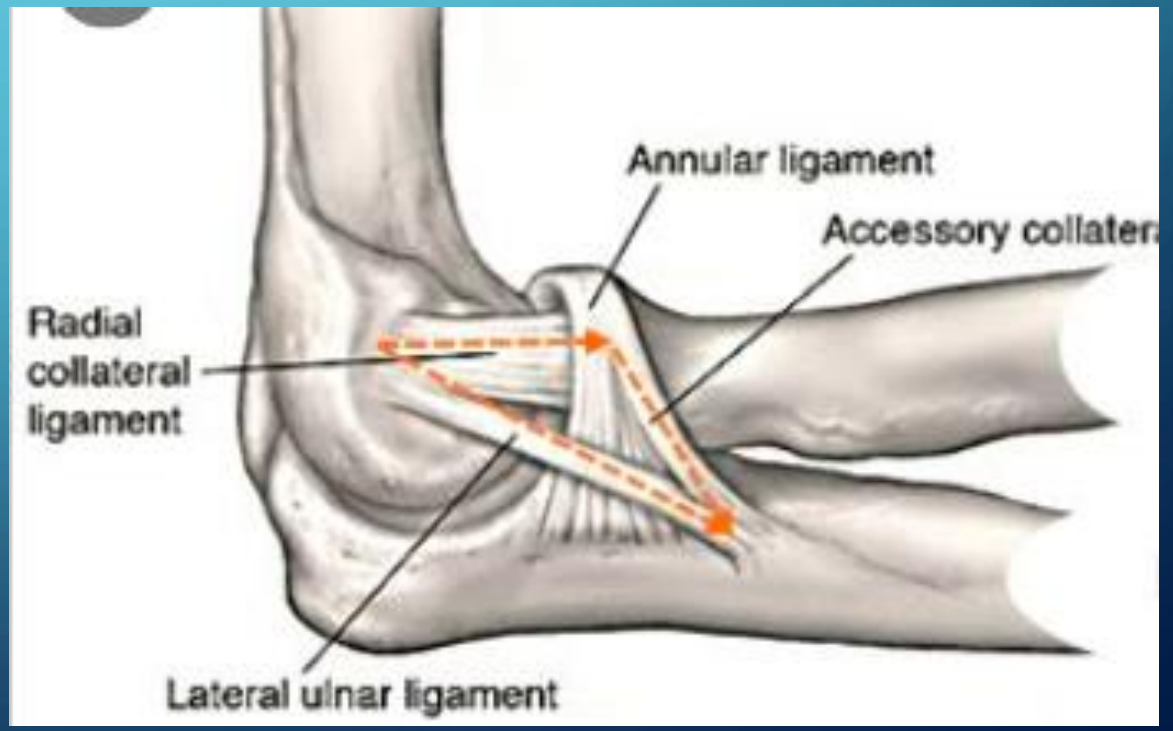




STATIC STABILIZERS: COLLATERAL LIGAMENTS

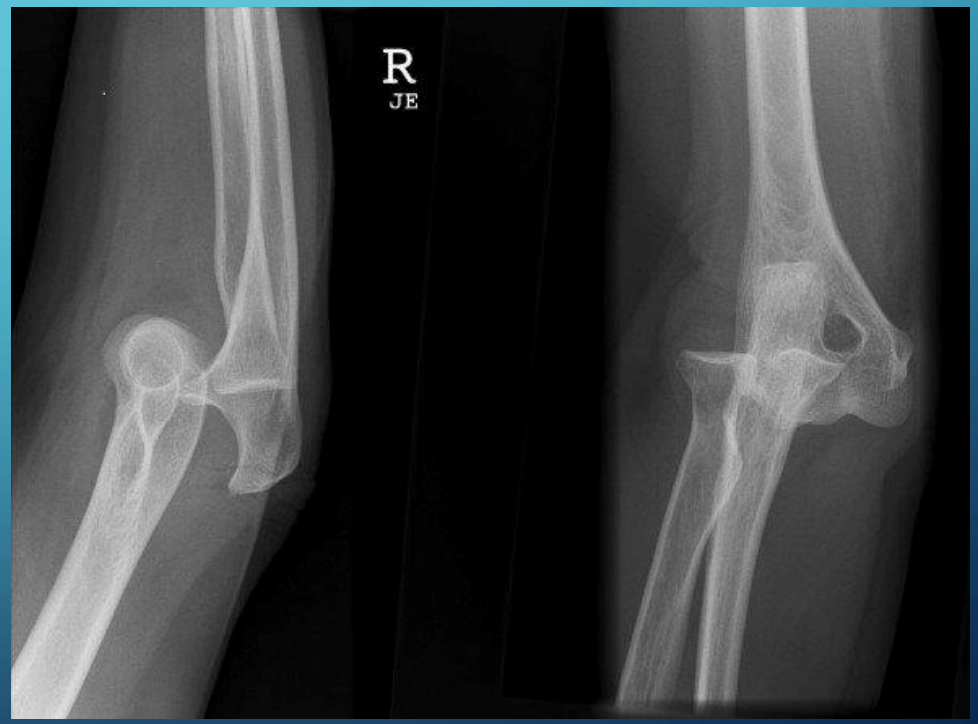
- Medial Collateral Ligaments
  - Anterior bundle MCL
    - Strong valgus stabilizer
    - Attached to sublime tubercle
- Lateral Collateral Ligaments
  - LUCL: Strong varus stabilizer
  - Annular ligament: stability to radial head





COMMON CLINICAL SCENARIO #3: ELBOW DISLOCATIONS

- Case: 44M, ski accident, ran into tree. Airlifted to UCH
- PE:
  - Arm immobilized on arrival
  - AIN/PIN/u intact
  - SILT r/u/m/lacn/macn
  - Radial 2+, BCR
- XR: elbow series
- Treatment:
  - Closed reduction under anaesthesia
    - Document instability through range of motion
  - Ligamentous reconstruction, if application

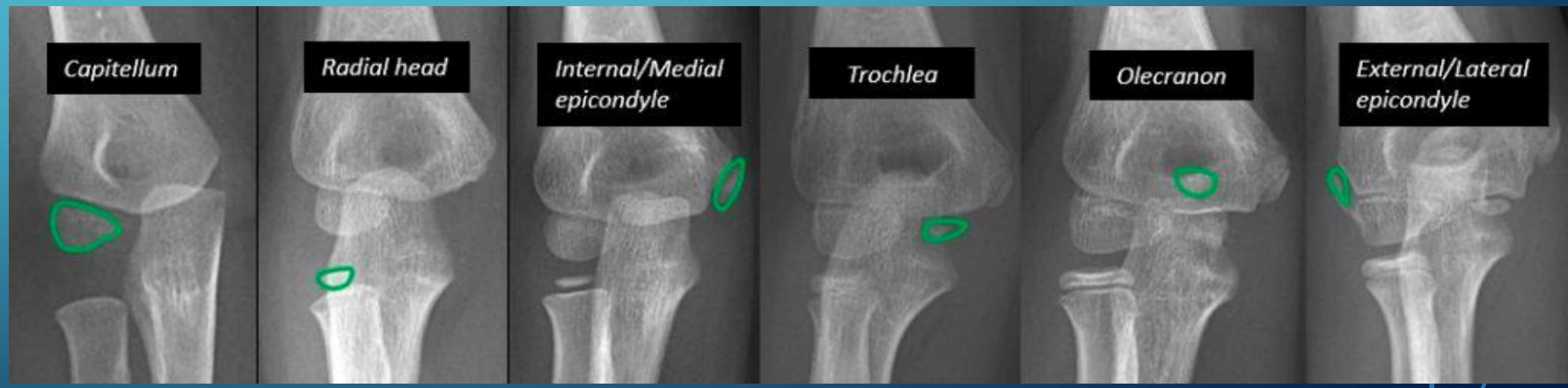


IMAGING: ELBOW

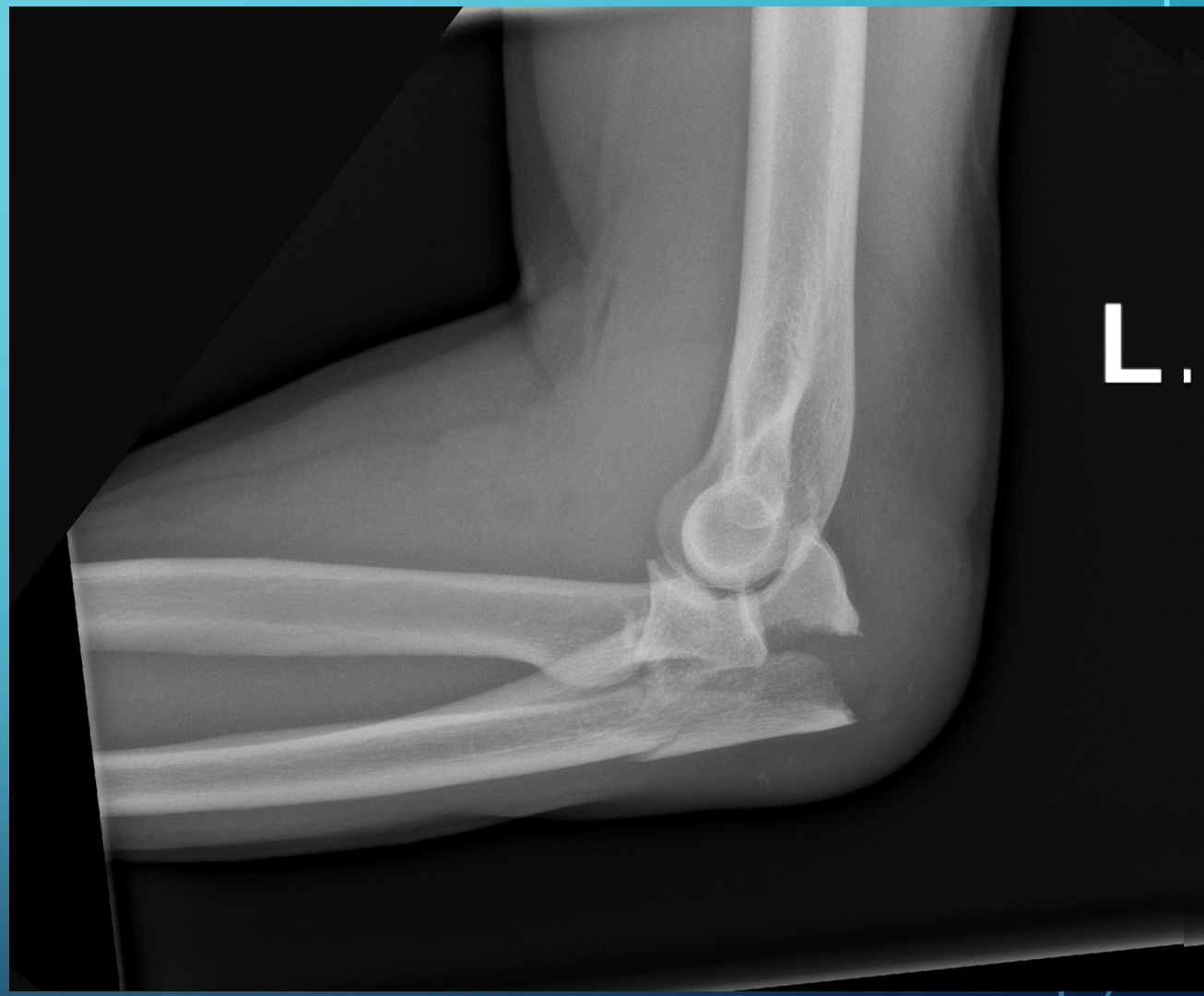
- Radiographs
  - Standard 3 view: AP/Lateral
  - Special:
    - Greenspan view: Radial head fractures
    - Internal/external oblique
    - Acute flexion AP
- Computed Tomography
  - Comminuted Elbow fractures
- MRI without contrast
  - Loose bodies
  - Ligamentous injury
  - Osteochondritis dessicans

IMAGING: ELBOW

- Radiographs
  - Standard 3 view: AP/Lateral
  - Special:
    - Greenspan view: Radial head fractures
    - Internal/external oblique
    - Acute flexion AP
  - Pediatric: Ossification centers
    - CRITOE (1-3-5-7-9-11)
- Computed Tomography
  - Comminuted Elbow fractures
- MRI without contrast
  - Loose bodies
  - Ligamentous injury
  - Osteochondritis dessicans

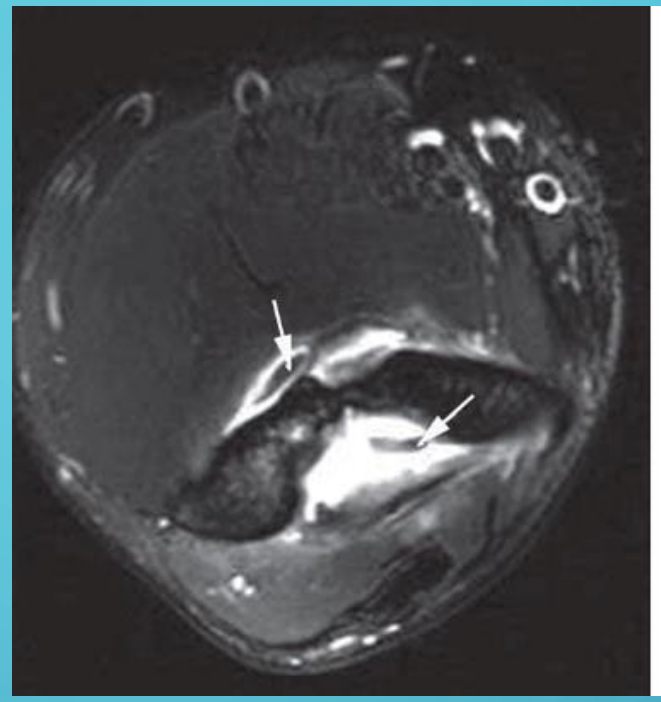


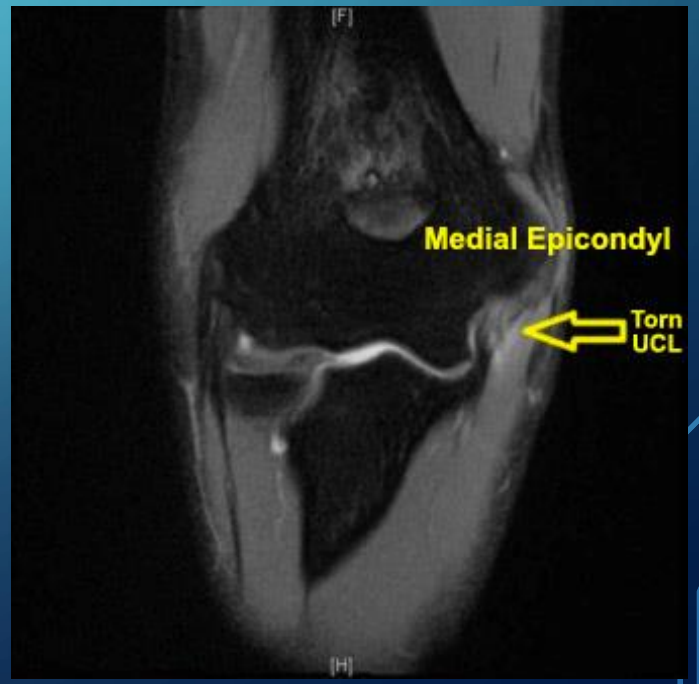

AL


L

IMAGING: ELBOW

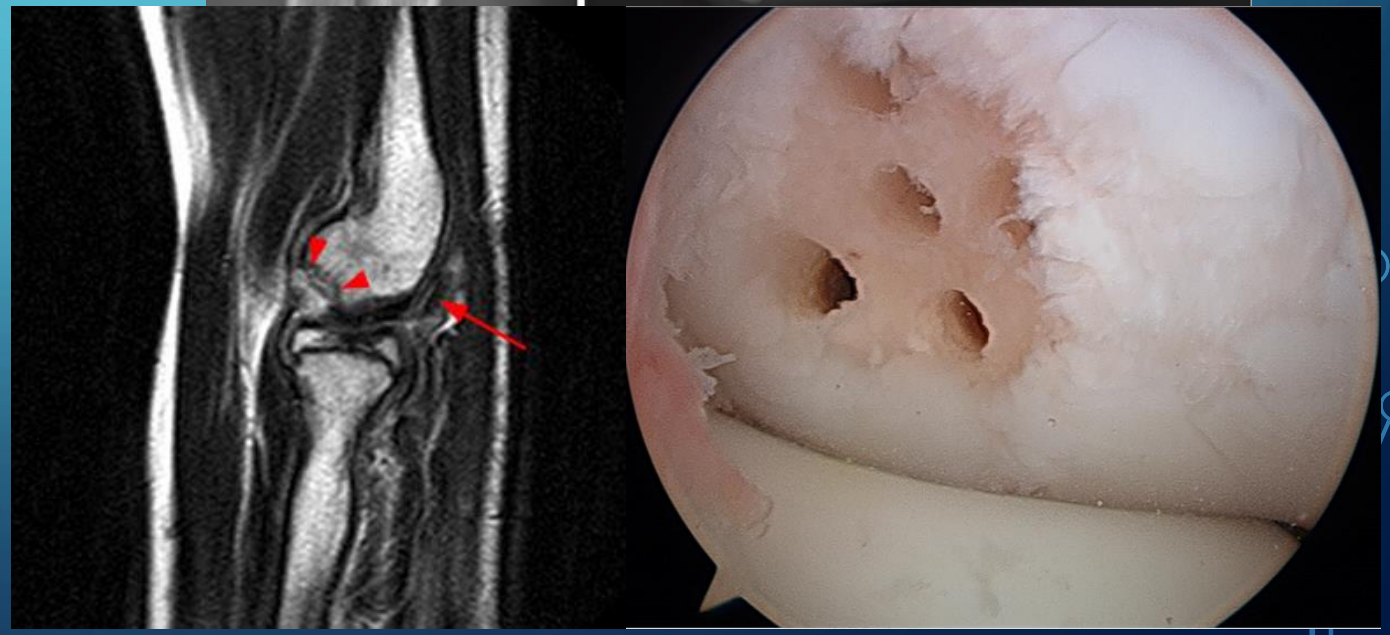
- Radiographs
  - Standard 3 view: AP/Lateral
  - Special:
    - Greenspan view: Radial head fractures
    - Internal/external oblique
    - Acute flexion AP
  - Pediatric: Ossification centers
    - CRITOE (1-3-5-7-9-11)
- Computed Tomography
  - Comminuted Elbow fractures
- MRI without contrast
  - Loose bodies
  - Ligamentous injury
    - LUCL
    - MCL
  - Osteochondritis dessicans





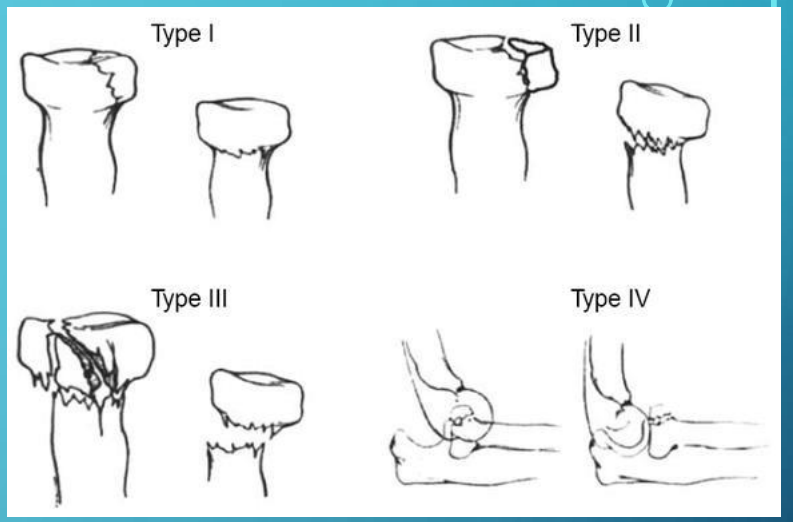
COMMON CLINICAL SCENARIO #4: OSTEOCHONDRITIS DESSICANS

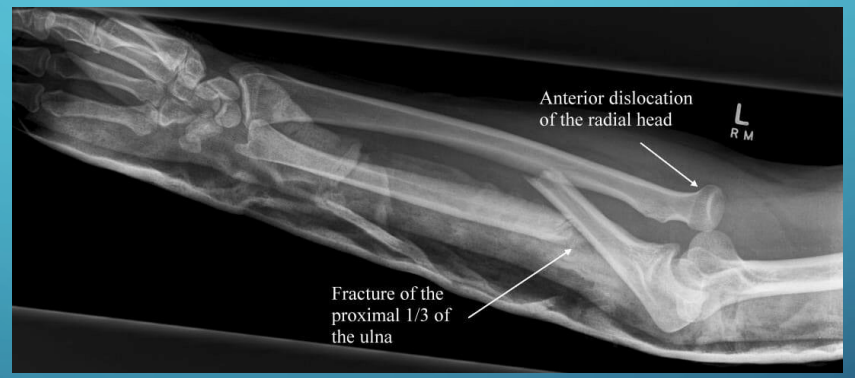
- 13F, Level 9 Gymnast
  - Persistent elbow pain w/ axial loading
  - Loss of elbow extension
  - Mechanical symptoms
  - Rest insufficient
- XR relatively normal
- Next steps:
  - MRI without contrast
- Diagnosis:
  - Osteochondritis Dessicans
- Intervention:
  - Rest/Cessation of Activity/Expectation modifications
  - Arthroscopic Microfracture
  - ORIF loose fragment
  - Osteochondral Autologous Transfer system (OATS)

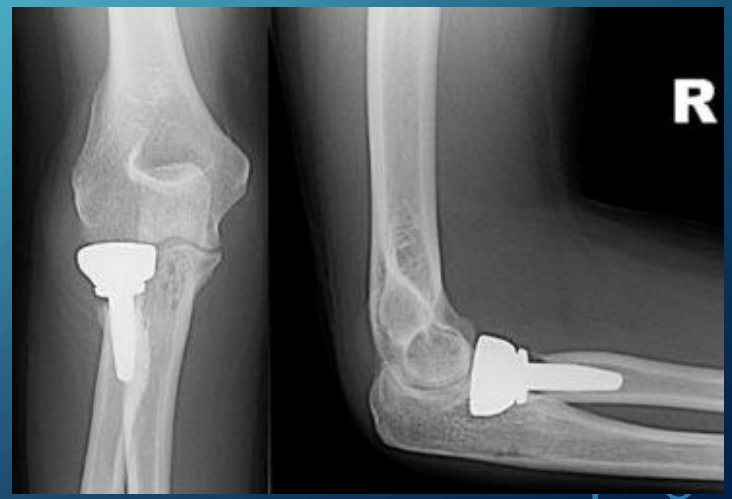


ELBOW FRACTURE/DISLOCATIONS

- Anatomy:
  - Dynamic vs. Static stabilizers
- Epidemiology: Axial Load
  - Simple
  - Posterolateral (most common)
    - Supination/Posterolateral valgus force
  - Terrible Triad
  - Posteromedial
    - Supination/Posteromedial varus force
- Classification:
  - Radial head fractures
    - Mason Classification
  - Monteggia
    - Bado
  - Essex Lopresti: Pain at wrist?
    - Obtain
- Treatment
  - Non-op management with early motion
  - ORIF
  - Radial head arthroplasty
  - Total elbow arthroplasty

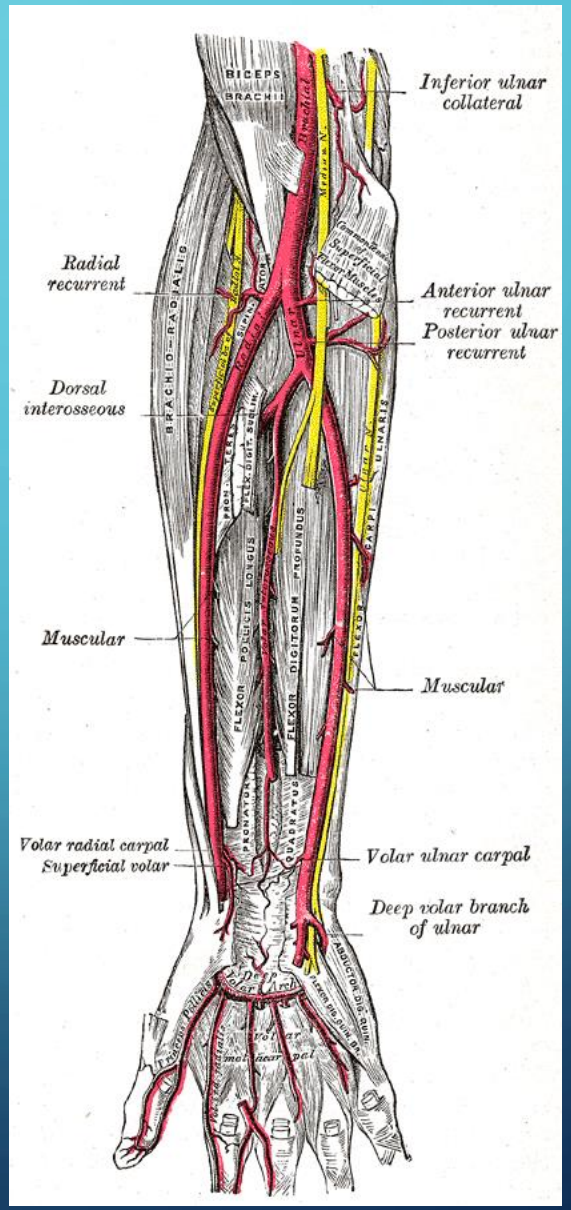


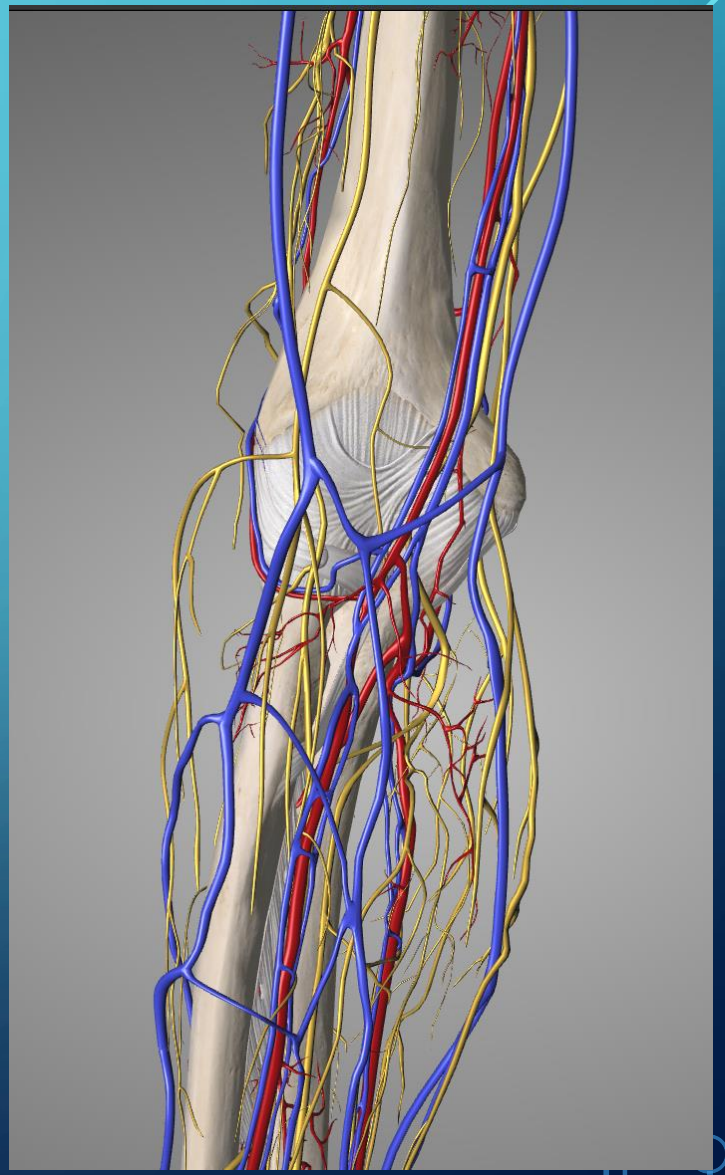




NEUROVASCULAR ELEMENTS: ELBOW

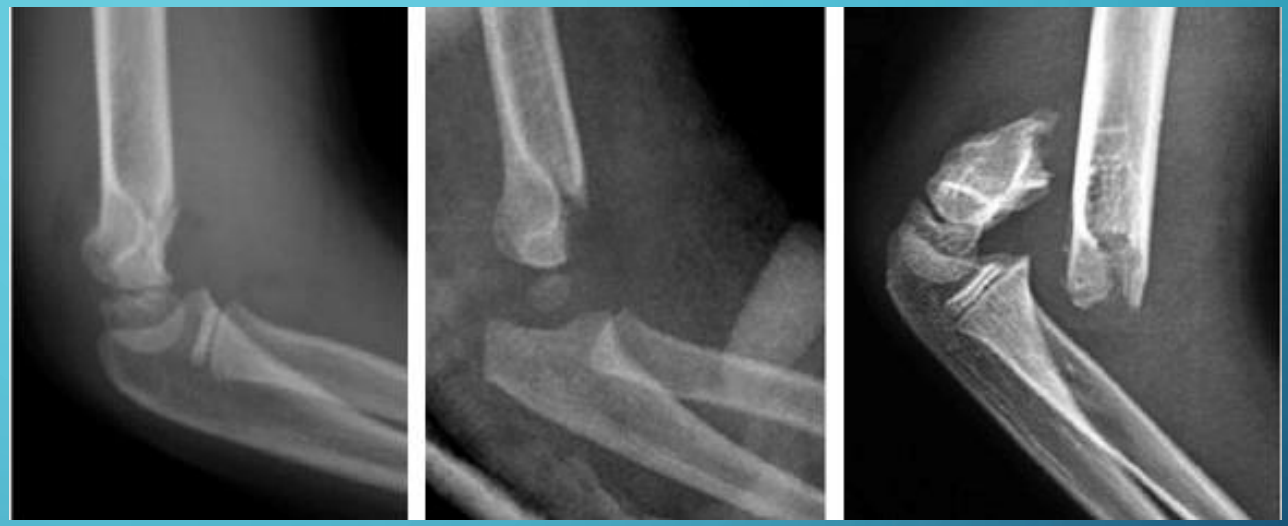
- Major Nerves Traversing Elbow
  - Ulnar n.
  - Median n.
  - Lateral antebrachial cutaneous (LABCN)
  - Medial antebrachial cutaneous (MABCN)
  - Radial n.
- Vascular Structures
  - Brachial A.
  - Cephalic/Basilic Vein

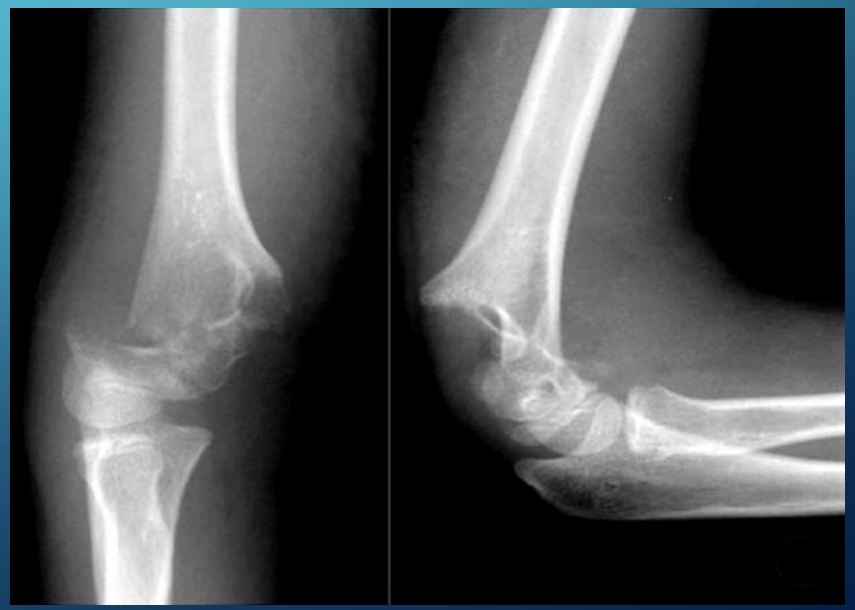




COMMON CLINICAL SCENARIO #5: SUPRACONDYLAR HUMERUS FRACTURES

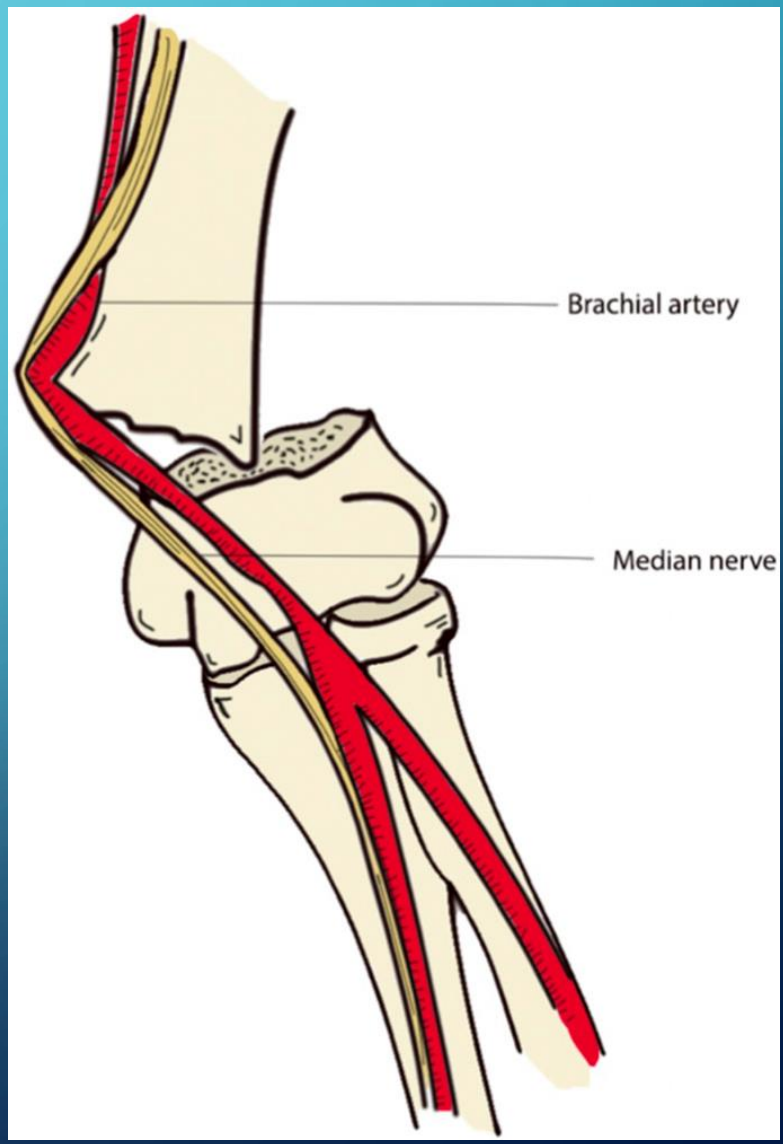
- 6F, falls from monkey bars. Elbow swelling and pain
- Radiographs obtained
  - Acute flexion AP
- Next step: Thorough Physical exam
  - Check perfusion
  - Neuro status
  - Compartment syndrome
  - Skin tenting/Threatening
- Determine Severity
- Discussion with surgeon on call
- Intervention
  - Cast: Type 1
  - Urgent Surgery: Type II
  - Emergent Surgery: Pulseless Hand, Type III/IV





COMMON CLINICAL SCENARIO #5: SUPRACONDYLAR HUMERUS FRACTURES

- 6F, falls from monkey bars. Elbow swelling and pain
- Radiographs obtained
  - Acute flexion AP
- Next step: Thorough Physical exam
  - Check perfusion
  - Neuro status
  - Compartment syndrome
  - Skin tenting/Threatening
- Determine Severity
- Discussion with surgeon on call
- Intervention
  - Cast: Type 1
  - Urgent Surgery: Type II
  - Emergent Surgery: Pulseless Hand, Type III/IV

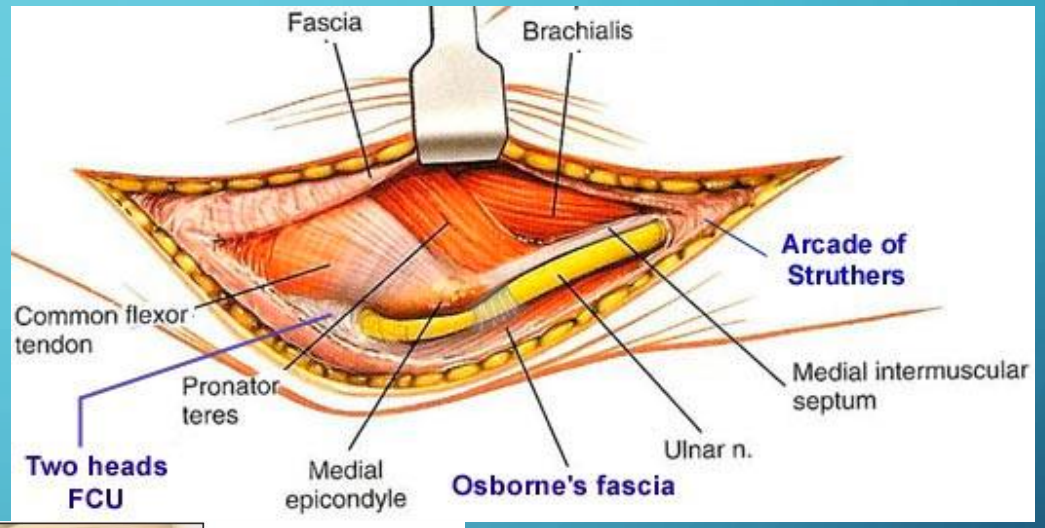


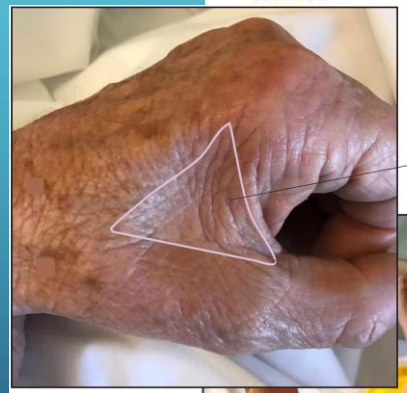
COMMON CLINICAL SCENARIO #5: SUPRACONDYLAR HUMERUS FRACTURES

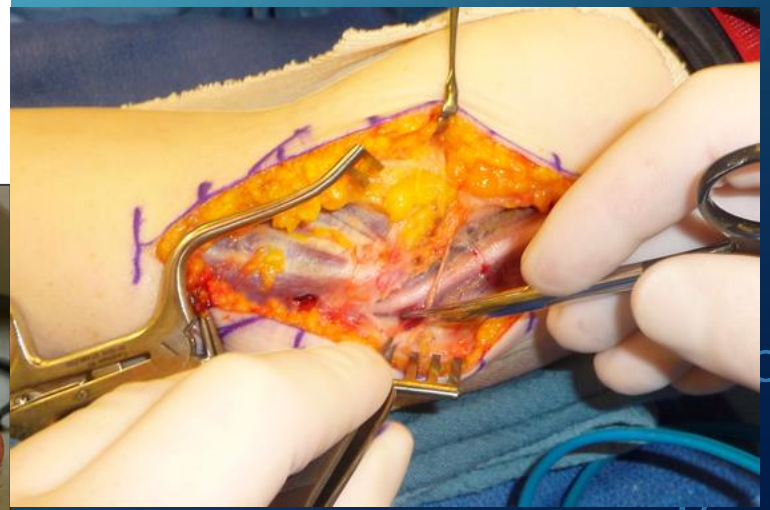
- 6F, falls from monkey bars. Elbow swelling and pain
- Radiographs obtained
  - Acute flexion AP
- Next step: Thorough Physical exam
  - Check perfusion
  - Neuro status
  - Compartment syndrome
  - Skin tenting/Threatening
- Determine Severity
- Discussion with surgeon on call
- Intervention
  - Cast: Type 1
  - Urgent Surgery: Type II
  - Emergent Surgery: Pulseless Hand, Type III/IV

COMMON CLINICAL SCENARIO #6: CUBITAL TUNNEL SYNDROME

- 55M, numbness and tingling in ulnar most digits. Clumsiness and overall weakness of hand.
- Imaging negative/No injury
- Physical exam tests:
  - Elbow Flexion test
  - + Tinel's medial elbow
  - Hypothenar wasting
- Advanced diagnostics:
  - EMG
- Intervention:
  - Night splinting to prevent elbow flexion
  - Cubital tunnel decompression +/- anterior transposition







COMMON CLINICAL SCENARIO #7: OLECRANON BURSITIS

- 45M., swelling and "electrical pain" from posterior aspect of elbow.
- No injury
- XR negative
- Physical exam tests:
  - TTP posterior elbw
  - Fluid filled pocket overlying olecranon
- Advanced diagnostics:
  - No required unless concern for septic olecranon bursitis
- Intervention:
  - Warm Compresses
  - Drainage/CS injection
  - Surgical debridement
- Pitfalls:
  - May develop persistent draining sinus

COMMON SPLINTS/CASTS

- Posterior Long arm +/- struts
  - Olecranon fractures/Dislocations
- Hinged Elbow brace:
  - UCL/LUCL sprains
- Sling: radial head/neck fracture
- Wrist brace: Lateral epicondylitis
- Counter force brace: Lateral/Medial epicondylitis
- Flexion preventing splint: Cubital Tunnel Syndrome
- Elbow pad: Olecranon bursitis

TAKE HOME POINTS

- Elbows have both dynamic (muscle) and static (ligament/bony) stabilizers
- Obtaining correct radiographs may be difficult, but crucial to diagnosis
- Physical exam is as important as imaging
  - Check wrist to rule out additional injuries
- Elbow fracture patterns can predict instability
- Over-treatment (aspiration/long term splinting) can be detrimental

RESOURCES

- Orthobullets: Wikipedia of Orthopedics
- Handbook of Fractures
- Essential Anatomy 5
- AO Website
- Elbow Podcasts:
  - Upper Hand with Drs. Chuck Goldfarb/Chris Dye

THANK YOU!

- Contact Info:
  - Email: matthew.belton@cuanschutz.edu
  - Cell: 760.953.6000