

Upper Extremity Injuries

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Encore Sports Medicine Symposium

Orange Beach, AL

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Upper Extremity Injuries: Objectives

- Review Relevant Anatomy
 - Hand, Wrist, Forearm, and Elbow
- Review Fracture Terminology
- Evaluation and Treatment of Common Conditions
 - Hand, Wrist, Forearm, Elbow, and Shoulder



Fracture Terminology

Angulated

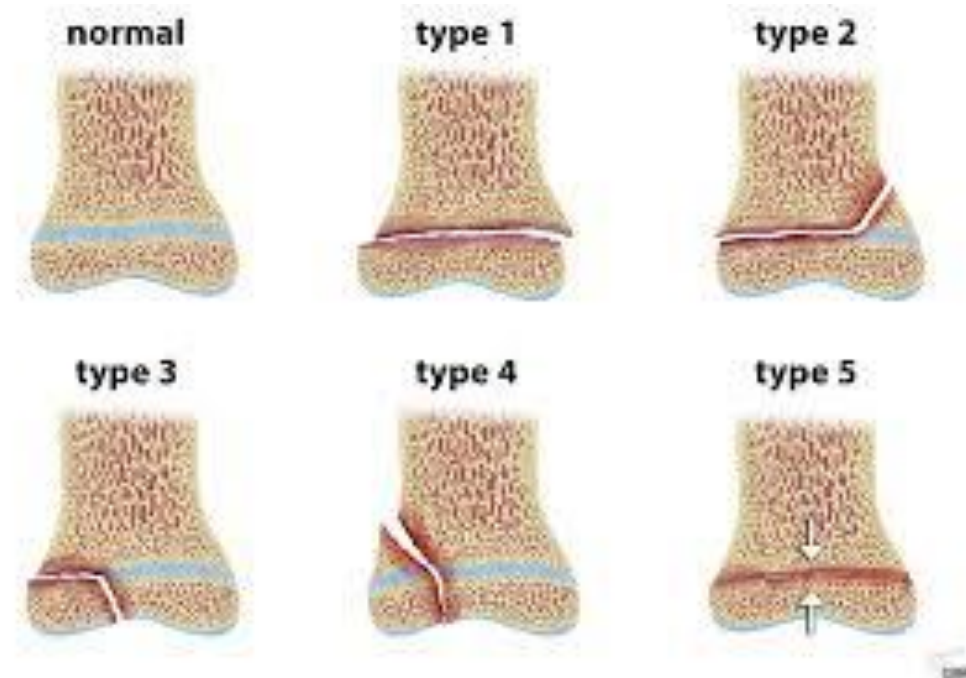


Displaced



Salter-Harris Growth Plate Injuries

- Categories I-IV
- Progressive Severity
- Diminished Prognosis
- Greater Risk of Growth Plate Arrest



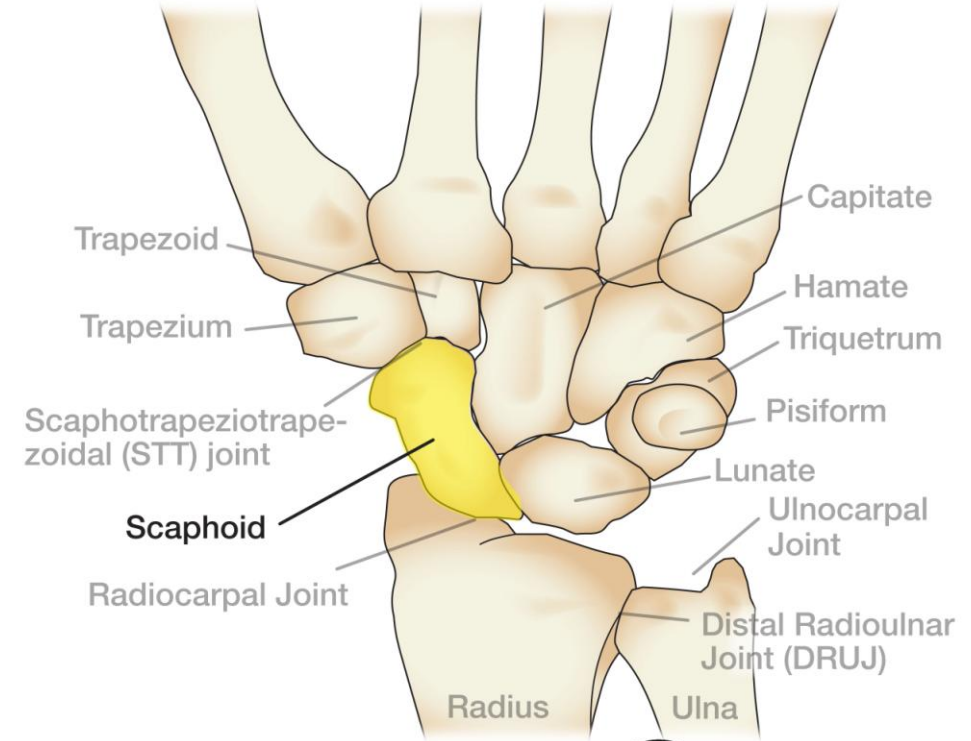
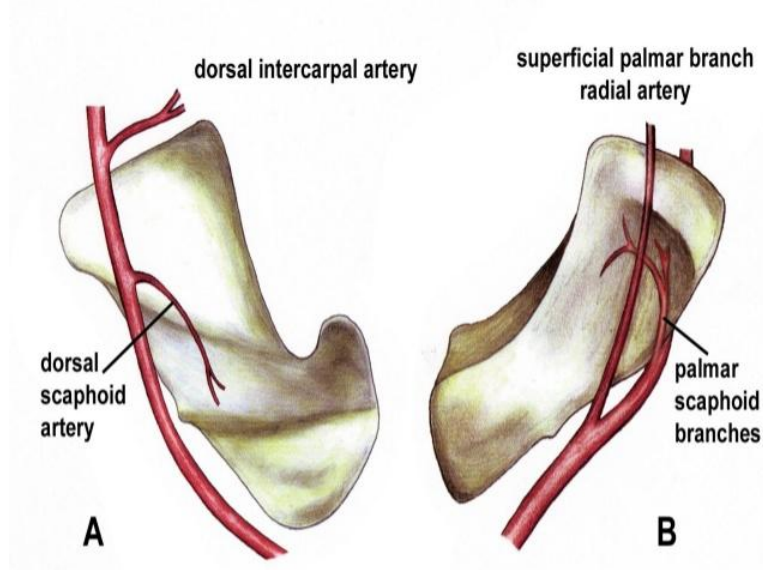
Hand Anatomy

- Hand 19 Bones
 - Metacarpals
 - Phalanges
- Wrist: 8 Bones
 - Scaphoid Key Bridge Bone
 - Capitate- Largest
 - Pisiform- Smallest



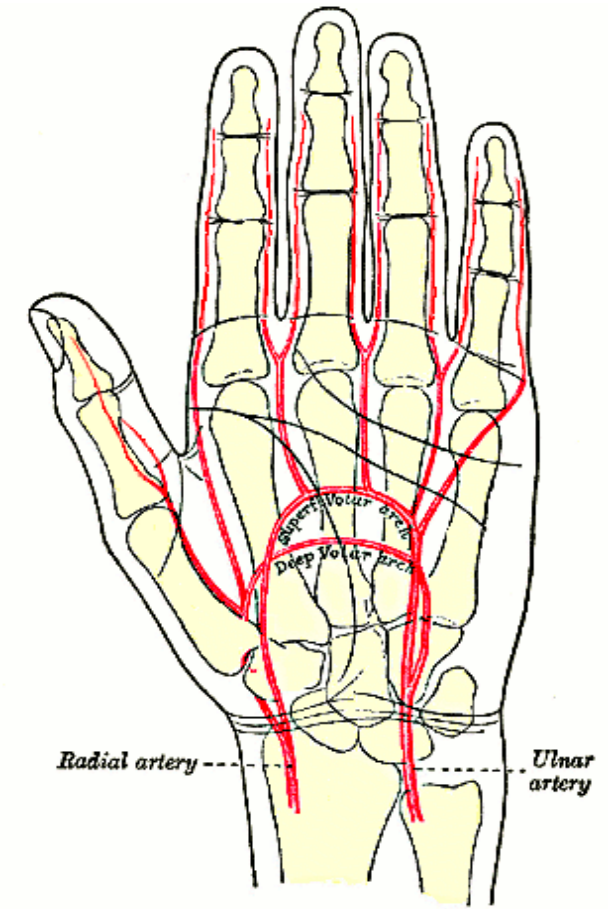
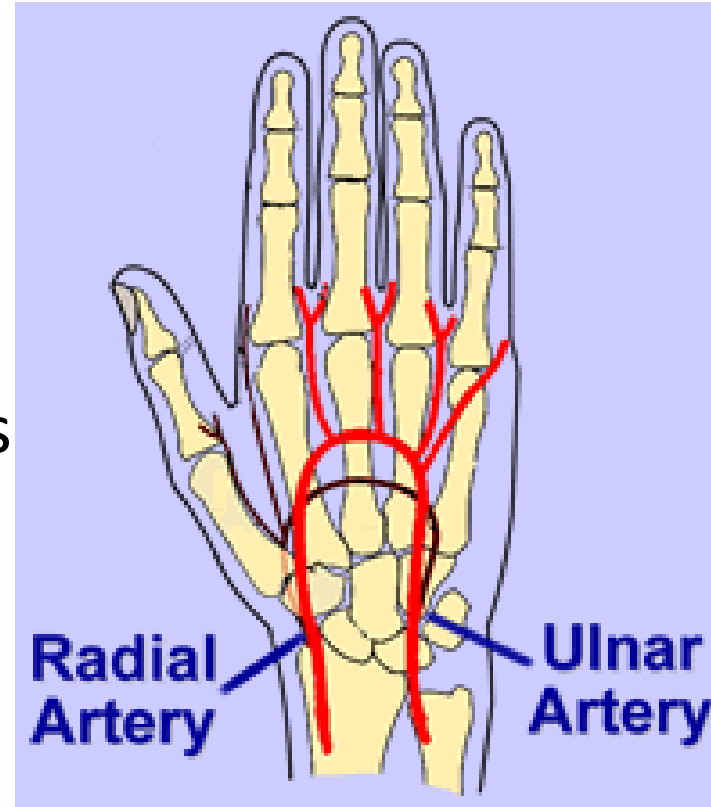
Scaphoid

- Large
- Kidney Bean Shape
- Slow “Trickle Down” Blood Supply



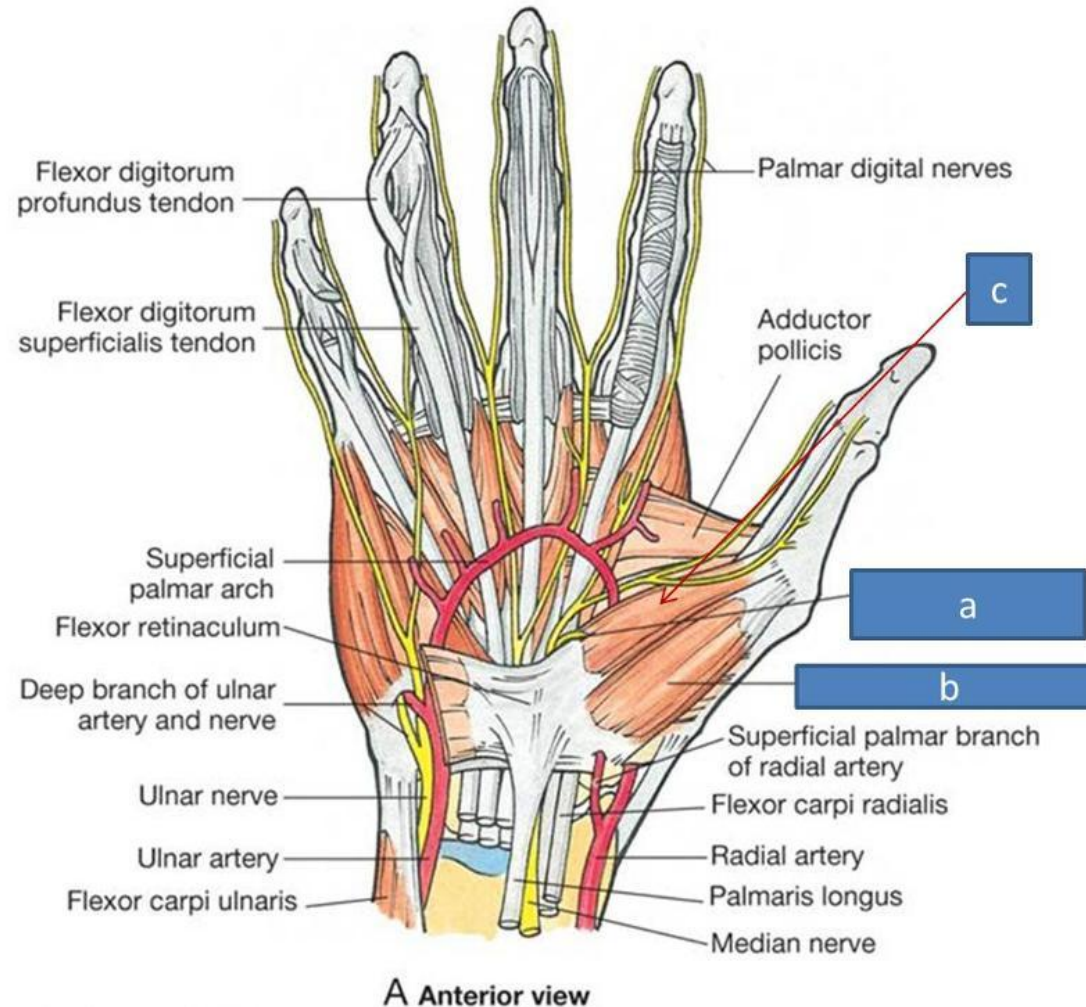
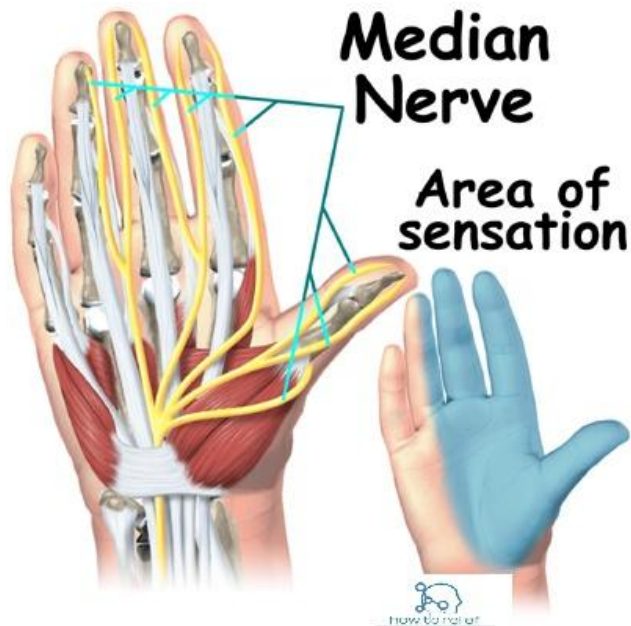
Hand/Wrist Blood Supply

- 2 Arteries
 - Radial
 - Ulnar
- Arcade in Palm
- Dual Blood Supply to Digits



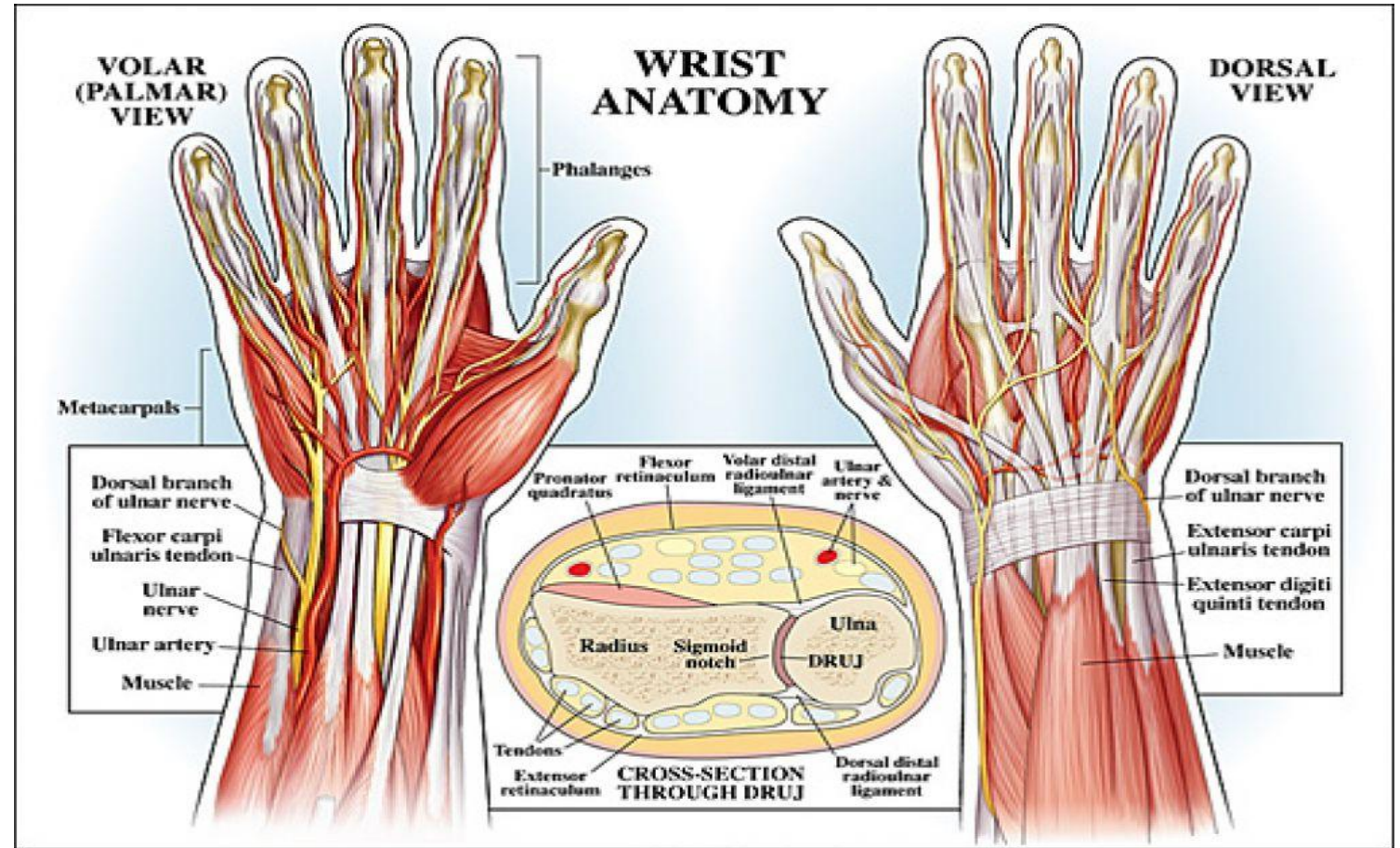
Hand/Wrist Innervation

- Median Nerve
 - Carpal Tunnel
- Ulnar Nerve
 - Guyon's Canal



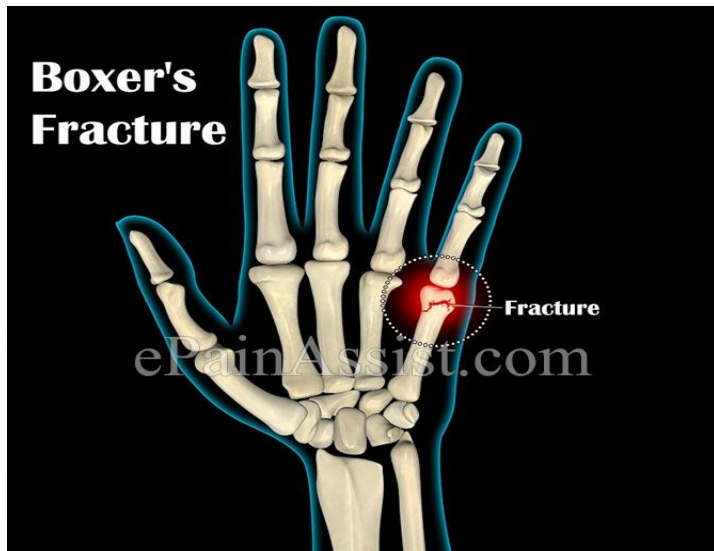
Hand/Wrist Tendons

- Palmar Side
 - Flexion
 - Carpal Canal
 - 9 Tendons
 - 2 Additional in Wrist
- Dorsal Side
 - Dorsiflexion/Extension
 - 12 Tendons
 - 7 Compartments



Boxer's Fracture

- Small Finger
- Fifth Metacarpal
- More Common in Men
- Angulated



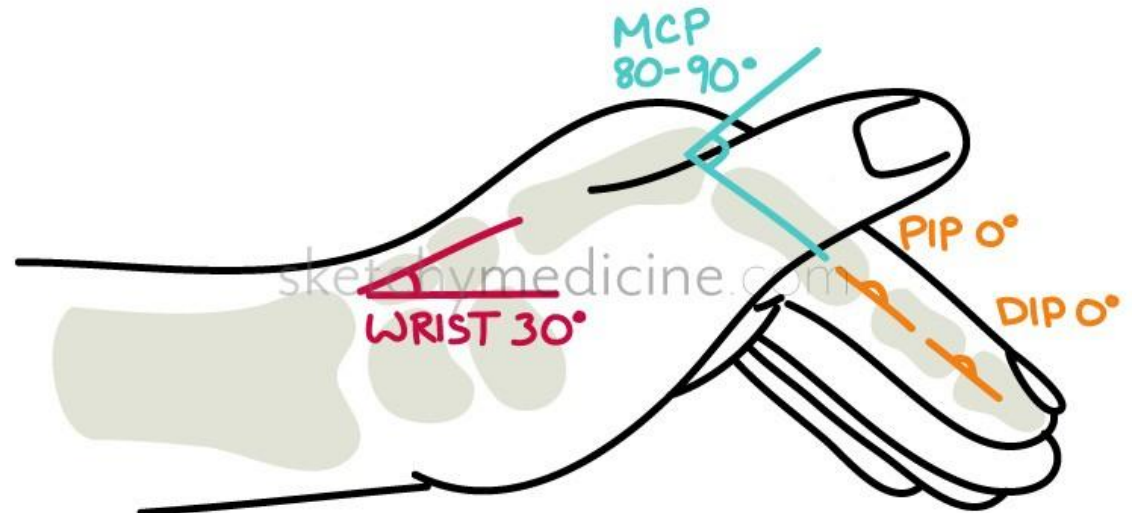
Boxer's Fracture Treatment

- Closed Reduction and Cast
- Pinning (and Cast)
- Functional Splint
- Buddy Tape and Early Motion

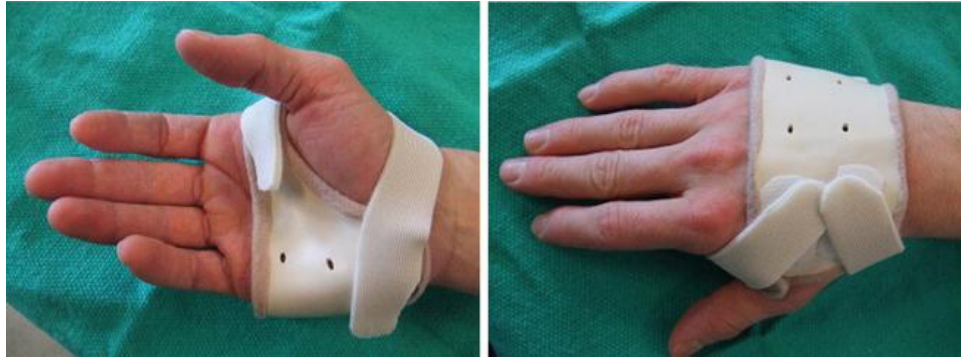


Metacarpal Head/Neck Bone Shape

- “Cam”: Greater Diameter is in Transverse Plane
- Always Immobilize MP Joint in Flexion (60 degrees)
- Keeps Collateral Ligaments Stretched
- Allows for easier flexion and less stiffness



Boxer's Fracture Functional Splints



Boxer's Fracture Rehab

- Consider early start with AROM if fracture stabilized (pinned)
- Begin AROM/APROM at 5 weeks
- Grip strengthening
- Buddy Tape and Immediate ROM for Certain Fractures



Wrist Fractures: Distal Radius

- Most Common
- Young and Old
- Angulation
- Displacement
- Comminution
- Articular Involvement



Distal Radius Fractures: Treatment Options

- Closed Reduction and Splint or Cast
- Closed Reduction, Pinning and Cast
- Open Reduction Internal Fixation
 - Plate and Screws
- External Fixation



Dx Radius Fx: Closed Reduction and Casting

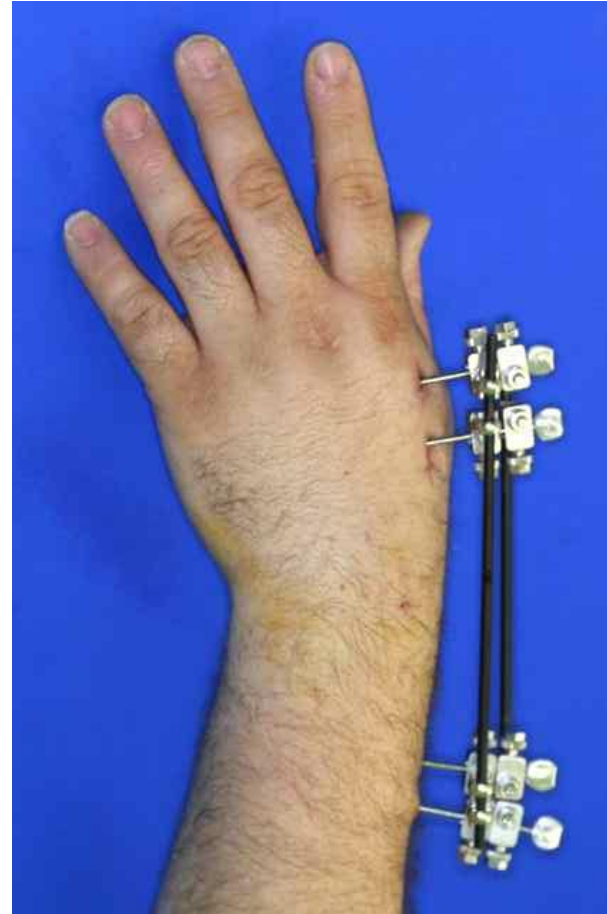


Distal Radius Fracture Treatment

Percutaneous Pinning



Distal Radius Fracture Surgery: External Fixation

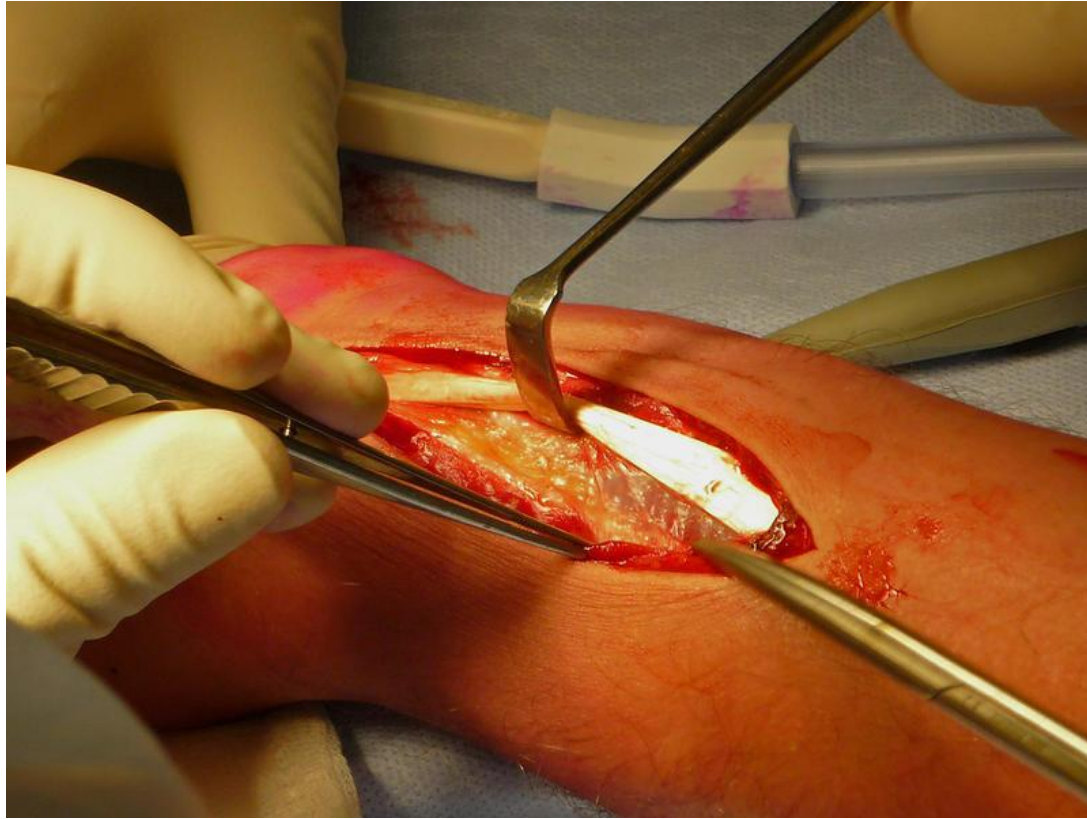


Distal Radius Fracture Surgery

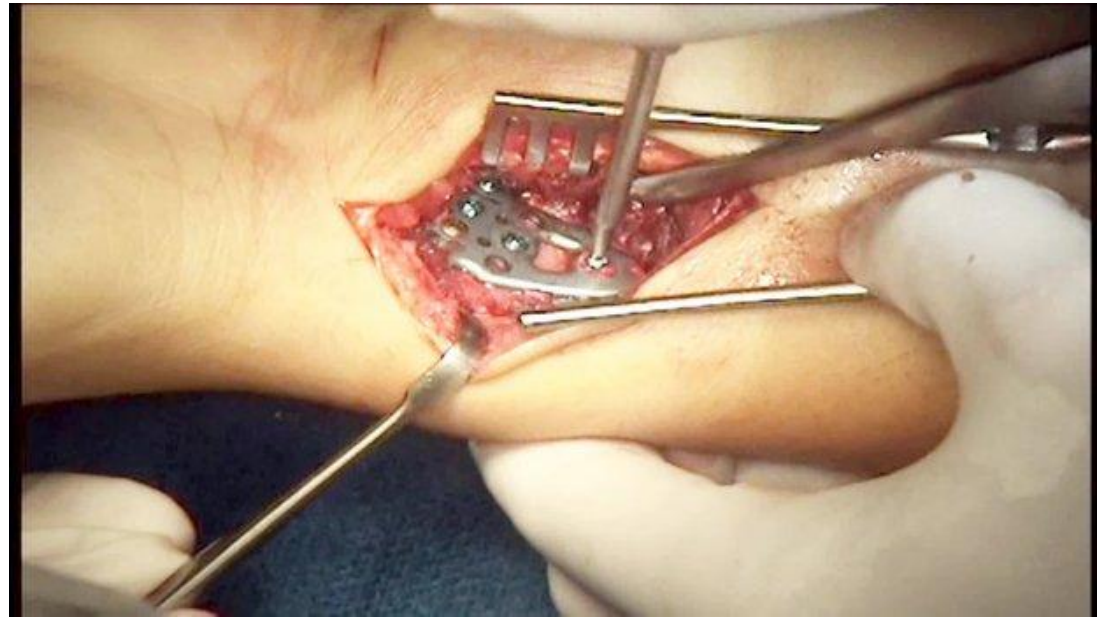
Open Reduction Internal Fixation Plate



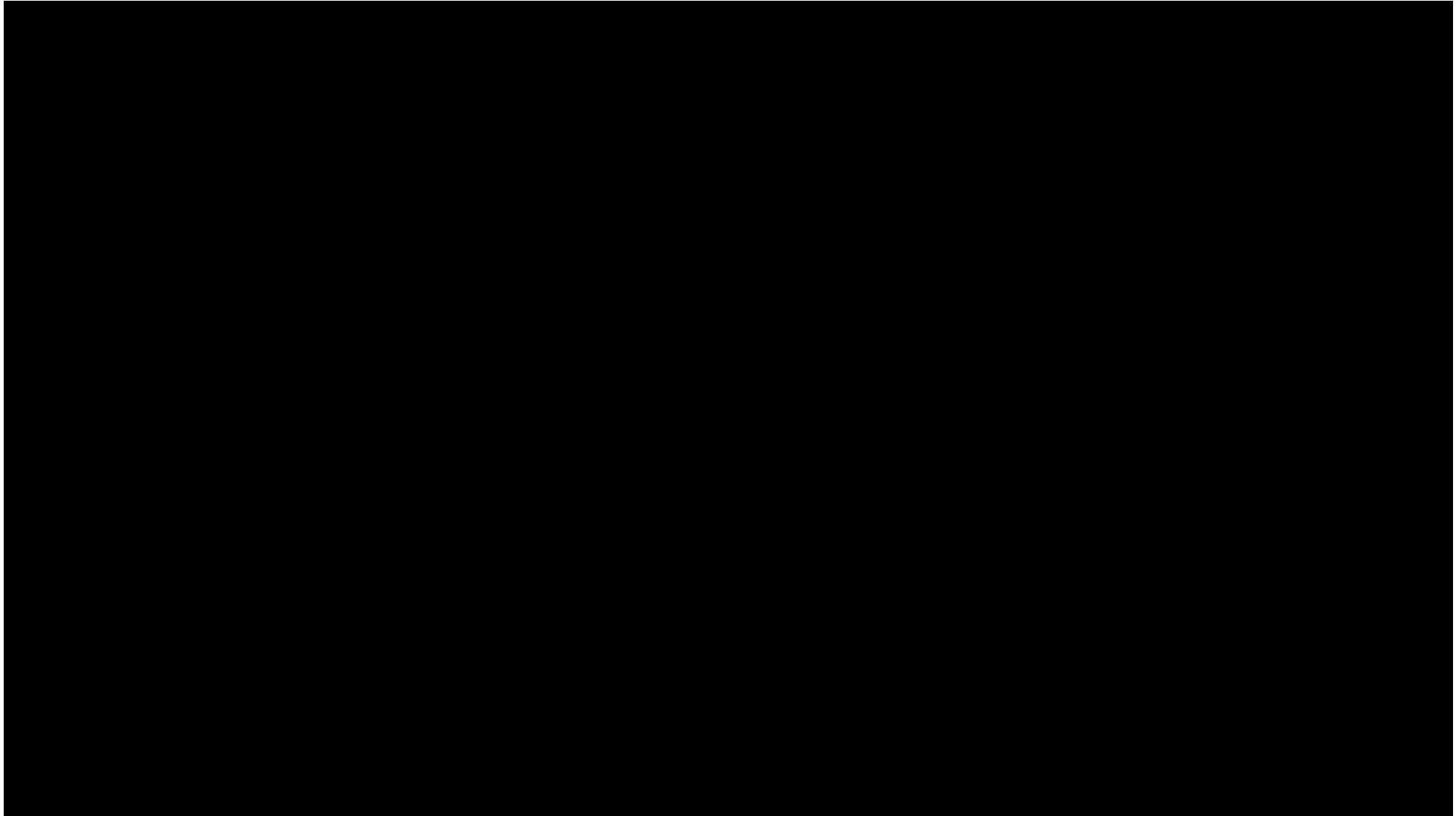
ORIF Distal Radius Fracture Technique



ORIF Distal Radius Technique (Continued)

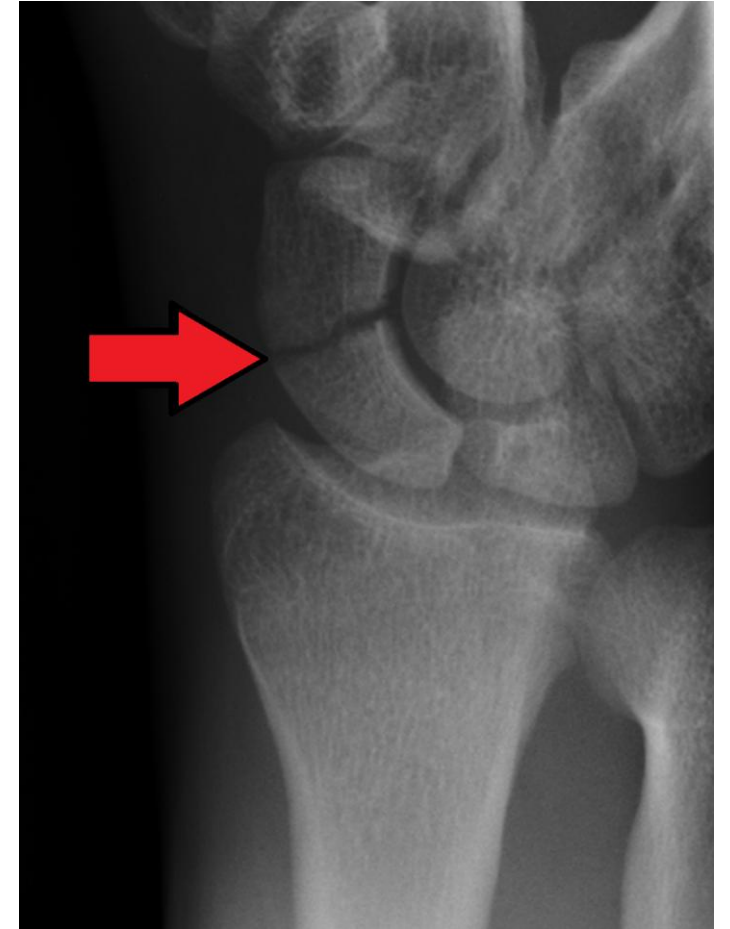


Volar Plate Open Reduction Internal Fixation

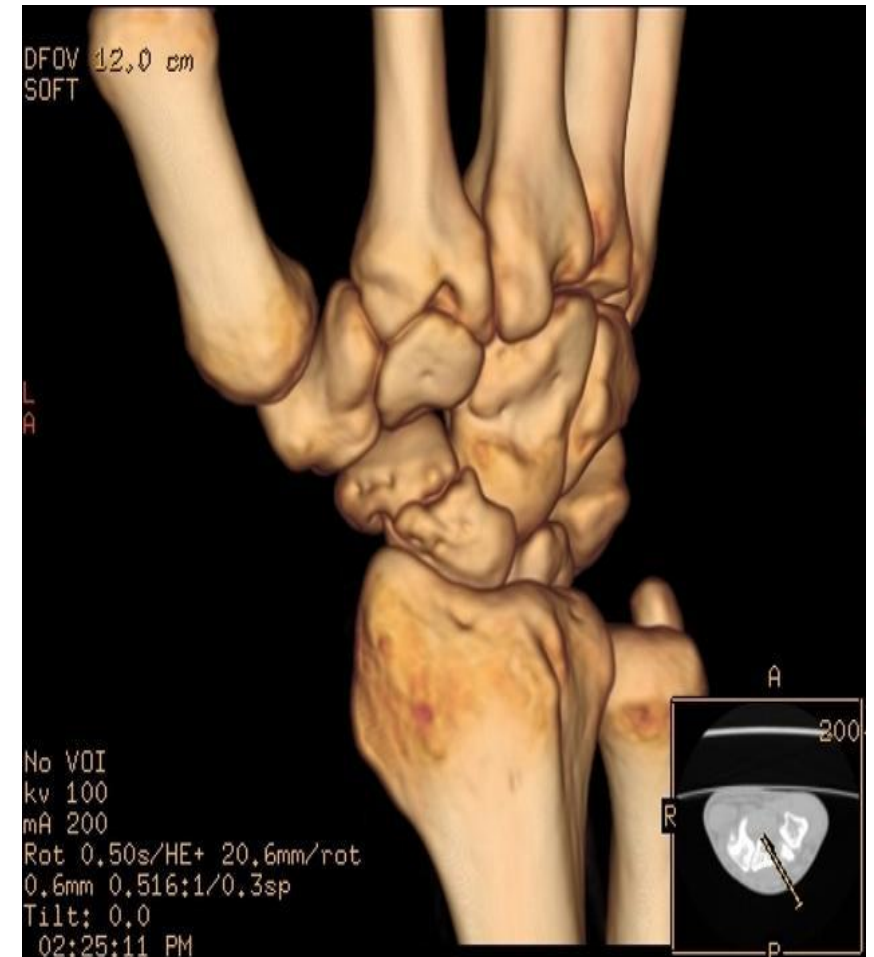
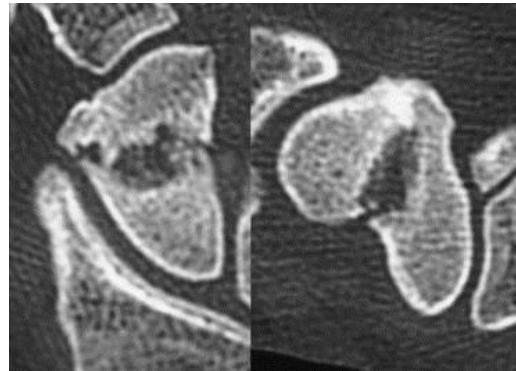


Scaphoid Fracture

- Difficult to Recognize
 - Athlete “Sprain”
 - X-Rays Difficult to Detect
 - Slow to Heal
- Angulated?
- Displaced?
- CT Scan Helpful



Scaphoid Fracture CT Scan



Scaphoid Fracture Treatment

- Non-Displaced
 - Cast (Include Thumb)
 - Prolonged Immobilization
- Displaced: Internal Fixation (ORIF)
- Rapid Return to Sports: ORIF



Scaphoid Fracture Rehab

- ORIF Rapid AROM, Grip Strengthening 2-4 Weeks
- Closed Treatment: Begin in 8-12 Weeks



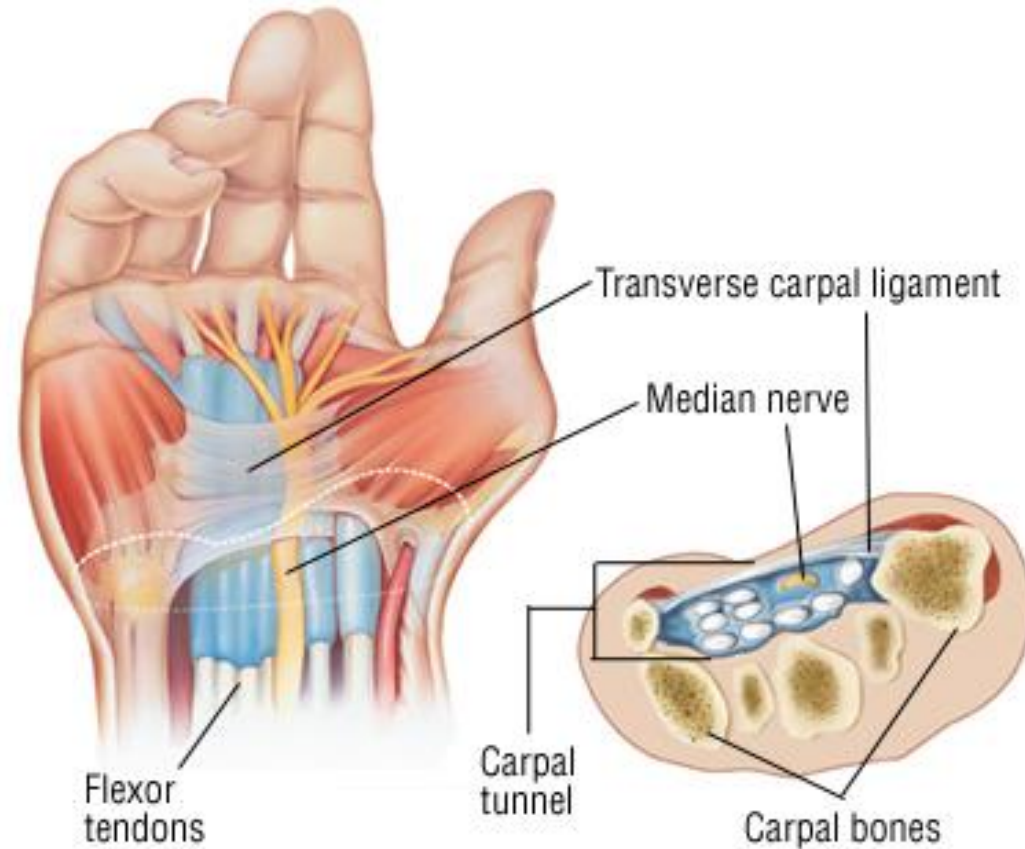
Carpal Tunnel Syndrome

- Most Expensive Upper Extremity Condition
 - 2 Billion Dollars
 - Average 27 Lost Work Days
 - About 5-10 % Working Population
- Symptoms
 - Numbness and Tingling
 - Weakness
 - First Three Digits
 - Awaken by Pain



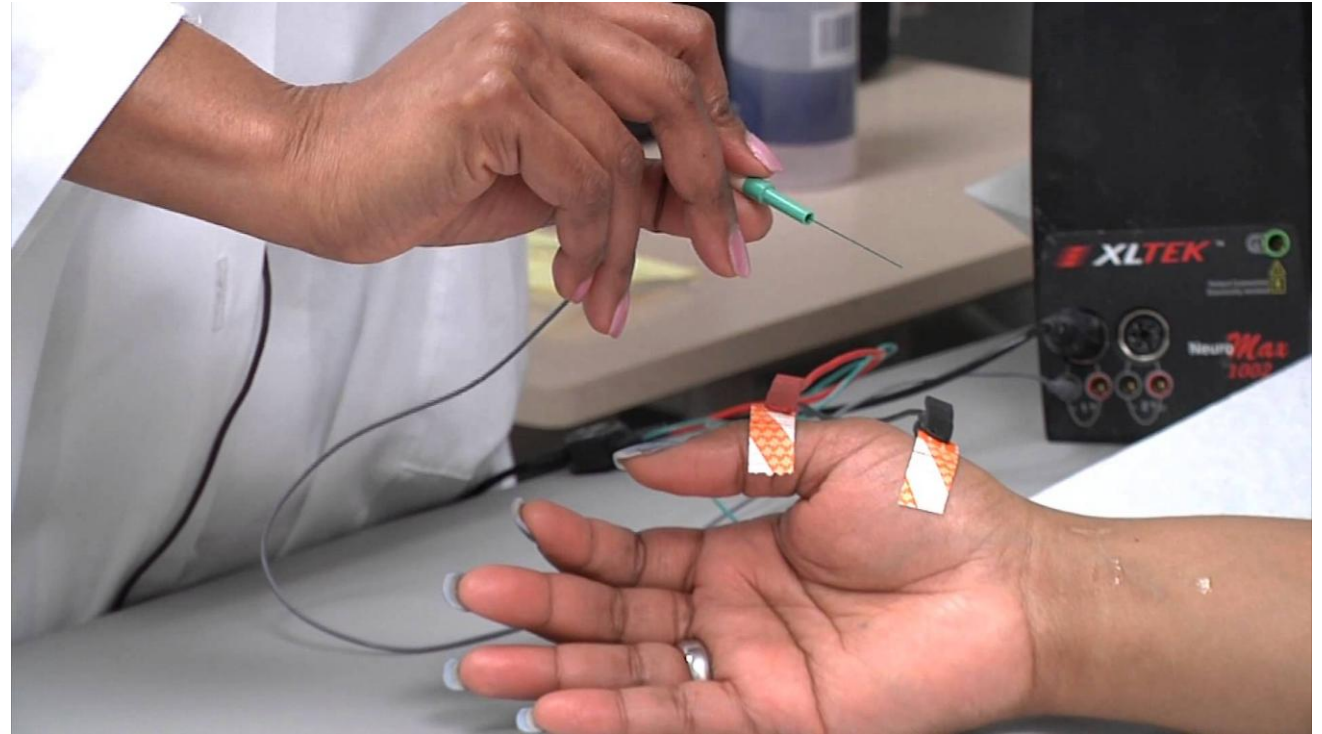
Carpal Tunnel Syndrome

- Median Nerve Compression
- Repetitive Use
- Crowded Carpal Canal
- May be Preventable



Carpal Tunnel Syndrome Diagnosis/Treatment

- Clinical Exam
- Nerve Conduction Velocity
- Electromyogram
- Wrist Splint



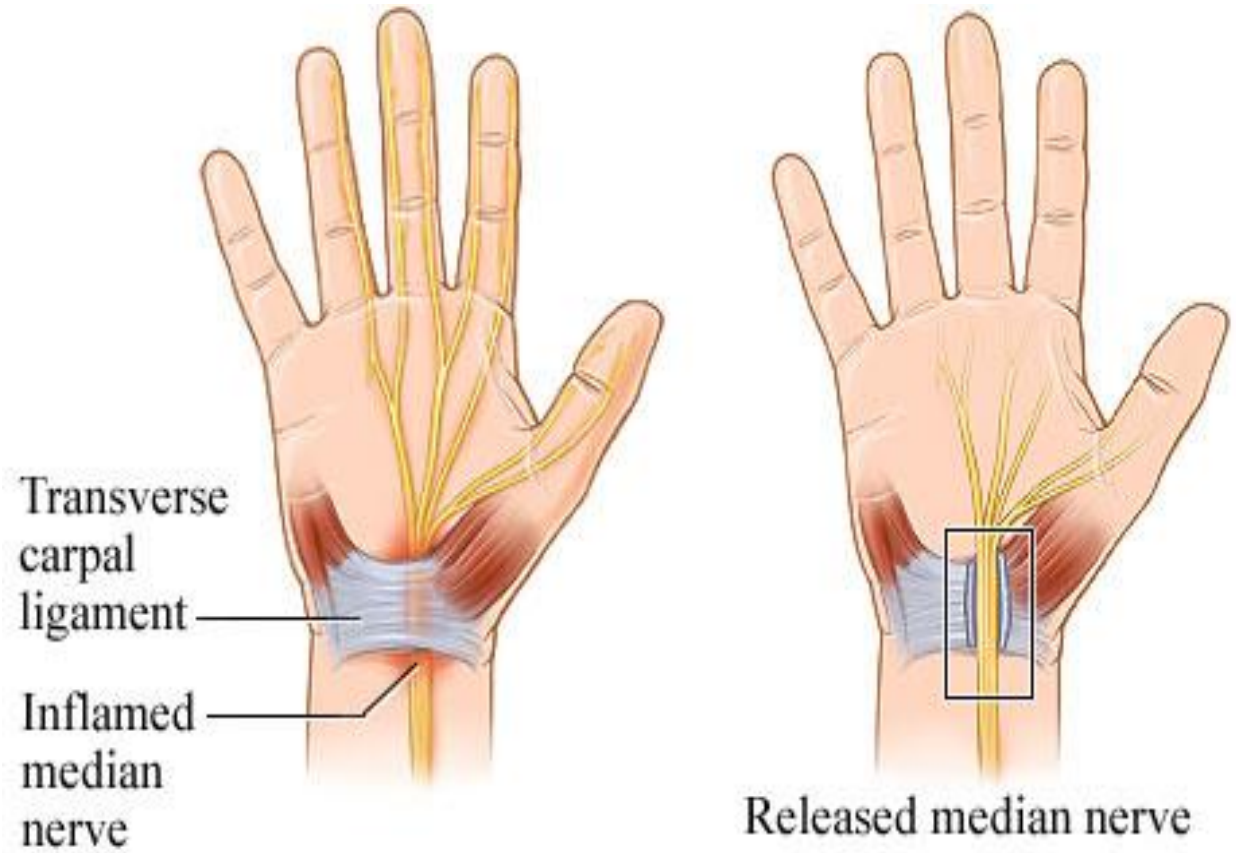
Carpal Tunnel Syndrome (CTS) Treatment

- Rest
- Work Place Modifications
- Wrist Splinting
- Stretching



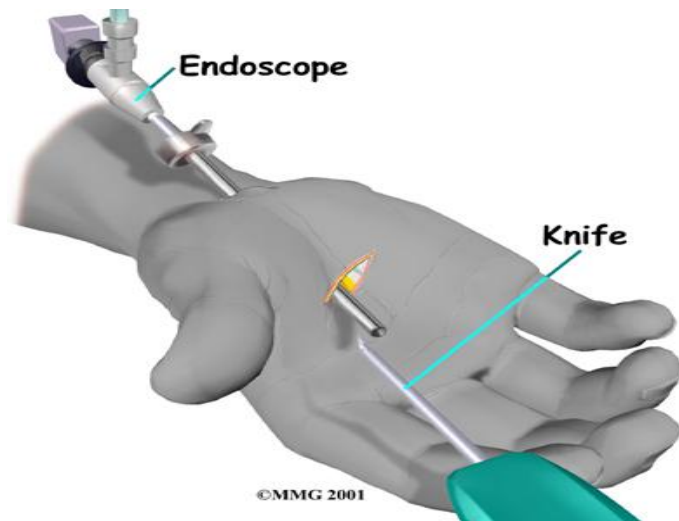
Carpal Tunnel Syndrome: Surgery

- Open
- Endoscopic
- Full Recovery 4-6 Weeks

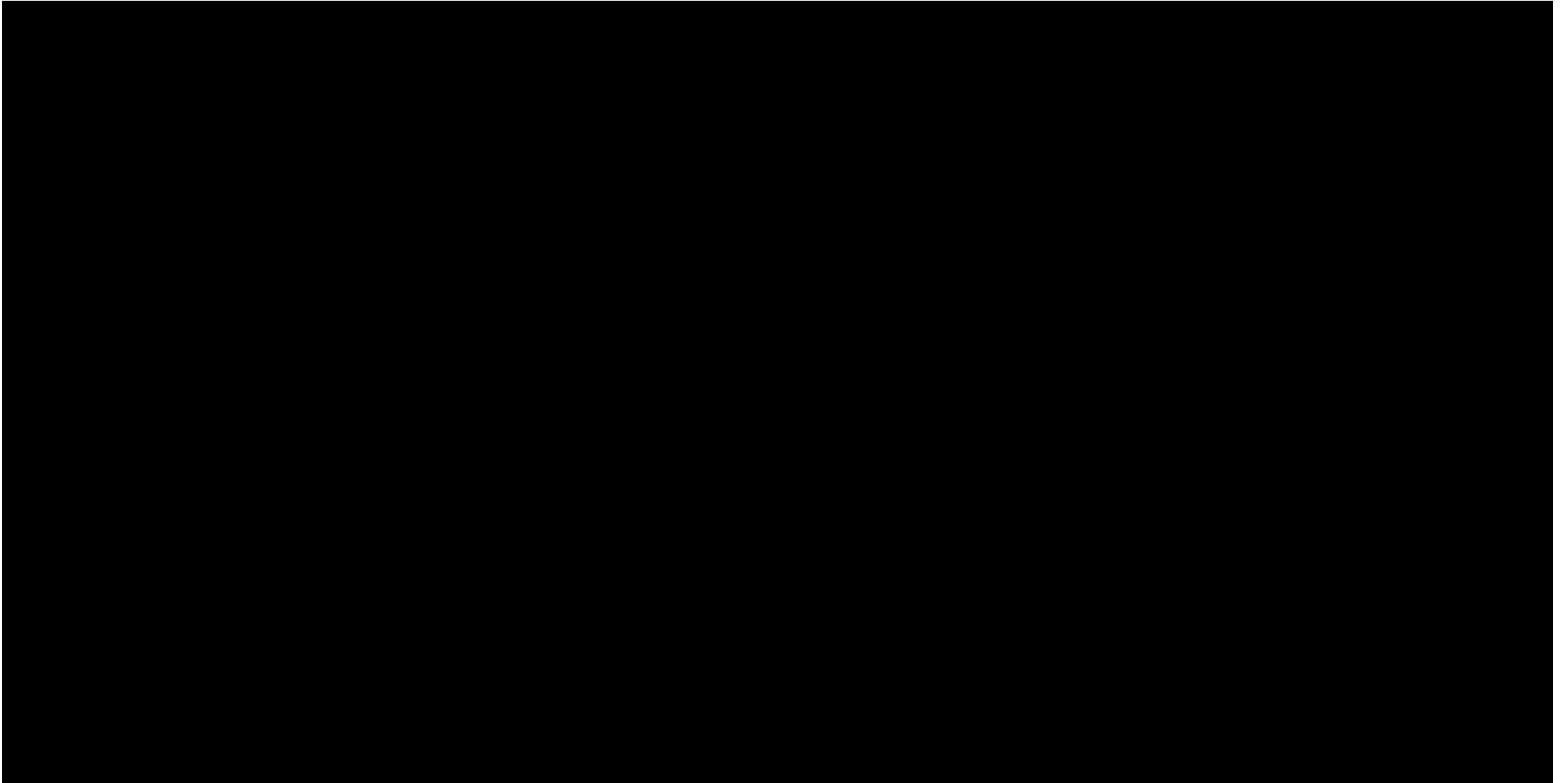


Endoscopic Carpal Tunnel Release (ECTR)

- Smaller Incision
- Less Pain
- Rapid Return to Work

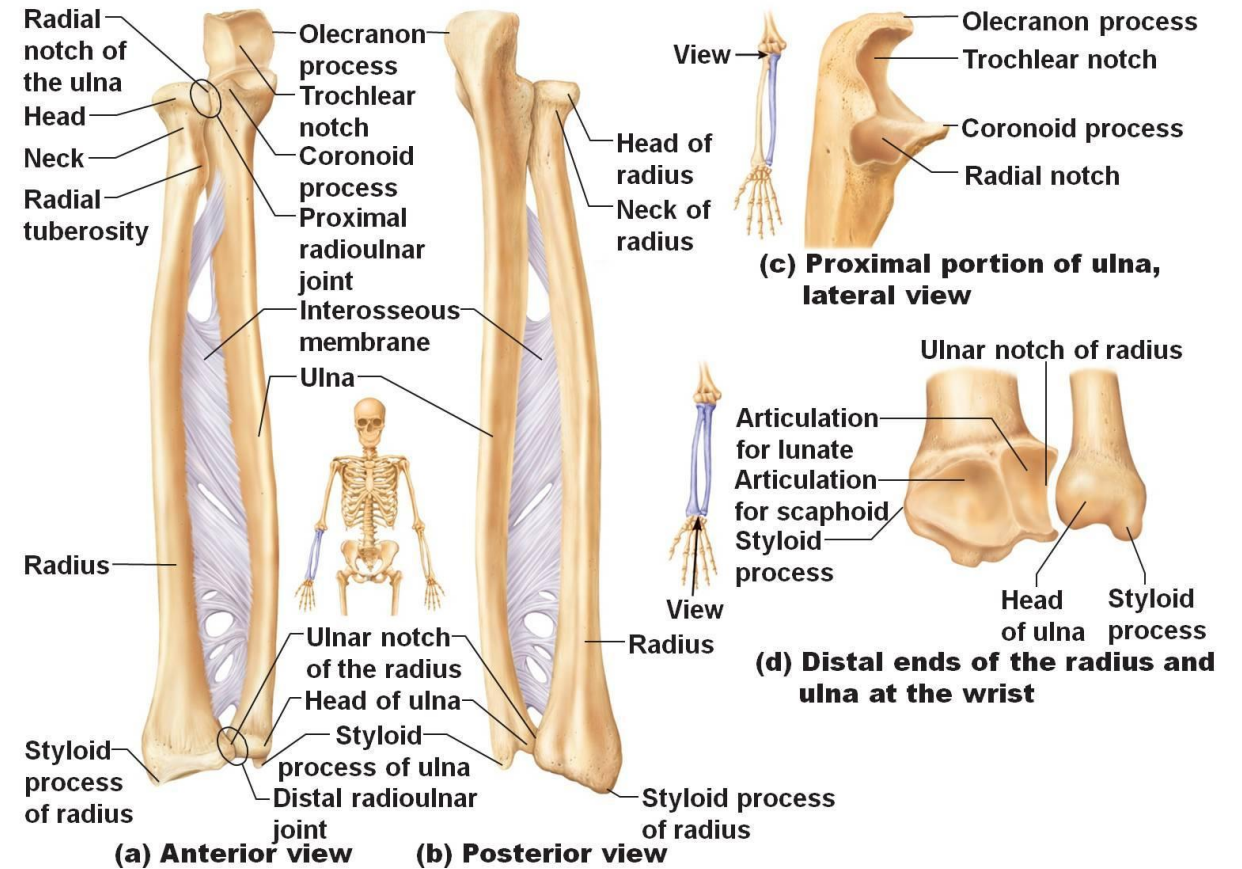


Endoscopic Carpal Tunnel Release Video Demo



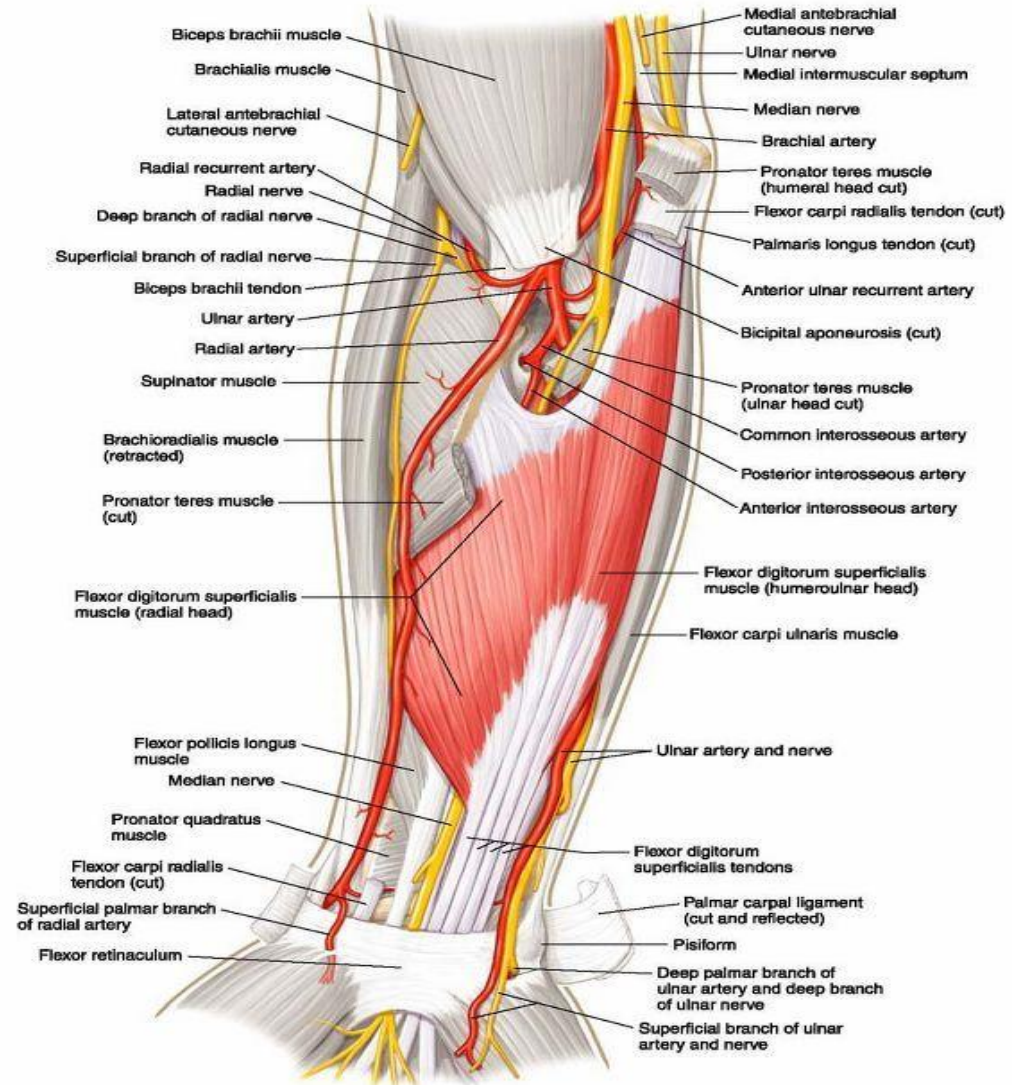
Forearm Anatomy

- 2 Bones
 - Radius
 - Ulna
- Interosseous Membrane
- 2 Arteries
- 3 Nerves



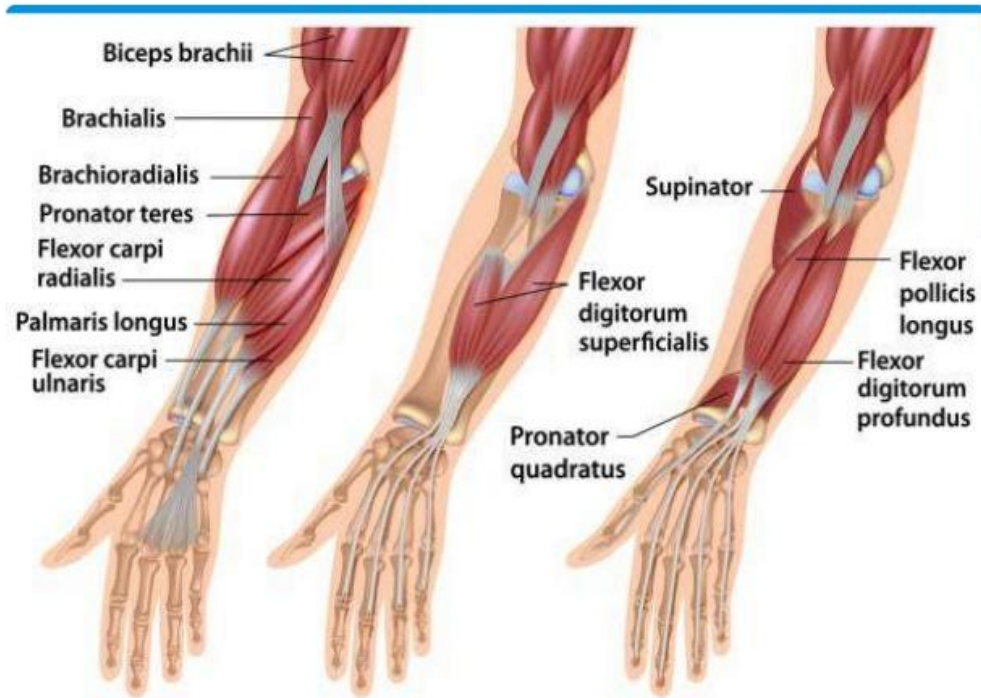
Forearm Anatomy

- Vessels
 - Radial Artery
 - Ulnar Artery
- Nerves
 - Radial (Posterior Interosseous)
 - Median
 - Ulnar

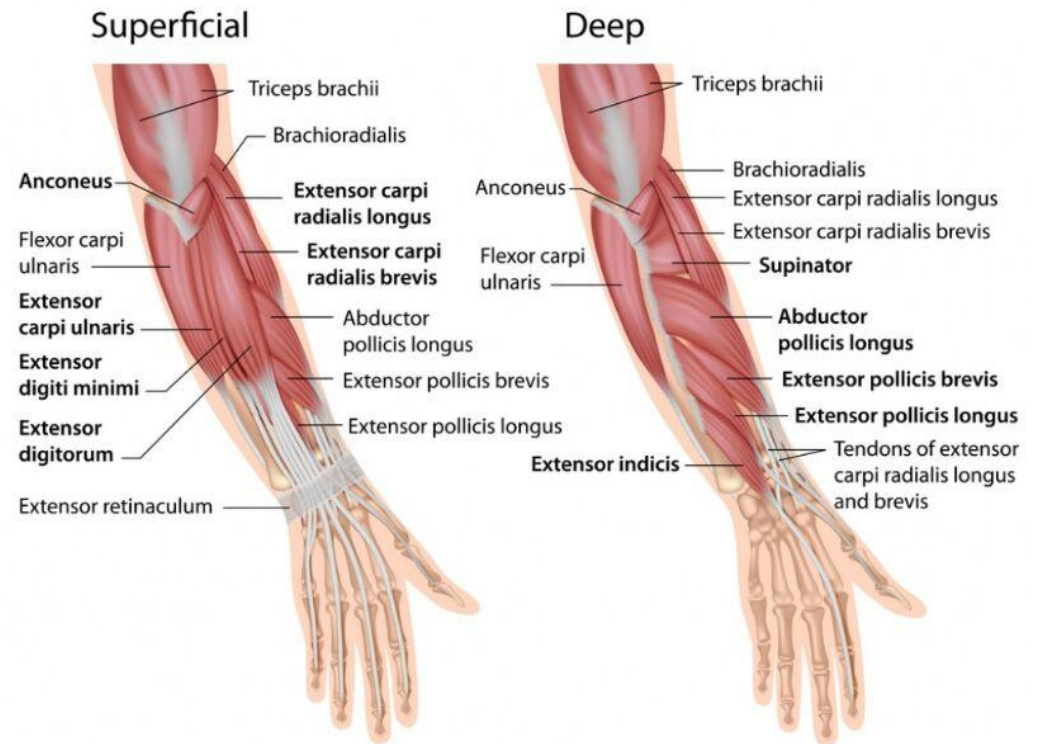


Forearm Muscles

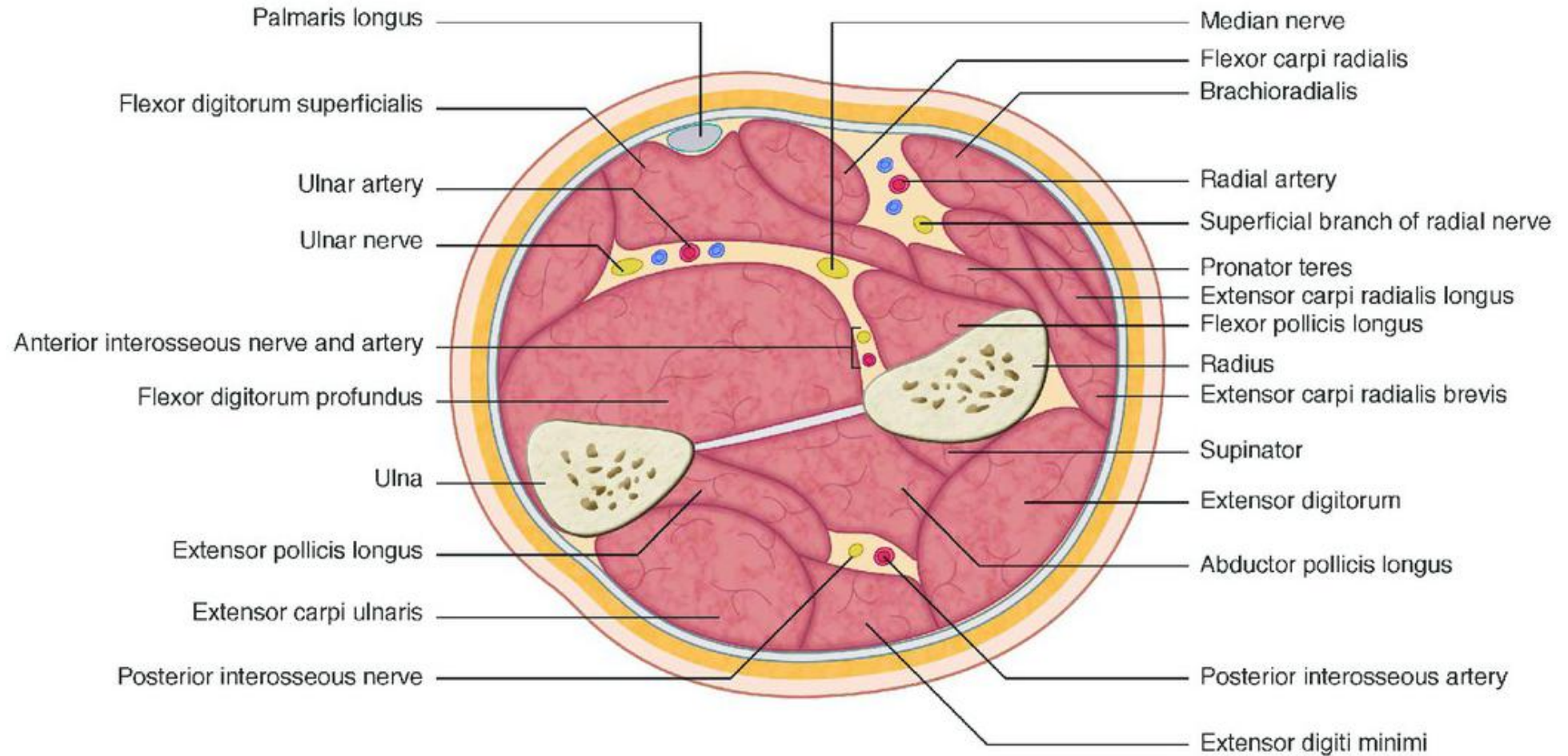
Flexors



Extensors



Forearm Cross Section



Both Bone Forearm Fractures (Radius and Ulna)

- Second Most Common Long Bone Injury
- Usually Occurs from Fall or Defending Strike to Head or Athletic Injury
- Most Fractures are in Distal Third
- More Common in Males
- Check for Associated Elbow Injuries



Both Bone Forearm Fractures in Adults Treatment

- Open Reduction Internal Fixation in Most Situations
- Plates and Screws Most Common
- Two Incisions
- Potential Complications
 - Compartment Syndrome
 - Nerve Injuries



Both Bone Forearm Fractures

Open Reduction Internal Fixation



Fig. 5a. Placement of non-locking screws in a locking plate. By placing non-locking screws on both ends of the fracture first helps to bring the plate down to bone.

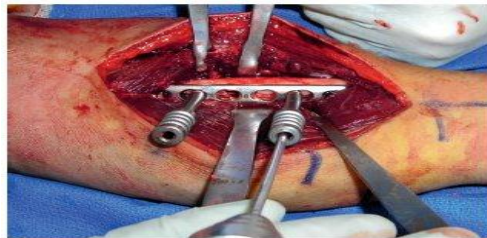
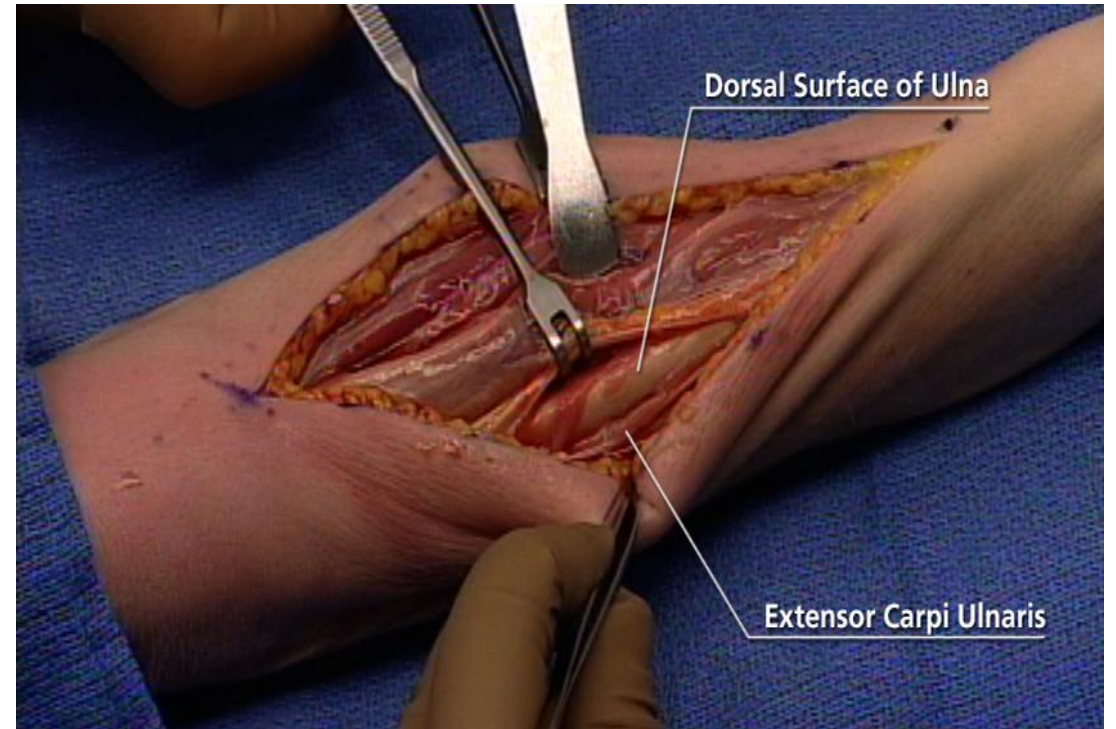


Fig. 5b. Placement of fixed trajectory locking screws through drill guides.



Fig. 5c. Locking plate fixed with a combination of locking and non-locking screws.

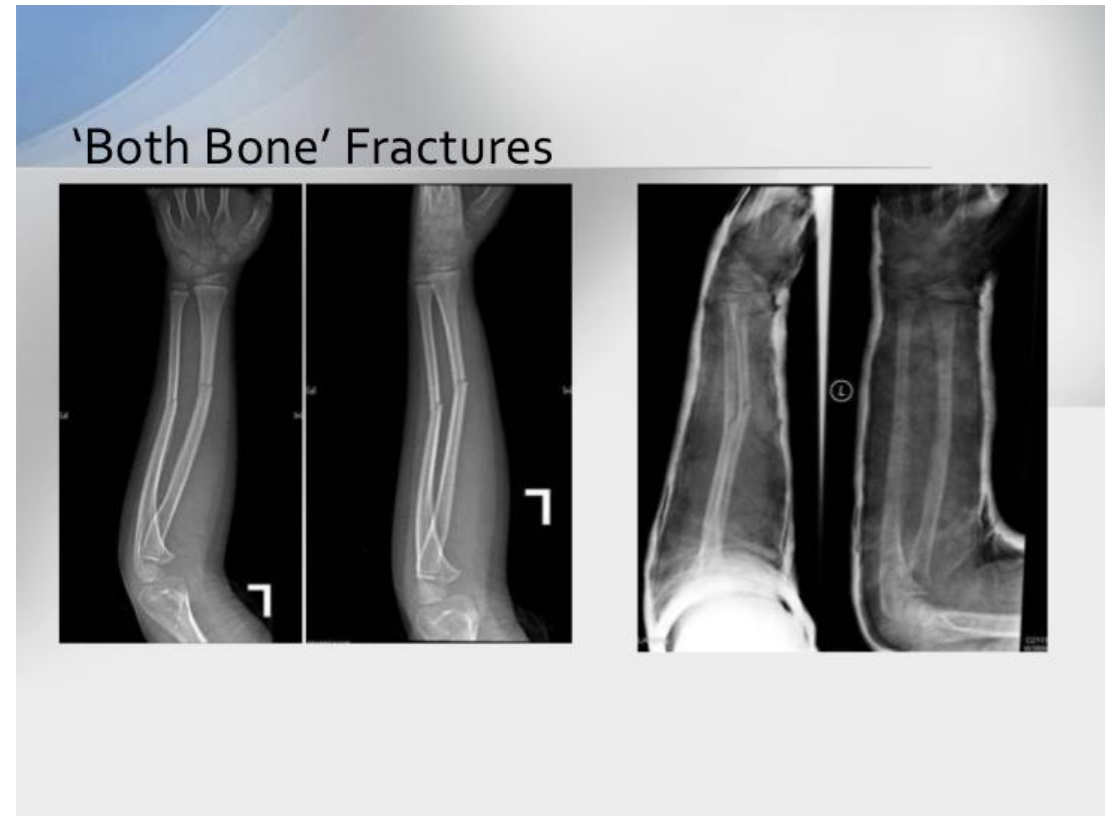


Both Bone Forearm Fractures in Children



Both Bone Forearm Fractures in Children

- Minimally Angulated, Young (Less than 10 Yrs Old) Closed Tx
- Distal Third angulated, Pinning
- More angulated or displaced, Older child: Open Reduction
 - Plates
 - Titanium Elastic Intramedullary Nail



Both Bone Forearm Fracture in Children

- Open Reduction Internal Fixation (ORIF)
- Plates and Screws
- Older Children
- Near Skeletal Maturity
- Use Smaller Plates
- Leave Hardware in

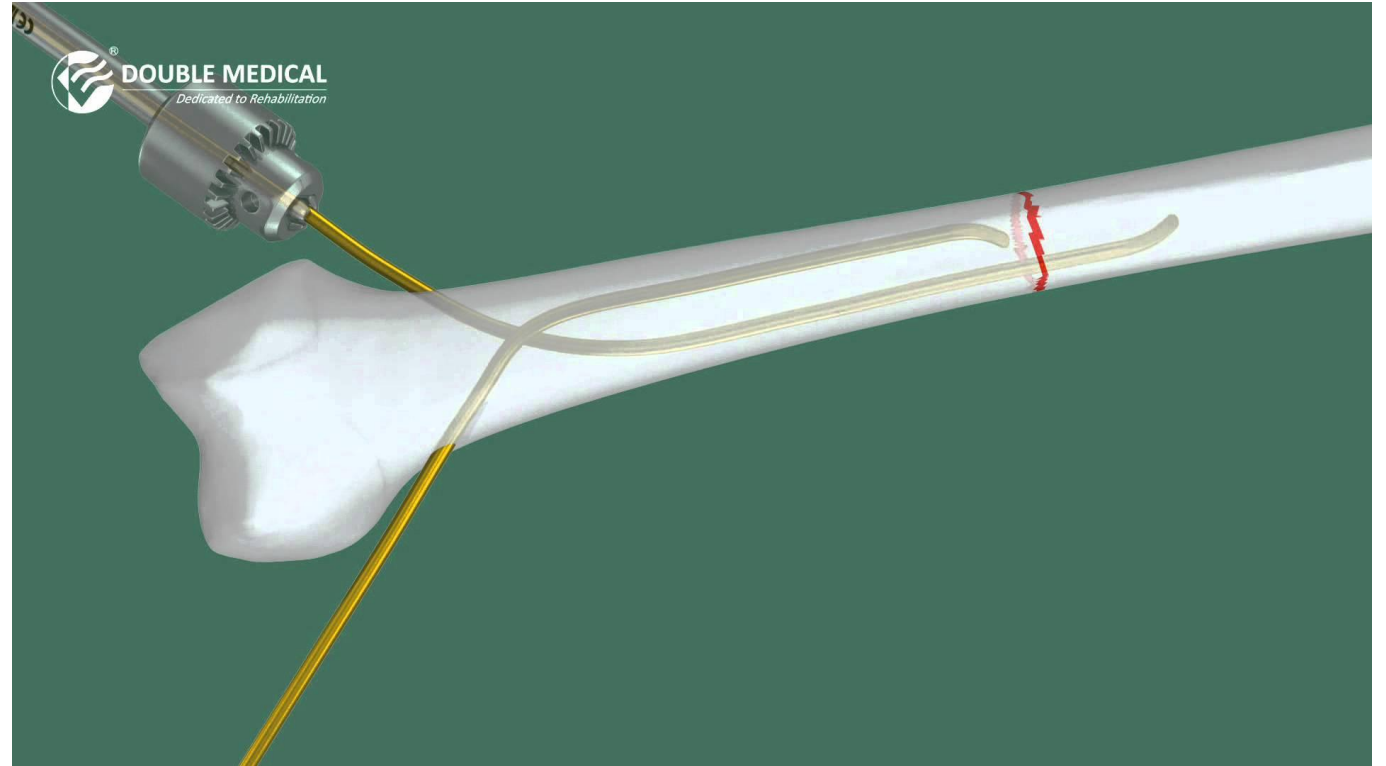


Both Bone Forearm Fracture in Children Titanium Elastic Nail

- Younger Children
- Open Growth Plates
- Open or Closed Reduction
- Nails Will Be Removed
- No Residual Hardware



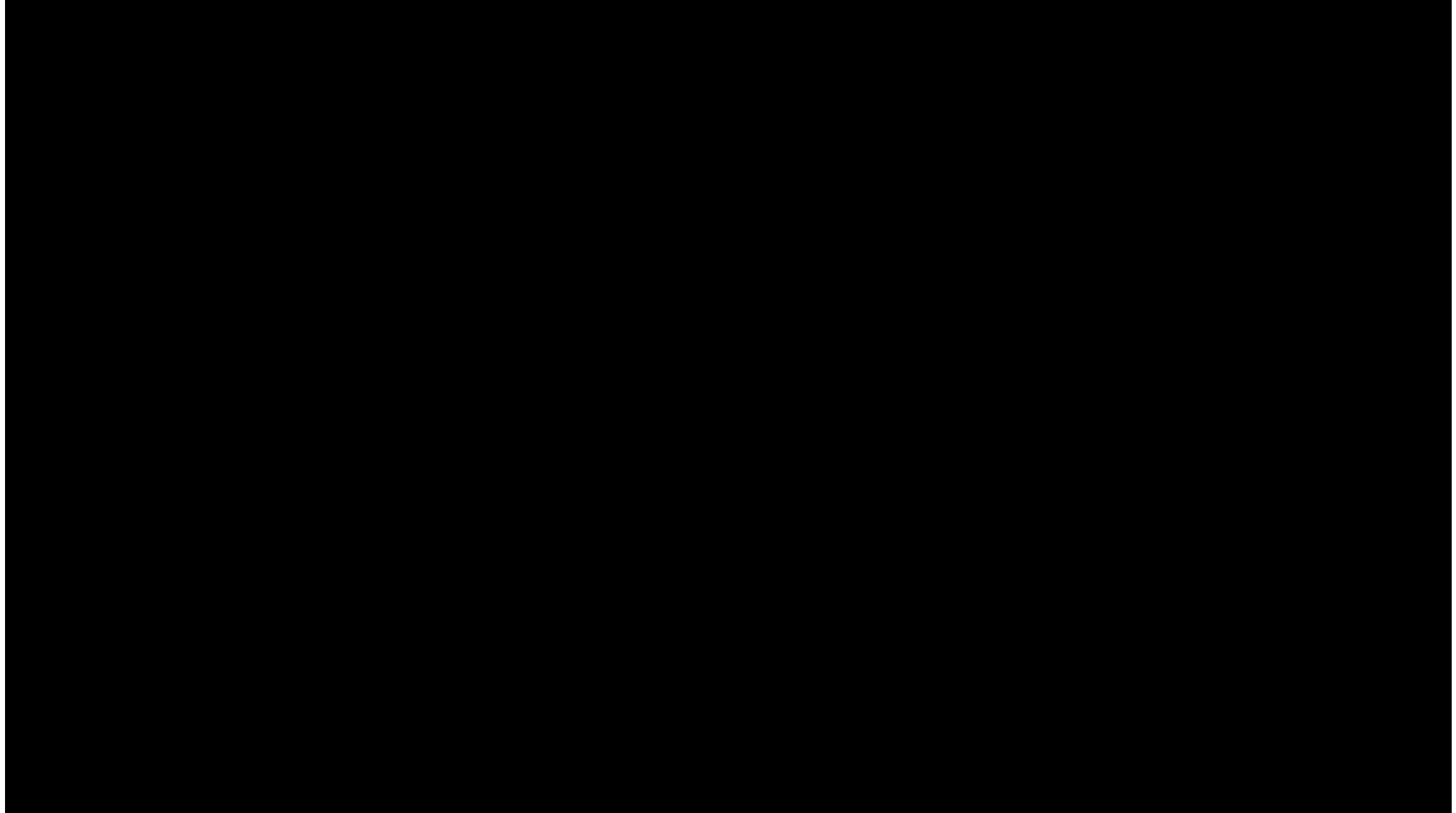
Both Bone Forearm Fracture in Children (Titanium Elastic Nail)



Both Bone Forearm Fracture in Children (Titanium Elastic Intramedullary Nails)



Titanium Elastic Nail Insertion in Forearm

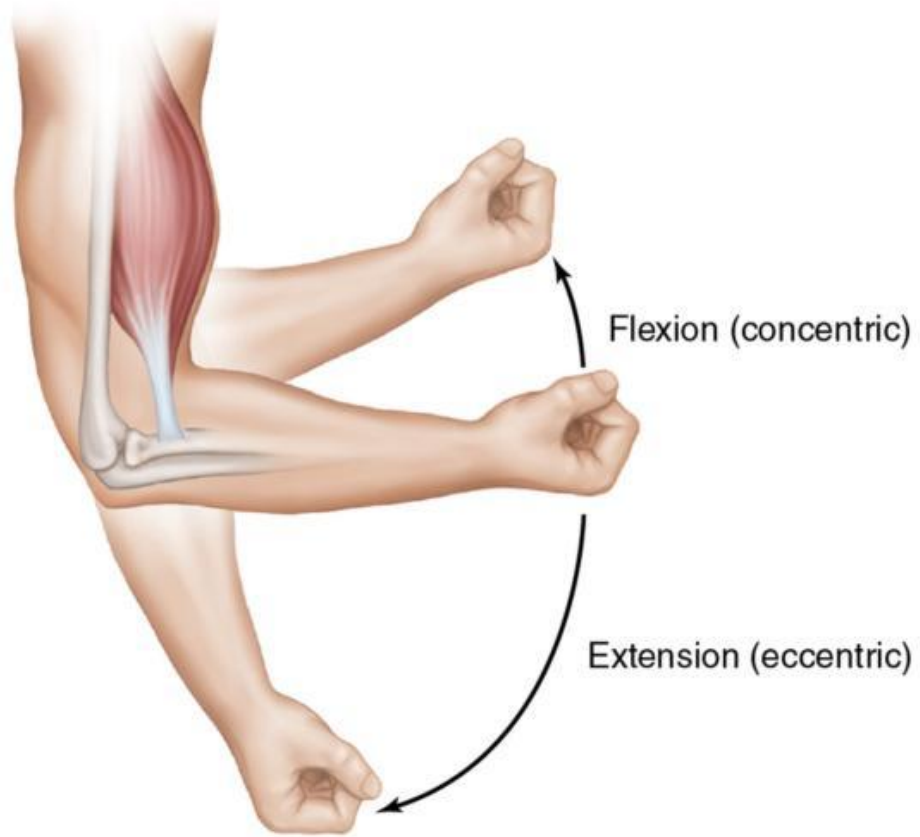


Elbow Anatomy

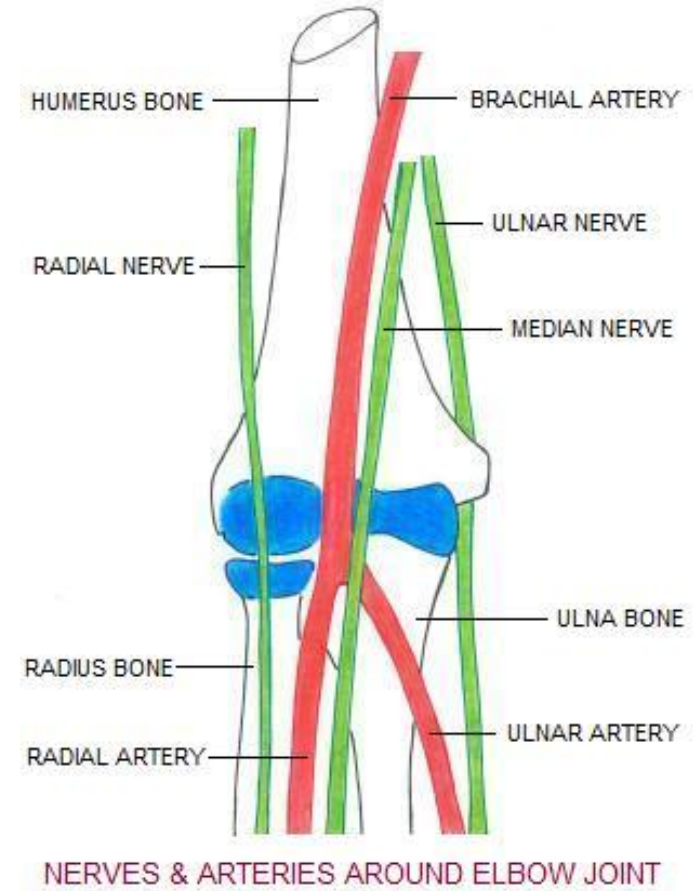
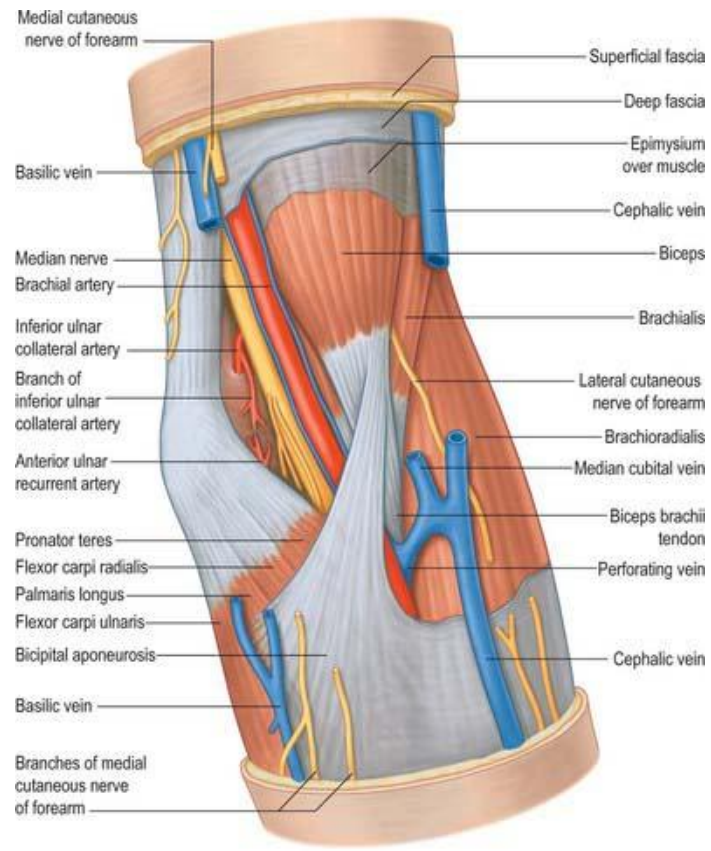
- Three Bones
 - Radius
 - Ulna
 - Humerus



Elbow Joint

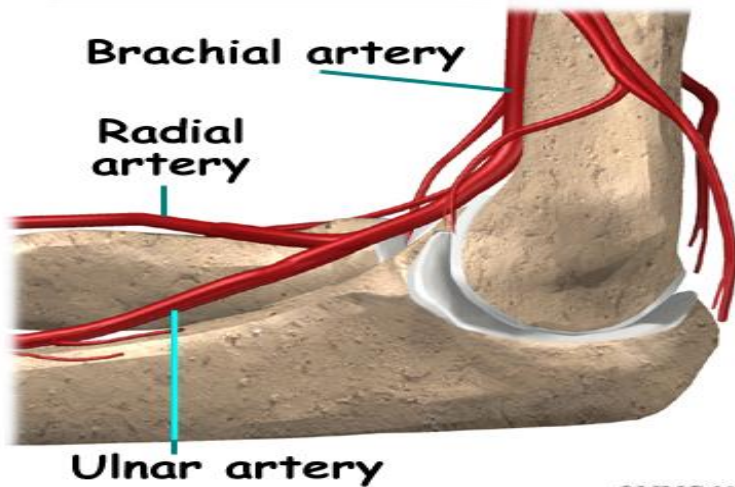


Elbow Soft Tissues

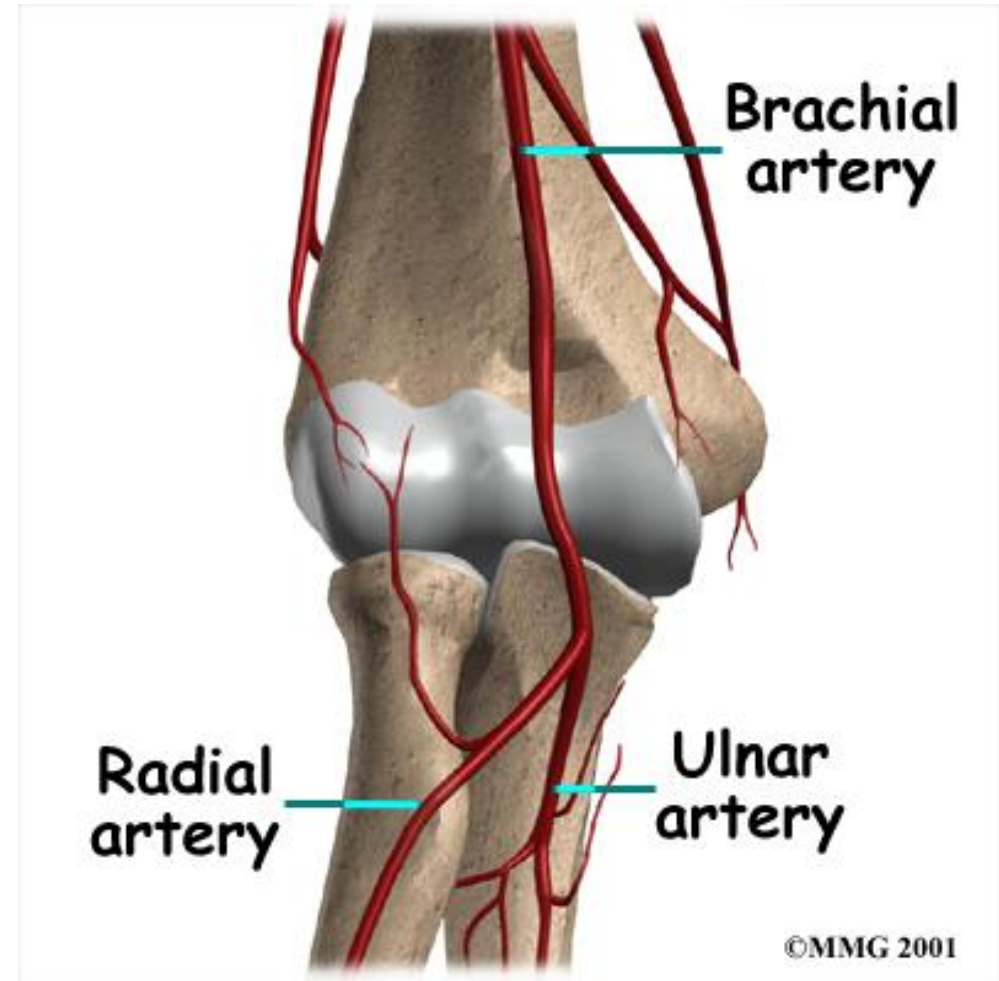


Elbow Blood Supply

- Brachial
 - Radial Artery
 - Ulnar Artery
- Recurrent Branches



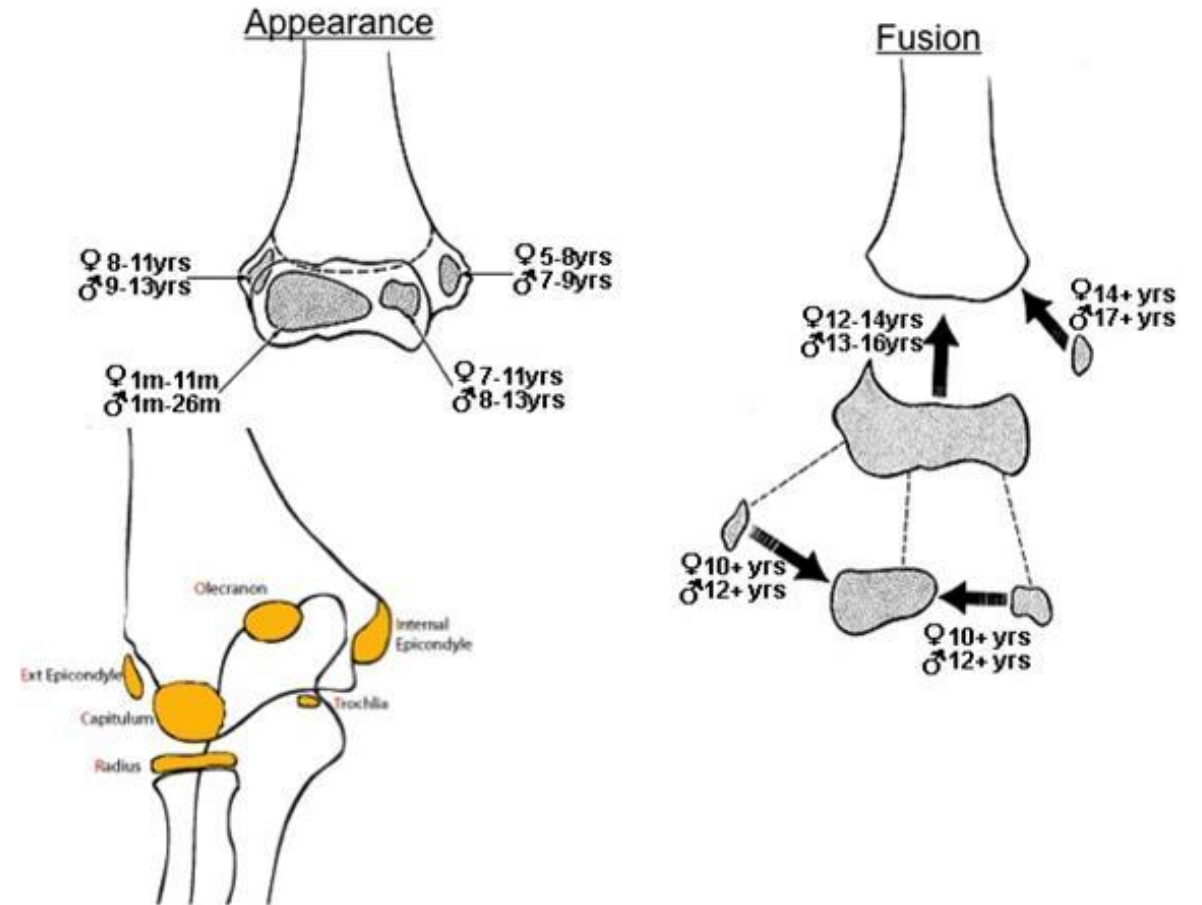
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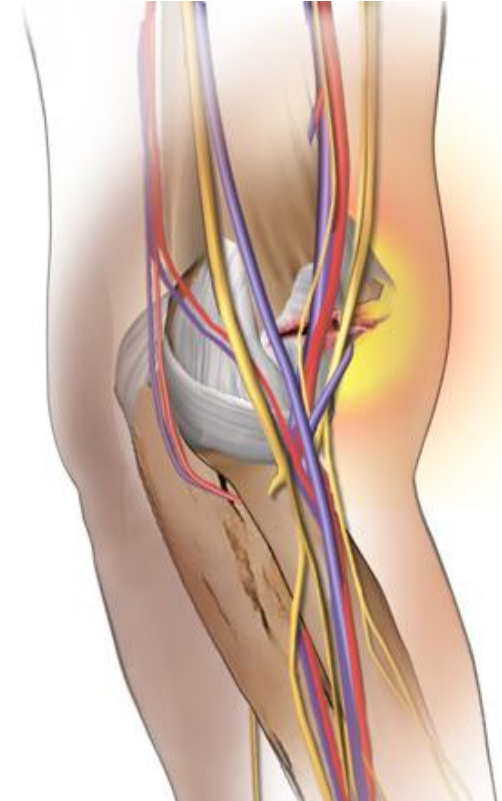
Pediatric Elbow Fractures

- Supracondylar Fracture
- Involves Many of the Growth Plates in Distal Humerus



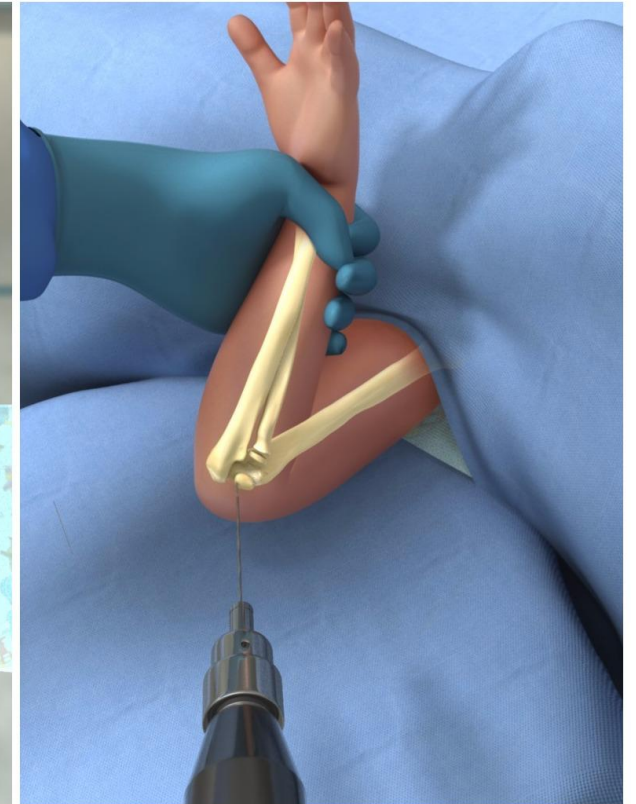
Supracondylar Fractures

- Children Less than 10 yrs. Old
- 30% of all Extremity Fxs. In Kids
- Hyperextension
- Fall on out-stretched Hand



Supracondylar Fractures: Treatment

- Minimally Angulated: Cast
- Angulated
 - Closed Reduction
 - Pinning
 - Long Arm Cast or Splint
- Completely Displaced
 - Open Reduction
 - Pinning
 - Long Arm Cast or Splint

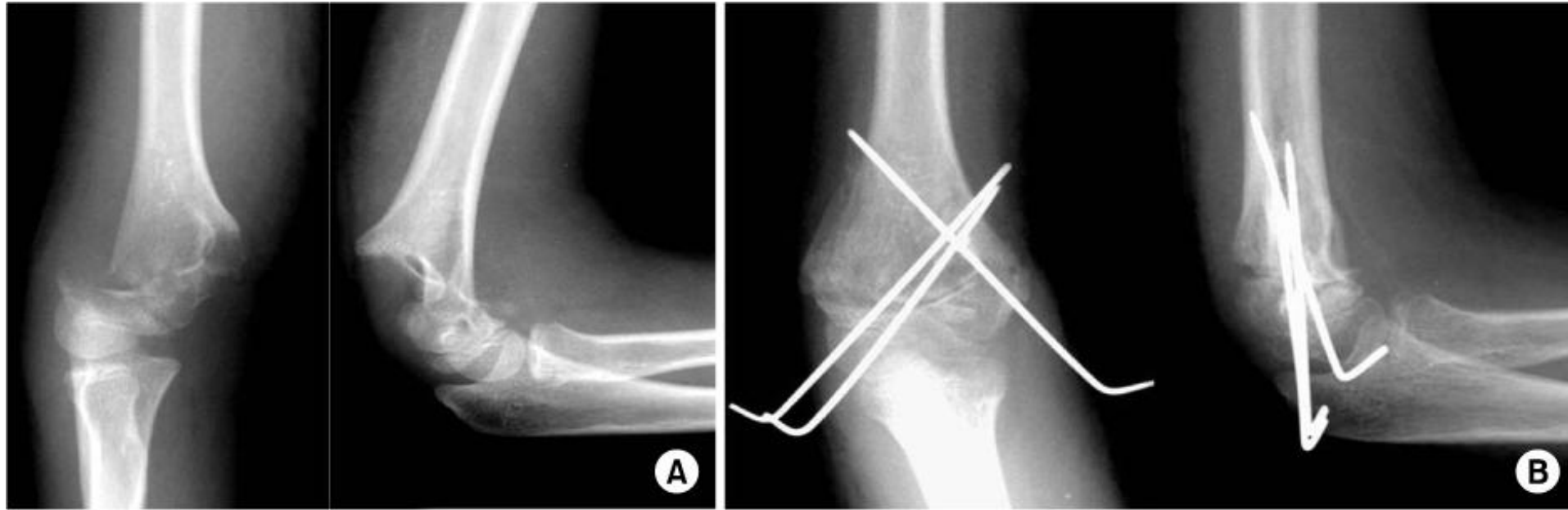


Supracondylar Fractures: Aftercare

- Long Arm Cast Six Weeks
- Remove Pins (in OR)
- Gentle Active Range of Motion



Supracondylar Fractures: Surgical Treatment



Supracondylar Fractures Associated Injuries

- Nerves
 - Radial
 - Median
 - Ulnar
- Arteries
 - Brachial (At the level of Fx)
- Muscles (Forearm)
 - Compartment Syndrome



Supracondylar Elbow Fracture Complications

Varus Deformity

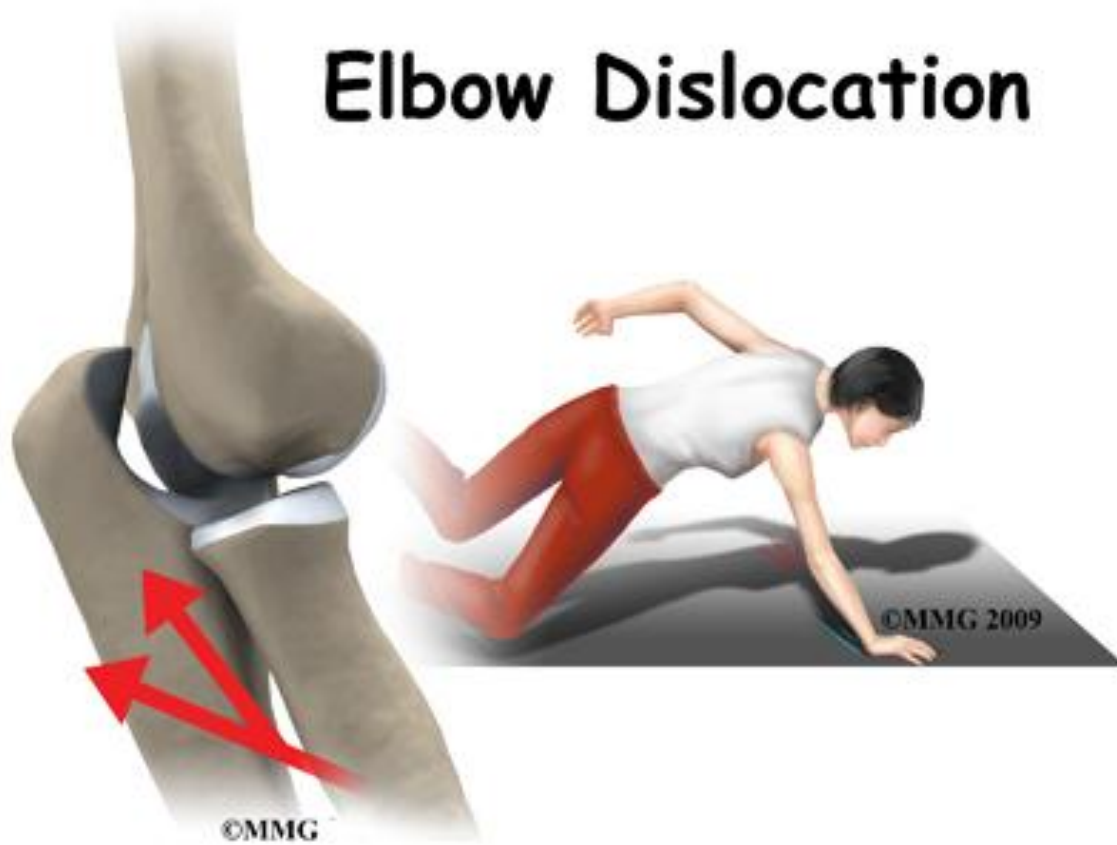


Elbow Dislocation

- Second most common dislocation
- Many types: Posterior most common
- Mechanism of injury: Fall on outstretched hand, elbow extended



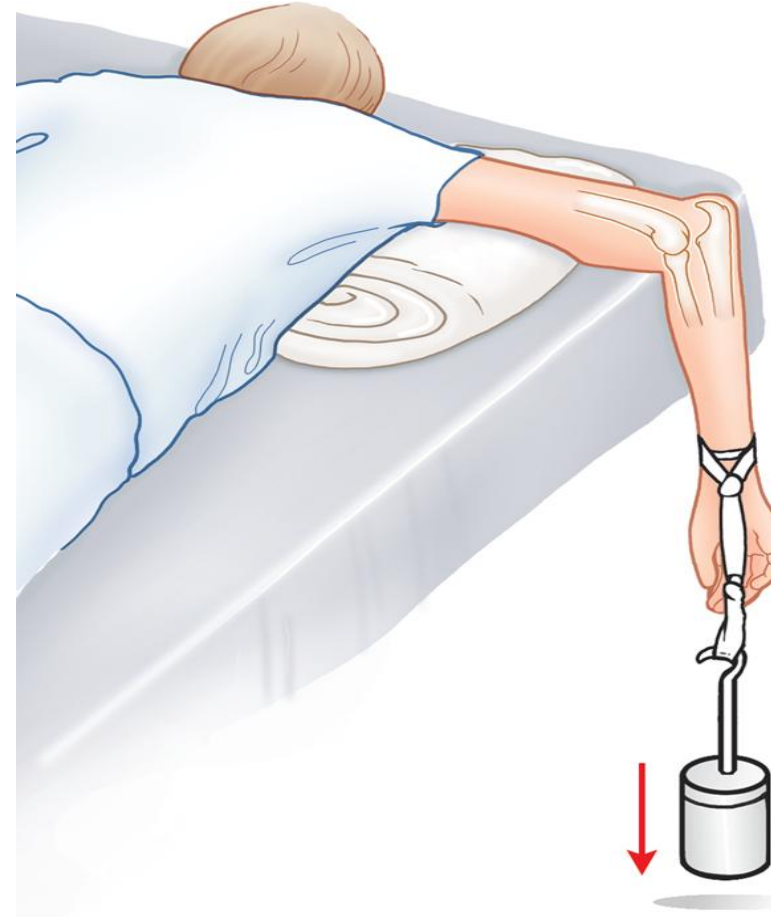
Elbow Dislocation



Source: K.J. Knoop, L.B. Stack, A.B. Storrow, R.J. Thurman:
The Atlas of Emergency Medicine, 4th Edition,
www.accessemergencymedicine.com
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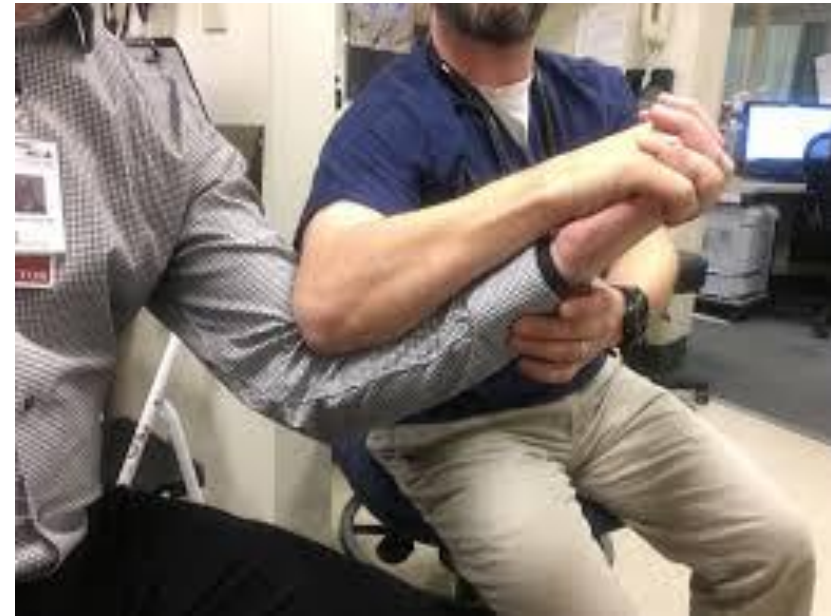
Elbow Dislocation: Treatment

- Closed Reduction
- Usually Accomplished in ER
- Traction, Sedation Helpful
- Posterior Splint after Reduction



Source: Reichman EF: *Emergency Medicine Procedures*,
Second Edition: www.accessemergencymedicine.com
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Elbow Dislocation: Closed Reduction



Elbow Dislocation: Aftercare and Rehab

- ROM as early as 2 weeks if stable
- Hinged elbow brace
- Progressive extension

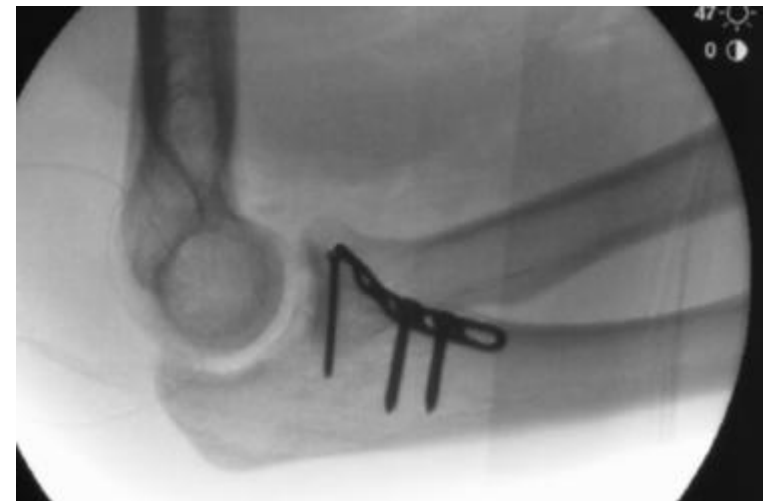
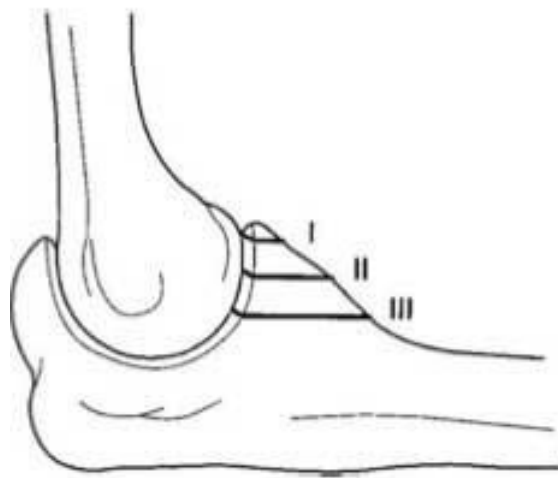


Elbow Dislocation: Complications

- Flexion Contracture
- Additional Fractures
 - Radial Head
 - Coronoid Process
 - Medial Epicondyle
- Recurrent Instability
 - MCL Tear
 - Coronoid Fracture



Coronoid Fracture



Shoulder/Proximal Humerus Fracture in Children

- Usually a Growth Plate Injury
- Salter Harris II
- Most Common Age: 11-14 yrs.
- Significant Angulation and Displacement Usually Acceptable
- If Necessary: Percutaneous Pinning

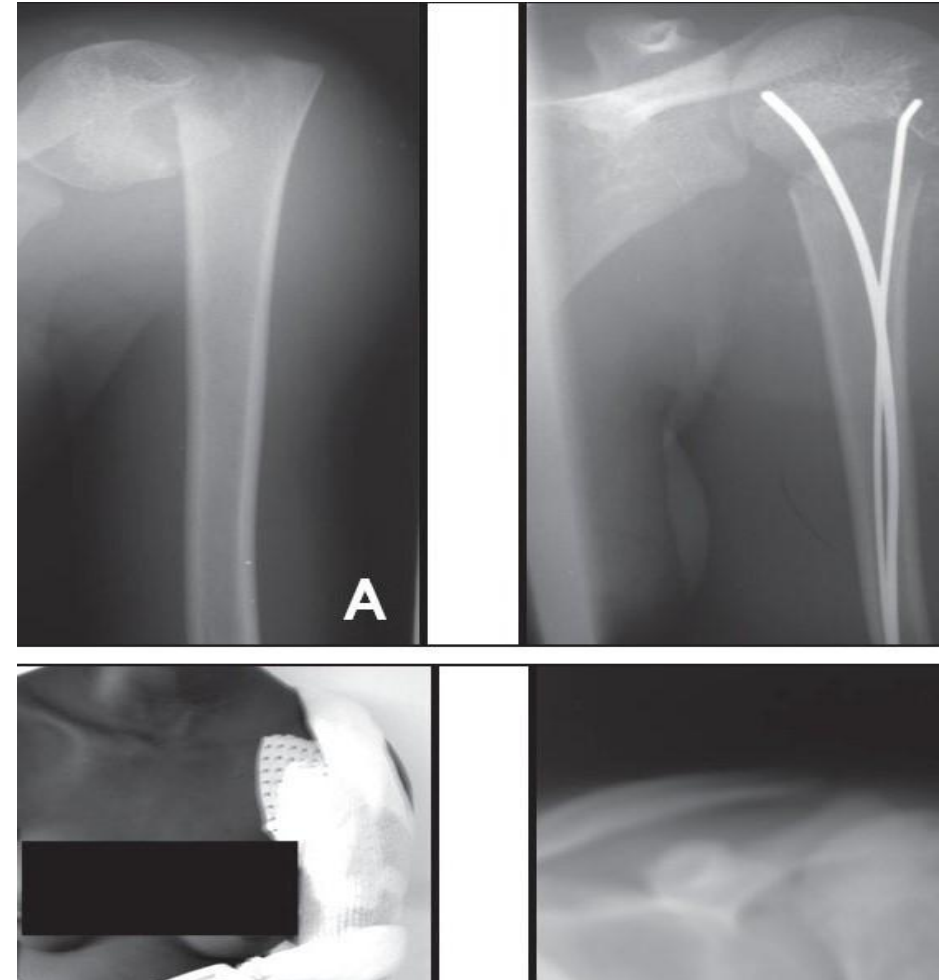
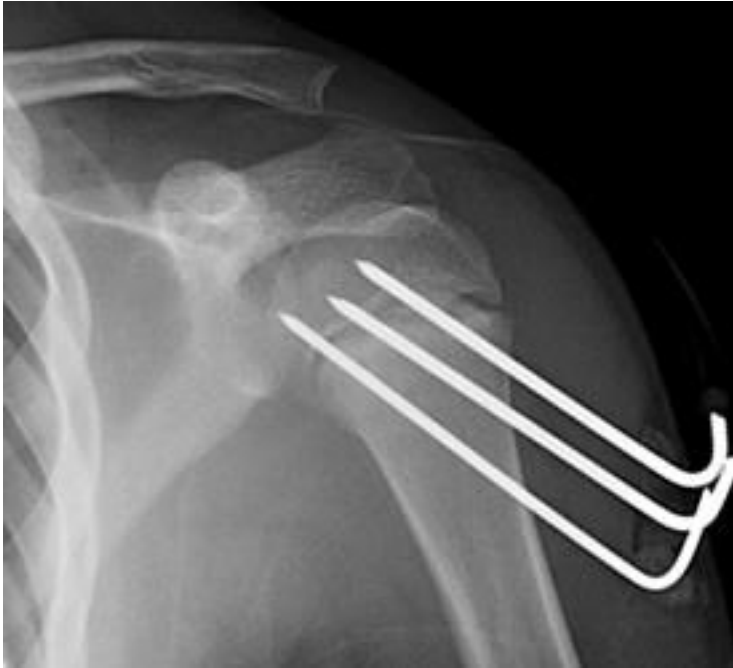


Proximal Humerus Fracture

- Age 5-12: Up to 50% Angulation and 50% Displacement Acceptable
- Age 13+: Up to 30% Angulation and 30% Displacement Acceptable
- Sling/Shoulder Immobilizer



Proximal Humerus Fracture Surgical Treatment



Acromio-Clavicular (AC) Separations

- Fall onto shoulder
- Upper arm falls away from distal clavicle
- Early childhood: Salter Harris II Fracture of distal clavicle
- Five grades of severity



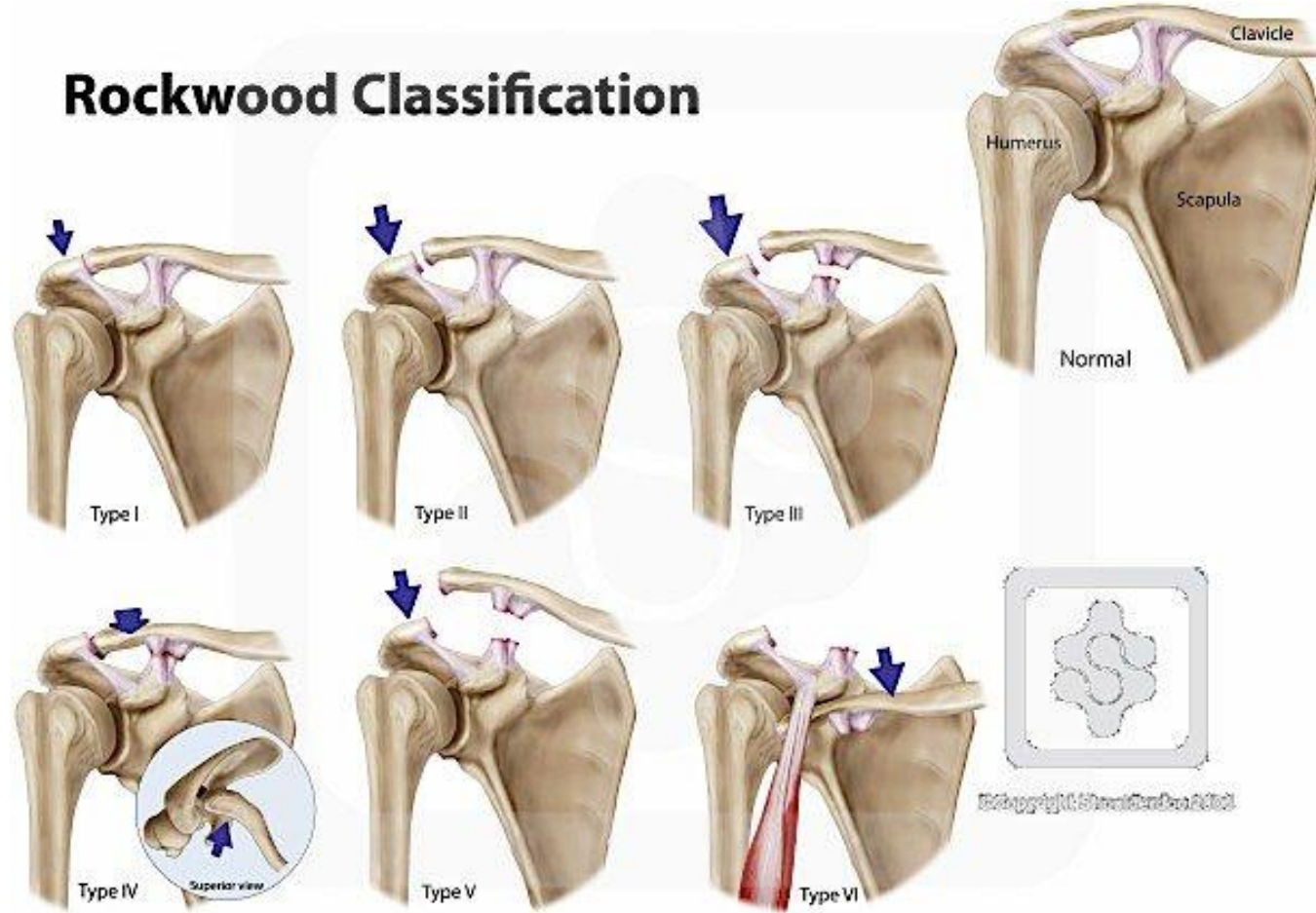
AC Joint Anatomy

Normal Acromioclavicular joint



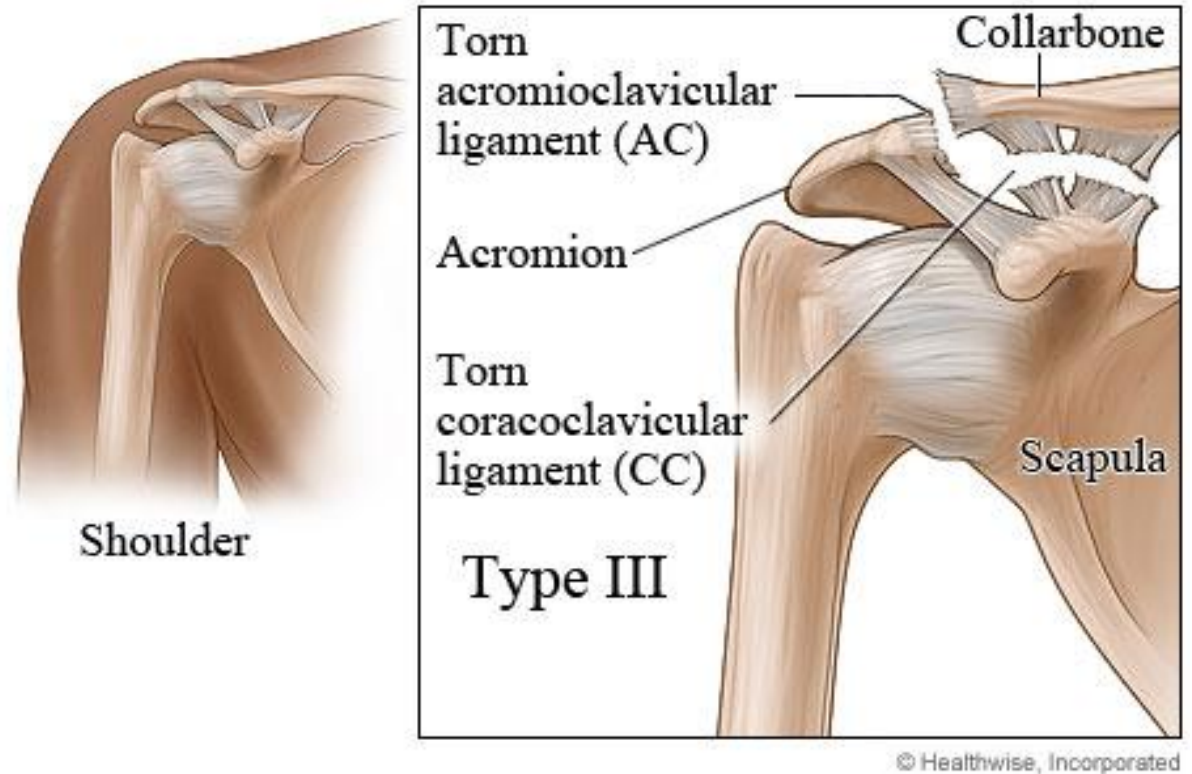
AC Separation Classification

Rockwood Classification



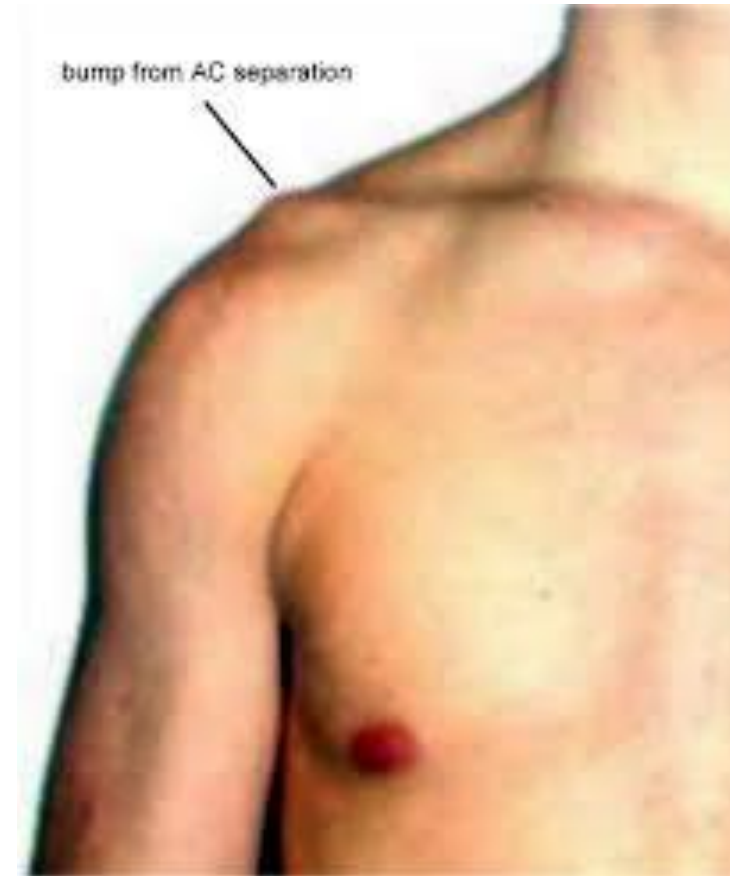
AC Separation: Classification

- I: Sprain without ligament tear
- II: Sprain with tear of AC ligament
- III: Sprain with Tear of CC ligaments
- IV: Above with posterior displacement of clavicle to trapezius muscle
- V: Above with superior migration



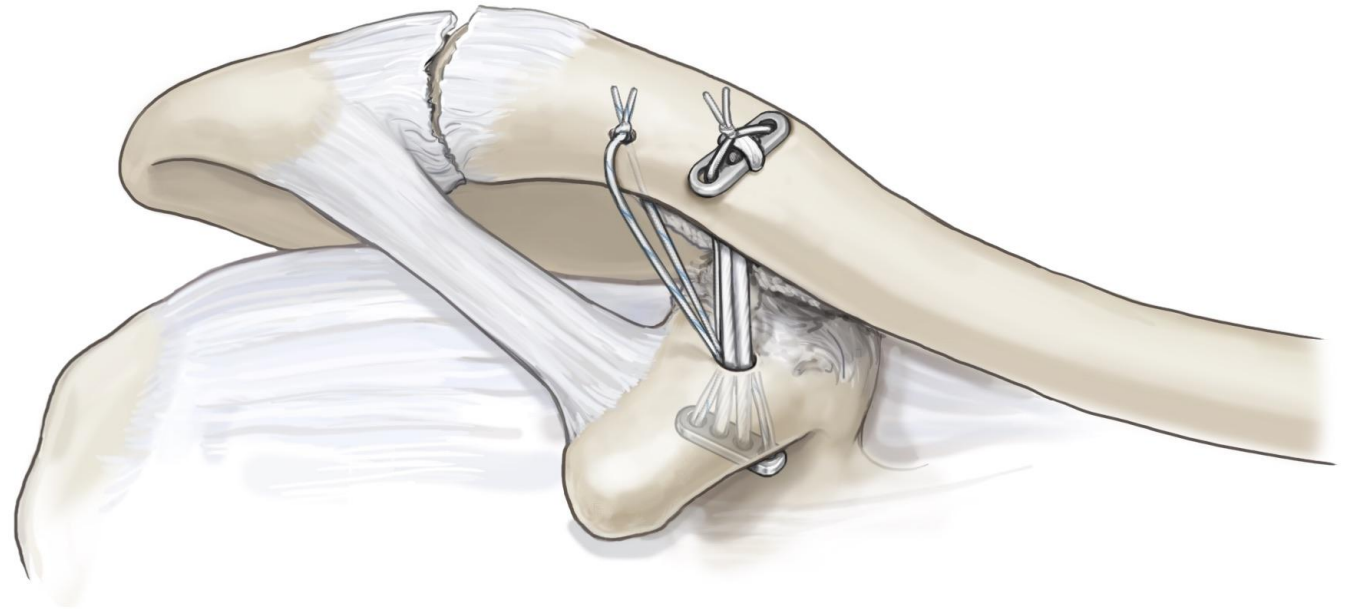
AC Separation: Treatment

- I: Non-Operative, Brief immobilizer followed by ROM
- II: Same as above
- III: Variable: Some have surgery
- IV: Surgical repair
- V: Surgical repair



AC Separation: Surgical Repair

- Repair CC Ligaments
- Distal Clavicle to Coracoid
- Reinforce with heavy suture
- (Internal Brace)



AC Separation: Return to Sports

- Grade I-II : As early as 2 weeks
 - Consider brace
- Grade III: 4-6 weeks
- Surgery: 8 weeks

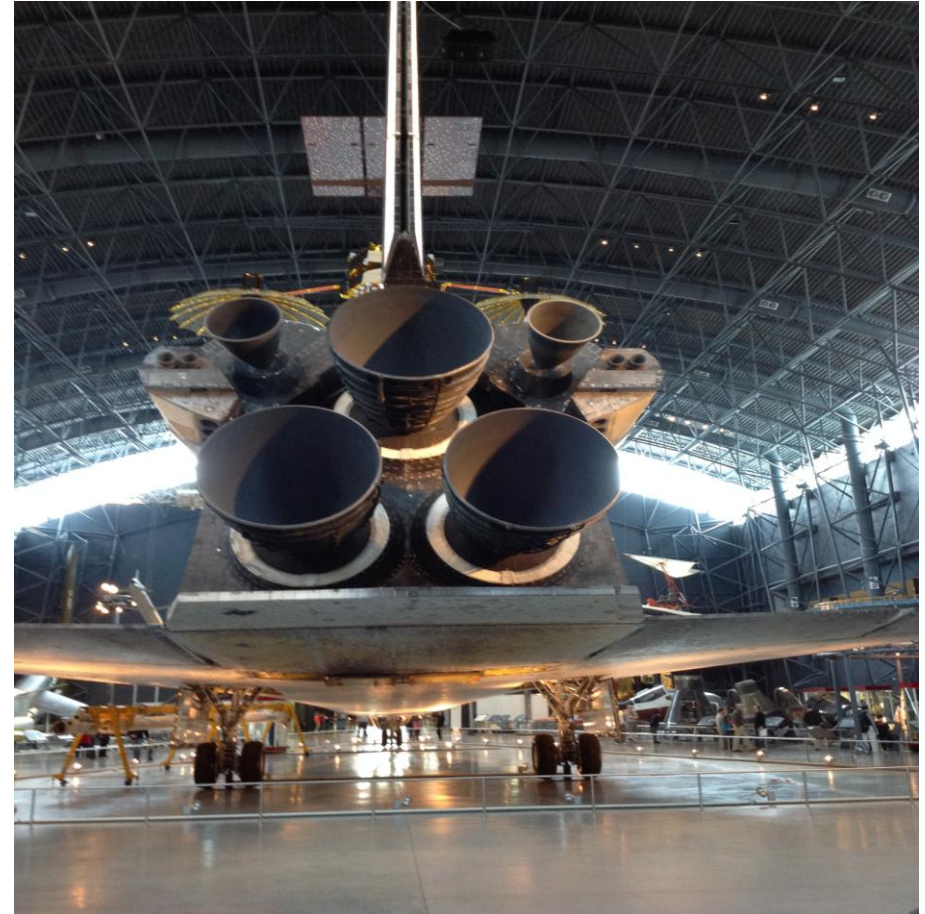


AC Separation/ Post Traumatic DJD



Upper Extremity Injuries: Summary

- Reviewed Relevant Anatomy
 - Hand
 - Wrist
 - Forearm
 - Elbow
- Discussed Fracture Terminology
- Reviewed Evaluation and Treatment Common Injuries from Hand to Elbow



Thank You!

