

Examination of the Normal and Injured Elbow

ACSM Essentials of Sports Medicine
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Intro



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Presentations

Publications

Travel

**Intern
Arthroscopy**

**James E. Ireland
Foundation**

Web Links

**Other Readings
and Discussion**

ACSM_TPC_2017

Mary Lloyd Ireland M.D.



Injuries IN Baseball

James R. Andrews
Bertram Zarins
Kevin E. Wilk



ASMI
American Sports Medicine Institute

Lippincott • Raven

CHAPTER 17

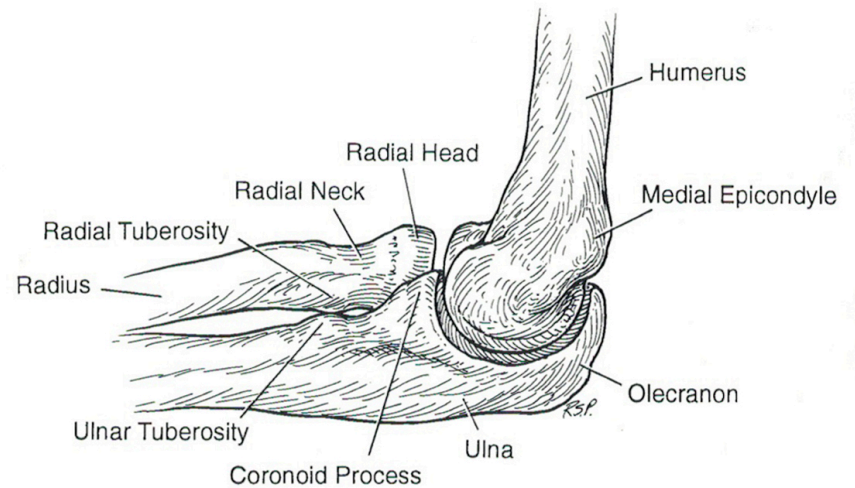
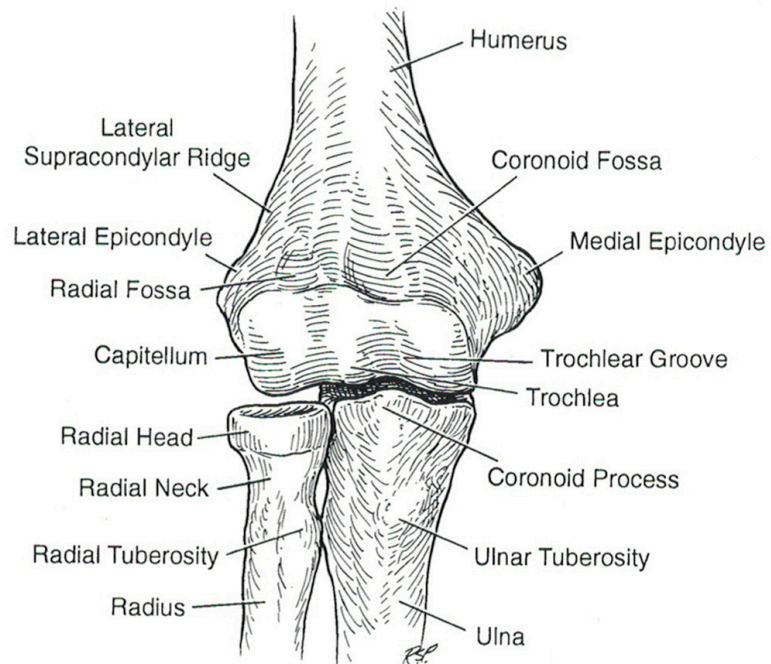
Functional Anatomy of the Elbow

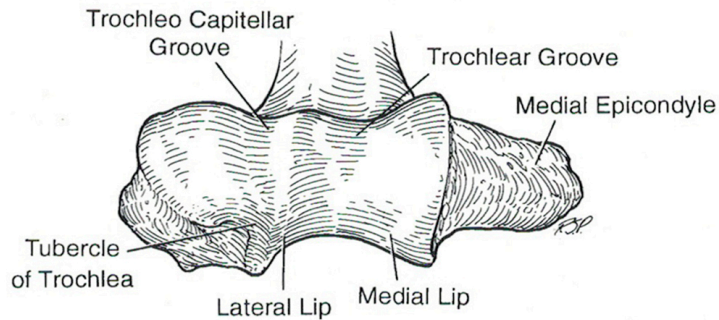
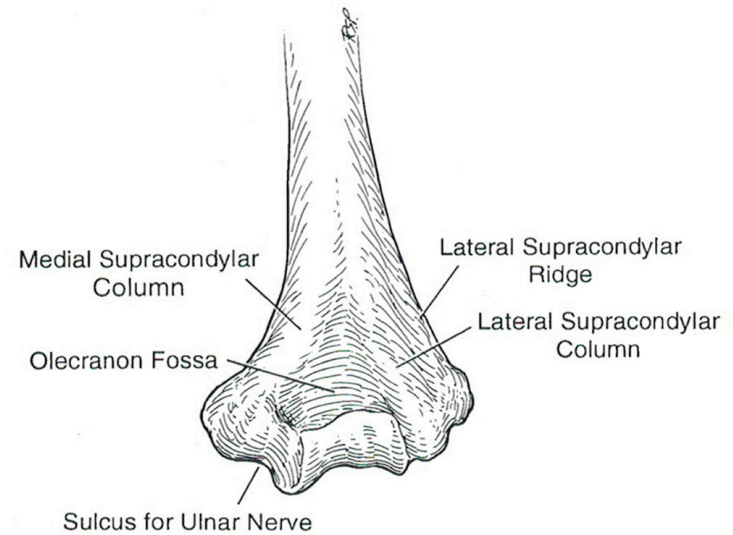
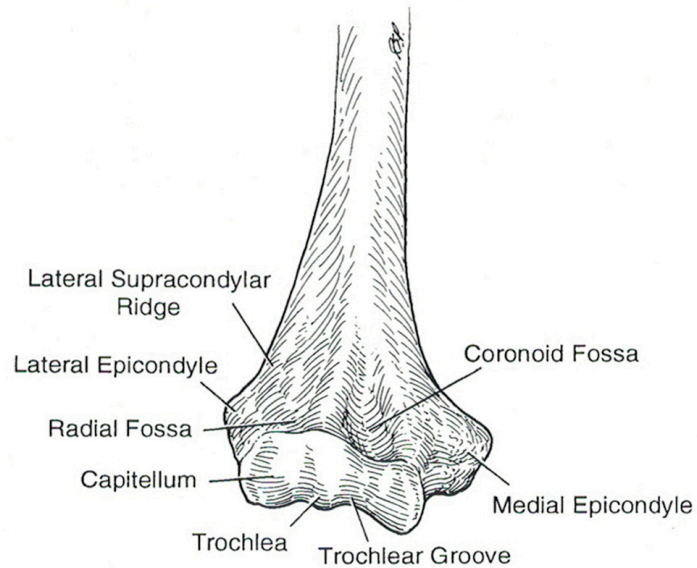
Mary Lloyd Ireland, Yvonne E. Satterwhite, Craig C. McKirgan,
Michael Stroyan, and Kevin E. Wilk

(Illustrated by Rich Pennell, CMI, Medical Illustrator,
Medical Center Arts and Graphics, 509 Health Sciences
Learning Center, 760 Rose Street Lexington, KY 40536-0232.

Injuries in Baseball, edited by James R. Andrews,
Bertram Zarins, and Kevin E. Wilk,
Lippincott-Raven Publishers, Philadelphia © 1998.

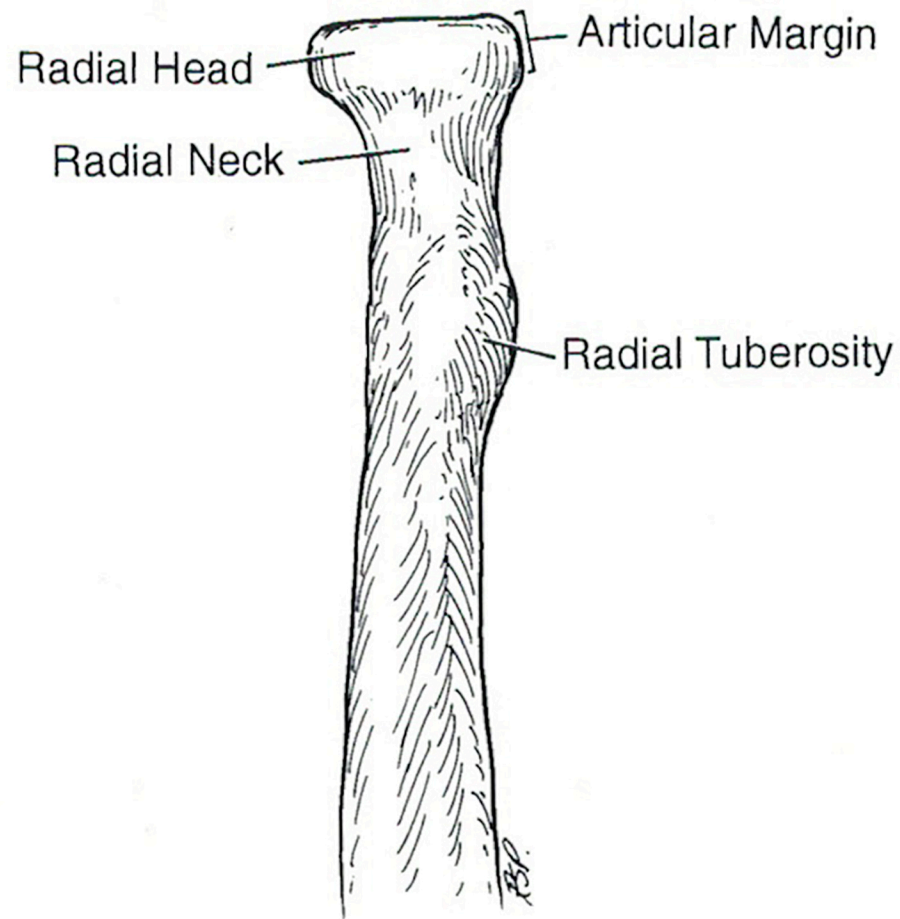
INJURIES IN BASEBALL



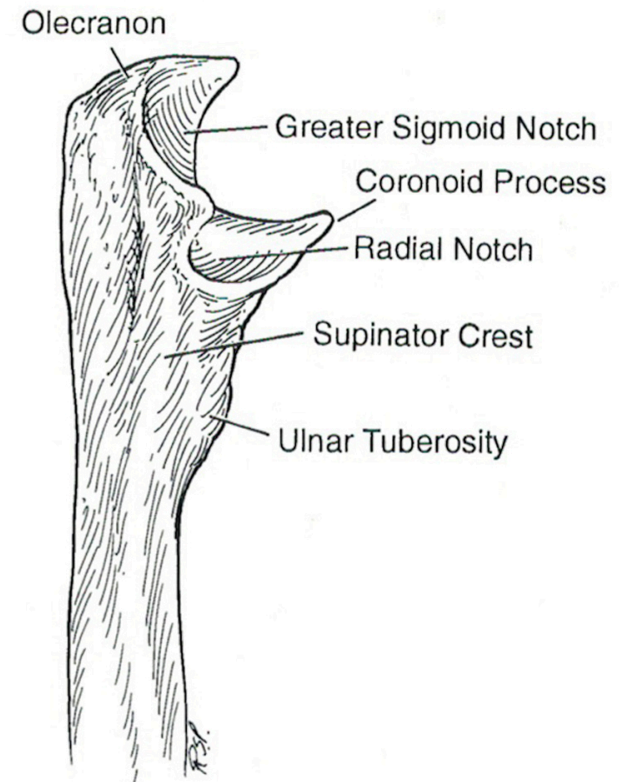
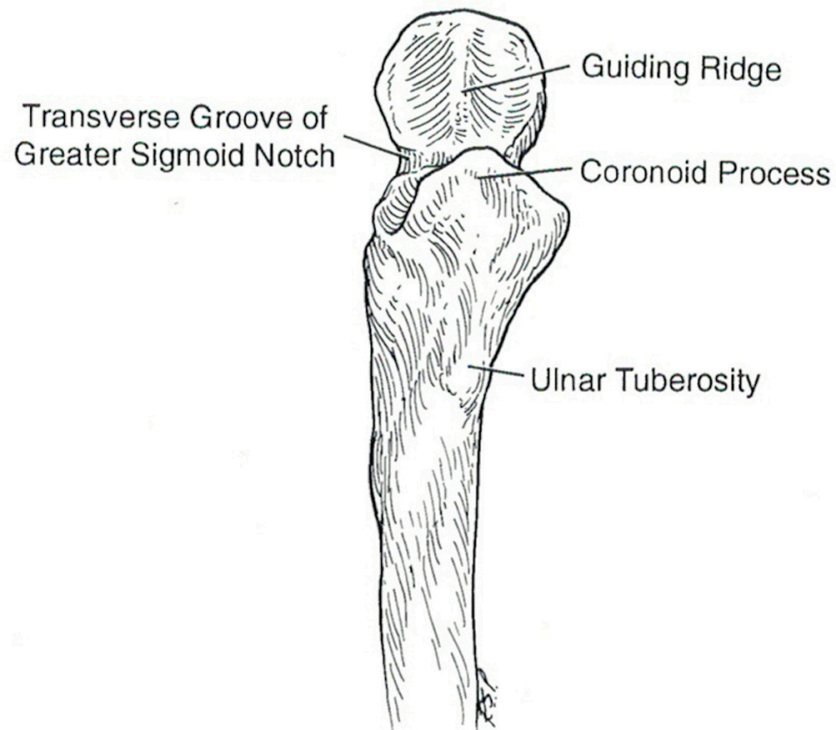


Humerus

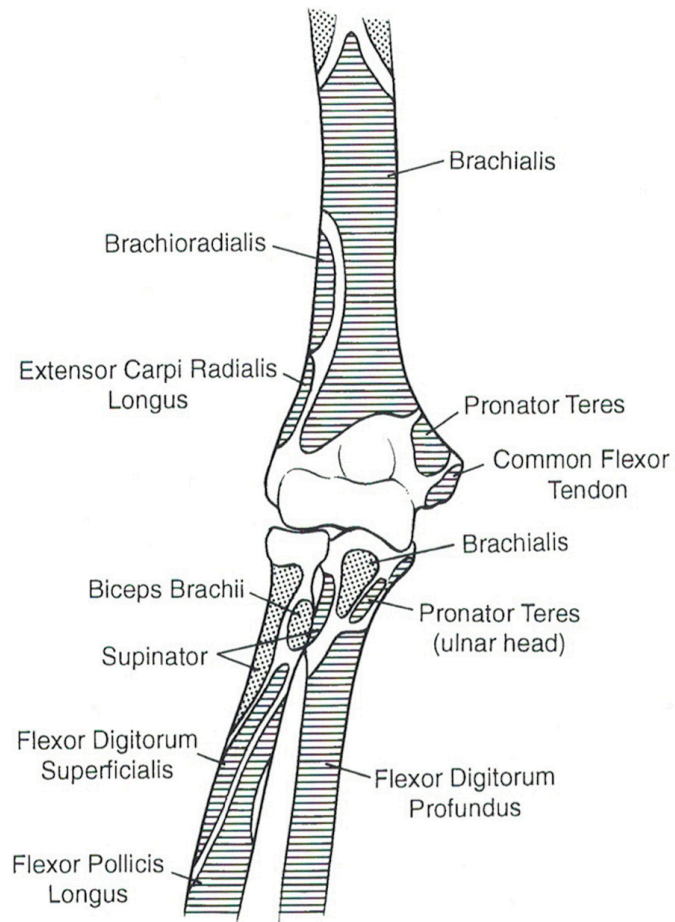
Radius



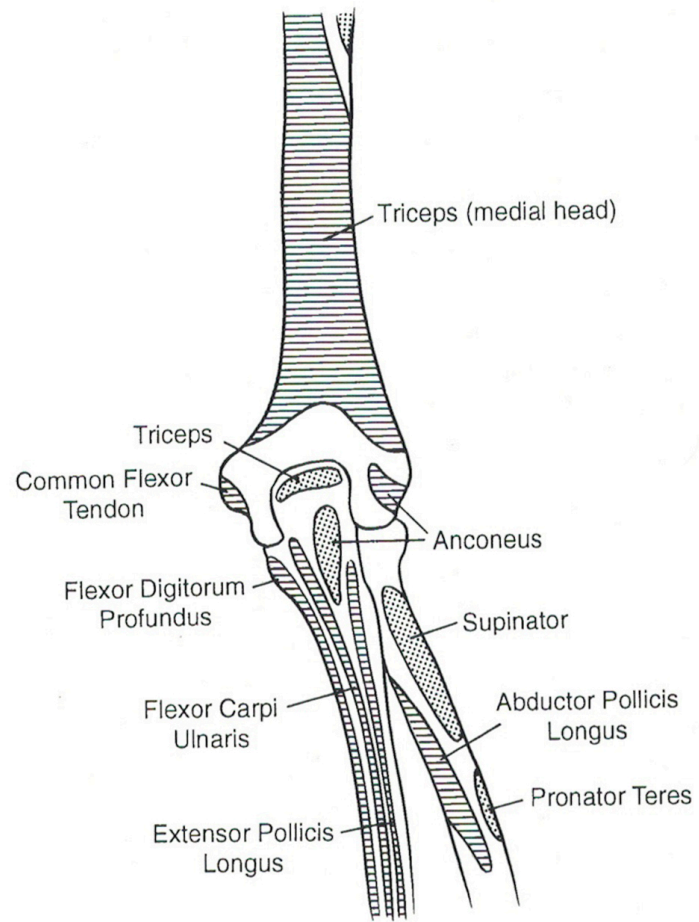
ULNA



Muscle Origins and Insertions



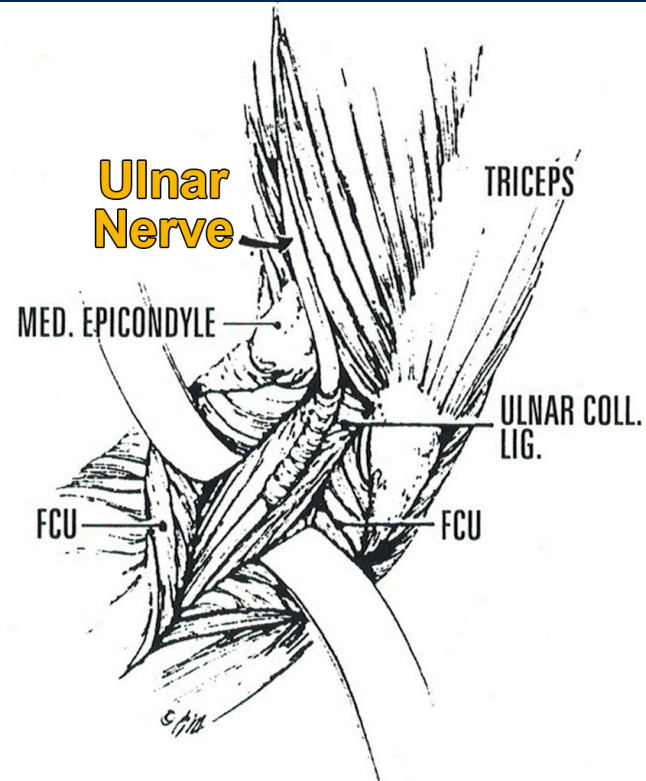
Anterior



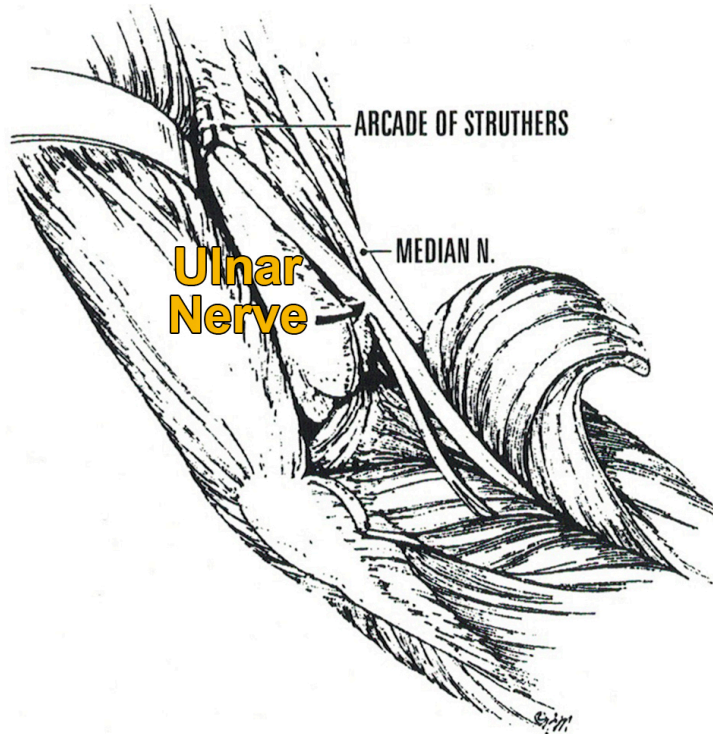
Posterior



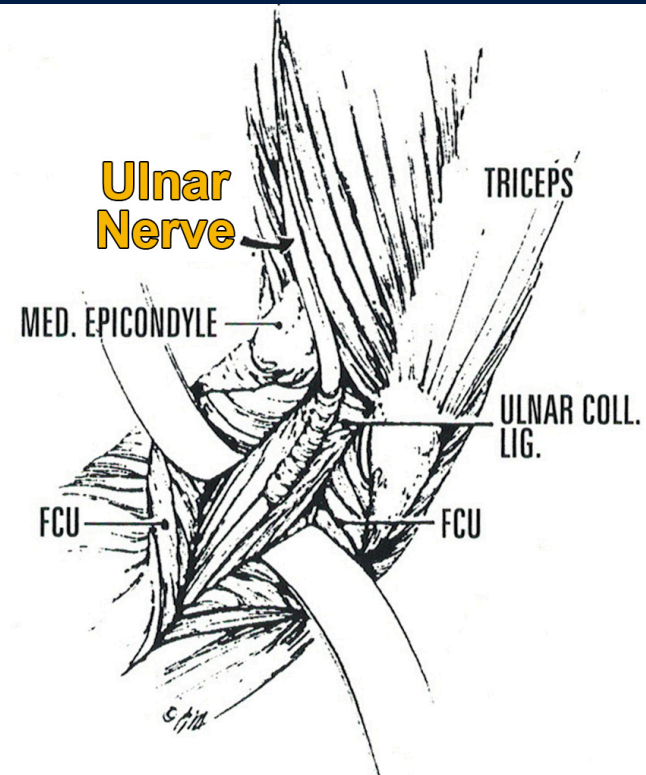
The ulnar nerve (*arrow*) passes from the anterior to posterior compartments of the brachium through the arcade of Struthers, which is located 8 cm proximal to the medial epicondyle.



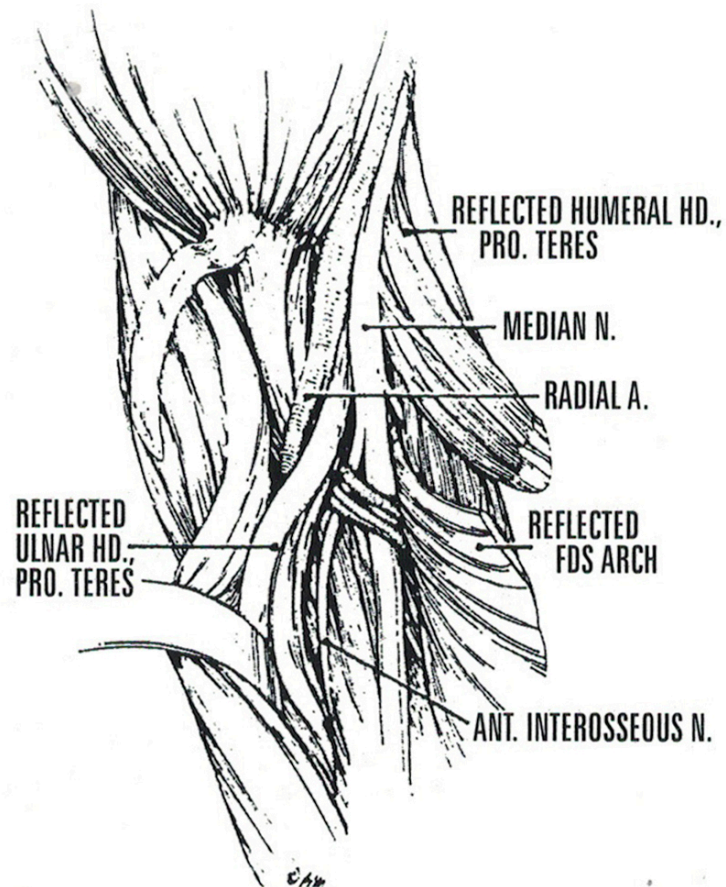
The ulnar nerve relationship to the ulnar collateral ligament and entering the forearm between the heads of the flexor carpi ulnaris is shown. The retinaculum overlies the ulnar nerve and the cubital tunnel.



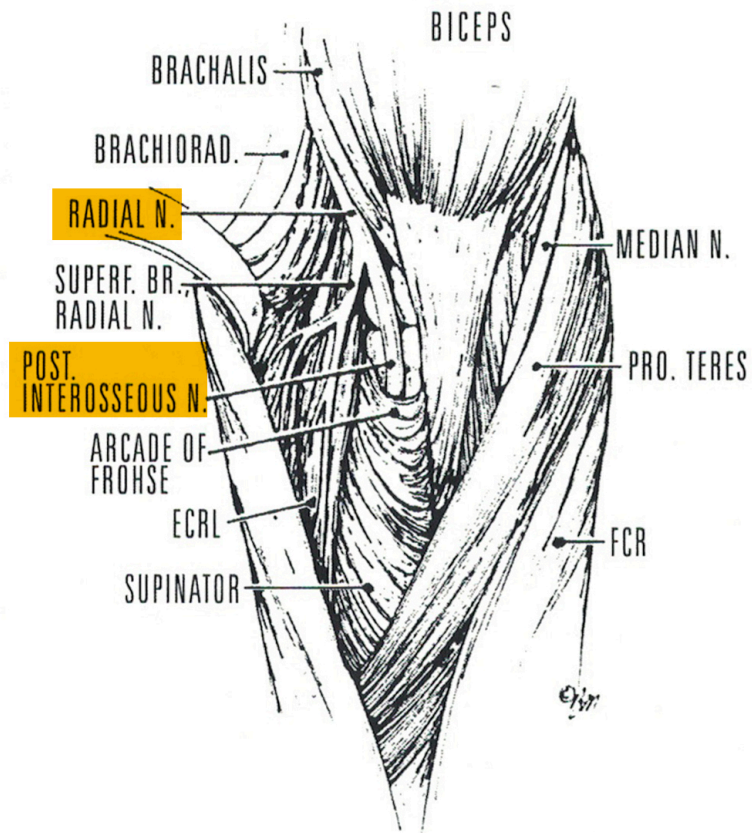
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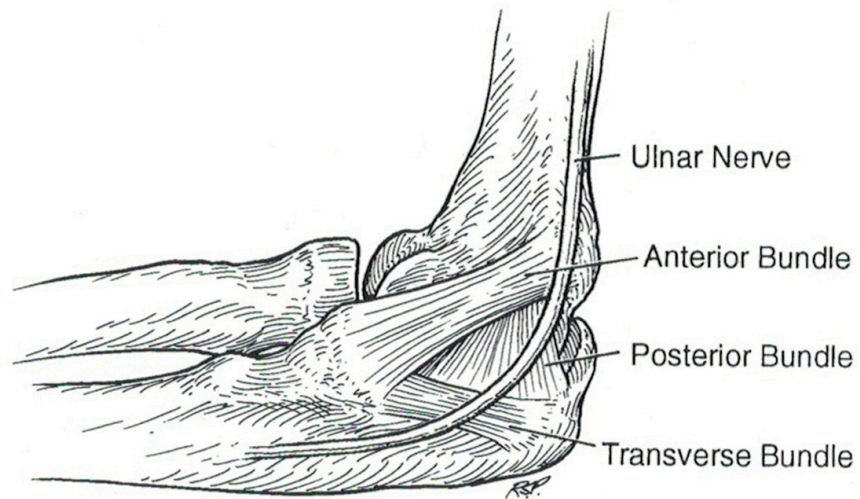
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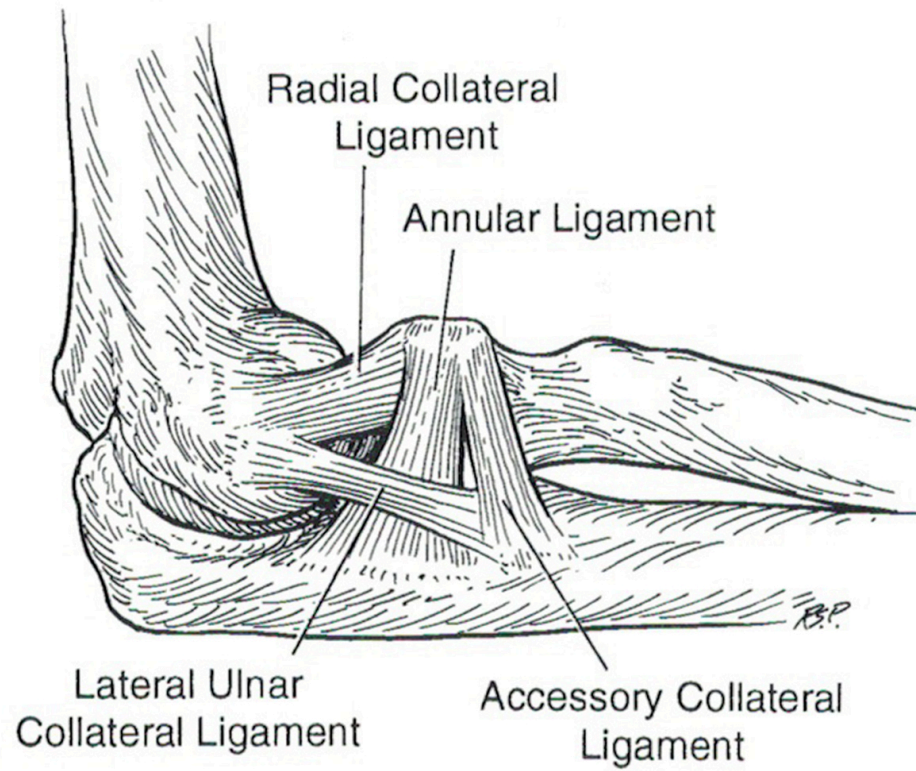
The median nerve is shown as it enters the elbow area emerging from the pronator teres heads. Branches of the anterior interosseous nerve are shown and their relationship with the radial artery.



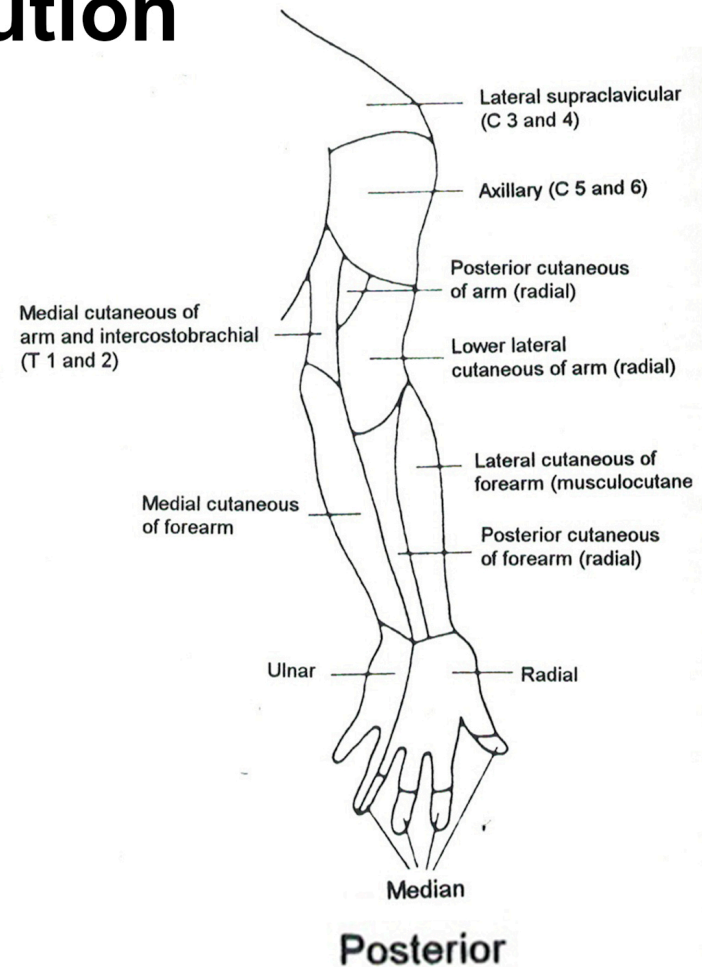
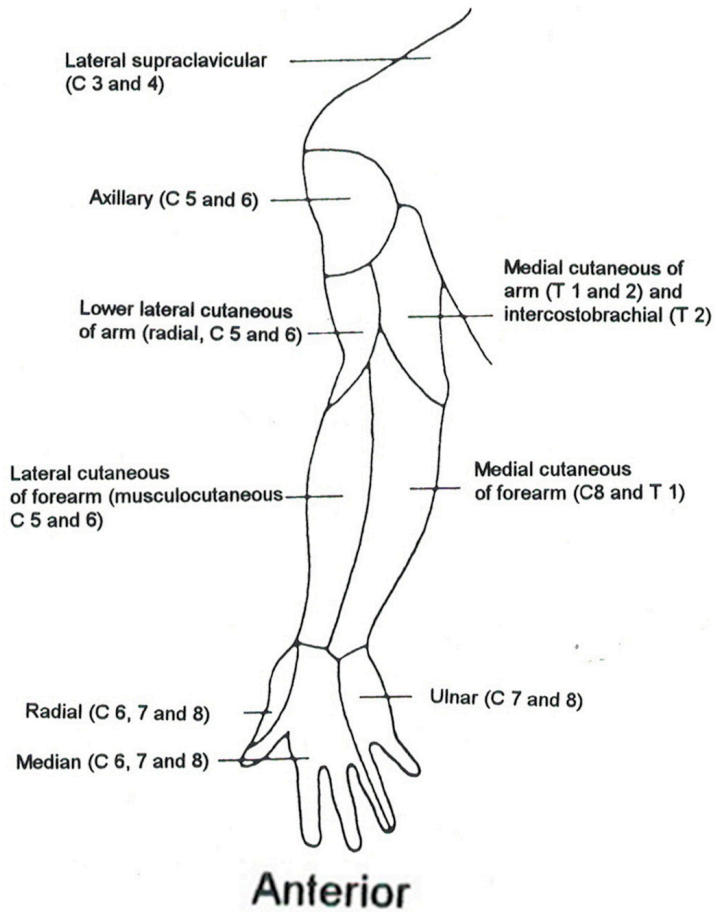
The radial nerve as it emerges between the brachialis musculature is shown. Branches of the radial nerve into the superficial branch and the posterior interosseous is shown.



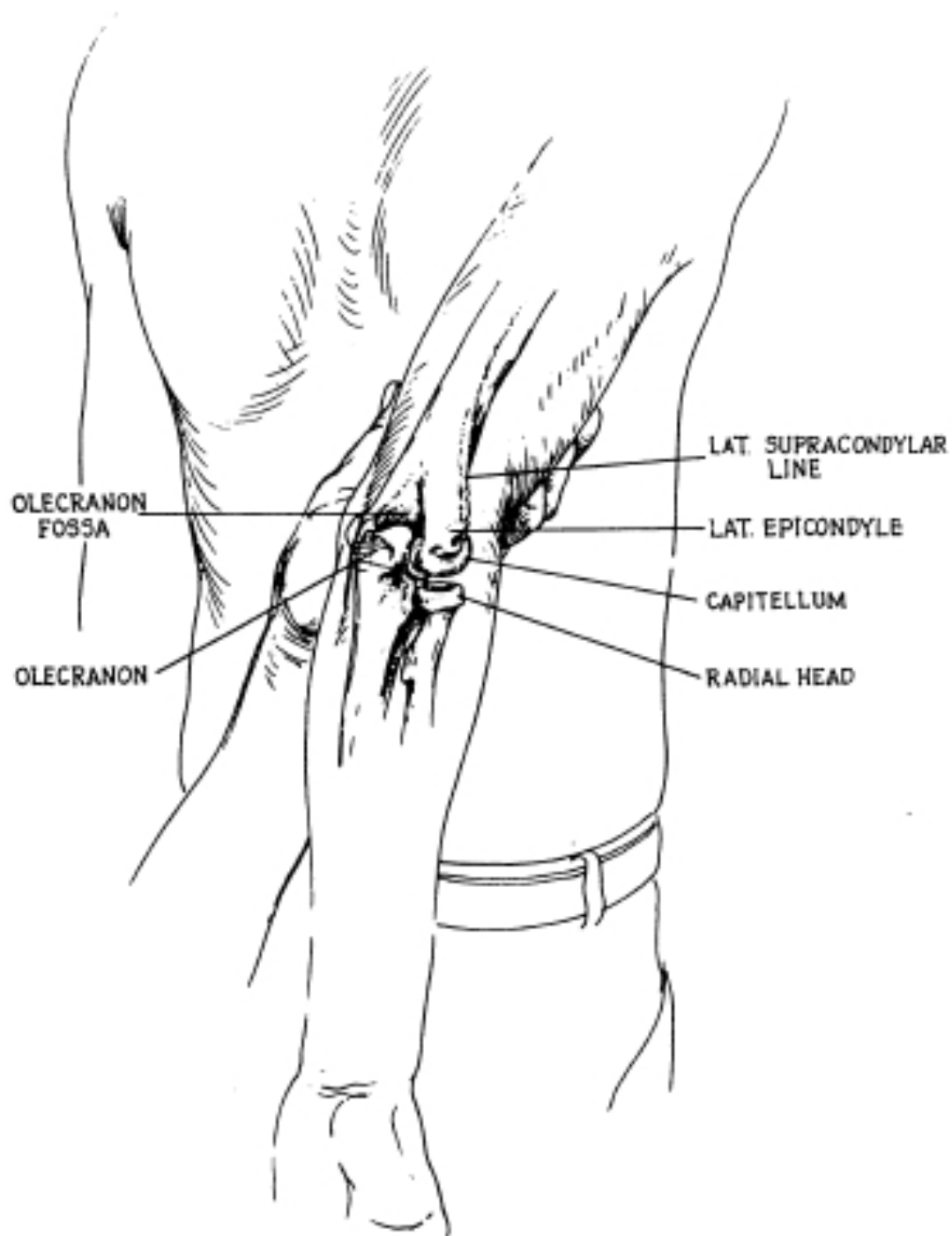
The ulnar collateral ligament is shown and consists of important anterior bundle. Also demonstrated are the transverse and posterior bundle. The ulnar nerve is also shown.



Sensory Distribution

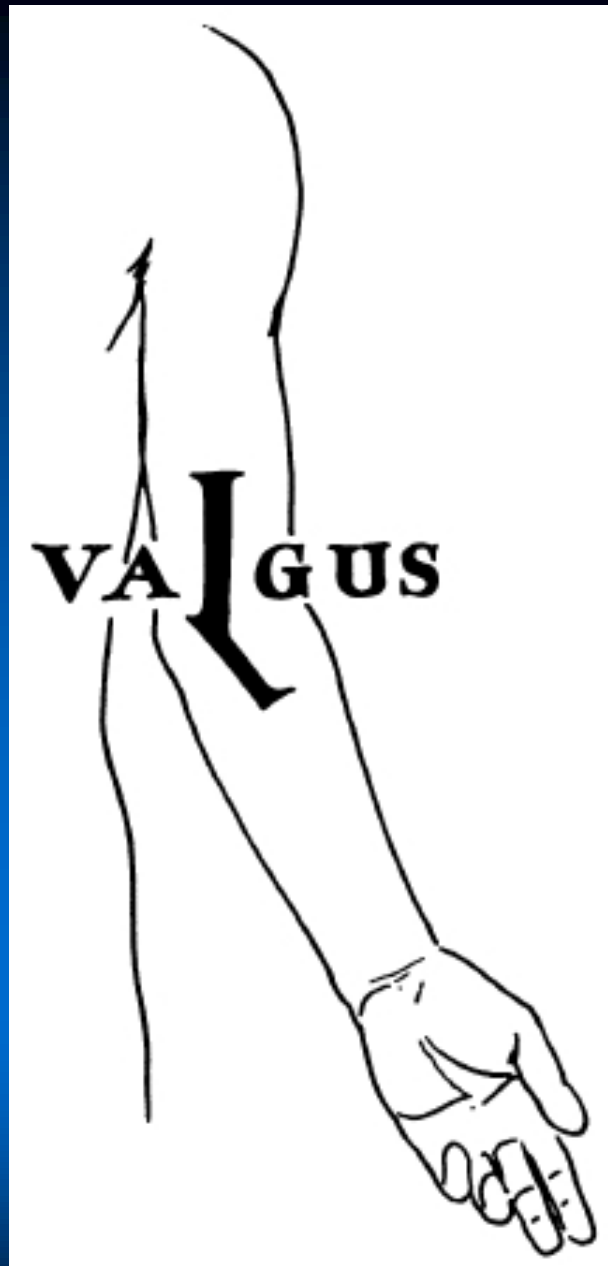


Palpat



Normal Exam





INTRODUCTION

Use your knowledge of anatomy with detailed history, including mechanism of injury, to arrive at the correct diagnosis.

INTRODUCTION

**Compare the normal side.
Do exam normal, then injured.
Do painful test last.**

INTRODUCTION

Think of the elbow as four compartments.

- Medial
- Lateral
- Posterior
- Anterior

Differential Diagnosis : Skeletally **MATURE**

ANTERIOR

Muscular	Bony	Ligamentous	Neurologic
<ul style="list-style-type: none">• Biceps tendinitis• Strain• Rupture (tear)<ul style="list-style-type: none">-partial-complete• Level<ul style="list-style-type: none">- Muscle belly- Musculo-tendinous<ul style="list-style-type: none">-insertion-Bicipital tuberosity	<ul style="list-style-type: none">• Fracture<ul style="list-style-type: none">- Coronoid	<ul style="list-style-type: none">• Capsular Sprain• Hyper-extended elbow	<ul style="list-style-type: none">• Median nerve entrapment

Differential Diagnosis : Skeletally MATURE

POSTERIOR

Muscular	Bony	Ligamentous	Neurologic
<ul style="list-style-type: none">• Triceps<ul style="list-style-type: none">- Strain- Rupture (Tear)<ul style="list-style-type: none">-partial-complete- Tendinitis	<ul style="list-style-type: none">• Olecranon fracture<ul style="list-style-type: none">- Bursal-Contusion-Inflammation• Valgus extension overload• Spurs postero-medial	—	<ul style="list-style-type: none">• Referred radiculopathy from neck

Differential Diagnosis: Skeletally MATURE

MEDIAL

Muscular	Bony	Ligamentous	Neurologic
<ul style="list-style-type: none">• Flexor Pronator Strain	<ul style="list-style-type: none">• Medial humeral epicondylitis• Traction spur fracture• Ossification UCL• Repetitive Stresses	<ul style="list-style-type: none">• UCL sprain degree	<ul style="list-style-type: none">• Ulnar nerve<ul style="list-style-type: none">- Inflammation- Subluxation- Entrapment (cubital tunnel syndrome)- Pronator syndrome

Differential Diagnosis : Skeletally MATURE

LATERAL

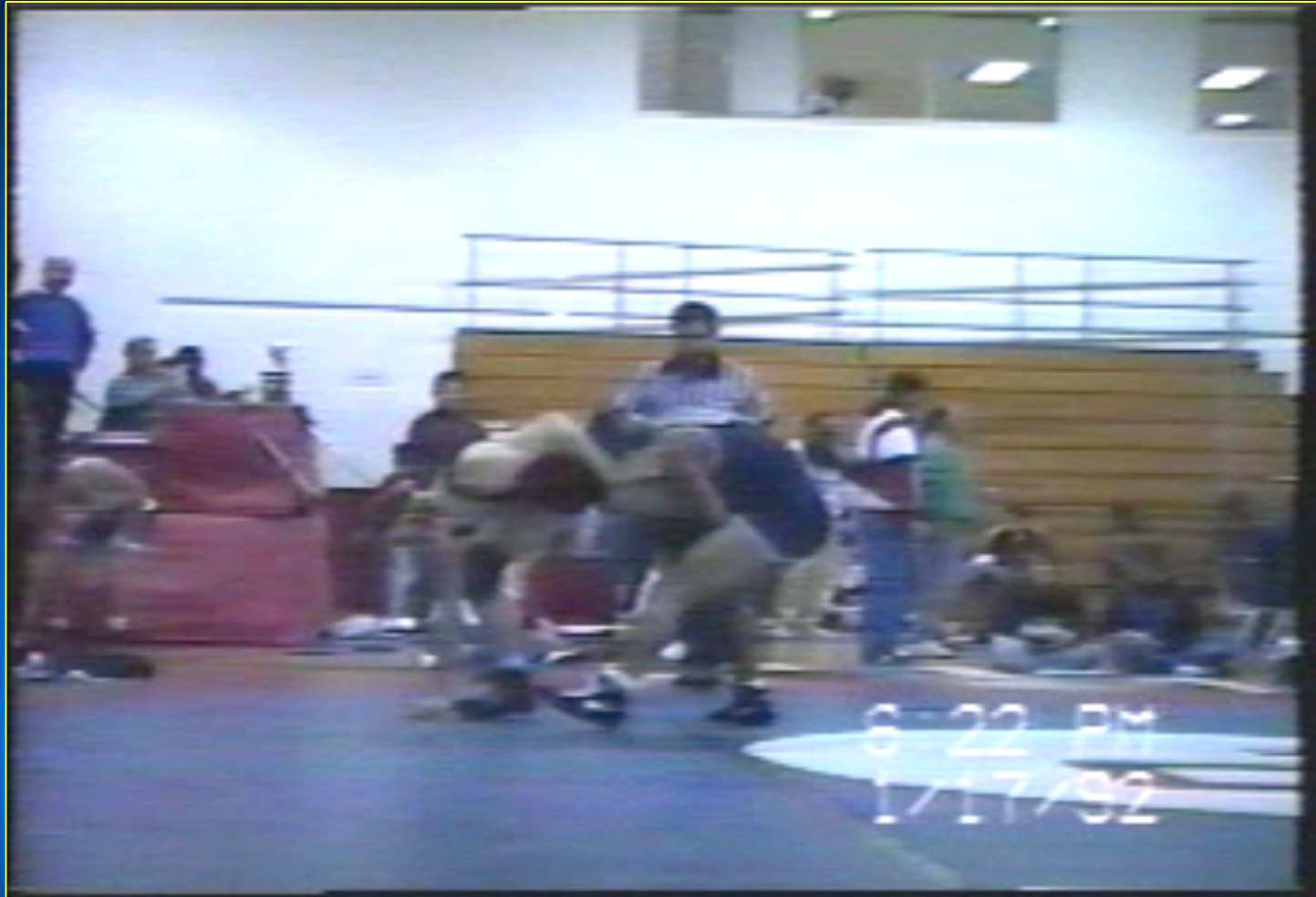
Muscular	Bony	Ligamentous	Neurologic
<ul style="list-style-type: none">• Extensor Supinator Strain• Lateral humeral epicondylitis (tennis elbow)	<ul style="list-style-type: none">• Fracture radial head• Subluxation radial head	<ul style="list-style-type: none">• Radial collateral (rare)• Instability like PLRI knee (rare)	<ul style="list-style-type: none">• Radial nerve entrapment



"Tennis Elbow" Test

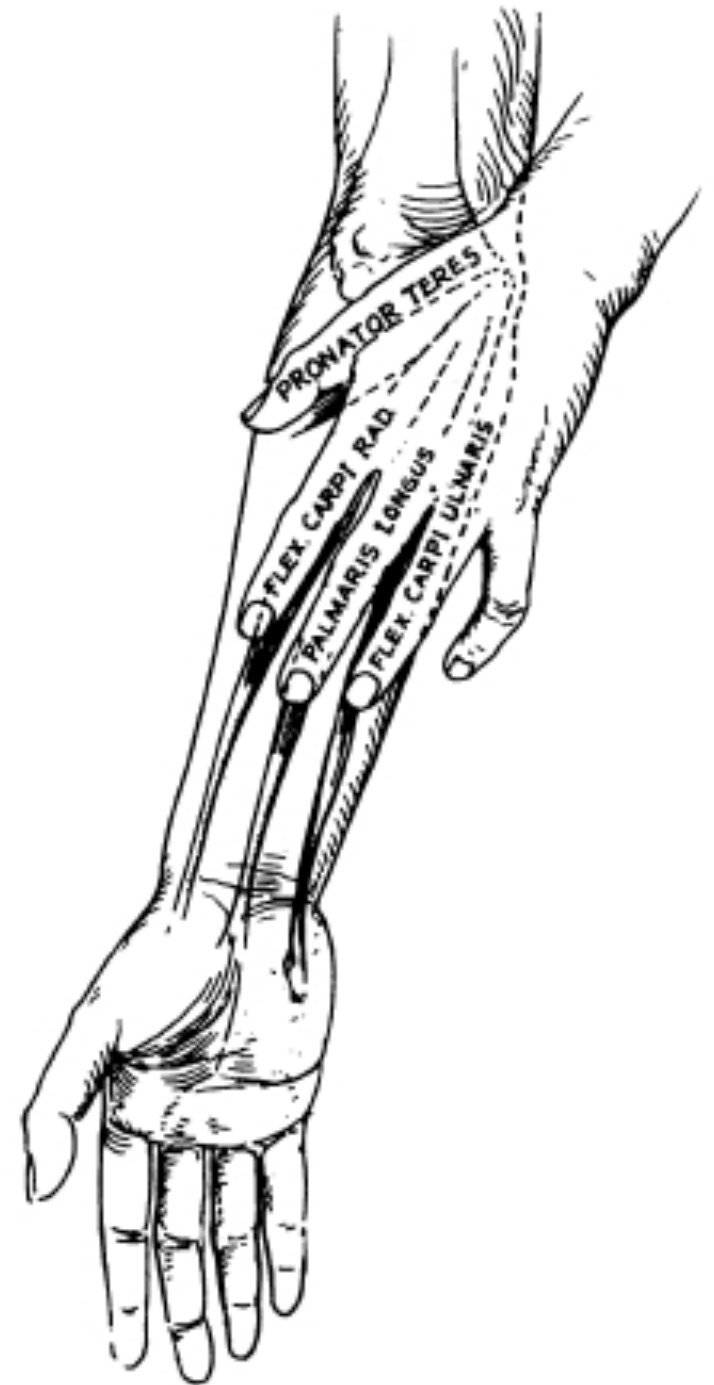
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Elbow Dislocation Video courtesy of Lyle Cain, M.D.



Medial Elbow Pain

Muscular Origins Medial Epicondyle



Medial Elbow Pain

Determine structure involved by history and physical

- UCL
- Flexor pronator origin
- Ulnar nerve

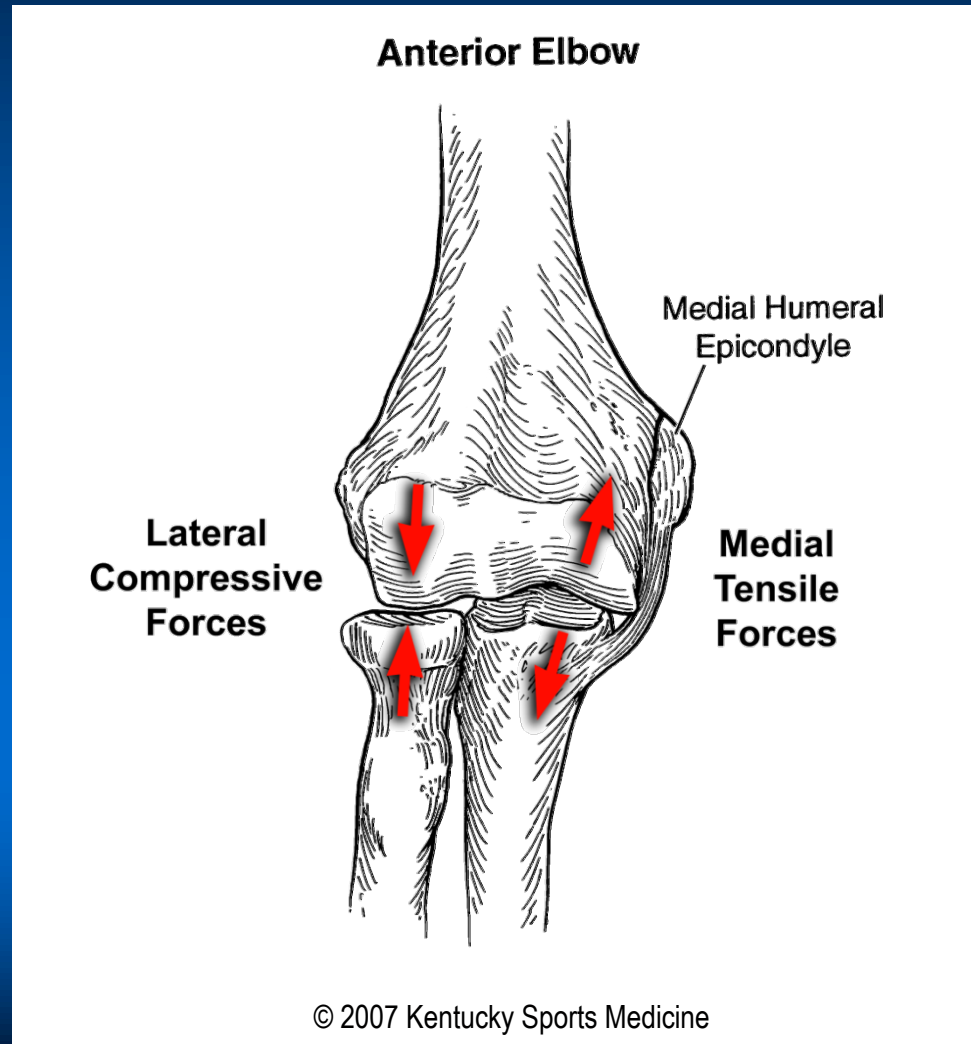
Treatment directed at diagnosis

Medial elbow pain diagnoses in throwers

- Medial epicondyle stress fracture
- UCL tear
- Ulnar neuritis/hypermobility
- Flexor-pronator strain much less common
- Subluxating medial triceps
- Valgus extension overload
 - (elbow impingement)
- Sublime tubercle fracture proximal ulna

Lateral Forces = Compression

Medial Forces = Tension



In throwing:

- **Distraction forces** are medial
 - Soft tissue (UCL or flexor pronator) injuries occur (OCD, loose bodies) with distraction
- **Compression forces** are lateral
 - More common bony involvement with compression.

Throwing



Medial Elbow Pain

Make the diagnosis...

- What sport?
- What position?
- How did it happen?
- What did it feel like?
- Associated symptoms?
- Where does it hurt?
- When does it hurt?

History and Physical are Key

Moving Valgus Stress Test - MVST

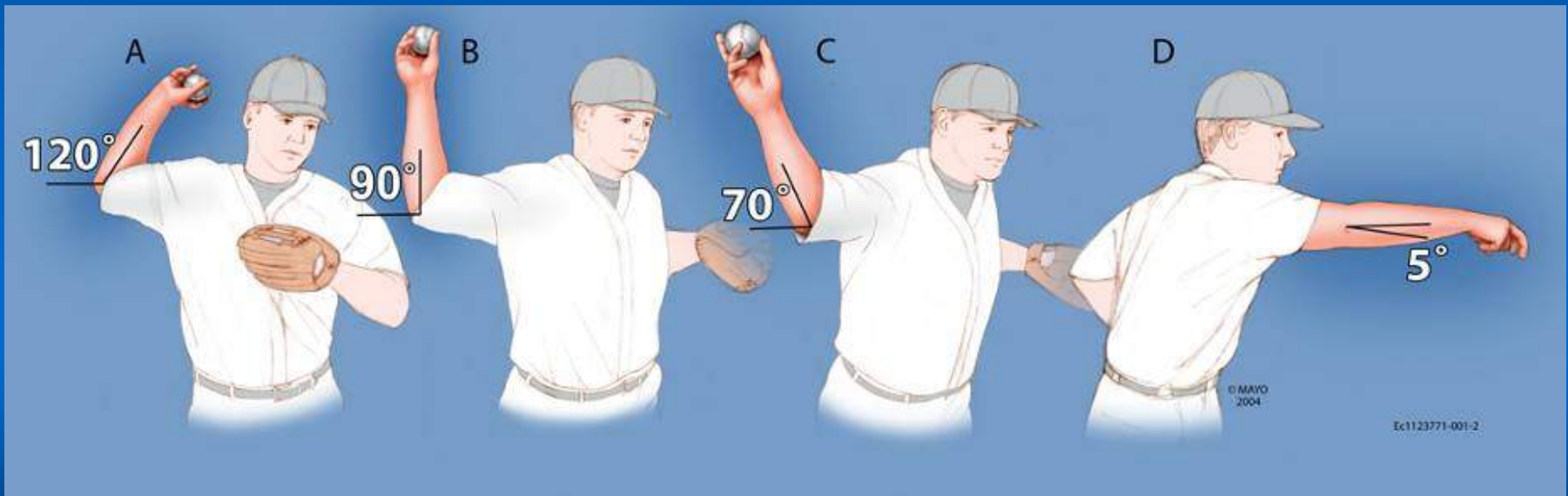
- Shoulder abducted 90°
- Elbow maximally flexed
- Valgus torque
- Elbow quickly extended



O'Driscoll AJSM 2005

Why does the MVST work?

- Reproduces stress of throw
 - Late cocking-early acceleration
 - Pain at point of max stress...
 - Confirmed by history

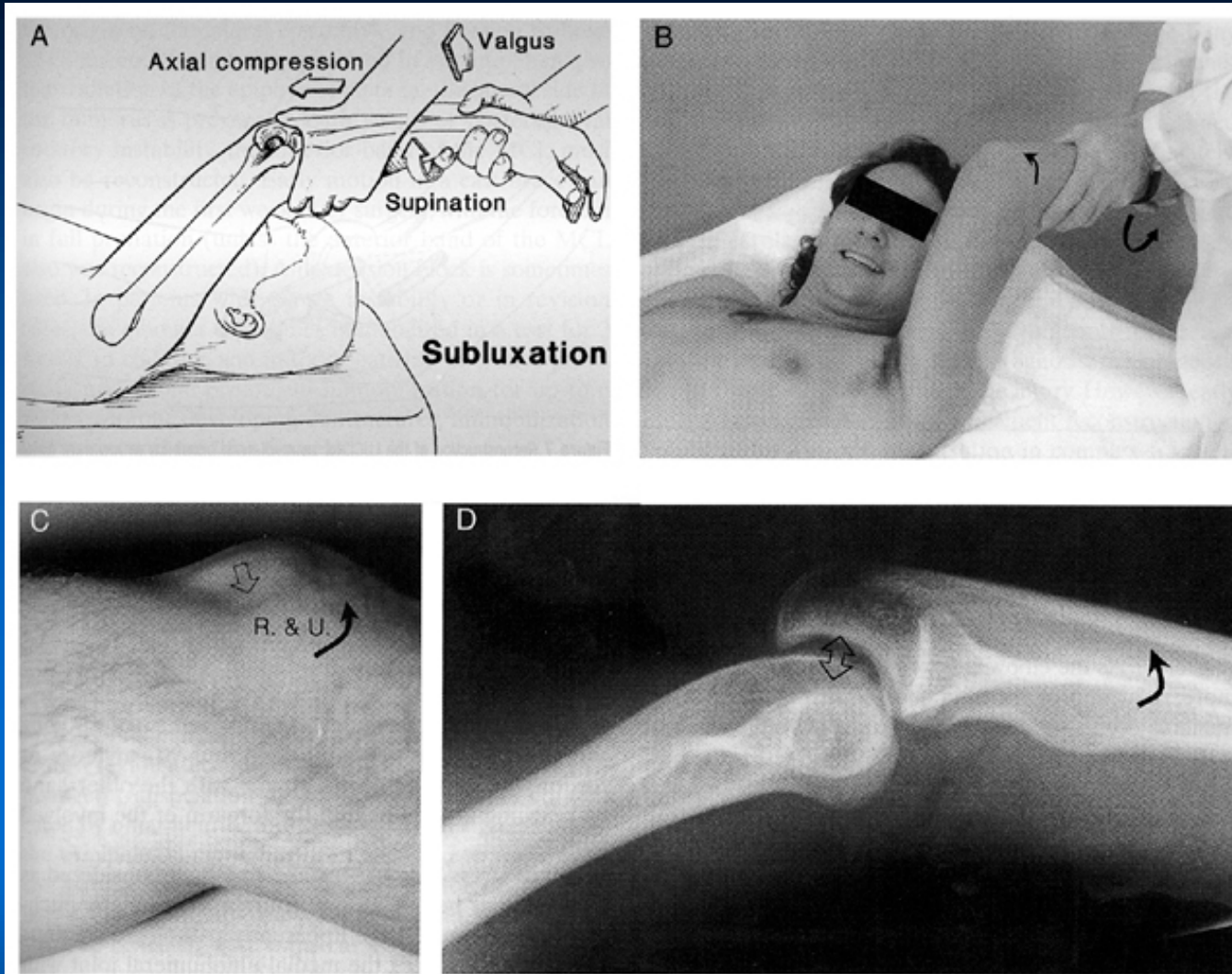


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Acute UCL Tear

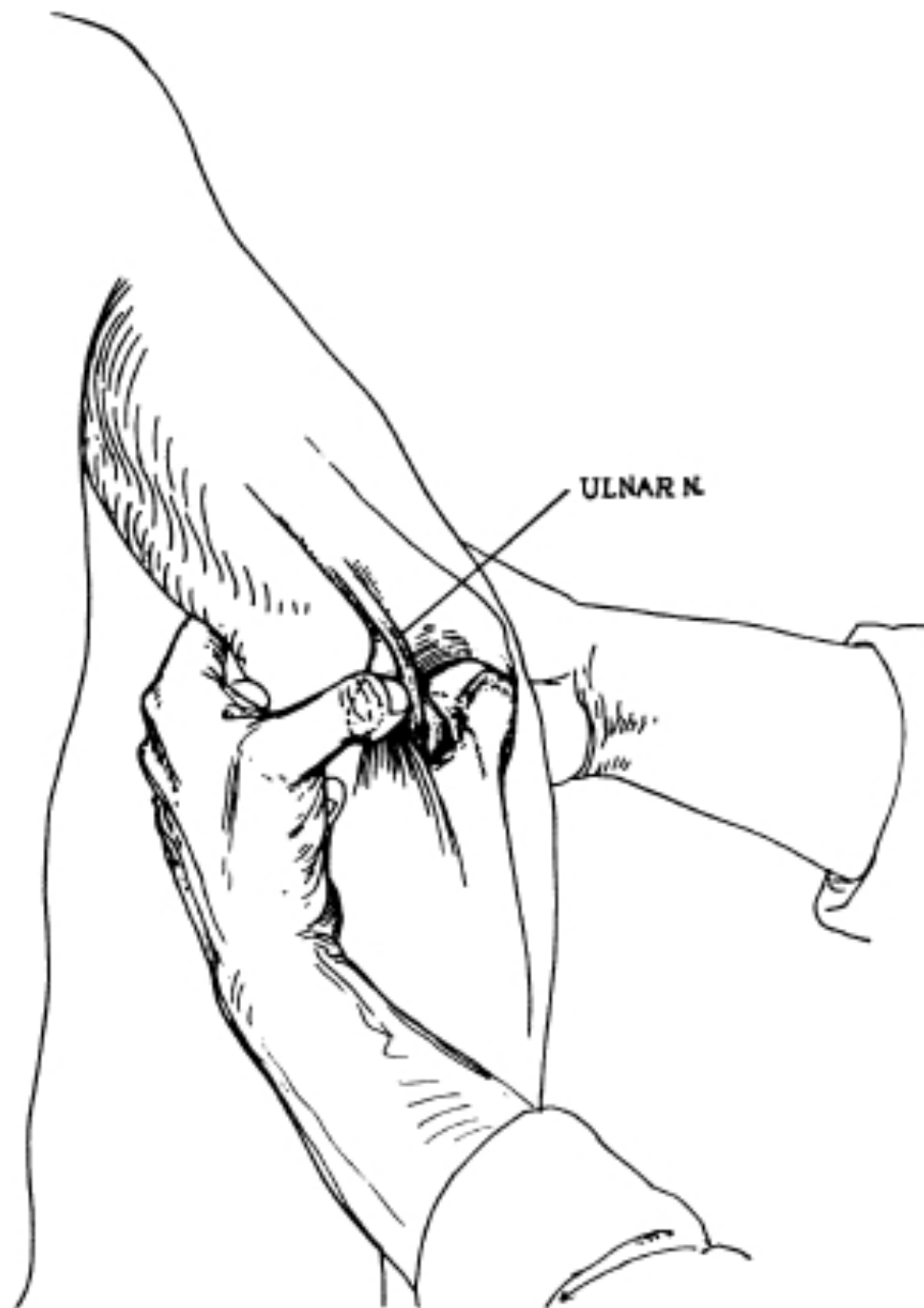
22 YO
RH Dominant Male
Fell on Rt. Arm Playing
Backyard Football

Posterolateral Rotatory Instability



O'Driscoll SW, "Acute, Recurrent and Chronic Elbow Instabilities," Chapter 30 in Norris TR ed., *Orthopaedic Knowledge Update: Shoulder and Elbow 2* (AAOS), 2002., p. 319.

Ulnar N

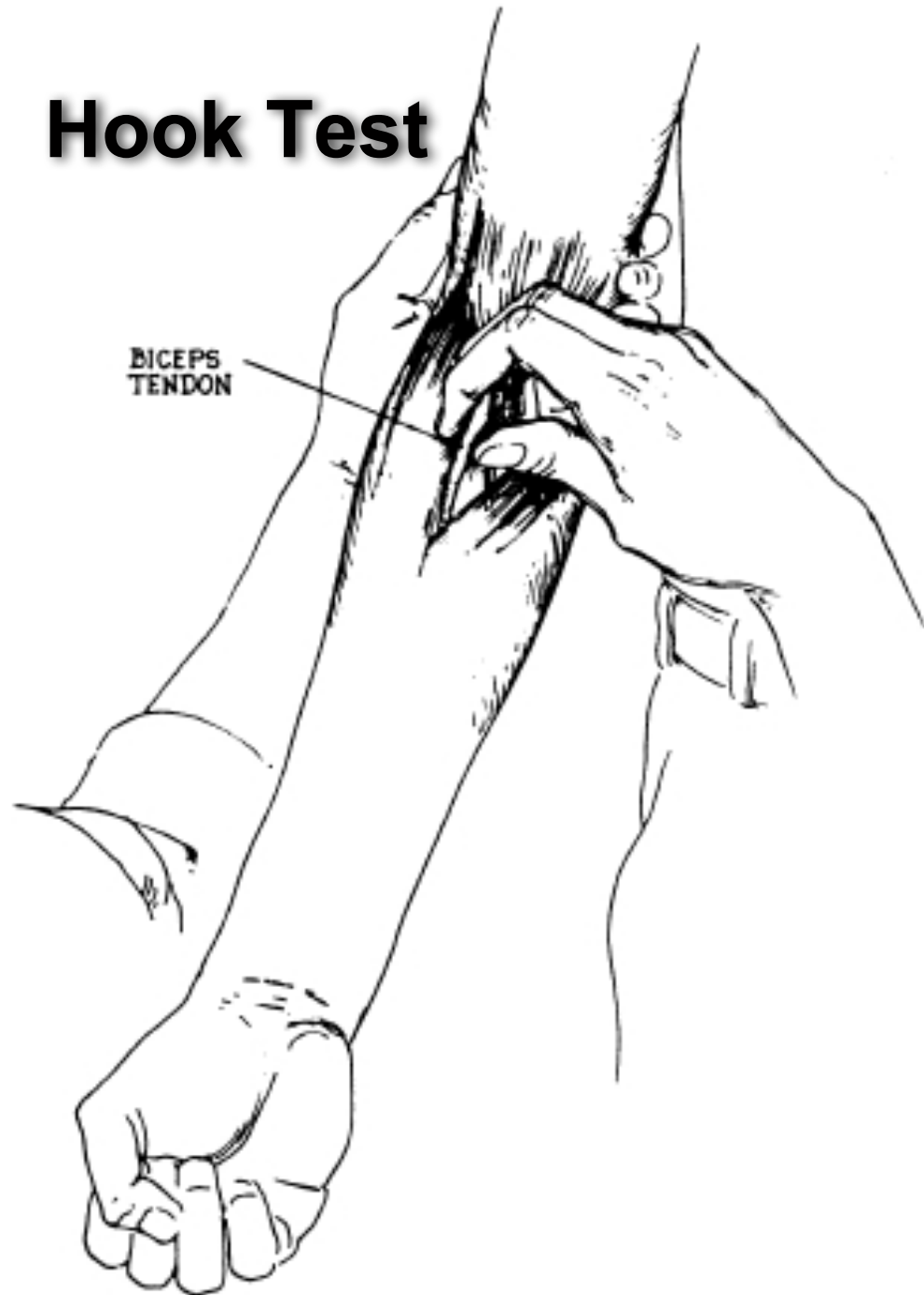


Ulnar Nerve Hypermobility



Biceps Muscle and Distal Attachment

Hook Test



Biceps Muscle Partial Tear



Proximal Biceps Rupture Pop Eye Deformity



Distal Biceps Tendon Rupture



Physical Exam



Postop Bilateral Biceps Tendon Rupture



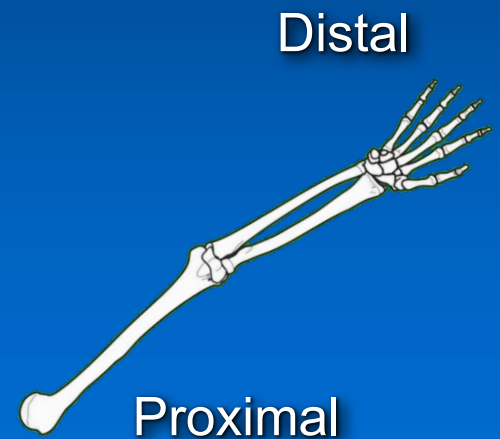
46 YO WM Postal Carrier

- Slipped while holding on to a storm door
- Felt pain in his right elbow
- Developed swelling
- Operative findings: complete biceps tendon tear, significant hematoma formation
 - Underwent evacuation of hematoma and single incision suture anchor repair

Complete Biceps Tendon Rupture



Anterior Approach Passage with Beath Pin Surgical footage



Differential Diagnosis : Skeletally MATURE

POSTERIOR

Muscular	Bony	Ligamentous	Neurologic
<ul style="list-style-type: none">• Triceps<ul style="list-style-type: none">- Strain- Rupture (Tear)<ul style="list-style-type: none">-partial-complete- Tendinitis	<ul style="list-style-type: none">• Olecranon fracture<ul style="list-style-type: none">- Bursal-Contusion-Inflammation• Valgus extension overload• Spurs postero-medial	—	<ul style="list-style-type: none">• Referred radiculopathy from neck

Olecranon Bursitis Triceps Strain

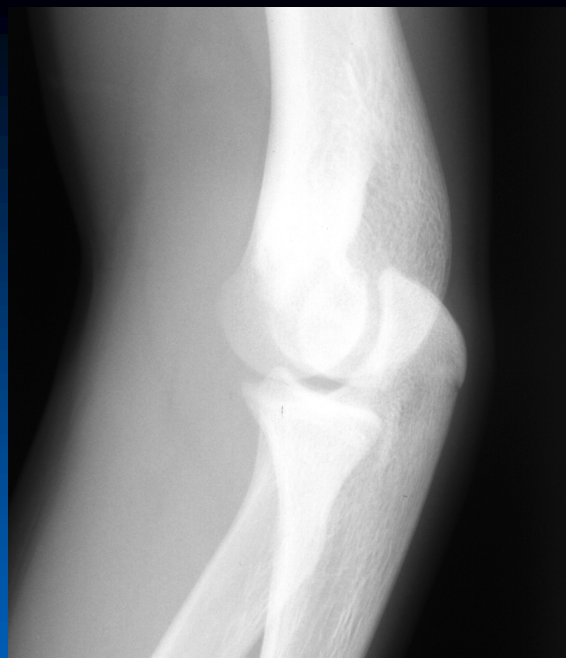


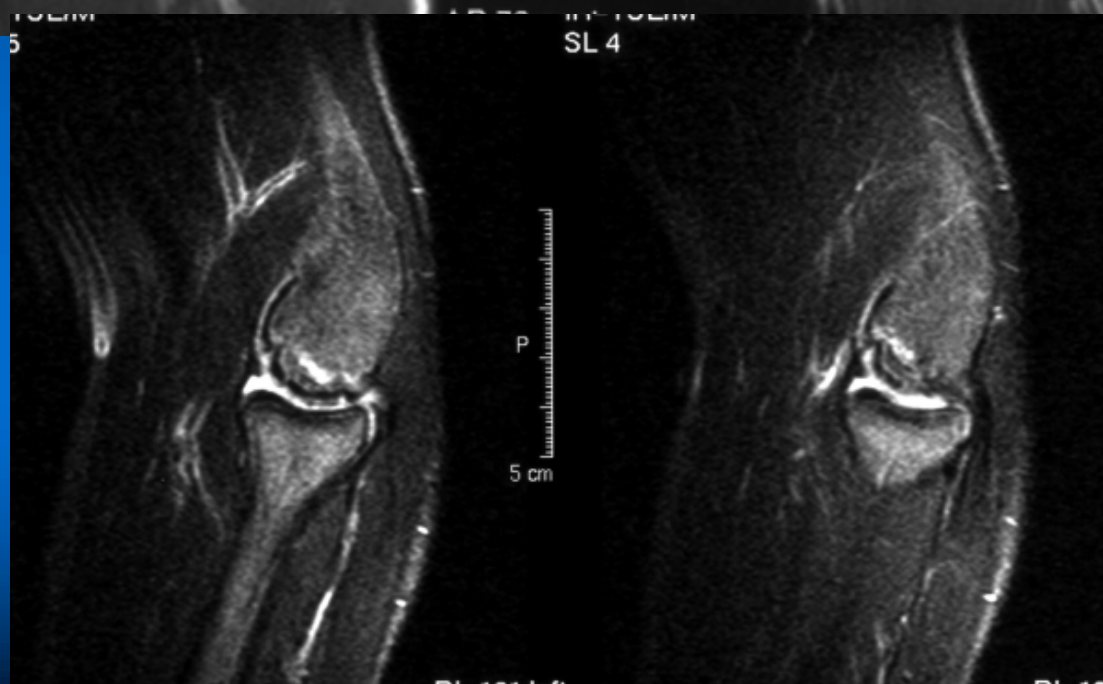
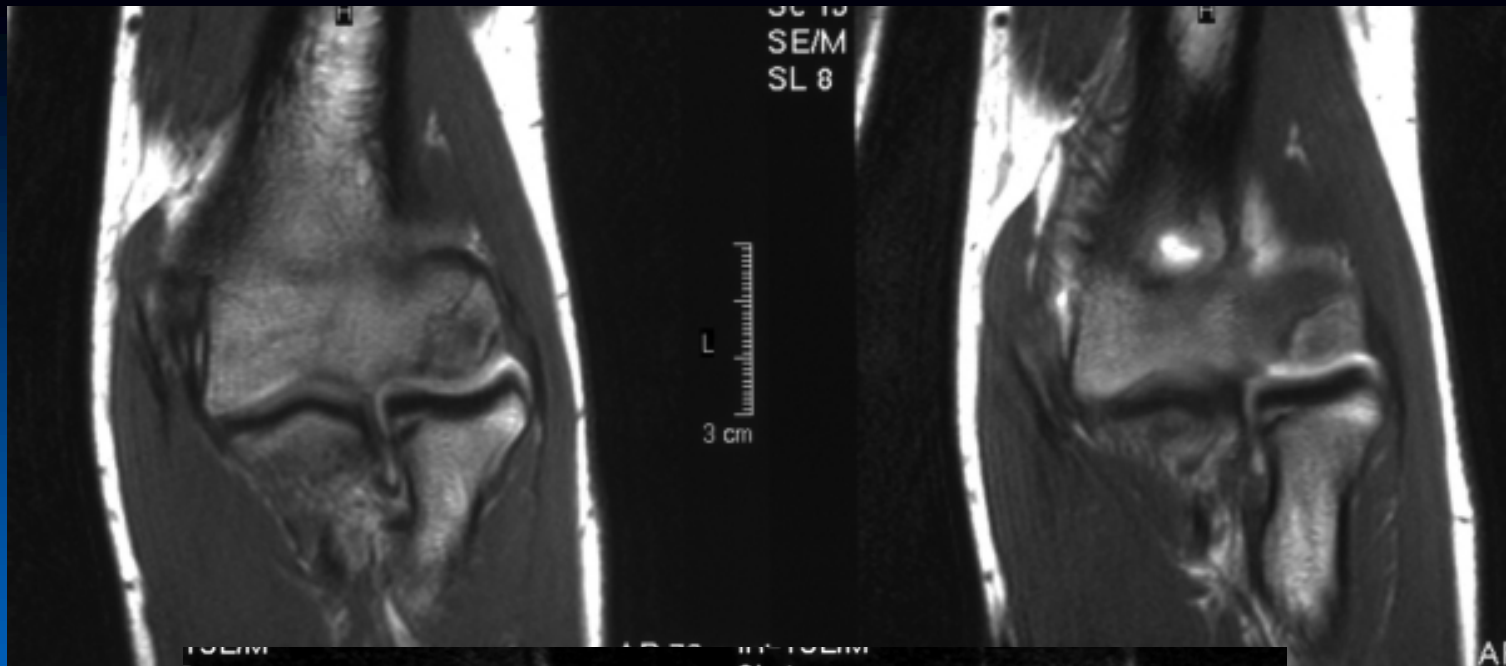
14 YO WM LH-Dominant

- Avid baseball pitcher
- Pain in left elbow, 2 months
- Could not straighten out elbow.

Pre-Op

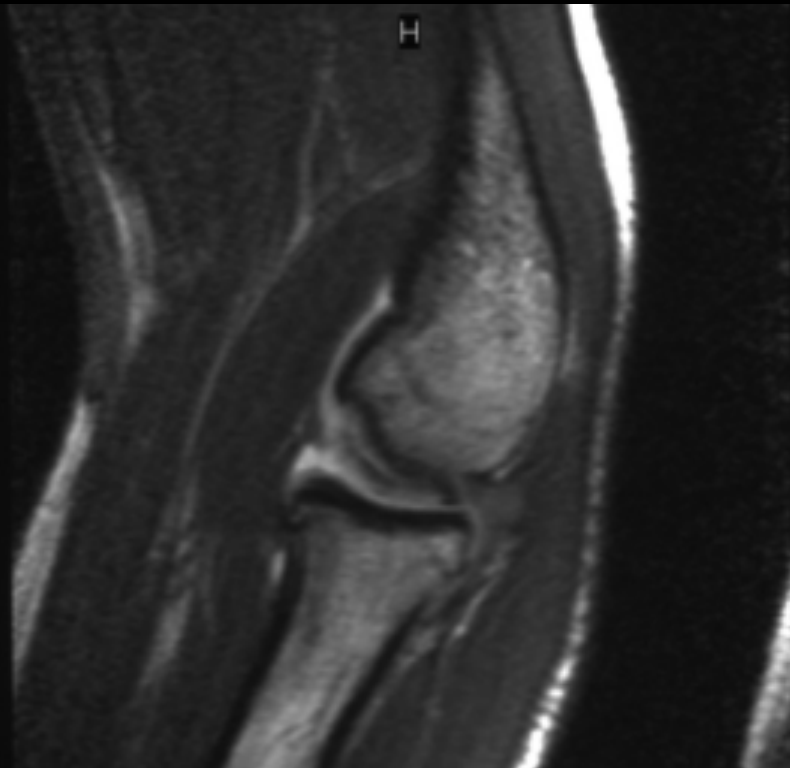






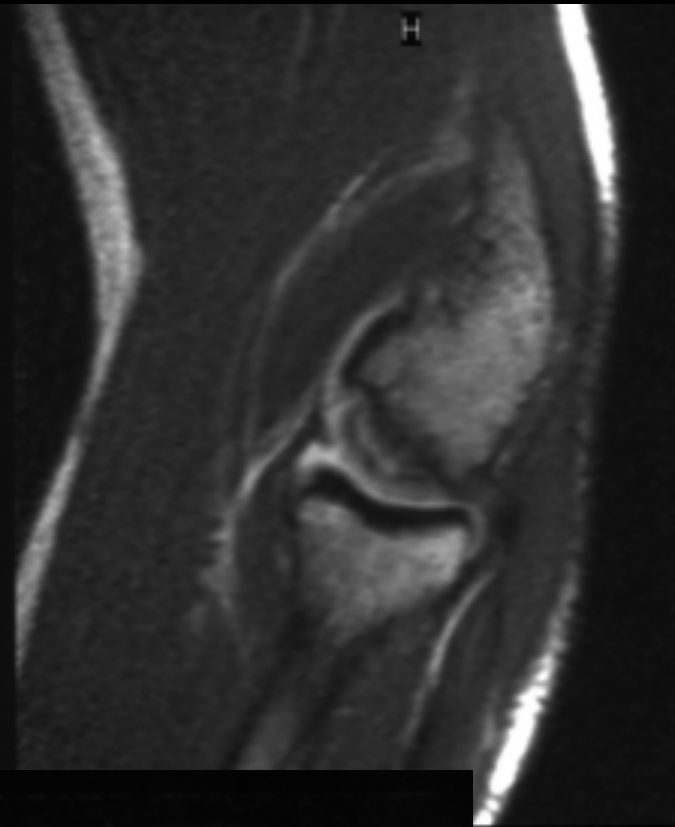
c 14
E/M
L 5

H

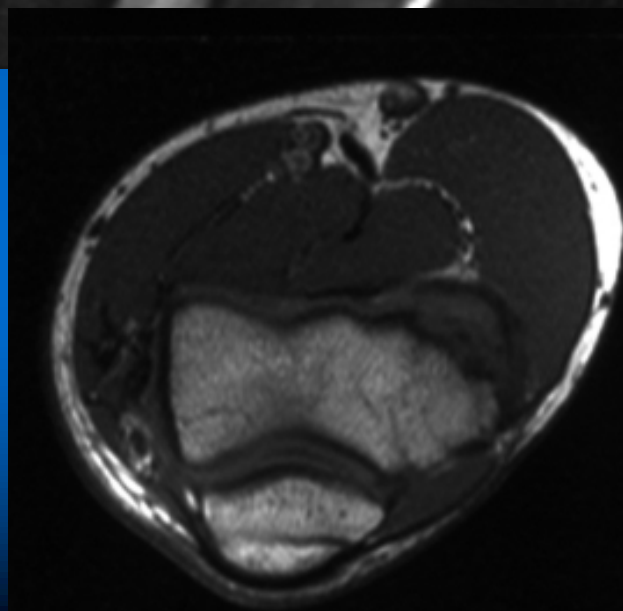


Sc 14
SE/M
SL 4

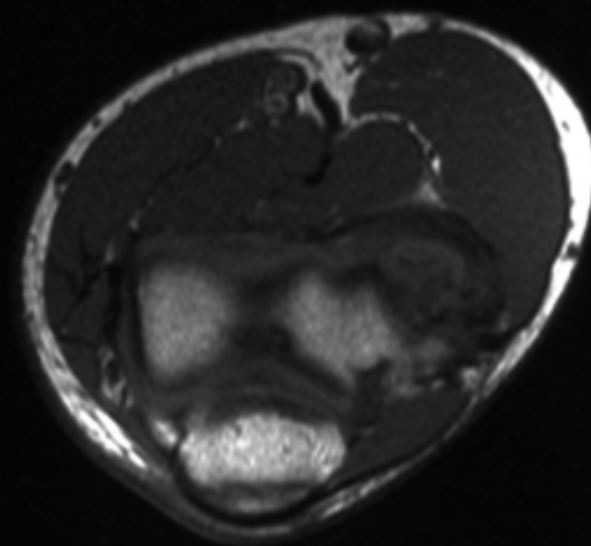
H



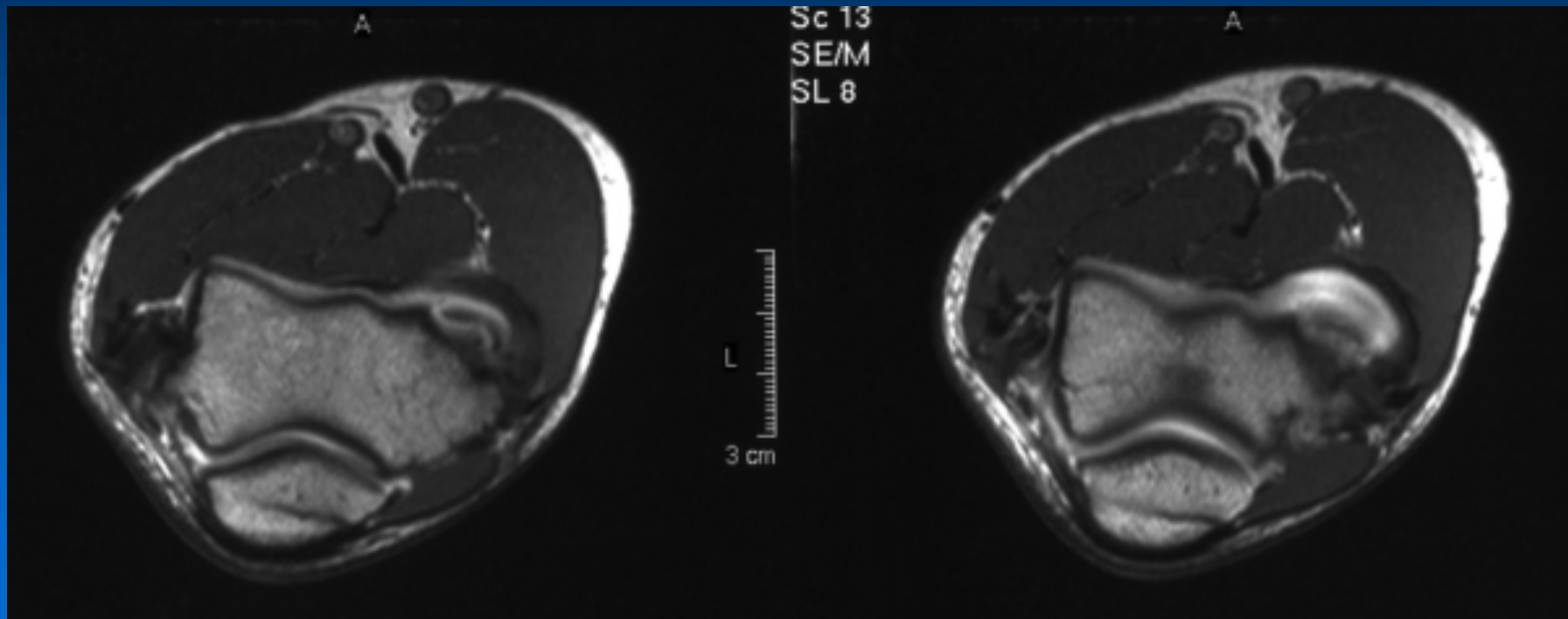
P
3 cm

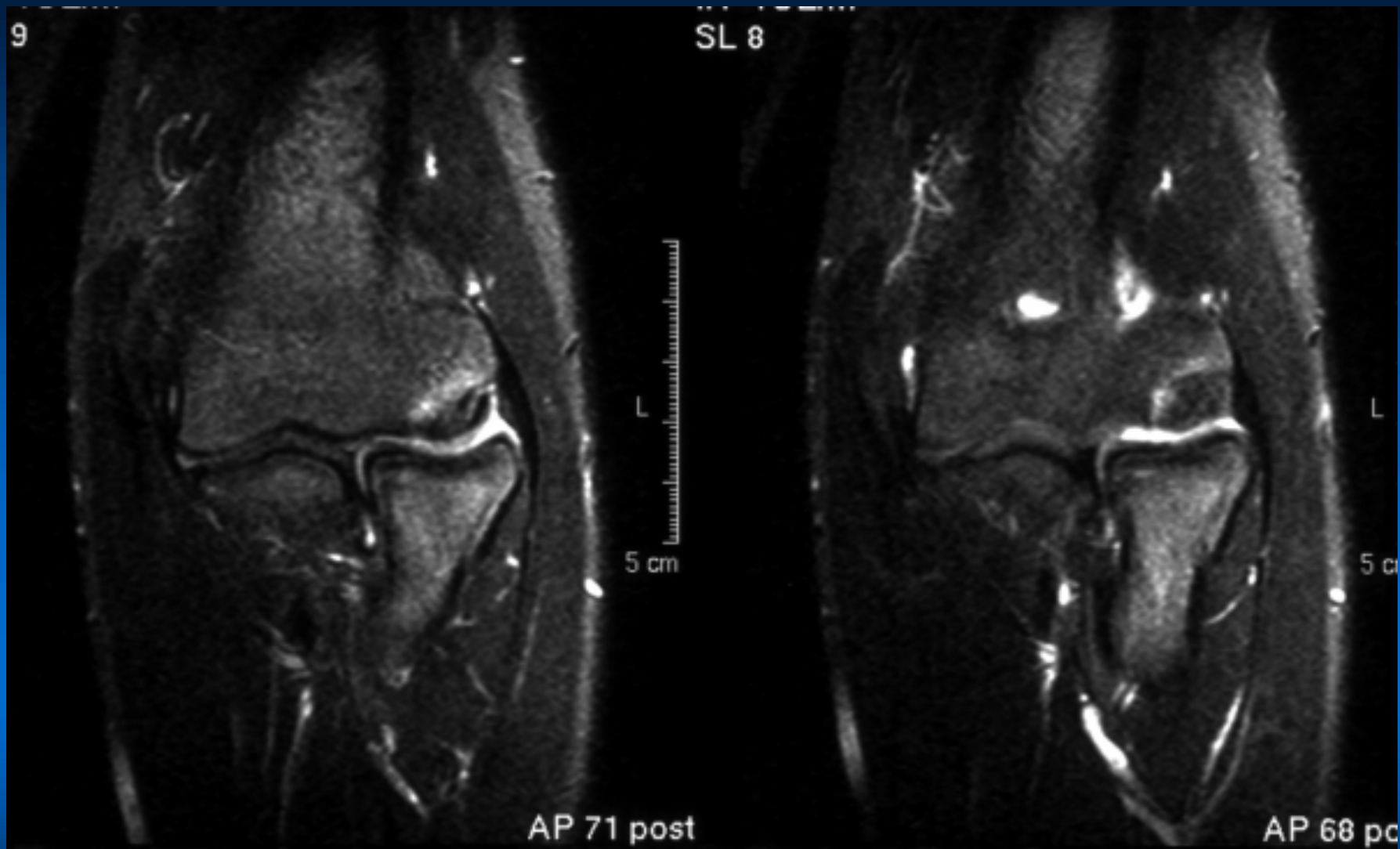


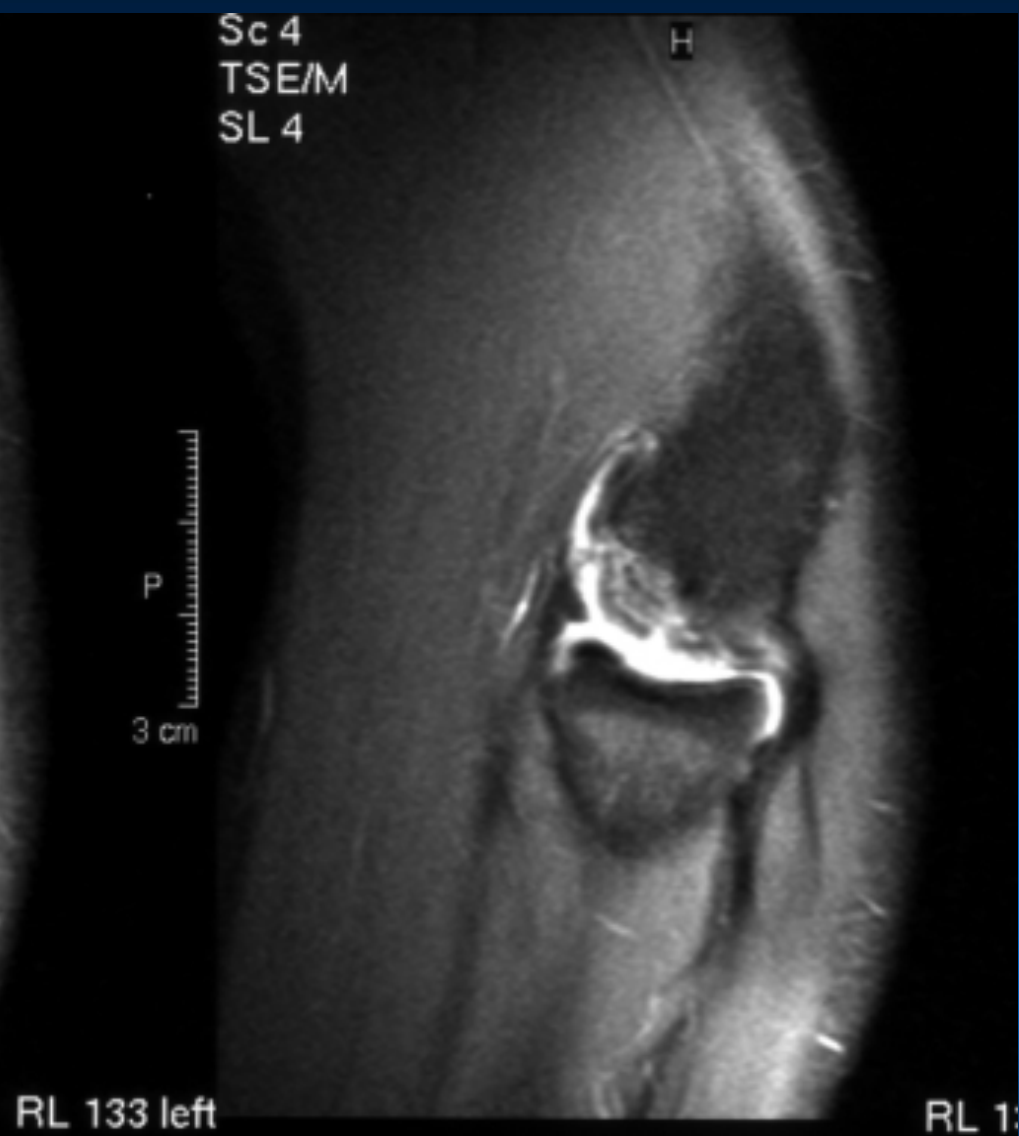
L
3 cm



L
3 cm

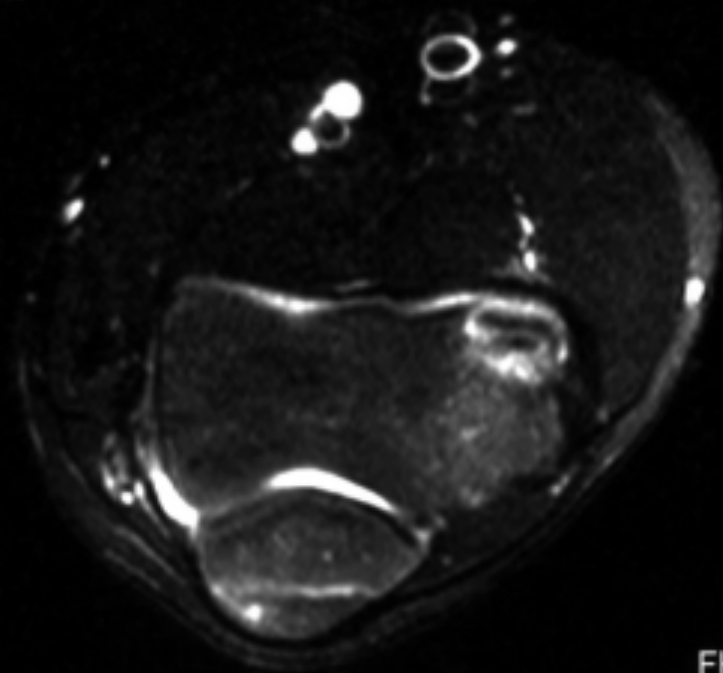






C 7
SE/M
L 8

A

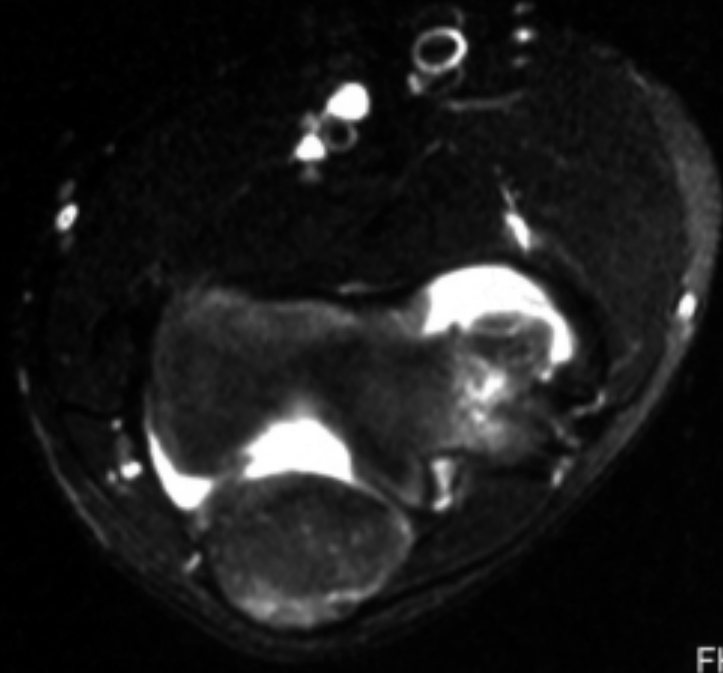


L
2 cm

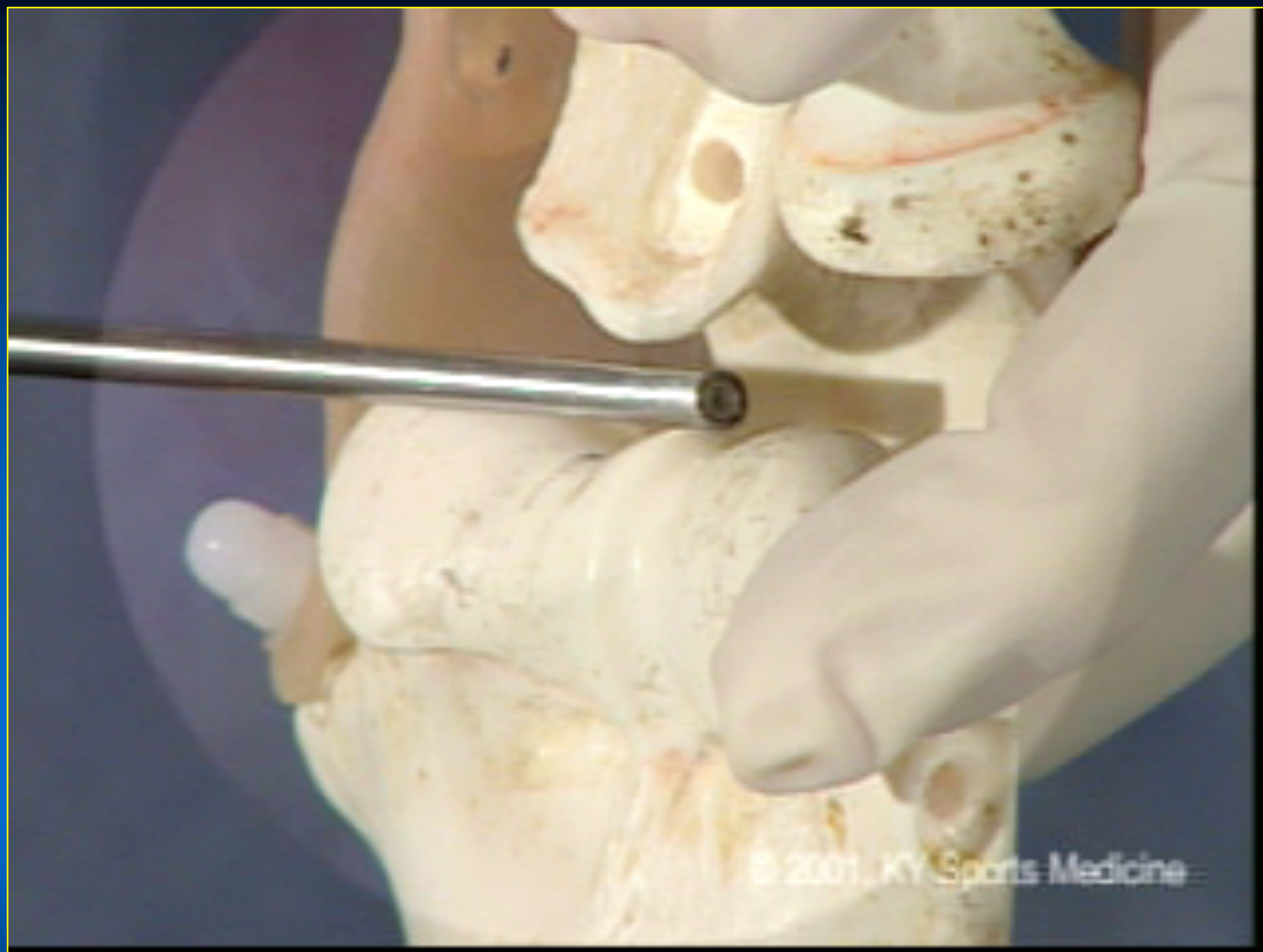
FH -22 feet

Sc 7
TSE/M
SL 7

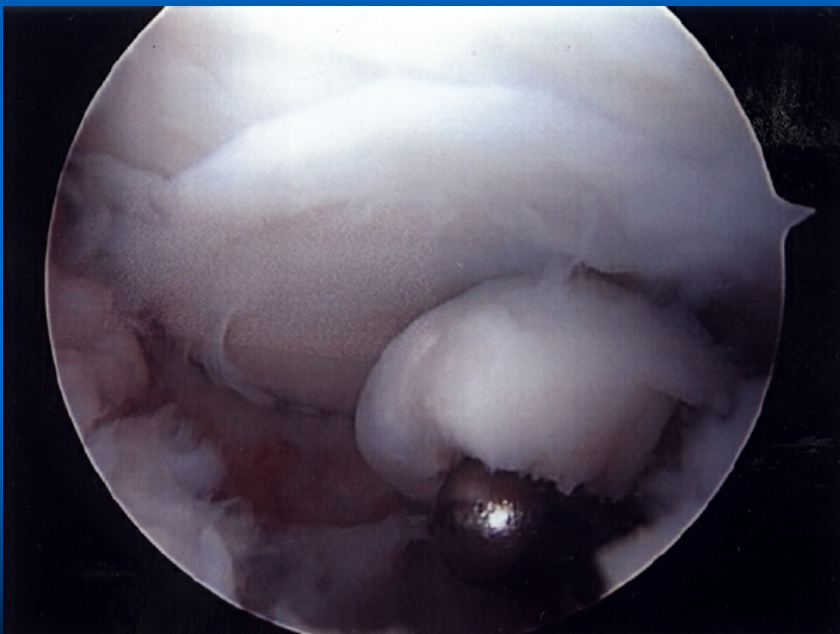
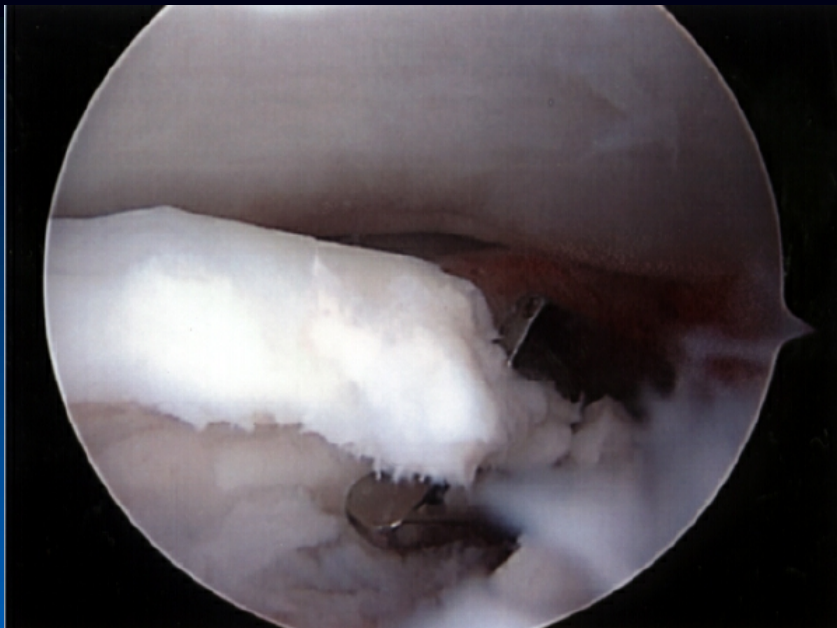
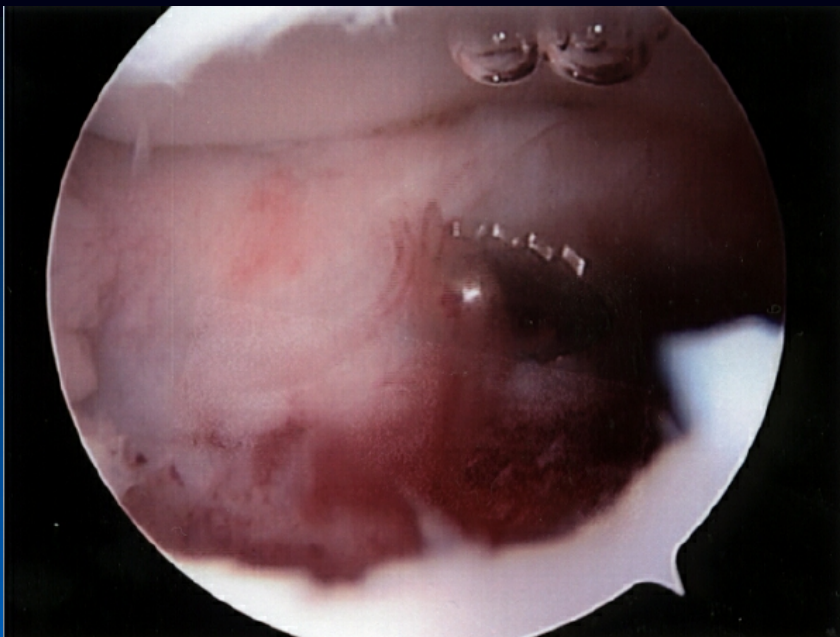
A

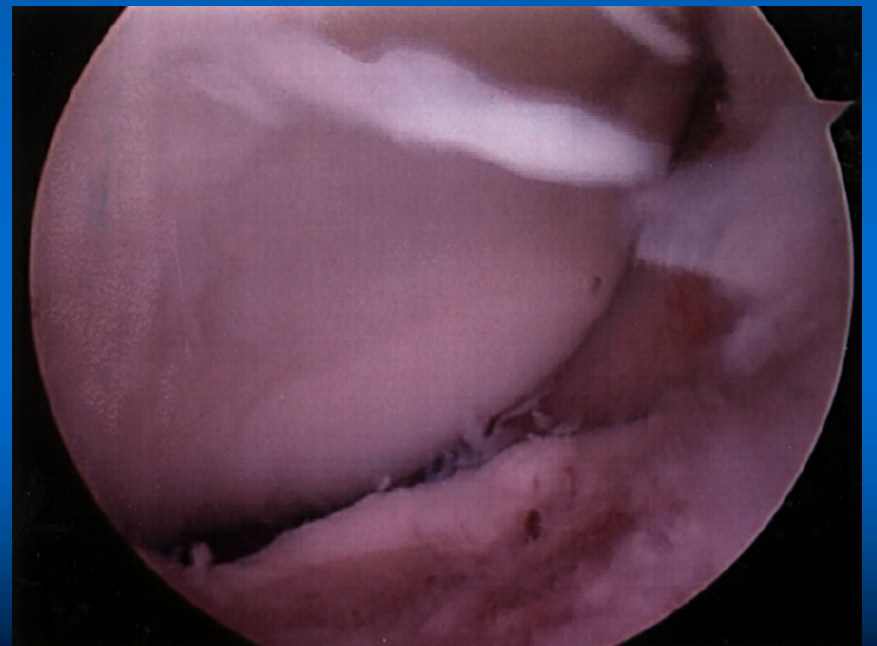
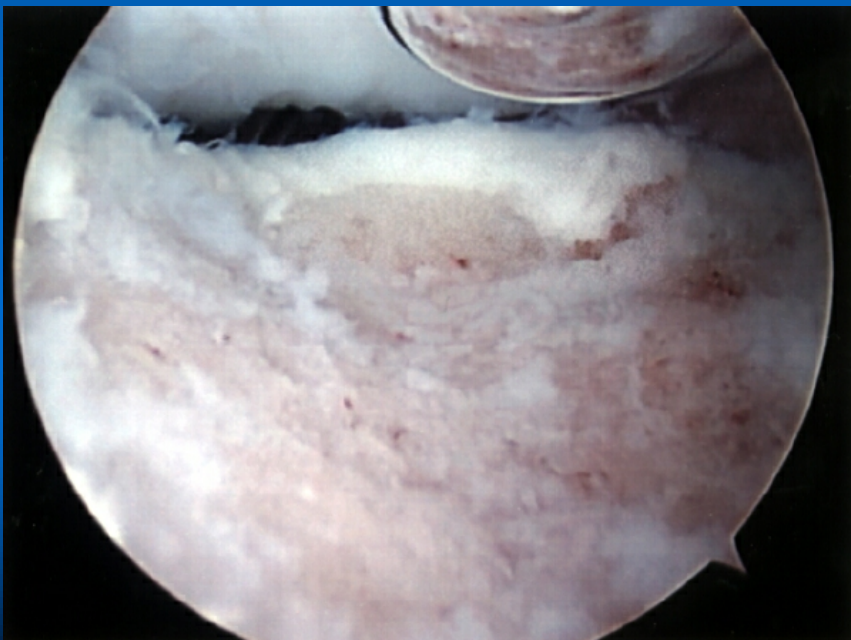
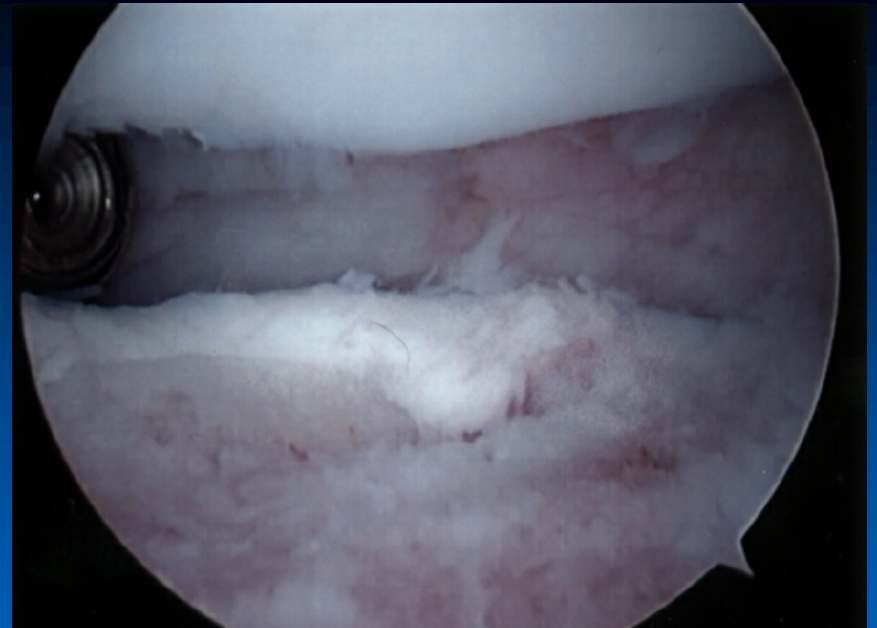
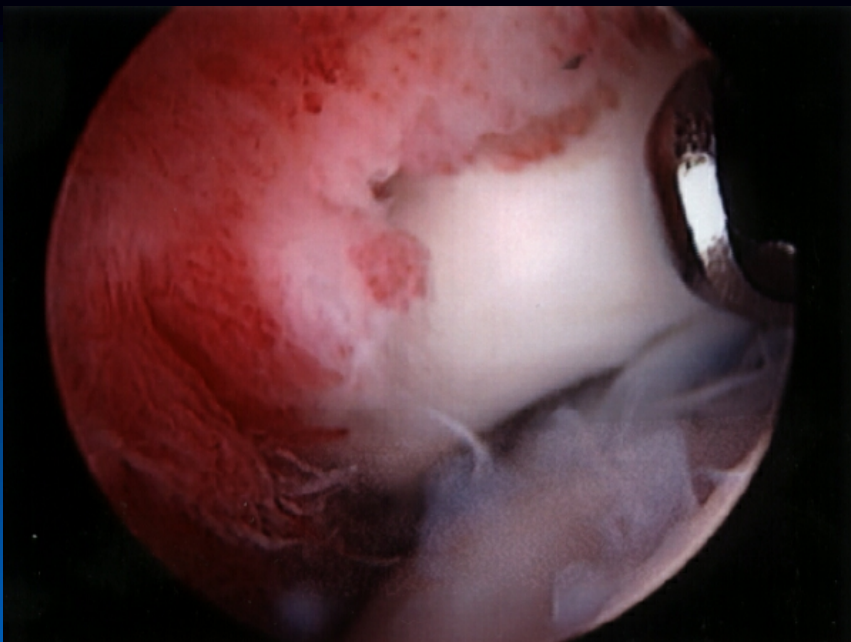


FH -

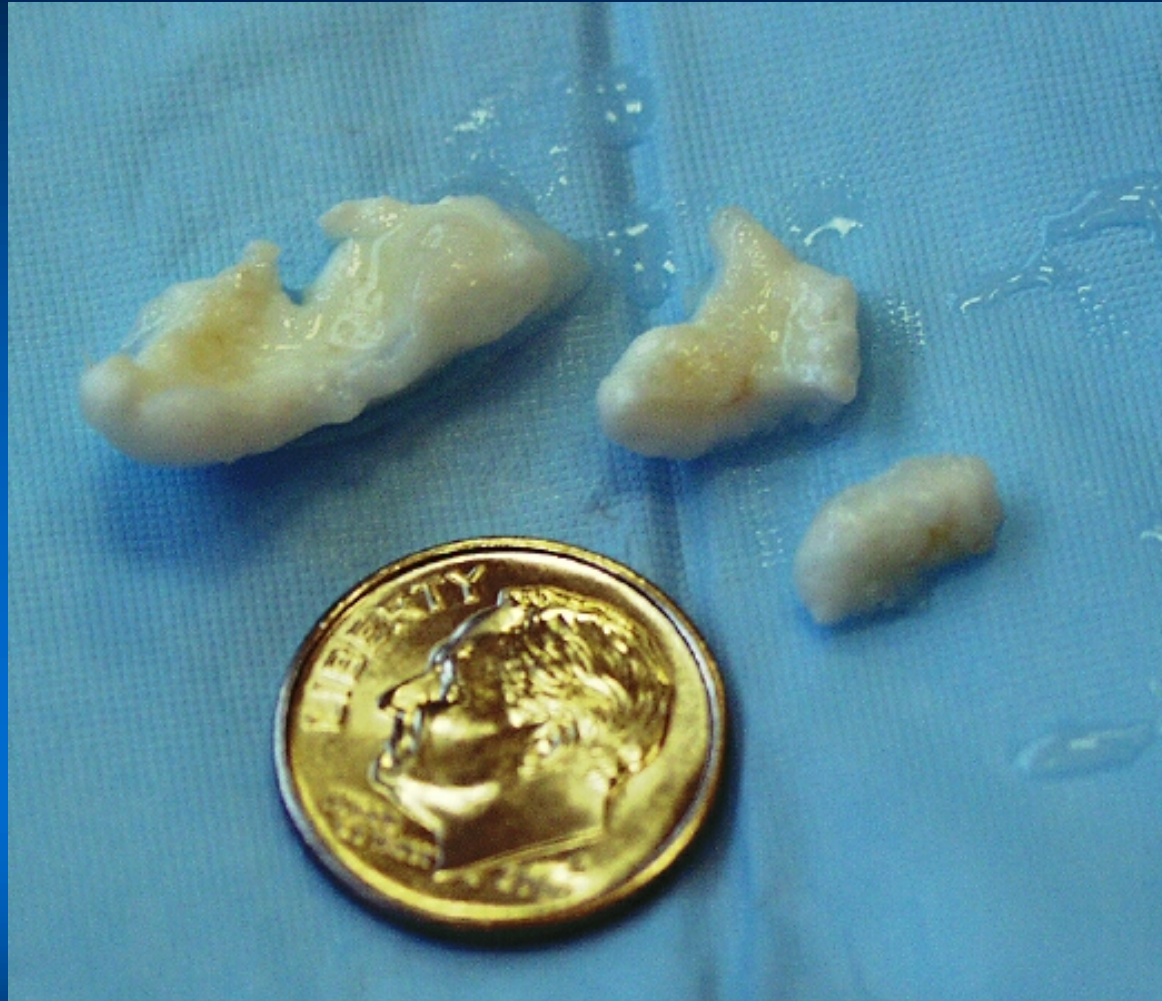


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Loose Bodies





10/16/2003 2 year, 3 mo. followup



Differential Diagnosis: Skeletally IMMATURE

ANTERIOR

Acute	Chronic
<ul style="list-style-type: none">• Distal Physeal Humerus Fracture• Capsular Sprain• Hyperextended Elbow	<ul style="list-style-type: none">• Loose Bodies

Differential Diagnosis: Skeletally IMMATURE

MEDIAL

Acute

- Avulsion Fracture Medial Humeral Epicondyle
- Ulnar Collateral Ligament Sprain (rare)
- Ulnar Nerve Subluxation (rare)
- Fracture

Chronic

- Medial Humeral Epicondyle Overgrowth
- Stress Reaction
- Nerve Instability

Differential Diagnosis: Skeletally IMMATURE

POSTERIOR

Acute	Chronic
<ul style="list-style-type: none">• Olecranon Fracture• Olecranon Apophysitis• Olecranon Bursal Contusion	<ul style="list-style-type: none">• Olecranon Traction Apophysitis• Olecranon Spurs• Loose Bodies• Posteromedial Spurs

Differential Diagnosis: Skeletally IMMATURE

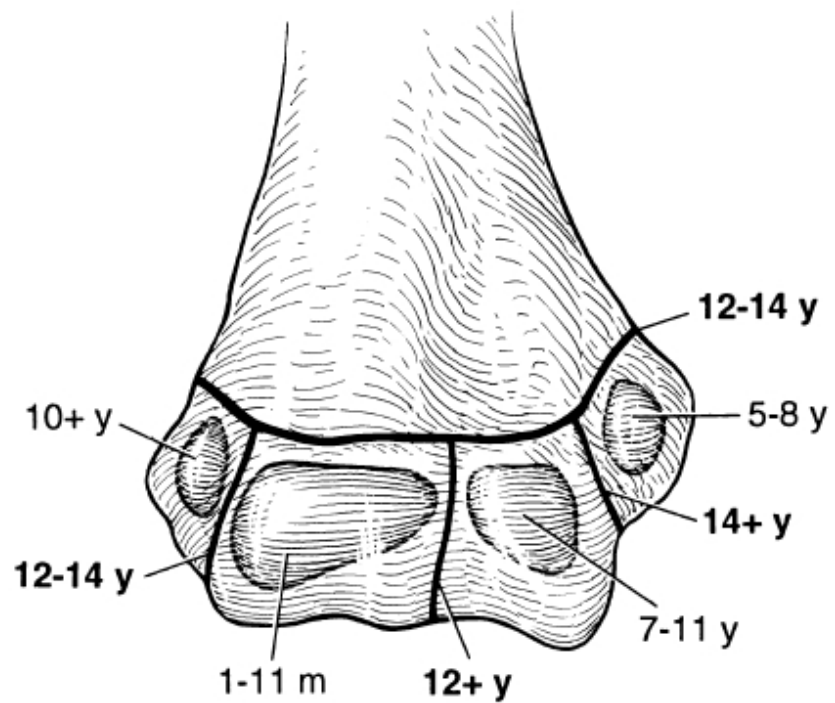
LATERAL

Acute

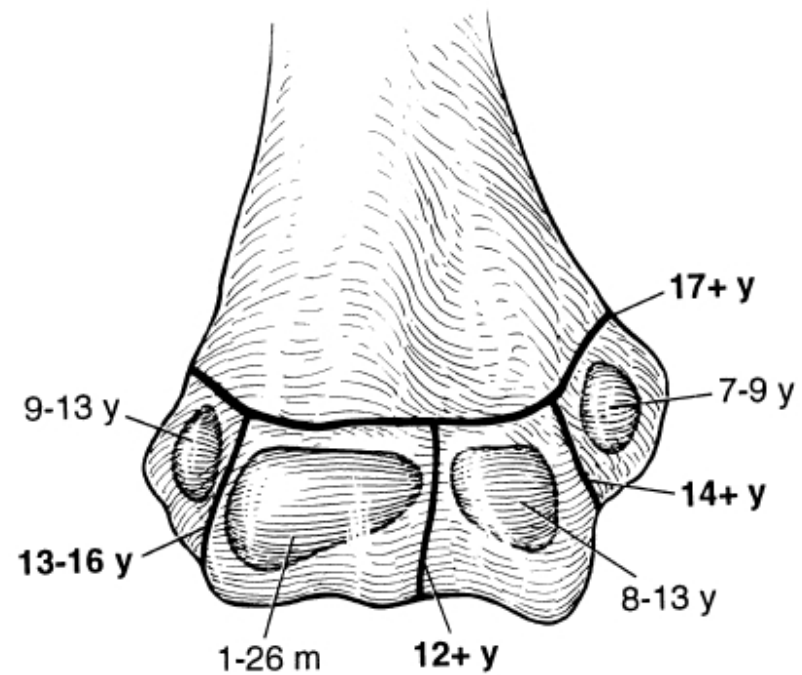
- Osteochondritis Dissecans Capitellum
- Osteochondral Fracture Capitellum
- Avulsion Fracture Lateral Humeral Epicondyle
- Anterior Subluxation Radial Head
- Fracture Capitellum Radial Head

Chronic

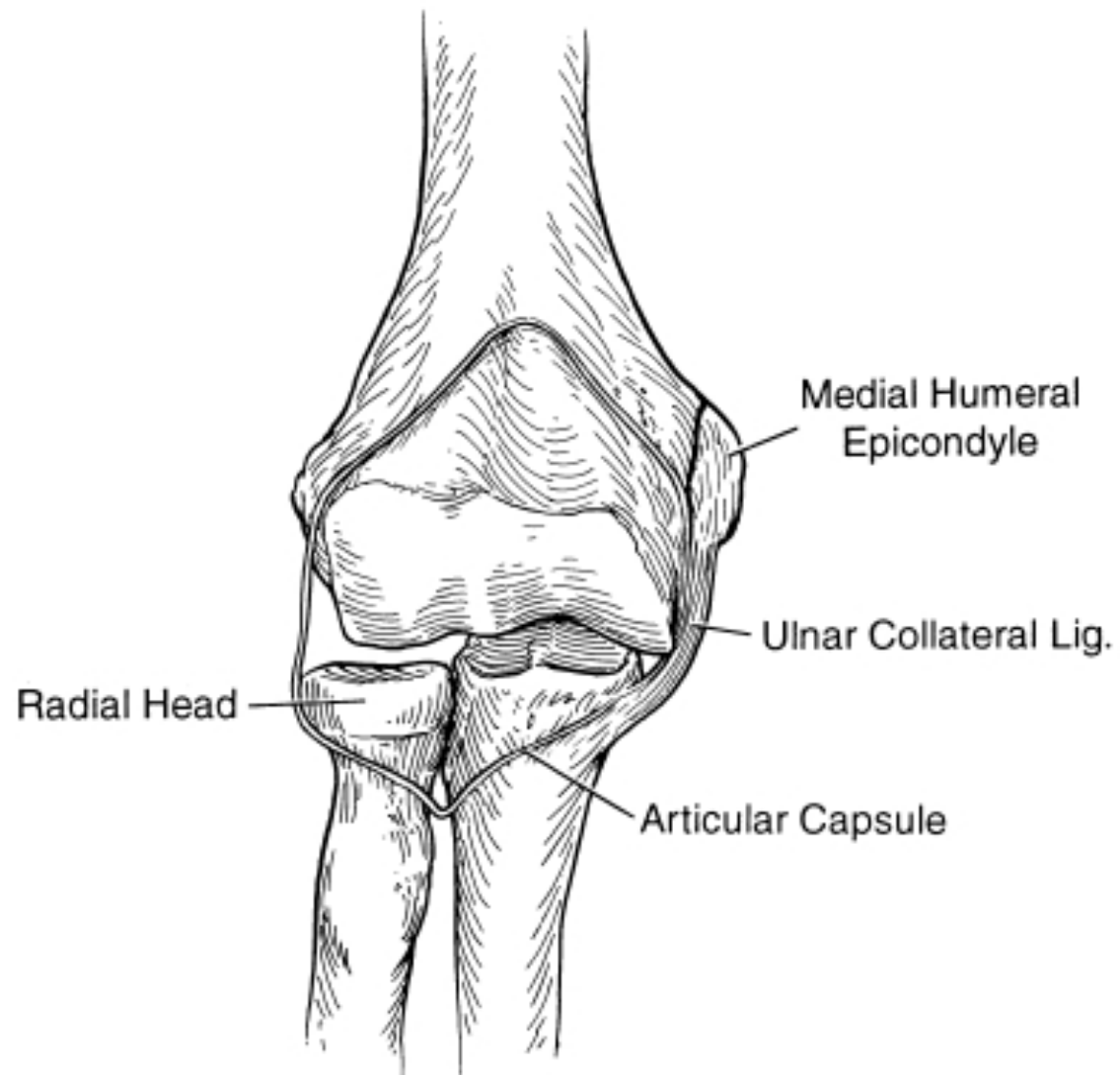
- Lateral Humeral Epicondylitis
- Radial Head hypertrophy/overdevelopment
- Loose Bodies
- Osteochondritis dissecans Capitellum
- Osteochondritis Radial Head



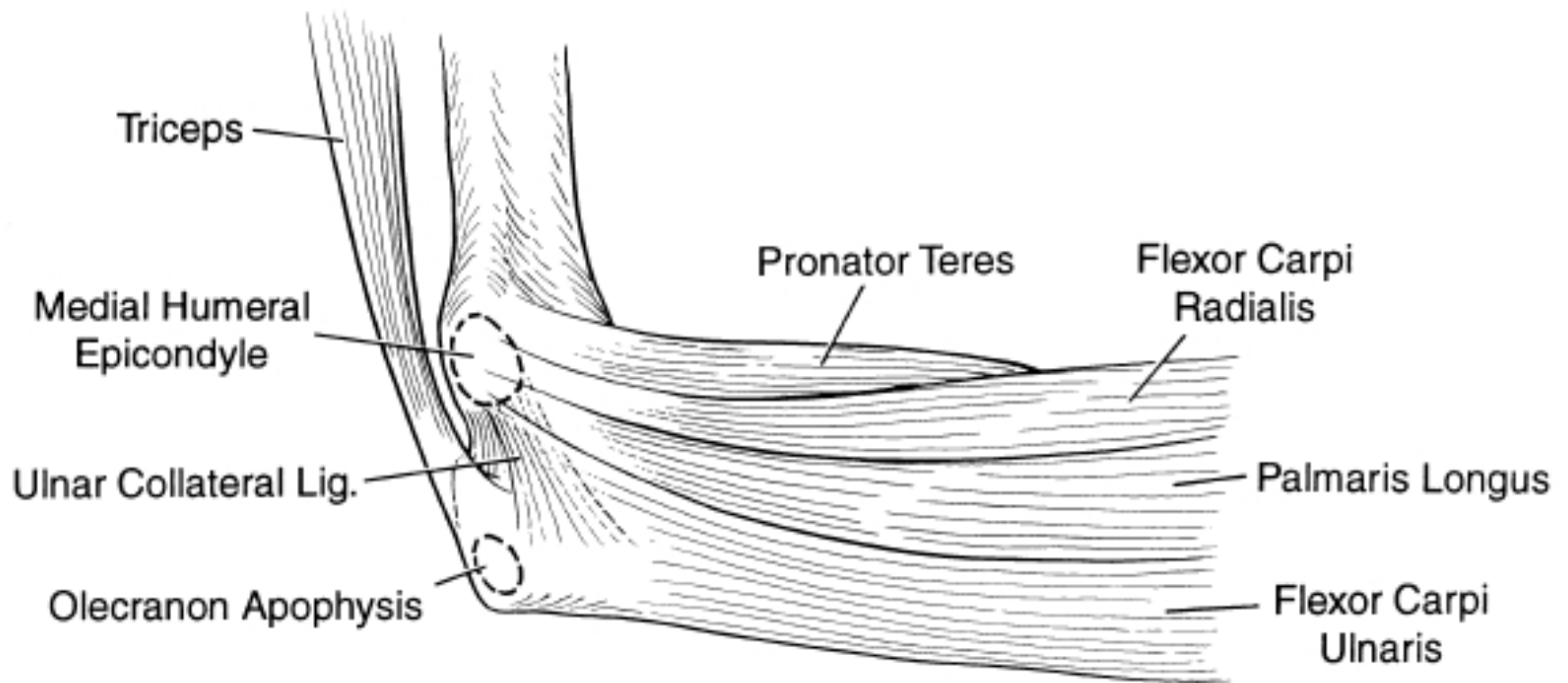
Girls



Boys



Anterior Elbow

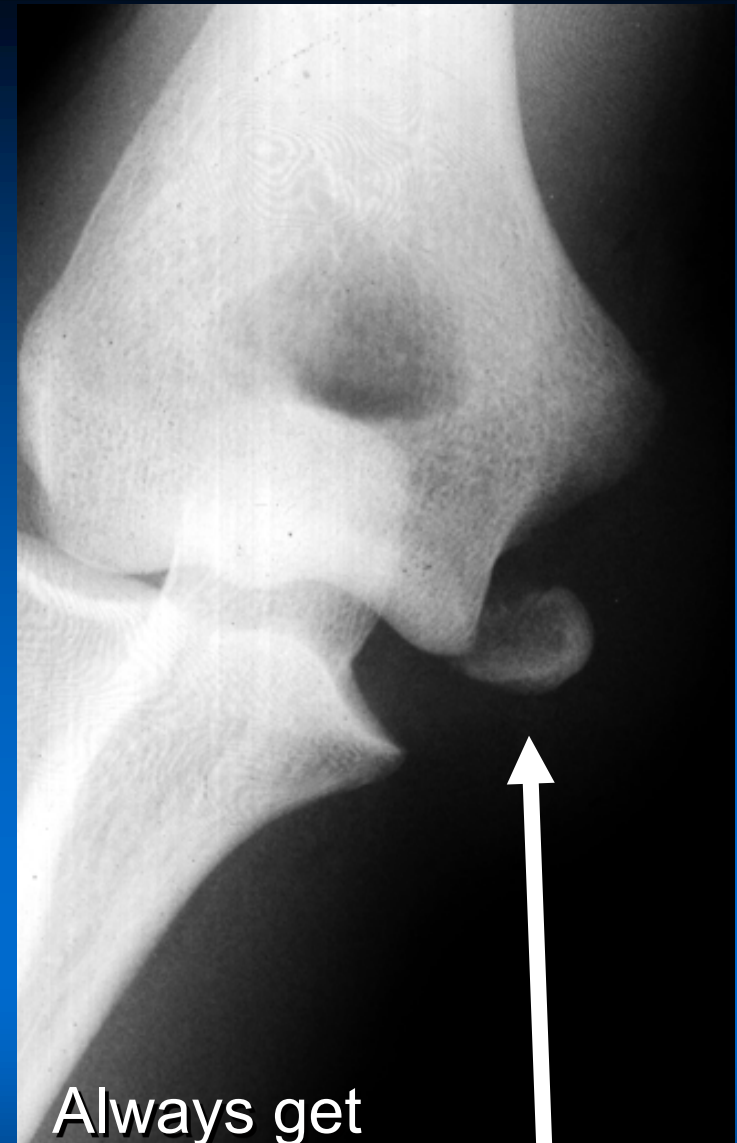


Medial Elbow

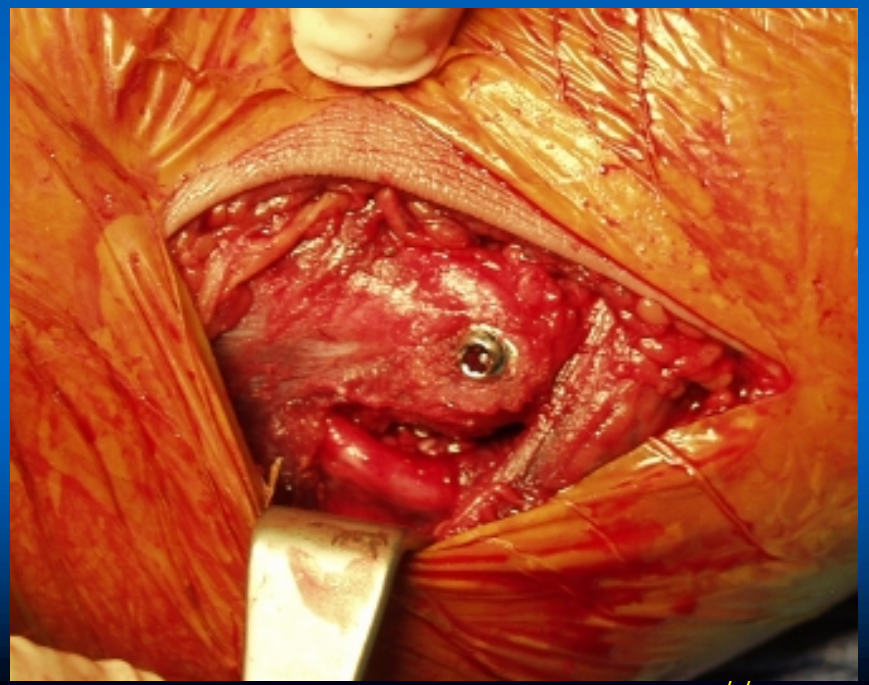
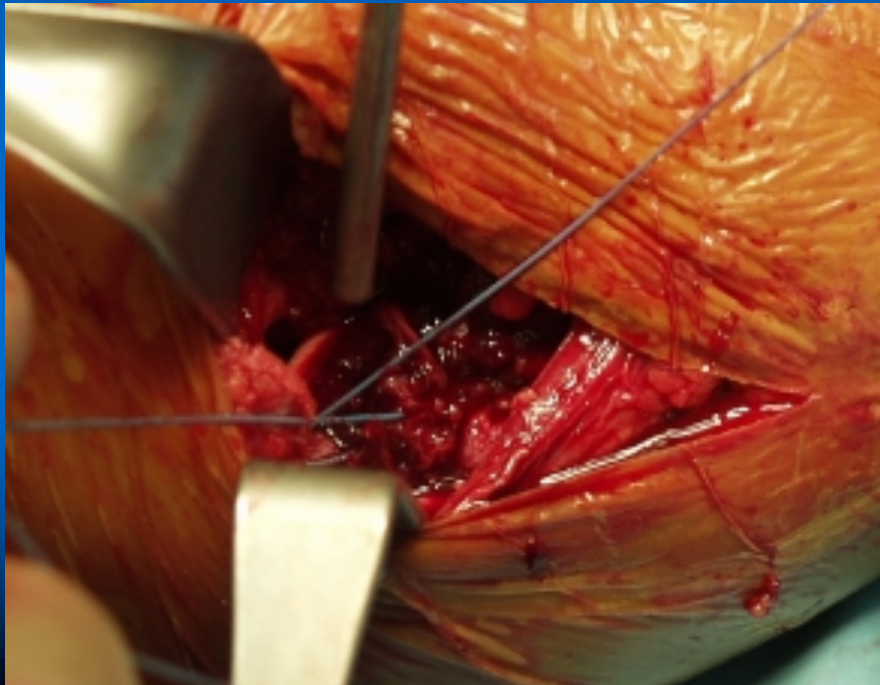
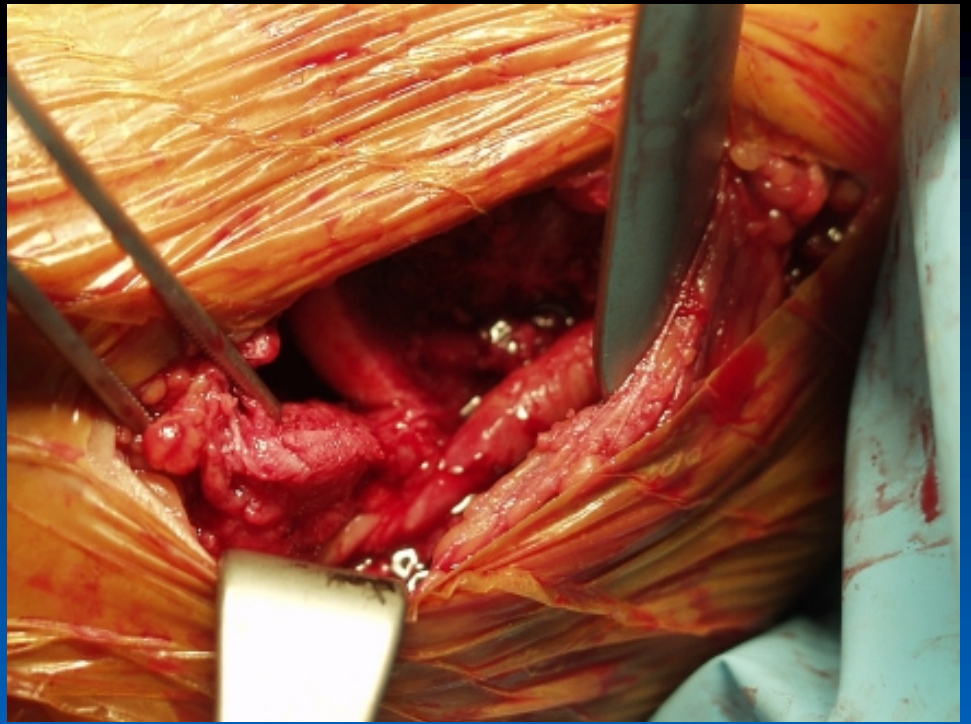
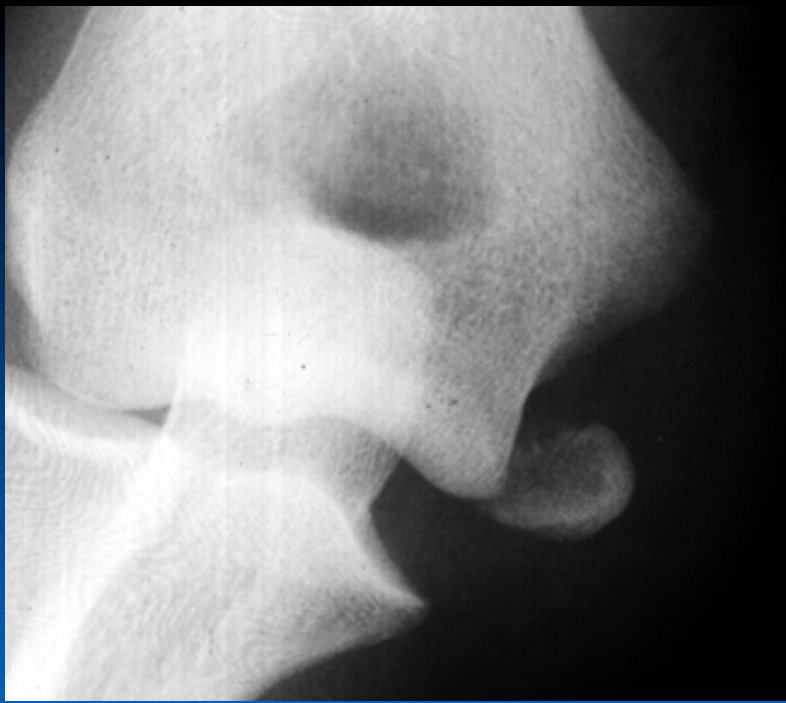
Posterior Elbow Dislocation

**15 YO Football Athlete
Contact Back of Humerus
Hand on Ground
Elbow Flexed 90°**





Always get
post-reduction films

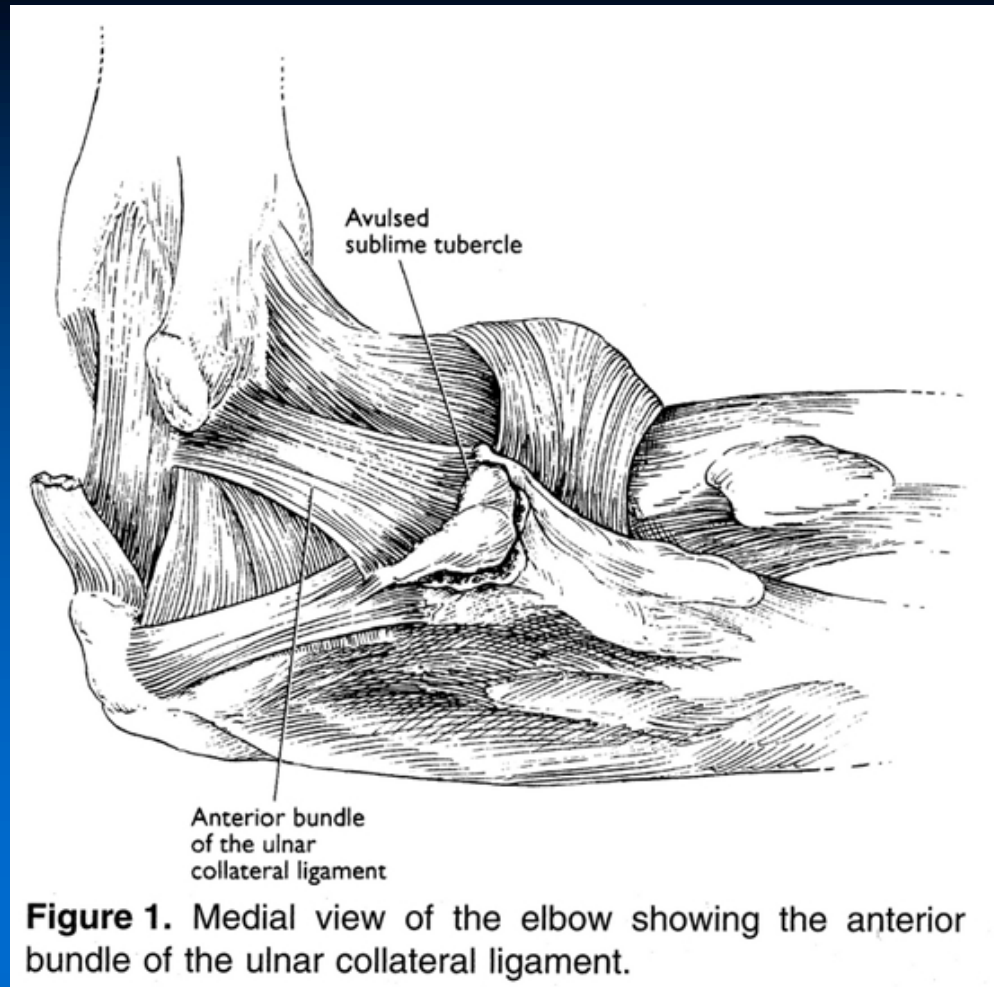




Reducing a Posterior Elbow Dislocation

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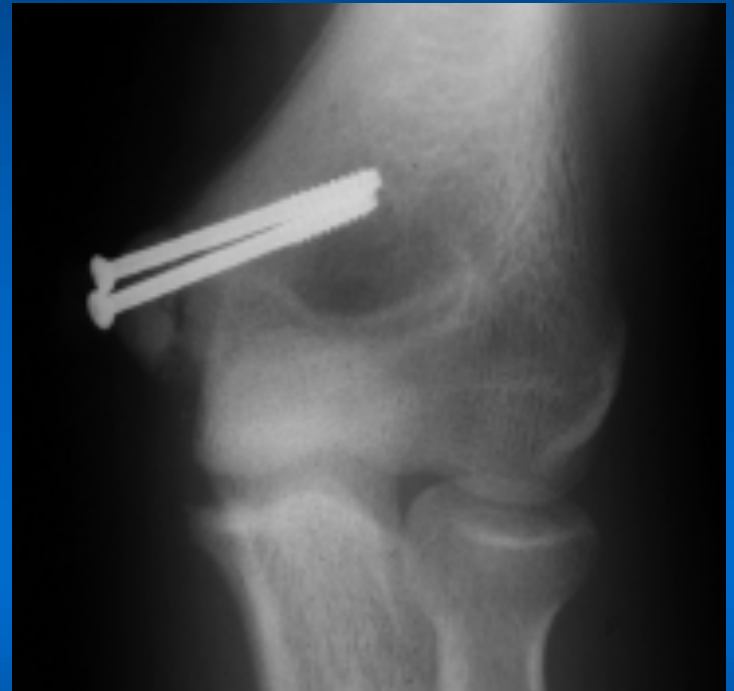
Elbow



Salvo JP et. al, “**Avulsion Fracture of the Ulnar Sublime Tubercle in Overhead Throwing Athletes,**” Am J Sports Med 30(3), 2002, 426-431.

Medial epicondyle fracture

- Controversial
 - Displaced extra-articular fractures



To Fix, or Not to Fix?

**12 year old medial elbow pain for 4 months
Pitcher and Quarterback**



1 mo.



3 mos. healed

12 year, 11-mo. Old RHD Pitcher

- 3 week history, medial elbow pain
- Kept throwing
- Little League, now in All-Stars
- PE:
 - Height 6' 2", Weight 190 lbs.
 - Medial elbow pain
 - No instability

Case courtesy of Dr. Adam Smith

Elbow initial xrays



Medial epicondyle displaced fracture
UCL tear complete vs. partial

Follow up:

2 week:



4-week:



6-week:



4 month:



BB Bullet Appearance to medial epicondyle fracture

- **May heal if you don't allow pitching too early**
- **May take long time to heal, but UCL is intact**

BB Gun

- Don't allow to fire too soon

FUN *all year round!*

CHRISTMAS

FUN - to kids, "Daisy" is the answer for the boy who likes to shoot. It's the only gun that's safe, fun, and easy to use. It's the only gun that's guaranteed to give you hours of fun. It's the only gun that's guaranteed to give you hours of fun. It's the only gun that's guaranteed to give you hours of fun.

No. 25 \$9.95

DAISY PUMP GUN FOR CHRISTMAS!

Big, Big, Big! It's the King of all BB guns! It's the one that's guaranteed to give you hours of fun. It's the one that's guaranteed to give you hours of fun. It's the one that's guaranteed to give you hours of fun.

13" **8"**

Y EAGLE POWER SCOPE MOUNTED

No. 94 DAISY WESTERN CARBINE

SCOUTS!

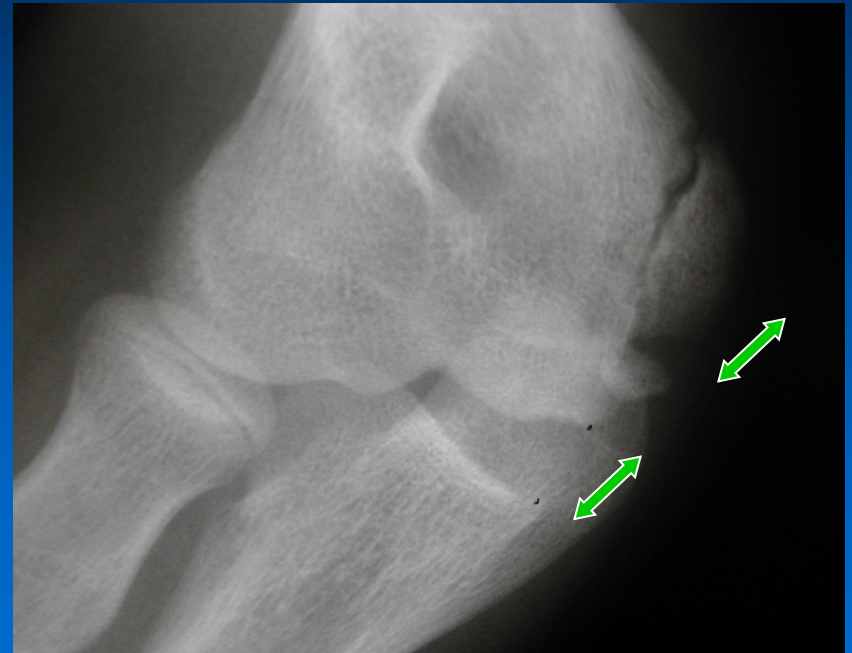
LEADERS!

COUPON NOW!

DAISY BULLS EYE BBs and AIR RIFLES

FOR THE HOLIDAYS, SEND FOR YOURS AT THE LEAST COST!

14 YO Pitcher, medial elbow pain for a year, open medial humeral epiphysis torn UCL



Stress Views

UCL reconstruction performed, baseball career ended

Risk Factors

- Overuse
- Fatigue
- High Pitch Velocity
- Showcase Participation
- Age Groups – Age Matched Case Control Study
 - 95 pitchers surgery / 45 adolescent no surgery
 - Multivariant Analysis, Injury Risk Pitching:
 - >8 months/year 5-fold
 - >80 pitches/game 4-fold
 - >85 mph 2.6X
 - Arm fatigue 36X

Dr. Andrews:

“ . . . the speed gun is the worst invention in the history of Little League baseball.”

Olsen II SJ, Fleisig GS, Dun S, Loftice J, Andrews JR, “**Risk Factors for Shoulder and Elbow Injuries in Adolescent Baseball Pitchers,**” Am J Sports Med 34(6); 2006,905-912.

Conclusion: 13 YO “Big Pitcher” Syndrome

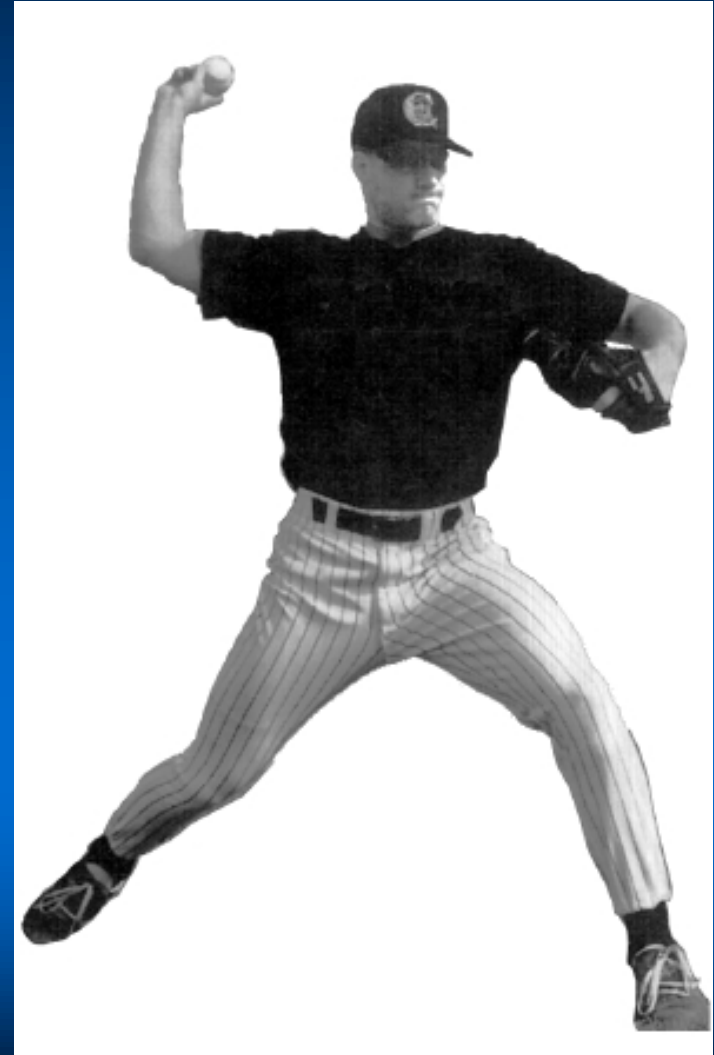
- Skeletally and mentally immature
- Fast growth phase
- Poor pitching mechanics
- Hip weakness
= UE overuse injury



Protect our young athletes

- Reduce rate of Rotator Cuff and UCL tears in young pitchers

Little League pitchers do NOT become Big League pitchers



STOP Elbow Injuries in Youth Baseball: Youth Sports Injury Prevention

Sports
Trauma and
Overuse
Prevention



www.stopsportsinjuries.org

Former High School Pitcher

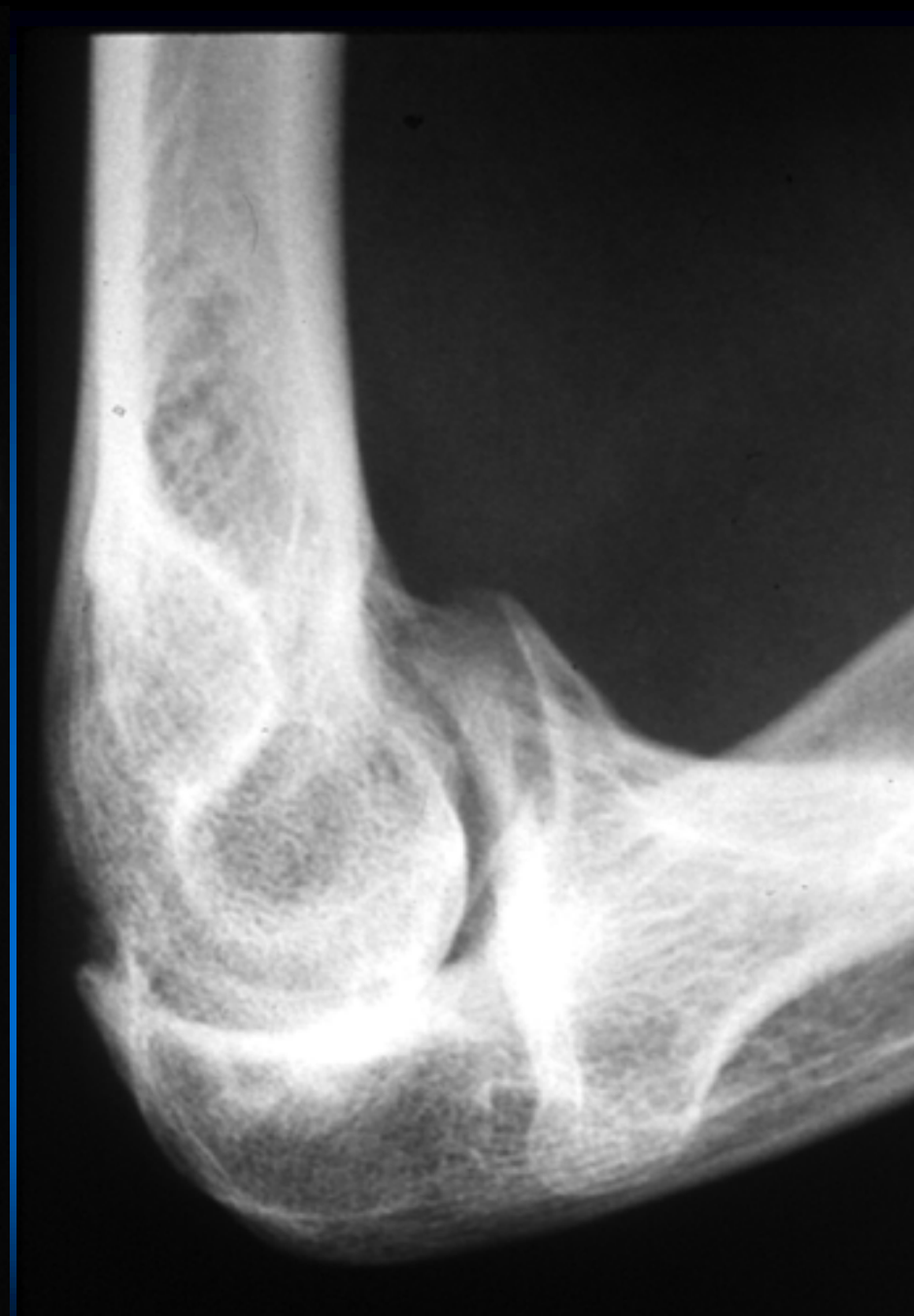
Right Elbow Pain when he threw,
but kept throwing

Now loss of supination
40°-110° ROM with pain





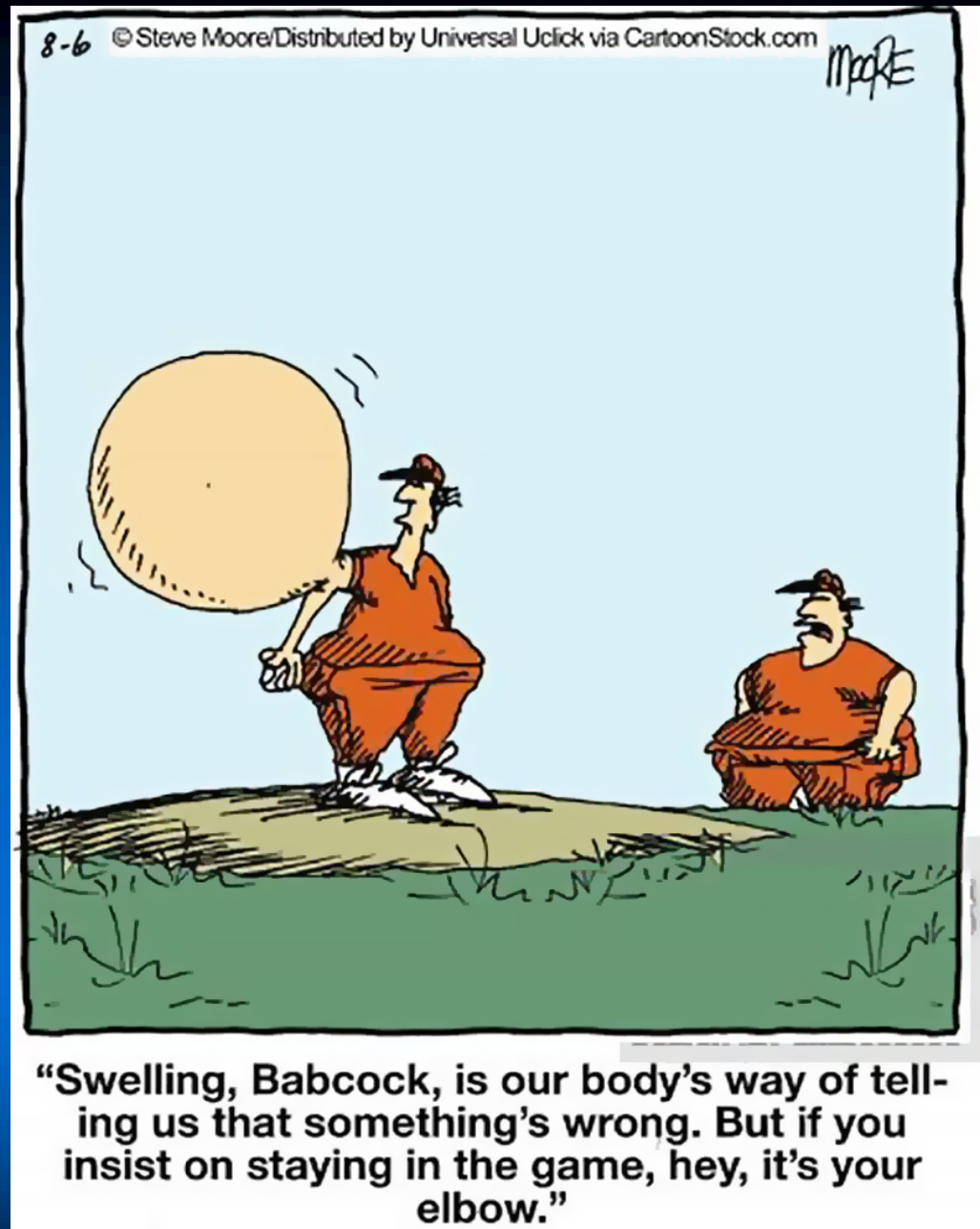




CONCLUSIONS

If you understand anatomy, mechanisms of injury and biomechanics of the sport:

- **elbow examination will lead you to the correct diagnosis**



CONCLUSIONS

- Know the uniqueness of skeletally immature elbow
- Protect the young elbow.
- You, the healthcare provider, often become the parent.

