Overview of the Shoulder and Elbow in the Adolescent Athlete

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Objectives

- Become familiar with trends in sports injuries in youth
- Review pertinent anatomy and exam in the shoulder and elbow
- Examine conditions of the shoulder and elbow in the young athlete

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Trends

- Over 70% of children and adolescents play an organized sport
- Overuse ~ **50%** of youth sports injuries
- **15%** all sports injuries involve the upper extremity
- **45%** upper extremity injuries involve shoulder
- Specialization
  - Burnout, anxiety, depression, and attrition
  - Family financial stress
    - Club sports = $$$
  - Will they get a scholarship?
    - 1%
  - Will they go pro?
    - 0.03-0.5%

"We think he's going to be a fabulous basketball player."

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YOUNG Athletes ≠ Adult Athletes

- Youth
  - Less coordination and control
  - Lower speed, size & strength
- Adolescents
  - Increased injury risk (during growth spurt)
  - Greater speed, size & strength
    - Yet still developing complex motor skills
  - More immature = impulsive & emotional
- Growing bones
  - Variance of appearance of 1º and 2º ossification centers
  - Physes are at risk of injury over sprain/strain
- Increased joint laxity
  - Many young athletes with overuse injuries have increased joint laxity
  - May stabilize after adolescent growth

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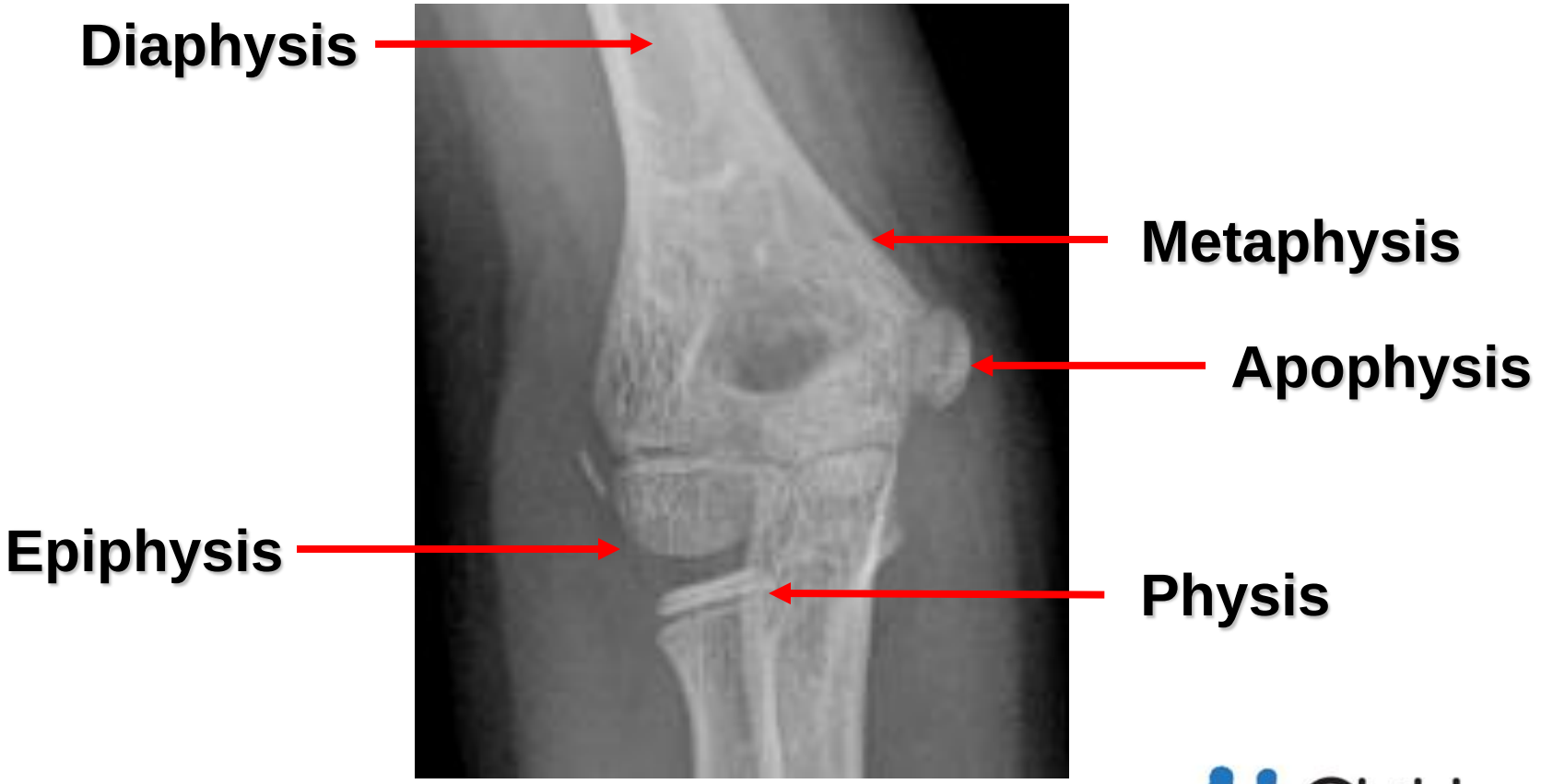
The Growing Bone



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Exam Pearls

- Examine the joint above and below
- Compare to the opposite side
- Don’t forget to evaluate the neck
- Always do a neurovascular exam

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Shoulder

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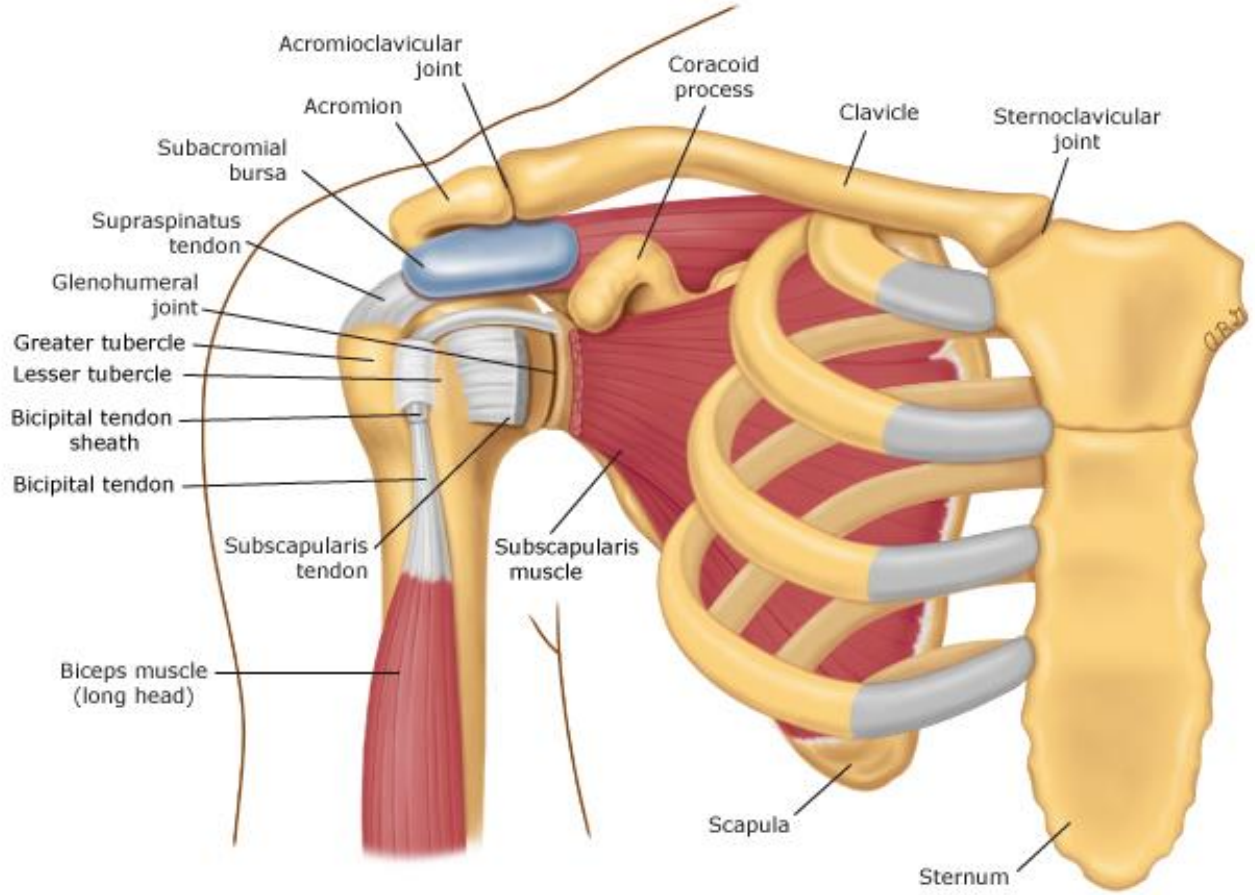
Shoulder Anatomy - Anterior



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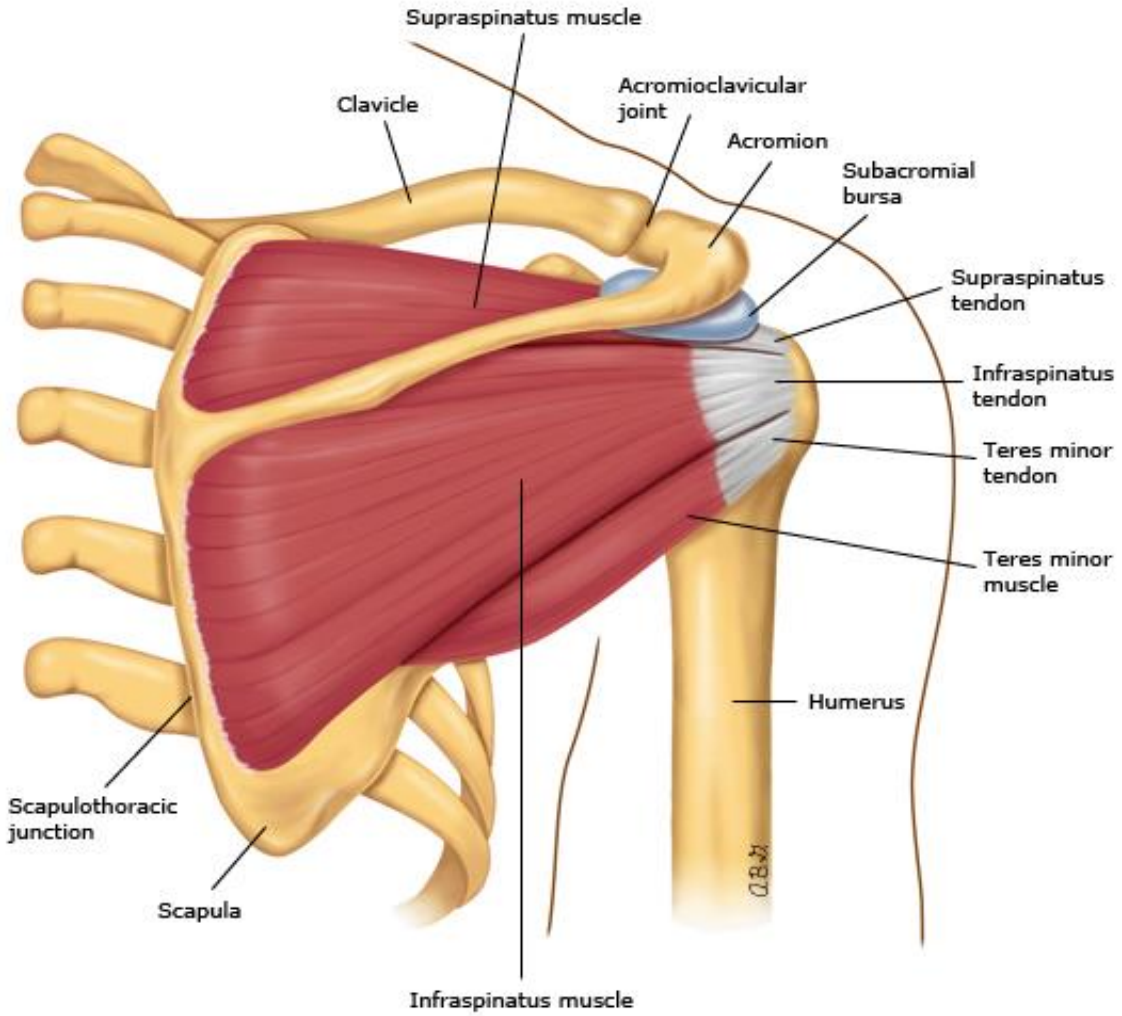
Shoulder Anatomy - Posterior



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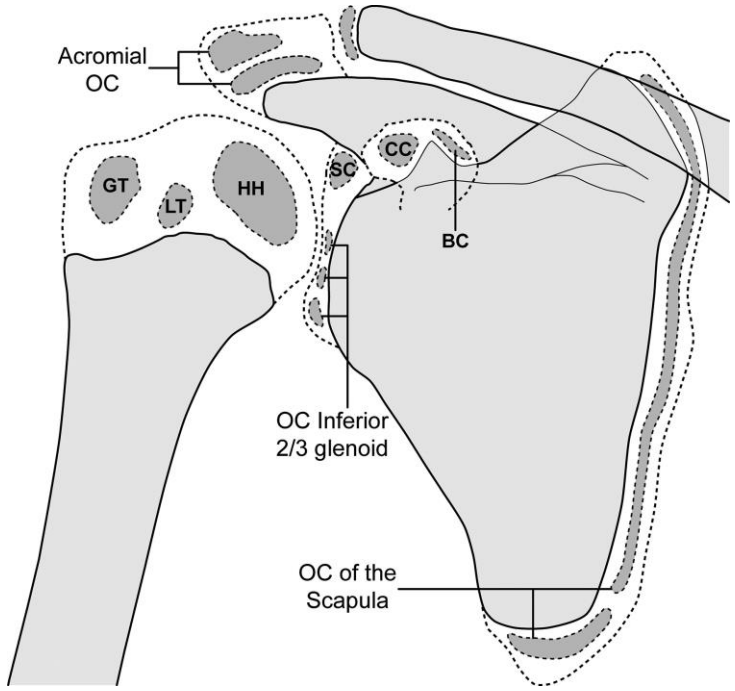
Shoulder Ossification/Fusion



Bone Structure and Ossification Center	Age of Child at Appearance	Age of Subject at Fusion (y)
Proximal humerus		
Head of the humerus	1–6 mo	3–5
Greater tuberosity	9–12 mo	3–5
Lesser tuberosity	12–16 mo	3–5
Scapula: glenoid		
Subcoracoid	8–10 y	14–17
Centers in the inferior two-thirds of the glenoid	14–15 y	17–18
Scapula: coracoid process		
Center of the coracoid process	3 mo	15–17
Base of the coracoid process	8–10 y	15–17
Scapula: acromion		
Acromial secondary ossification centers	14–16 y	18–25

From Delgado J. Radiographics 2016

Proximal humerus may not close until 18!

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Shoulder Exam

- Inspection/Observation
- Palpation
- Range of Motion/Strength
- Special tests

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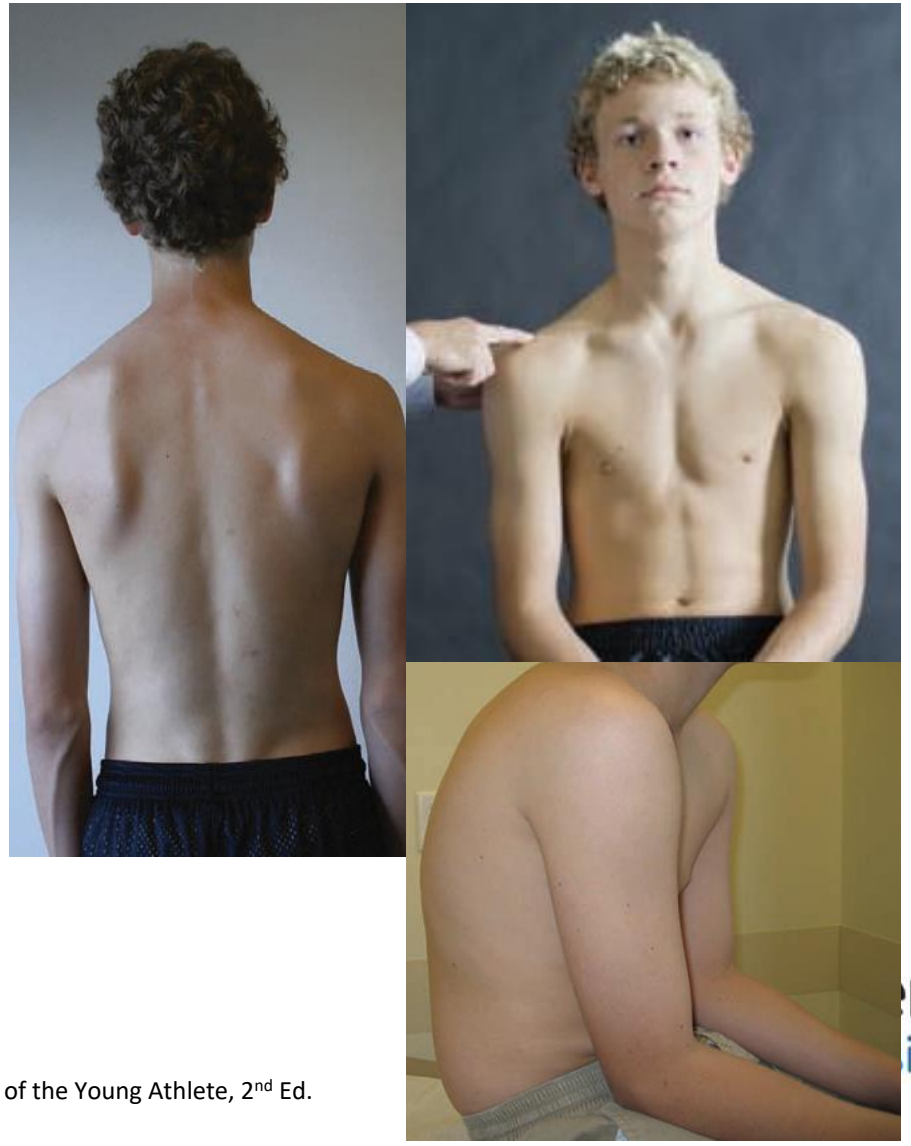
Inspection/Observation/Palpation

- Shoulder height, scoliosis, deformity
- Scapular winging at rest
- Rounded posture, kyphosis
- Active
  - Shoulder “hiking” with abduction (RC)
  - Scapular winging with abduction or wall pushup



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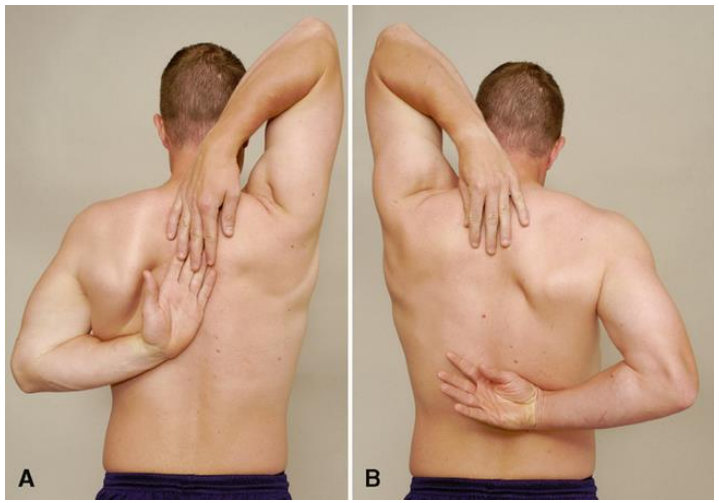
Range of Motion / Strength

Apley Scratch Test



https://musculoskeletalkey.com/shoulder-6/

- Side Abduction: 150 degrees
- Forward flexion: 180 degrees
- Extension: 45-60 degrees
- External Rotation: 90 degrees
- Internal rotation: 70-90 degrees

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Special Tests

- Instability
  - Load-shift/drawer test
  - Sulcus sign
  - Apprehension Relocation test
- Impingement/Rotator Cuff
  - Neer's sign
  - Hawkins' test
  - Empty Can test
- Labrum/Biceps
  - Speed's test
  - O'Brien's test
- AC Joint
  - Piano Key test
  - Crossed adduction test
- Neuro/Vascular
  - Spurling
  - Allen/Adson tests

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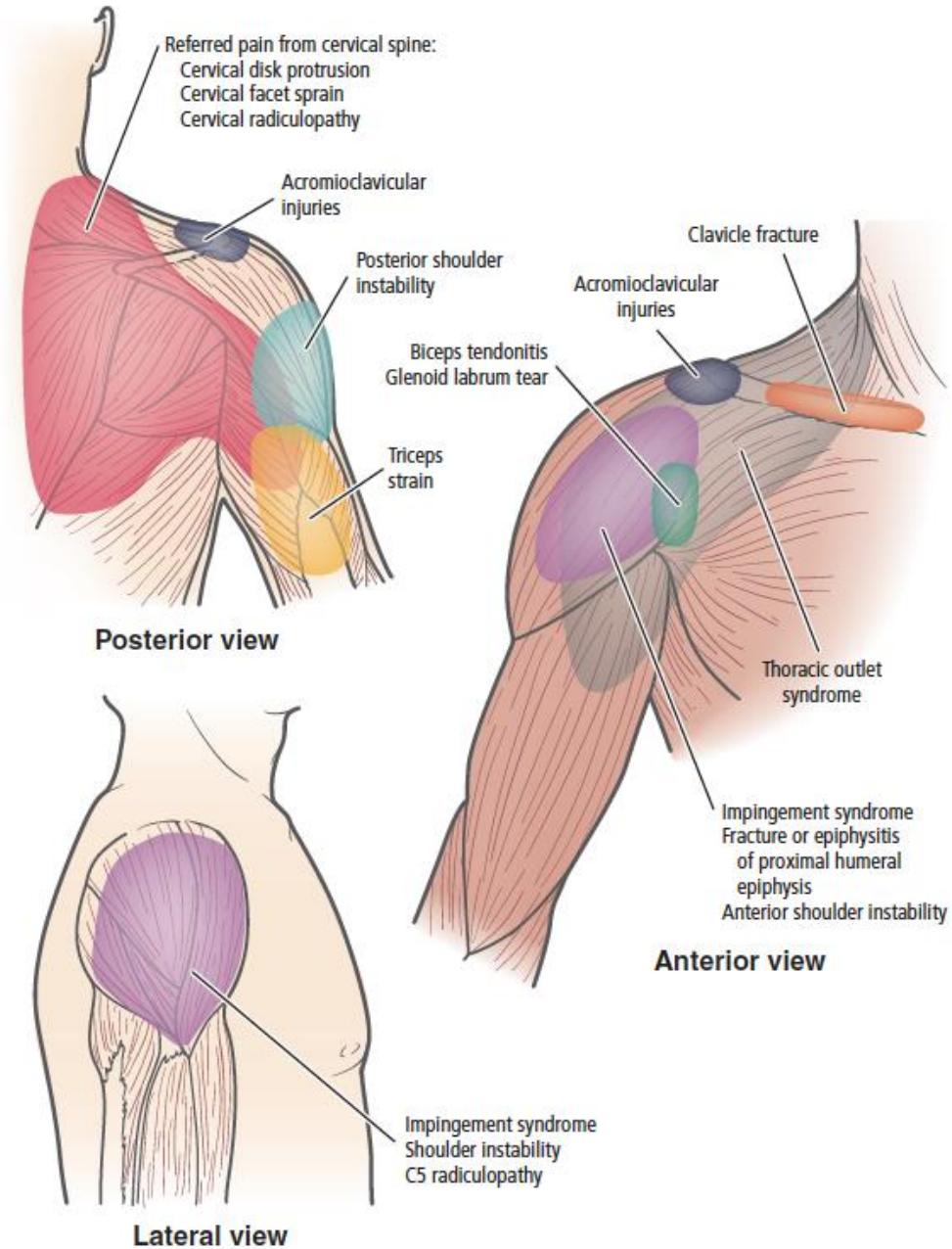
Shoulder



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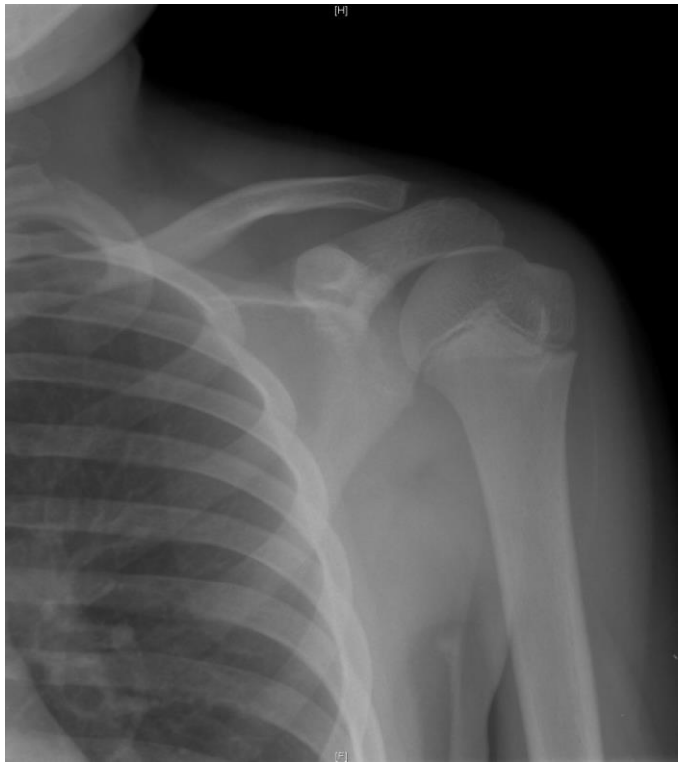
11 yo female catcher R shoulder pain



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Little League Shoulder

- Proximal humeral epiphysiolysis
- Age 8-15 yrs
- Pitchers, catchers, infielders
- Shoulder pain with throwing, usually insidious onset, decreased accuracy/velocity
- TTP of proximal humerus, shoulder weakness
- X-rays:
  - normal or widening of physis, sclerosis, cystic changes (can x-ray opposite side to compare)
- Management
  - Rest from intense throwing and pitching for 2-3 months and normalization of x-rays
  - PT to correct biomechanical errors, strengthen scapular stabilizers, improve core/LE strength
  - Gradual return to throwing program
  - Adhere to pitch counts
  - Rest from intense throwing/pitching 2-3 months/year

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Elbow

Elbow Anatomy

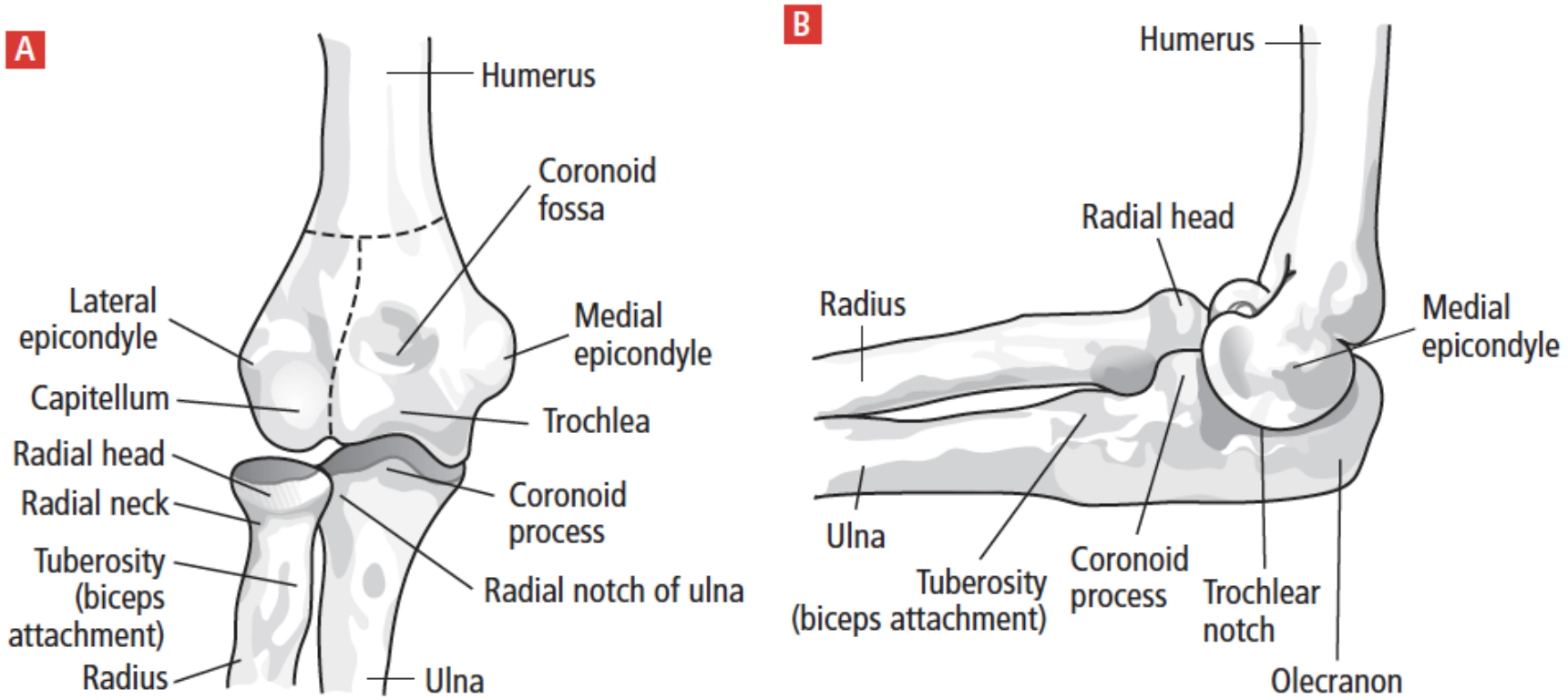

FIGURE 35.1 Elbow anatomy. (A) Anterior view. (B) Medial view.

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Elbow Ossification

- Capitellum 1 (6m-2y)
- Radial Head 3 (3-6y)
- Internal (medial) epicondyle 5 (4-7y)
- Trochlea 7 (7-10y)
- Olecranon 9 (6-12y)
- External (lateral) epicondyle 11 (10-14y)

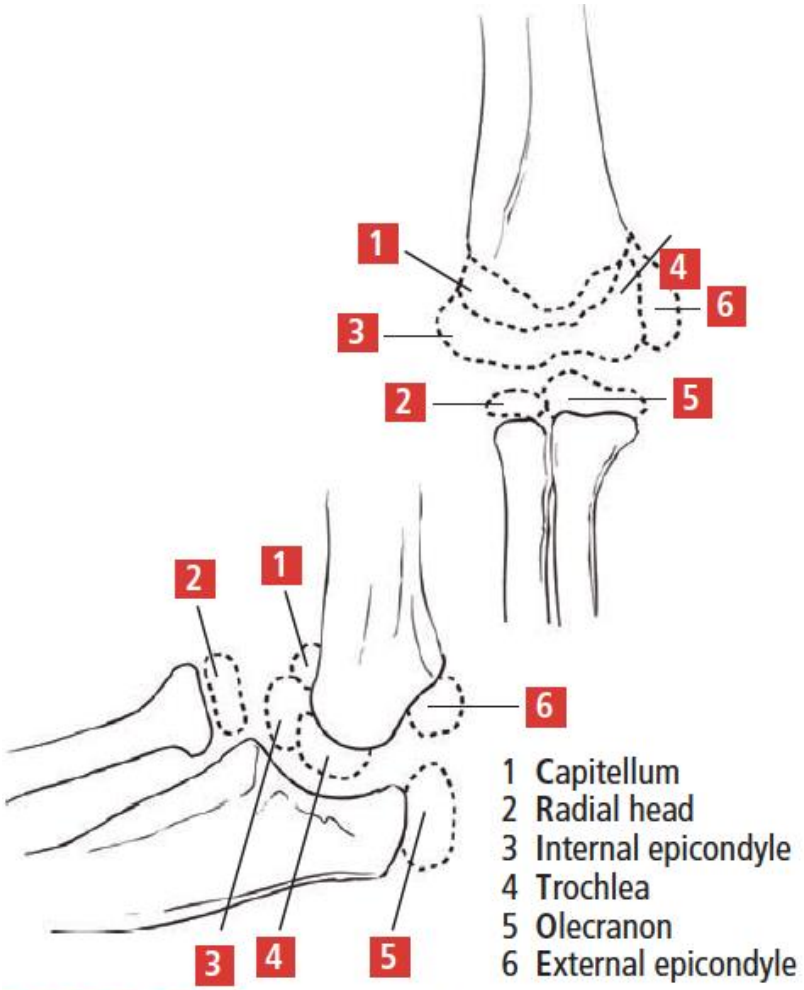

FIGURE 35.4 The ossification centers of the elbow in order of their appearance.

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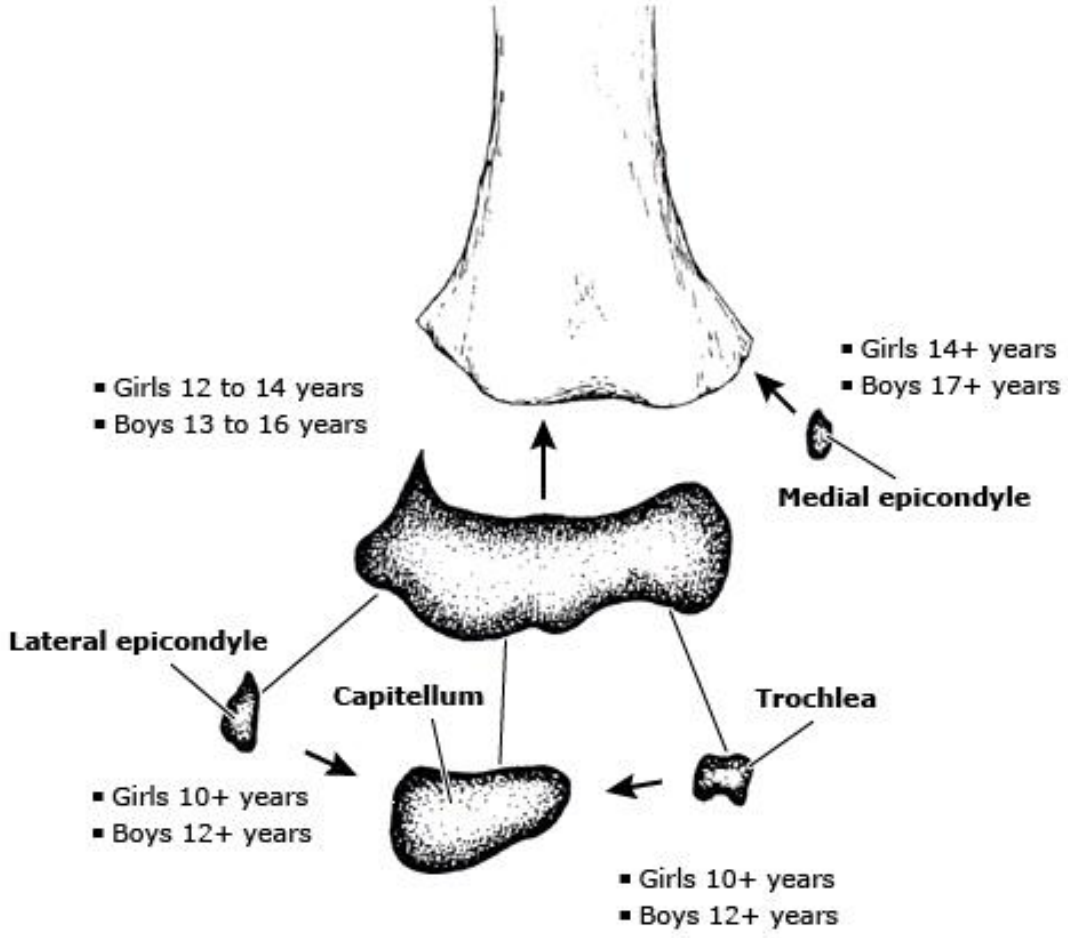
Elbow Fusion



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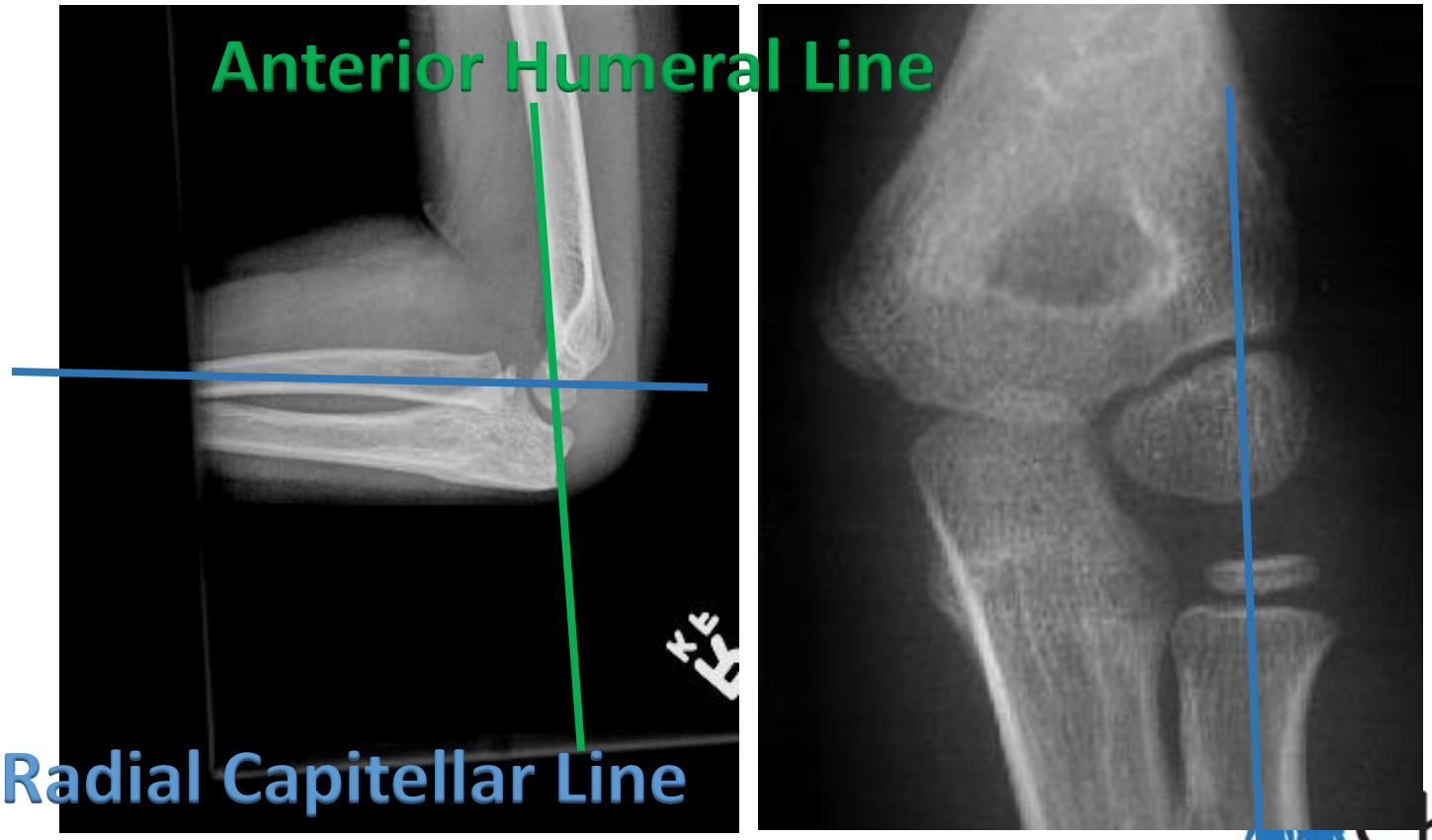
Normal Elbow Lines



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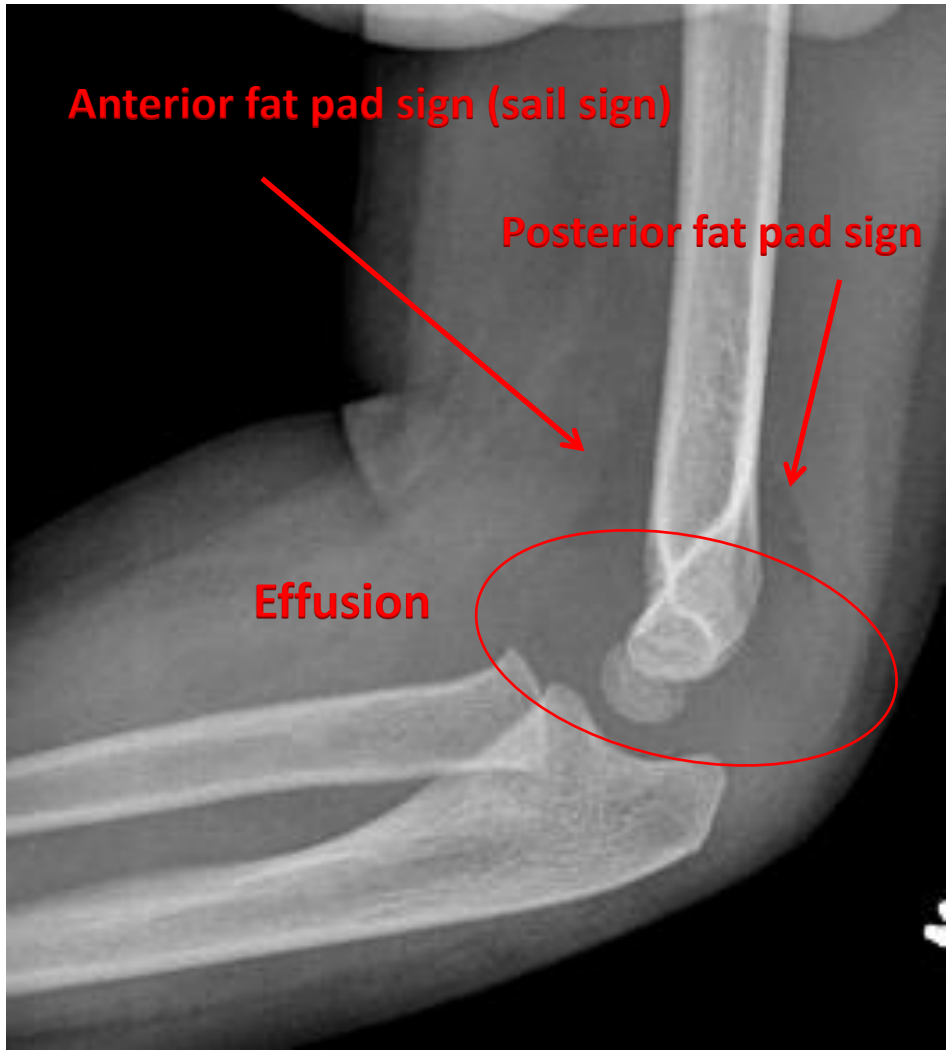
Elbow Joint Effusion



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Elbow Exam

- Inspection/Observation
- Palpation
- Range of Motion/Strength
- Special tests

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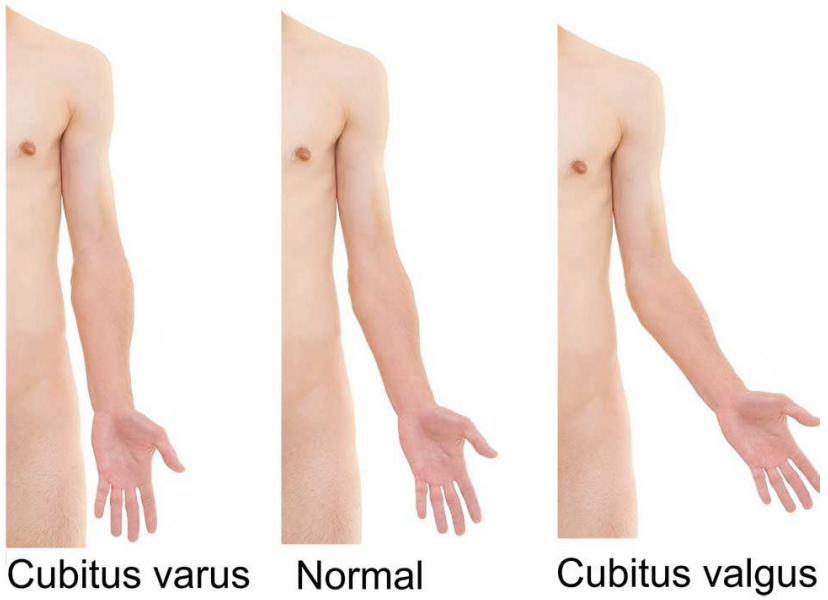
Inspection/Observation/Palpation

- Symmetry, carrying angle
- Swelling, deformity, skin abnormality, discoloration
- Bony tenderness



https://www.healthline.com/health/cubitus-valgus

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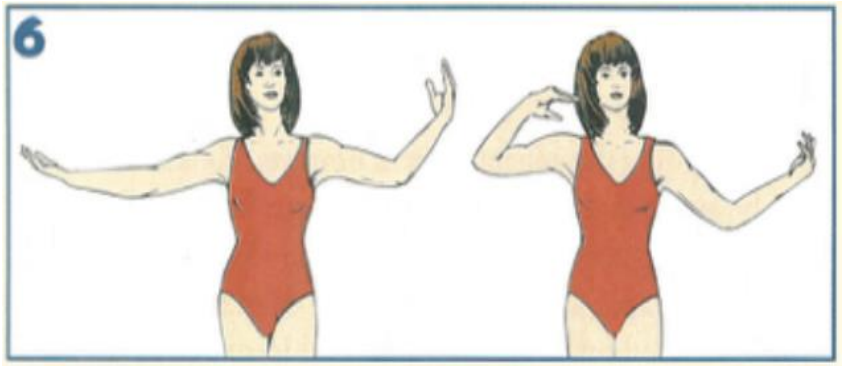
Range of Motion / Strength

- Extension: 0 to -10 degrees
- Flexion: 150 degrees
- Pronation: 70 degrees
- Supination: 85 degrees
- Wrist and hand motor
  - “OK” sign checks for normal motor function



From AAP PPE 5th Ed.

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Special Tests

- Instability
  - Valgus stress test
  - Varus stress test
  - Milking maneuver
- Epicondylitis/ apophysits testing
- Ulnar nerve
  - Tinel’s test
  - Snapping/subluxation
- Biceps
  - Hook test

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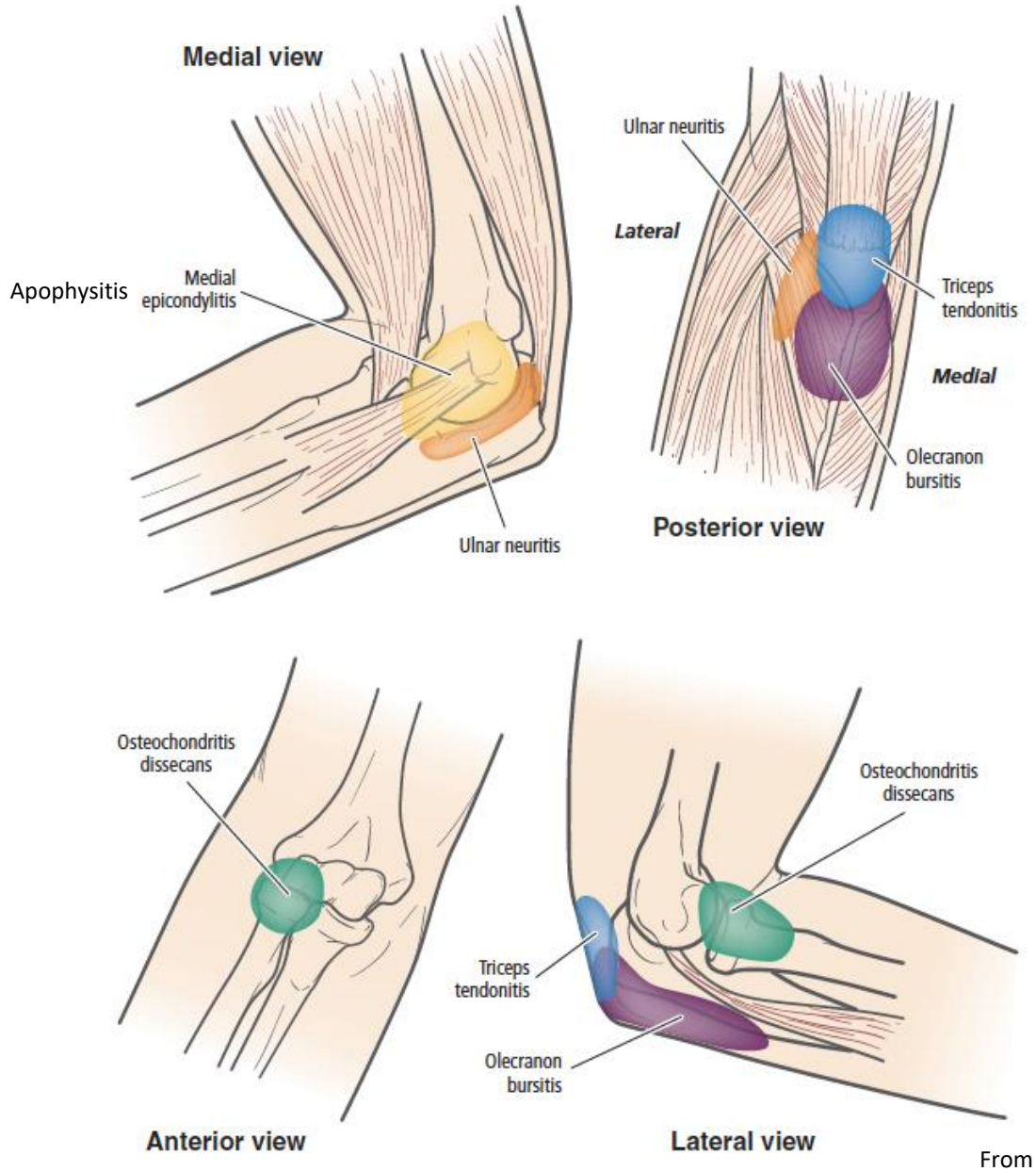
Elbow and Forearm



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13 yo baseball pitcher with R medial elbow pain

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Little League Elbow

- Medial epicondyle apophysitis– humeral origin of the ulnar collateral ligament
- Age 8-15 yrs
- Pitchers, catchers, infielders
- Medial elbow pain with throwing (late cocking, early acceleration phase)
- Tenderness of the medial epicondyle, pain w/valgus stress, resistance
- X-rays: normal or widened apophysis, sclerosis, irregularity
- Management
  - Rest from intense throwing and pitching for 2-3 months and normalization of x-rays
  - PT to correct biomechanical errors, strengthen scapular stabilizers, improve core/LE strength
  - Gradual return to throwing program
  - Adhere to pitch counts
  - Rest from intense throwing/pitching 2-3 months/year

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Osteochondritis Dissecans (OCD) of the Humerus

- Subchondral bone with articular cartilage separates from the surrounding bone (vascular and/or traumatic)
- Due to compressive forces
  - Baseball/softball, gymnasts, cheer, wrestling
- Typically progresses to loose body formation
- Restrict from UE activity and refer to ortho surgery
- Advanced imaging helpful to for surgical planning

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Needs Further Evaluation

- Emergent
  - Severe swelling or deformity
  - Neurovascular compromise
  - Severe pain
  - Fever
- Urgent
  - Joint effusion
  - Bony tenderness
  - Diminished ROM
  - Persistent weakness or pain with daily activity

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RECOVERY

TAKING 1 MONTH OFF FROM A SPORT AT LEAST 3 TIMES PER YEAR ALLOWS FOR PHYSICAL AND PSYCHOLOGICAL RECOVERY

INJURY PREVENTION

HAVING AT LEAST 1 – 2 DAYS OFF PER WEEK FROM A SPORT CAN DECREASE THE CHANCE FOR INJURIES

PRIMARY FOCUS

LEARN LIFELONG PHYSICAL ACTIVITY SKILLS AND HAVE FUN

PLAY A VARIETY OF SPORTS

PARTICIPATING IN MULTIPLE SPORTS DECREASES THE CHANCE OF INJURIES, STRESS AND BURNOUT

SPECIALIZATION

DELAYING SPECIALIZING IN A SINGLE SPORT UNTIL LATE ADOLESCENCE MAY LEAD TO A HIGHER CHANCE OF ACCOMPLISHING ATHLETIC GOALS

EARLY DIVERSIFICATION & LATER SPECIALIZATION

PROVIDES A GREATER CHANCE OF LIFETIME SPORTS INVOLVEMENT, LIFETIME PHYSICAL FITNESS AND POSSIBLY ELITE PARTICIPATION

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From Brenner J. Pediatrics 2016

Summary

- High rates of injuries, many (50%) overuse
- Adolescent athletes are different that adult athletes
  - Consider growth and development related conditions first over tendinous and ligamentous injury
- Remember the opposite side during the exam and radiographs
- Strength and mechanics of the shoulder/scapula crucial to rehab of the overhead athlete
- Prevention is best by limiting yearly exposure (a few months off if possible)

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References/Further Reading

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