1 Shoulder & Elbow OITE Review
   Key Anatomy Points Commonly Tested
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2 Brachial Plexus
   • Review anatomy of brachial plexus immediately before exam
   • Cords are named for anatomic relationship to axillary artery

3 Axillary Nerve
   • Terminal branch of posterior cord
   • Traverses the inferior border of subscapularis
   • Passes through the quadrilateral space
   • Anterior branch innervates teres minor, gives rise to upper lateral cutaneous nerve of arm
   • Posterior branch innervates deltoid from posterior to anterior

4 Suprascapular Nerve
   • Arises from superior trunk
   • Passes through superior scapular notch, under transverse scapular ligament
   • Innervates the supraspinatus
   • Transverses the spinoglenoid notch beneath scapular spine
   • Innervates the infraspinatus

5 Humeral Head Vascularity
   • In 1990, ascending branch anterior humeral circumflex artery thought to account for majority of blood flow to humeral head
   • In 2010, posterior humeral circumflex artery found to be primary source of blood flow

6 Quantitative Assessment of the Vascularity of the Proximal Part of the Humerus
   Hettrich et al., JBJS 2010; 92A: 943–48
   • 24 fresh frozen cadaver shoulders
   • Gadolinium injected into axillary artery after ligation of either anterior or posterior humeral circumflex artery
   • MRI volumetric analysis of gadolinium uptake
   • Posterior humeral circumflex artery accounts for 64% humeral head blood flow while anterior humeral circumflex artery accounts for 36% flow
   • Cadaver study (HSS, New York)

7 Thoracoacromial Artery
   • Clavicular, pectoral, deltoid and acromial branches
   • Acromial branch may bleed during acromioplasty

8 Quadrilateral Space
   • Superior boundary – teres minor
   • Inferior boundary – teres major
   • Medial boundary – long head of triceps
   • Lateral boundary – humeral neck
   • Transmits – axillary nerve, posterior humeral circumflex artery

9 Triangular Space
   • Superior border – teres major
   • Medial border – long head of triceps
• Lateral border – lateral head triceps, humeral shaft
• Transmits – radial nerve, profunda brachii artery

10 Triangular Interval
• Superior boundary – teres minor
• Inferior boundary – teres major
• Lateral boundary – long head of triceps
• Transmits – circumflex scapular artery

11 Cadaver Shoulder Selective Ligament Sectioning Studies
• SGHL restrains inferior translation w/arm adducted
• MGHL restrains anterior translation w/arm 45° abducted
• Anterior band IGHL restrains anterior translation w/arm 90° abducted–ER
• Posterior band IGHL restrains posterior translation w/flexion–IR

12 Deltopectoral Approach – Superficial Dissection
• Deltoid is innervated by axillary nerve
• Pectoralis major is innervated by medial & lateral pectoral nerves
• Landmark for interval is cephalic vein (taken with deltoid)

13 Deltopectoral Approach – Deep Dissection
• Key landmark is long head biceps in bicipital groove
• Medial landmark is conjoined tendon
• Subscapularis management – (1) vertical tenotomy, (2) take-down from lesser tuberosity, (3) horizontal split or (4) lesser tuberosity osteotomy

14 Subscapularis Anatomy
• Largest, strongest rotator cuff muscle
• Contributes 50% total rotator cuff force
• Strong internal rotator
• Dynamic anterior stabilizer
• Dual innervation – upper & lower subscapularis nerves which are branches of posterior cord

15 Bony Anatomy of Subscapularis Footprint
• Lesser tuberosity insertion of subscapularis
• Large trapezoidal footprint is 16–18 mm in medial–to–lateral dimension, 25 mm in superior–to–inferior dimension
• 60% tendon attaches to wide superior one-third of footprint

16 Upper Subscapularis Stabilizes Long Head of Biceps
• Long head biceps subluxation implies rupture of the SGHL
• LHB subluxation implies subscapularis tendon tear

17 Deltoid–Splitting Approach to Shoulder
• Minimally invasive, not extensile
• Axillary nerve at risk an average of 5–7 cm inferior to lateral acromion
• Deltoid origin take-down necessary to enhance exposure

18 Posterior Approach to Shoulder
• Deltoid released from scapular spine
• Interval between infraspinatus superiorly, teres minor inferiorly
• At risk are axillary nerve, suprascapular nerve

19 Distal Biceps Insertion Anatomy at Radial Tuberosity
• Long head biceps has large oval insertion proximally
• Short head biceps has very small band insertion distally
20 Distal Biceps Insertion
- Posteroulnar aspect of radial tuberosity
- Semilunar or type I insertions accounts for 80%
- Oval or type II insertions accounts for 20%

21 Distal Biceps Potential Mechanisms of Rupture: Arterial Supply, Mechanical Impingement
Seiler et al., JSES 1995; 4: 149–56
- Proximal one-third distal biceps tendon supplied by brachial artery
- Distal one-third supplied by posterior interosseous recurrent artery
- 2–cm middle-third is a hypovascular zone where blood supply is from paratenon
- Radioulnar interval for tendon is 48% less in pronation than in supination

22 Bicipital Aponeurosis (Lacertus Fibrosis)
- Develops biceps, volar forearm muscles
- Static, lacertus stabilizes the biceps
- As forearm muscles contract, biceps is pulled medially
- Leading edge may compress median nerve (lacertus syndrome)

23 Lateral Antebrachial Cutaneous Nerve
- Continuation of the musculocutaneous nerve
- Provides sensation to volar radial forearm
- At risk during anterior approach for distal biceps reattachment

24 Triceps Insertion Anatomy
- Lateral triceps tendon continuous with anconeus expansion
- Triceps tendon has thickened medial edge
- Major portion of insertion is dome-shaped area at olecanon process

25 Lateral Epicondylisis – Anatomy & Histology
- ECRB most commonly affected tendon
- EDC is involved in 35–50% patients
- No acute inflammation, rather angiofibroblastic tendinosis

26 Lateral Elbow Stability
- Lateral ulnar collateral ligament (LUCL) is primary stabilizer to varus stress
- Proximal or humeral attachment is at lateral epicondyle
- Distal or ulnar attachment is at crista supinatoris
- Annular ligament tightens in supination

27 Kocher Approach to Lateral Eblow
- Interval is between anconeus and ECU
- Dissection must be anterior to lateral epicondyle to avoid disrupting LUCL

28 Cubital Tunnel Syndrome
- Ulnar nerve compression at the elbow may be caused by Osborne's ligament or anconeus epitrochlearis
- Medial antebrachial cutaneous nerve is at risk during medial approach to ulnar nerve

29 Medial Elbow Stability
- Anterior band MCL primary stabilizer to valgus stress
- Proximal or humeral attachment at medial epicondylar ridge
- Distal or ulnar attachment at sublime tubercle of anteromedial coronoid facet
• Radial head is secondary elbow stabilizer

30 Medial Approach to Elbow
• For coronoid fractures, approach depends on size of coronoid fragment
• For small fragments, the “over the top” approach is between palmaris longus and FCU
• For medium-sized fragments, approach is through the FCU heads
• For large coronoid base fractures, approach may be posterior to the FCU along subcutaneous border of ulna
• Ulnar nerve must be identified and protected during these approaches