US Evaluation of Biceps Tendon

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Outline

• Function
  – Biomechanics

• Anatomy
  – Biceps Short head
  – Biceps Long head
  – Interval/Pulley
  – Distal

• Pathology
Biceps Brachii Function

- Biarticular muscle spanning shoulder and elbow
- Innervated by Musculocutaneous N
- Movement of Limb
  - Flexes shoulder elbow
  - Supinates elbow
  - Decelerates shoulder extension and elbow pronation
  - Can abduct shoulder with arm externally rotated
- Stabilizer?
Basic Anatomy-Proximal

- Two heads
  - Short head from coracoid
  - Long head from supraglenoid tubercle and superior labrum
  - Intertubercular groove
  - Intertubercular synovial sheath is diverticulum of joint
  - Portion LHB fibrocartilaginous facilitates gliding
Long Head Variability

- 9-23% pop variable heads
- Head can bifurcate shortly after its origin
- Also can have fascicles originating off humeral head directly
  - 37% of Colombians, 12% Africans
- Fascicles can also come off tuberosity and capsule
Short Head Biceps (SHB)

- Little research
- Origin from coracoid
- Close proximity to coracobrachialis
- More of an aponeurosis than true tendon (some muscle fiber but no synovial sheath)
- Straight course
- Rarely injured
Scanning of SHB

- Begin transverse
- Linear array
- Start at coracoid
- Follow down
- Relationship with coracobrachialis
Proximal Long Head Biceps (LHB)

- IA and EA component
- Ant Circumflex A- Articular portion
- Angled posteriorly
- Tapers more distally
- Distal avascular and fibrocartilaginous
  - Accommodates its sliding motion
Proximal LHB

• LHB 5-6 mm in diameter and 9 cm in length

• Size varies-
  – IA portion is elliptical
  – EA portion is both rounder and smaller

• 30° to 40° turn exits the joint (can displace with ER)

• Requires stabilization of the tendon by a **Pulley Sling of Rotator Interval**
LHB Transverse

- Palm Face Up/Neutral rotation
- Tuberosities and sulcus (groove)
- Fibrillar Hyperechoic
- Avoid anisotropy
  - Rock or tilt
- Proximal=Oval/crescent
- Distal-tapers
- Follow to Pect M Tendon
- Doppler-Artery lateral side
- Some fluid distally (not encircling)
- THL-Controversial/weak stabilizer
Scanning Long Head Biceps Transverse
Scanning Long Head Biceps

- Switch to longitudinal
- May need to heel toe
- Scan tuberosity to tuberosity
- Helps to confirm integrity
Pathology Biceps

- Tenosynovitis
- Tendinopathy
- Rupture
- Instability
Tenosynovitis

• Not all fluid is synovitis
• Fluid surrounding tendon
  – Disproportionate to joint
• Normal tendon
• Hyperemia
• Distinguish from Bursa

Compliments Dr Jay Smith
Tendinopathy

- Most common proximally
- Associated with cuff pathology
  - Biceps becomes stabilizer
- Narrow sulcus, bony irregularities
- +/- Fluid
- Hypertrophied/swollen
- Mixed echo (hyper/hypo)
- May get splits
Ruptures LHB Tears

- Most common >50
- 96% of all injuries
- Little or no trauma
  - Cuff lesions
- Popeye sign
- Don’t be fooled by thickened synovium
- Can be tricky
  - Go to pect tendon
- Check muscle echotexture
Use of US to Detect Biceps Pathology

- 71 patients were prospectively evaluated US to arthroscopy
- Ultrasound showed a 100% specificity and 96% sensitivity for subluxation or dislocation.
- Ultrasound detected all complete ruptures of the LHB
- Detected none of the 23 partial-thickness tears.
- Overall, ultrasound diagnosed 35 of 36 normal biceps tendons (specificity, 97%) and 17 of 35 abnormal biceps tendons (sensitivity, 49%).
- Ultrasound can reliably diagnose complete rupture, subluxation, or dislocation of the biceps tendon. It is not reliable for detecting intra-articular partial-thickness tears.

Instability-Understanding Restraints

SAFETY
At least he's not in the front seat.
Anatomy of Interval

- Separation of the supra and subscap
- Traversed by LHB tendon
- Superiorly supraspinatus
- The base of triangle is at coracoid
- Has Coracohumeral and Superior Glenohumeral Ligament restrains Biceps tendon
Coracohumeral Ligament (CHL)

- CHL has medial and lateral bands
- Blends with Subscap and Supraspinatus respectively
Superior Glenohumeral Ligament (SGHL)

- The SGHL more of a thickening in capsule
- Supraglenoid tubercle
- U-shaped sling crosses under CHL and the biceps tendon
Reflection Pulley

- SGHL blends with medial CHL=Reflection Pulley
- Inserts onto lesser tuberosity (fovea capitis)
- Stabilizes biceps
- Prevents medial subluxation
- Utilize Dynamic Scanning
- MR Arthrography
Pulley Injuries

- Predisposition with shallow sulcus, congenital interval defect, or prominent lesser tuberosity
- Associated with cuff pathology
  - Especially subscapularis
- Subluxing biceps
  - US utility here
- If missed cause post op failure
  - “The Hidden lesion”
Classifications-2 exist

Bennett Classification
Habermeyer
Scanning Interval and Pulley

- Tricks
- Optimize Interval
- Look medially for distinct structure
Distal Biceps Tendon

NO GYM REQUIRED
Lacertus Fibrosis

- Attaches to short head
- Difficult to identify on US
- Clinical relevance
  - Prevents retraction short head
Distal Tendon-Anterior Scanning

- Use high frequency
- Muscle tapers to tendon
- Superficial to Brachialis and lateral to artery
- Try to rotate 90°
- Difficulty given obliquity
- Use either lateral or medial approach
Distal tendon-Lateral approach

- Position 90°
- Place transducer in the coronal plane on the lateral aspect radius
- Basically parallel to the biceps tendon
- Advantage avoids anisoptropy
- Can do pronation supination
Distal tendon-Lateral approach

- Disadvantages
- Some refractive shadowing from supinator
- Some distal fibers obscured by the radius
Medial or Pronator Window

- Elbow at 90°
- Transducer placed parallel to the humeral shaft
- Slide transducer down then anteriorly
- Advantage has artery superficial which enhances visualization
- Avoids anisotropy
Pronator Window
Distal Biceps
Distal Biceps Transverse

- Best to identify both heads
- Long head larger
  - LH 7.2 mm² and SH 5.6 mm²
- Short head flatter
- AT MT jxn SH medial to LH
- Use pronation/supination to separate
- More distally
  - SH becomes more superficial and long goes deeper
- These can slide independent of one another
Distal Biceps Pathology

- Tears
  - Complete
  - Partial
- Tendinosis
- Bursitis
Distal Biceps Tear

- Usually at Tuberosity
- More commonly complete
- Men over age 40
- Proximal Popeye’s
- Risk Factors
  - Areas of relative hypovascularity
  - Mechanical impingement at tuberosity
  - Eccentric injury
Distal Complete Biceps tear

- Hypovascular area 1 cm prox
- Gap seen
- Fluid/hemorrhage-hypo fluid
- Posterior acoustic shadowing tendon stumps
- Waviness
- Long head tear retract
- Short head doesn’t because lacertus fibrosis
Distal complete tear
Tendinopathy vs Partial tears

- May be difficult to differentiate
- Thinning or thickening of the tendon
- Focal areas of hypoechogenicity and irregularity
- Associated with fluid in bursa
Distal Partial Tear

Partial Long tear
Distal Biceps Pitfalls

• Anisotropy-Use different approaches
• If chronic
  – Lack of fluid, more organized hyperechoic hematoma or scar tissue formation may simulate tendon integrity
• Use dynamic imaging to see if fibers intact
• MRI may be needed
Bicipitoradial Bursa

- Bursa surrounds the distal biceps tendon
- Normally not visualized
- Reduces friction
- Normally flattened
- Lined by synovium
- RA, infection, Partial tear, osteochondromatosis
- Radial N compression more common than median nerve
Summary

• US very useful for imaging biceps tendon
• For subluxed biceps suspect pulley/cuff pathology (Use Dynamic Imaging)
• Use various approaches for distal biceps
• Use long view to detect retraction
• Transverse view to discern heads


Lee et al Bilateral asymmetric supernumerary heads of biceps brachii Anat cell Bio 2011:44;238-40

Bibliography

- Bianchi Martinoli US of the Musculoskeletal System. The Shoulder Springer New York Pg 189