SLAP LESIONS, ROTATOR CUFF TEARS, AND INTERNAL IMPINGEMENT IN ATHLETES
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Anil Dutta, MD
Associate Professor
UTHSCSA Orthopaedics

Disclosure

• I have no relevant financial disclosures.

SLAP AND RCT IN ATHLETES

• LEARNING OBJECTIVES:
  • Understand the acute traumatic and repetitive overuse causes for SLAP and RCT in athletes
  • Review anatomy, diagnostic exam, and imaging
  • Understand the concept of Internal Impingement
  • Understand how Internal Impingement relates to SLAP tears and partial rotator cuff tears in athletes
  • Understand the sport specific issues for treatment and prognosis
  • Discuss current state of treatment (nonsurgical and surgical) for both conditions.

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• I HATE THIS TOPIC!

Rotator Cuff Function

• Dynamic Stabilizer of the Shoulder
• Force Coupler

Acromion Morphology

• Type I: Flat
• Type II: Curved
• Type III: Hooked
• 70% of Shoulders with tears had a hooked acromion

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CLASSICAL EXTERNAL IMPINGEMENT (NEER):

Stages
- NEER divided rotator cuff disease into 3 classical stages related to life cycle:
  - Stage I: subacromial edema and hemorrhage (< 25 years)
  - Stage II: Tendinosis Fibrosis (25-40)
  - Stage III: Cuff Failure (>40)

Causes: External Impingement
- CA Ligament
- Subacromial Spurs
- AC Joint Osteophytes

ROTATOR CUFF REPAIR
- OPEN
- MINI-OPEN
- ALL ARTHROSCOPIC

INTERNAL IMPINGEMENT

- Overhead sports (Late Cocking), Early Acceleration
  - Baseball
  - Volleyball
  - Swimming
  - Water Polo
  - Javelin
  - Tennis

Microinstability
Microtrauma

- Hyperangulation
- Abd (coronal) / Max ER
- Strain anterior capsule
- Anterior subluxation
- Loss of max. congruence
- Internal impingement
- SLAP tear - peel back

INTERNAL IMPINGEMENT

- Posterosuperior pain
- Follow through
- Late cocking
- Dead arm (heaviness w/o neurologic)
- Asynchronous ROM (ER vs. IR)
- Posterior capsular tightness
- Obligatory anterior translation
- PI tether causing PS rolling of humeral head
- GIRD: Glenohumeral Internal Rotation Deficit

The Usual Suspects

- INTERNAL IMPINGEMENT
- SLAP TEARS (PEEL BACK LESION)
- BICEPS DISEASE
- ANTERIOR MICROINSTABILITY
- POSTERIOR CAPSULAR TIGHTNESS
- (GIRD)
- TENSILE FAILURE OF THE ROTATOR CUFF (PTRCT)
- SCAPULAR DYSKINESIA (SICK SCAPULA SYNDROME)

SLAP TEAR: Type II

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SLAP TEARS

- CLASSIFICATION
  - TYPE I: Fraying: debride
  - TYPE II: Detached: repair
  - TYPE III: Bucket Handle Tear: debride
  - TYPE IV: Bucket Handle with involvement of biceps: biceps tenodesis

CLASSIFICATION

- TYPE I: Fraying: debride
- TYPE II: Detached: repair

Variations: Maffet (AJSM 95)

- TYPE V: Bankart to SLAP
- TYPE VI: Unstable flap with detachment of biceps
- TYPE VII: Biceps anchor separation with extension anteriorly into middle glenohumeral ligament

SLAP II Subtypes: Morgan and Burkhart

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TYPE II SLAP

SLAP with Global Labral Tear

ROTATOR CUFF TEARS IN ATHLETES: Key issues

What causes the Tear?

Sources
- Degeneration with age/use: In many cases it is WEAR and not TEAR. The tendon is degenerating and it has to be stimulated to regenerate (area of research)
- Acute Trauma (Shoulder dislocations or direct blows)
- Scapulothoracic Dysfunction
- Inflammatory Disease: Underlying systemic disease like Rheumatoid Arthritis.
- Underlying instability

ATHLETES
- In athletes it can be any of these factors or a combination. In athletes special focus is on
  - INSTABILITY (INTERNAL IMPINGEMENT)
  - ACUTE TRAUMA

SHOULDER IMPINGEMENT SYNDROME IN ATHLETES TREATED BY AN ANTERIOR ACROMIOPLASTY

89% Better subjectively but only 43% return to preinjury level of play.

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What causes the Tear: Blood Supply Deficiency

Blood Supply
• Anterior circumflex humeral
• Posterior circumflex humeral
• Suprascapular artery
• Thoracromial arch
• 3 vascular sources: Muscular, osseous, direct tendinous
• Watershed zone (1cm proximal to cuff insertion) (Codman)
• Hypervascularity?

CLINICAL EVALUATION: Keys
• Elicit history of Acute Trauma (Not always recalled)
• Record time frame, modifying factors, treatments
• Look for Instability on exam
• Look for Asymmetry (strength and ROM)
• Remember Scapular dysfunction

CLINICAL EVALUATION: SLAP AND RCT IN ATHLETES

History
• Anterolateral shoulder pain with radiation
• Weakness
• Worse with use-overhead
• Night pain/dependency
• Dead Arms symptoms/parasthesias
• Loss of control/velocity

Exam
• Strength and ROM (GIRD)
• Impingement Sign/Test
• Hawkins, Jobe
• O’Brien’s, Speed’s, Yergason
• Apprehension/Relocation/Jerk
• Anterior and Posterior Shift and Load
• Sulcus/Scapula Winging

IMAGING: MRI ARTHROGRAM

MRI: Full thickness RC tear

TYPE 2 SLAP
Type 2 SLAP and RCT

MANAGEMENT: Non-operative Treatment
- Non-operative management: team approach
- Coaches, trainers, therapists, parents, patient
- Rehabilitation program
- Expectations defined early

Rehabilitation Non-Operative
- 1 Improve Mechanics
- 2 Improve GIRD (posterior stretching)
- 3 Shoulder stabilization: emphasis on Subscapularis and infraspinatus strengthening
- 4 Scapular symmetry and correct dyskinesia
- 5 Rest (limit play and practice)
- 6 NSAIDS pm (avoid excessive or prolonged usage)
- 7 Injections (very limited role but for end of season or critical point in season a consideration)

Rotator Cuff Treatment in Throwers
- Tibone JBJS 86: Full Thickness Repair 50% RTP at PI level in 45 athletes
- Tibone CORR 85: SAD 43% RTP and 4/18 pitchers to PI status

Rotator Cuff Treatment in Throwers
- Reynolds, Andrews CORR 08: Debridements 76% RTP (at professional level), but 55% at same or higher level
- Payne et al (HSS) AJSM 97: Debridements: 2 groups. Trauma and insidious onset: Trauma Group 86% and 64% RTP but Group 2 66% sat and 45% RTP

Repair of PASTA
Conway Op Tech Sports Med 92
PASTA Repair

Rotator Cuff Treatment in Throwers: Repair
- Mazoue, Andrew 8% AJSM 06 (1/12 pitchers) RTP, 3/4 position players RTP
- Van Kleunen, Savoie (AJSM 12): 6/17 pts return to throwing. These patients had SLAP repair, posterior release, IS repair

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Anterior Stabilization in Throwers
- Jobe AJSM: 18/25 return to competition in throwers using open ACLR

• Habermeyer 21/21 AJSM 08 RTP Overhead athletes (European) even with 25% re-tear rate.
Anterior Capsulolabral Reconstruction
- The capsule is plicated
- Shift the inferior capsule flap proximally
- Shift the superior capsule flap distally

Jobe ACLR

Thermal Capsulorrapy
- Levitz (Andrews) Arthroscopy 2001: Heat probe 90% return to competition compared to 70% without heat probe (HP)
- Multiple reports of chondrolysis
- Poor results in many series for instability
- Risk for complete capsular necrosis

SLAP Repair in Throwers
- Brockmeier (HSS) JSES 09: 74% return to competition in throwers, 92% in athletes with trauma
- Pagnani (HSS) Arthroscopy 95: 12/13 overhead athletes returned to play (used simple tacks)
- Van Kleunen, Savoie (AJSM 12): 6/17 pts return to throwing. These patients had SLAP repair, posterior release, IS repair
- Morgan Ortho Clin NA2001: 46/53 overhead athletes RTP
- Sayd CORR ’12: Systematic Review Athletes: 83 G/E, 73% RTP, 63% overhead throwers RTP at same level
- Kim JBJS Q2: poorer results in throwers
- Field and Savoie ajsm 93: All Athletes RTP

SLAP BIOMECHANICS
- Rodosky AJSM 94: Cadaveric study Increase in Anterior Translation with SLAP
- CORR 89: Cadavers 15 Proximal Migration of humeral head with Biceps Tenotomy
- Panossian JSES 04 – Repairing SLAP restores anterior stability
- Mihata, Tibone AJSM 08: SLAP and anterior capsule laxity model in cadavers. Repairing SLAP doesn’t restore stability in ABER.
- Youm, Tibone, ElAttrache AJSM 08: Simulated SLAP doesn’t change kinematics

TYPE VIII SLAP / Post Labral
- Seroyer AJSM: Type VIII 13 pts ALL RTP, 63% at prior level. (rec and high school athletes)
- Radkowski AJSM 08: Posterior Labral Repairs in Throwers, retrospective 23 throwers 89% G/E but 55% RTP at PL

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**TYPE VIII SLAP**

**RCR and SLAP: Normal People**
- Alpert AJSM 10: Age > 40 no effect of SLAP repair
- Forsythe JBJS 11: Cohort study: SLAP and RCR => than RCR only

**RCR and SLAP: Normal People**
- Kim AJSM 12: Cuff repair with tenotomy better than cuff repair with SLAP repair
- Franceschi AJSM 08: (level I study): Results better with biceps tenotomy and RCR than with SLAP repair and RCR
- Boileau: RCR better with biceps tenotomy or tenodesis
- Kameteli Act Orthop Tr Surg: Good results with isolated SLAP repairs after 45 but results go down when you add RCR Abbot AJSM 09: Level 2 study Repair of RCR with SLAP debridement better than RCR with SLAP repair
- Oh JSES 2011: Results of RCR and SLAP not affected by unhealed SLAP
- Voos Warren (HSS): AJSM 07 Combined labral and scope repair 77% RTP but Bankart with RCR better than SLAP and RCR.

**RUGBY**
- Tambe Int J SH Surg: return to play in all 11 players with rotator cuff repair.
- Goldberg Br J Sports Med: 6/6 with RCR return to play

**U.S. CONTACT Athletes:**
**Football**
- Blevins (HSS) AJSM 96: 9/10 RTP in football and 7/10 at pre-injury level

**Golfers**
- Vives Arthroscopy 2001: 26/29 Golfers did well with RCR +/- SAD.
Golfers

- Vives Arthroscopy 2001: 26/29 Golfers did well with RCR +/- SAD.
- But Recovery is not 100%

TENNIS

- Sonnery-Cottet, Walch AJSM 02: 80% Middle Aged Tennis players do well with RCR and return to play
- Bigliani AJSM 92: 83% Good with RTP pre-injury, 13% (massive tears) RTP lower.

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Adolescents with RCR

- Subscapularis Tears can occur
- Can occur with instability episodes, avulsions
MRI Findings in Asymptomatic Throwers
- Halbrecht Arthroscopy 99: 7/10 abnormalities c/w internal impingement
- Miniaci AJSM 02: 79% Abnormalities
- Connor AJSM 03: 40% cuff tear c/w internal impingement

SUMMARY
- If you’re a pitcher or you’re dead you’re screwed
- If you’re normal or a regular athlete you have hope

BLACK BOX
- What Happened to Anterior Stabilization?
- What would happen if pitchers are treated like normal people?
- What if Type II SLAPs are all Type VIII SLAPs?
- Where are the articles on converting TYPE II SLAP repairs to biceps tenotomy/tenodesis?

THANK YOU

Clinical
Surgery: Techniques

- Rotator Cuff Debridement/Decompression
- Rotator Cuff Repairs
- SLAP debridement
- SLAP repair
- Anterior Stabilization /Posterior Capsule Release
- Biceps Tenotomy/Tenodesis

SLAP Tears

- Superior Labrum from anterior to posterior

SLAP Tears

- Classification
  - Type I: Fraying: debride
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Variations

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SLAP Tears

- Fall on abducted flexed arm or adducted arm
- Throwers in wind- up or follow through
- O'Briens test
- MRI Arthrogram
- Associated pathology (cuff tears, other labral tears, instability)
SLAP TEARS

• A: Part of the Instability Spectrum
• B: Thrower’s Shoulder
• Beware the degenerative SLAP repair

Ellman Classification

• A: articular side
  1: < 3mm deep
• B: bursal
  2: 3-6mm deep
• C: interstitial
  3: > 6mm deep

SNYDER CLASSIFICATION

• A: Articular
• B: Bursal
• C: Complete
  • 0: Normal cuff
  • I: Minimal, superficial bursal or synovial slight fraying < 1cm
  • II: Fraying or failure of fibers < 2cm
  • III: whole surface of tendon: < 3cm
  • IV: flap tear, whole tendon and possibly a second

Strategy for treatment

• > 6mm or 50% of cuff insertion
• 30 – 40 % bursal surface intact, PASTA type repair, less than 30 % intact than complete and repair.
• Athletes: 75% is threshold for repair

Incidence

• Yamanaka/Fukuda: 30% cuff tears > 40
• DePalma, Uhthoff: 32% > 59

• Yamanaka/Fukuda Cadaver study
  • 249 cadavers:
    • 55 interstitial
    • 18 bursal
    • 27 articular
Asymptomatic Tears

• 15% FT
• 20% PT
• But if > 60 years of age
• 28FT
• 26PT

Natural History

• Yamanka
• 40 Tears: evaluated one year later
• 8 better
• 21 larger
• 11 progressed to full thickness

CLINICAL RESULTS: DEBRIDEMENT

• Itoi: 82% satisfied with debridement
• Andrews: 36 pts 85% satisfied with debridement
• Ogilive-Harris: 50% better with debridement

REPAIR

• Yamaguchi: 88% healed and 93% satisfied after 1 year.

• ATHLETES:
  • Tibone 60% return to play
  • 40% with difficulty
  • Andrews: 16 athletes only 1 of 12 pitchers returned to play

WHEN TO FIX

• 6mm undersurface tear (footprint 12mm)
• 30-40% thickness symptomatic
• 75% in athletes

• COMPLETE TEAR for bursal and interstitial
• RETAIN BURSAL FIBERS for Articular
Anatomy

- Shoulder is really 4 articulations

Anatomy

- Muscles
  - Periscapular Muscles.
    - Trapezius
      - Spinal Accessory Nerve
    - Rhomboids
    - Dorsal Scapular Nerve
    - Latissimus Dorsi
    - Thoracodorsal Nerve
    - Serratus Anterior
    - Long Thoracic
    - Levator Scapula
    - C3-5, Dorsal Scapular Nerve.

Anatomy

- Muscles
  - Rotator Cuff.
    - Subscapularis
      - Upper and lower subscapular nerve
    - Supraspinatus
    - Infraspinatus
    - Suprascual Nerve
    - Teres Minor
    - Axillary Nerve.

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MASSIVE CUFF TEAR

• Debridement
• Biceps Tenotomy
• Repair
• Muscle Transfers
• Hemiarthroplasty

Arthroplasty for Massive Cuff Tear

HEMiarthroplasty

• REVERSE TOTAL SHOULDER

Anteriorsuperior Migration

REDNECK INSTITUTE
AQUATIC THERAPY CENTER

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Postoperative Treatment

- PROM – Tissue Healing
- AROM – progressive around 6-8 weeks
- Strengthening
- Scapular mobilization and strengthening

Postoperative Treatment

- Massive Tears: Longer protection – as long as 10-12 weeks
- Abduction pillow?

Natural History

- Prevalence: 14% full thickness and 20% partial by MRI in asymptomatic
- Over 60: 28% and 26%

Exam

- Impingement

Exam

- Supraspinatus strength
- Biceps
- AC Testing

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Advanced Testing

- MRI
- CT Arthrogram (fatty degeneration)
- Arthrogram
- Ultrasound

Review: Anatomy of Cuff

- 5 layers:
  - Layer 1: superficial fibers (include C-H ligament-bursal surface)
  - Layer 2: Tendon fibers of SS and IS Parallel
  - Layer 3: smaller and oblique
  - Layer 4: deep extension of C-H ligament
  - Layer 5: joint capsule

Coracromial Arch

- Coracoid Process
- Coracromial Ligament
- Acromion
- Os Acromiale

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Open Repairs

- Neer:
  - Satisfactory or better in 92%
  - Excellent: 78%
- Cofield:
  - 79% satisfactory
  - 65% excellent

Mini-Open

- Levy: 80% satisfactory

All Arthroscopic

- Weber: all arthroscopic vs mini-open: after 6 weeks identical outcomes.
- 80-90% success rates
- Double Row Repairs
- Implant choices increasing