SLAP LESIONS, ROTATOR CUFF TEARS, AND INTERNAL IMPINGEMENT IN ATHLETES
UT SPORTS MEDICINE SYMPOSIUM 2013
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Financial Disclosure

• Dr. Anil K. Dutta has no relevant financial relationships with commercial interests to disclose.

• I HATE THIS TOPIC!

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.
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

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
Subacromial Decompression

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

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

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)
  - TENSIILE FAILURE OF THE ROTATOR CUFF (PTRCT)
  - SCAPULAR DYSKINESIA (SICK SCAPULA SYNDROME)
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
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CLASSIFICATION

- TYPE III: Bucket Handle Tear : debride
- TYPE IV: Bucket Handle with involvement of biceps : biceps tenodesis
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

- Type II SLAP

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SLAP with Global Labral Tear

SLAP REPAIR
Tokish JBJS 09, Mazzocca
AJSM 01

ROTATOR CUFF TEARS IN ATHLETES : Key issues

• Classical Subacromial Impingement vs Internal Impingement?
• Acute Trauma vs Chronic Repetitive Trauma?
• Thrower vs Other Overhead Athlete vs Non Overhead?
• Instability present or absent?
• Labral tear present and what kind?
• Posterior tightness?
Shoulder Impingement Syndrome in Athletes Treated by an Anterior Acromioplasty

JAMESE TIBONE, M.D., FRANK W. JOBE, M.D., ROBERT K. KERLAN, M.D., VINCENT S. CARTER, M.D., CLARENCE L. SHIELDS, M.D., STEPHEN J. LOMBARDI, M.D., AND LEWIS A. YOCUM, M.D.
CORR 1985

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

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

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

<table>
<thead>
<tr>
<th>History</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterolateral shoulder pain</td>
<td>Strength and ROM (GIRD)</td>
</tr>
<tr>
<td>Weakness</td>
<td>Impingement Sign/Test</td>
</tr>
<tr>
<td>Worse with use-overhead</td>
<td>Hawkins, Jobe</td>
</tr>
<tr>
<td>Night pain/dependency</td>
<td>O’Brien’s, Speed’s, Yergason</td>
</tr>
<tr>
<td>Dead Arms symptoms/parasthesias</td>
<td>Apprehension/Relocation/Jerk</td>
</tr>
<tr>
<td>Loss of control/velocity</td>
<td>Anterior and Posterior Shift and Load</td>
</tr>
<tr>
<td></td>
<td>Sulcus/Scapula Winging</td>
</tr>
</tbody>
</table>

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 prn (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 (AJSM 06) 8% of 1/12 pitchers RTP, 3/4 position players RTP.
- Van Kleunen, Savoie (AJSM 12): 6/17 return to throwing. These patients had SLAP repair, posterior release, IS repair.

- Habermeyer 21/21 RTP Overhead athletes (European) with 25% re-tear rate.
Rotator Cuff Treatment in Throwers: Repair
• Mazoue, Andrew, (2006) RTP, 3/4 position players
• Van Kleunen, (2012) RTP
These patients return to throwing. IS repair
• Habermeyer (2008) RTP Overhead athletes (European) even with 25% re-tear rate.

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

Anterior Capsulolabral Reconstruction
• the capsule is plicated
• Shift the inferior capsule flap proximally
• Shift the superior capsule flap distally

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Thermal Capsulorraphy

- 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 02: 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

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.
  • 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.
**TENNIS**

- Sonnery-Cottet, Walch AJSM 02: 80% Middle Aged Tennis players do well with RCR and return to play
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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

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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
MAGNAGEMENT OF PARTIAL THICKNESS ROTATOR CUFF TEARS

ANIL DUTTA, MD

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 reparation.
• 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
- Ogilve-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

THANK YOU
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.

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Anatomy

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

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Cuff Muscles
MASSIVE CUFF TEAR

- Debridement
- Biceps Tenotomy
- Repair
- Muscle Transfers
- Hemiarthroplasty

• Latissimus Transfer

Arthroplasty for Massive Cuff Tear

HEMIARTHROPLASTY

• REVERSE TOTAL SHOULDER

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Anterior superior Migration

REDNECK INSTITUTE
AQUATIC THERAPY CENTER

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

Exam

• Biceps
• AC Testing

Advanced Testing

• MRI
• CT Arthrogram (fatty degeneration)
• Arthrogram
• Ultrasound
Surgery

SUBACROMIAL DECOMPRESSION: CA Release

SUBACROMIAL DECOMPRESSION
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

Open Repairs

• Neer:
  • Satisfactory or better in 92%
  • Excellent: 78%
• Cofield:
  • 79% satisfactory
  • 65% excellent
Open Repairs

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