Current Management of Shoulder Injuries in the Overhead Athlete

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Disclosures

• Nothing to Disclose
• Patient videos, consent for educational use
• Smith and Nephew
  o Education Support, Arthroscopy Lab
Anatomy

Coracoacromial Ligament
Acromion
Clavicle
Supraspinatus
Infraspinatus
Tendon of Long Head of Biceps
Humerus
Torn Rotator Cuff
Acromion
Bursa
Coracoid process
Clavicle
Humerus
Humeral Footprint

- Thickness of Footprint
  - Supraspinatus Avg thickness 12-14 mm
  - Infraspinatus Avg thickness 13-15 mm
  - Subscapularis Avg thickness 17-19 mm
- Dugas et al 2002 JSES
Rotator Cuff Tears

- Rot cuff tear types
  - Partial Thickness
    - Articular sided (3x as common)
      - Supraspinatus (usually non-throwing athlete, older)
      - Infraspinatus (usually throwing athlete, younger)
    - Internal Impingement
  - Bursal sided
    - Full thickness
      - Intrinsic Factors
      - Extrinsic Factors
      - Traumatic
    - Full thickness retracted (massive)
Normal Cuff
Partial Thickness Tear
Full Thickness Tear
Traumatic Cuff Tear
Massive Cuff Tear
• Partial Thickness

  o Articular Side
    • Internal Impingement
    • Intrinsic Factors

  o Bursal Side
    • Outlet Impingement
    • Extrinsic Factors

• Full Thickness

  And/Or

• Or
Classification of Partial Thickness

- Ellman
  - Location of tear
    - Bursal
    - Articular
    - Intratendinous
  - Depth of tear
    - Grade I = <3mm (25%)
    - Grade II = 3-6mm (25-50%)
    - Grade III = >6mm (>50%)

- JBJS 2012  No evidence for 50% “Line in Sand”
Why?
Biomechanical?
1. Biomechanical Factors

- **Supraspinatus**
  - Articular side has half the strength of the bursal side
    - Nakijima et al 1994 JSES
    - Articular sided bundles less organized, thinner
    - Articular sided tears 3-5x more common than bursal
  
- Strain in the intact tendon fibers increases rapidly after 50% of tendon thickness lost
  - Yang et al 2009 JSES
2. Intrinsic Factors

- Vascularity
  - Funakoshi AJSM 2010
    - Contrast Enhanced Ultrasound showed a decrease in the articular side of the rotator cuff with increasing age, no difference on the bursal vascularity
  - Rathbun CORR 1990
    - Critical zone of hypovascularity near the insertion of the supraspinatus correlates with degeneration

- Increasing age, decreased blood supply correlates with articular sided tears
  - Sano et al 1999 JSES
2. Intrinsic Factors

- Genetic Factors: Increased RR for 2nd and 3rd generation relatives of patients with RCT under age 40
  - Tashjian et al 2009 JBJS

- Acromion morphology usually normal in articular sided PTRTC tears
  - Ko et al 2006 JSES
  - Ozak et al 1988 JBJS
3. **Extrinsic Factors**

- **Trauma**
  - Dislocation
  - Can result in partial thickness or full thickness tear

- **Mechanical Compression** by coracoacromial arch
  - Bursal sided tears
  - Scapular Position
Internal Impingement

Seen in overhead athletes
- Infraspinatus and post/superior labral wear

What is it?
Why does it produce similar pathology?
Evolution of Internal Impingement Etiology
• 1985 Andrews
  o “Large eccentric traction force on the supraspinatus and infraspinatus during throwing motion”
Davidson et al 1995 JSES

- Minor instability and fatigue of the dynamic stabilizers causes anterior subluxation and secondary impingement and repetitive microtrauma.
• Burkhart, Morgan, Kibler 2003 Arthroscopy
  o An altered posterosuperior rotation point of the humerus from posterior capsular contracture, GIRD, and repetitive torsional and shear overload generated by hyperexternal rotation
Diagnosis

• Physical exam
  o Partial Thickness Cuff Tear
    • Supraspinatus – strong but painful in PTRTC
  • Positive Impingement tests with PTRCT
    o Neer, Hawkins, Impingement test
  • Infraspinatus strong min pain
Diagnosis

- In the overhead athlete - PTRCT is often associated with posterosuperior labral tear (30%-50%)
  - Levy et al AJSM 2011
  - Morgan Arthroscopy 1998
  - Ryu Arthroscopy 1992
  - Snyder Arthroscopy 1991
  - Andrews et al AJSM 1985
Labral Tears

- Shoulder socket shown from side view
- Glenoid (shoulder socket)
- Labrum
- Capsule
- Biceps tendon
- The labrum is torn from front to back (anterior to posterior)
- SLAP lesion
Diagnosis

• Physical exam
  o Labral Tear

  • SLAP – Obriens, 90/90, Speeds, Hawkins

• Anterior – Apprehension/Relocation, Inferior load

• Posterior – Posterior load and Jerk test, Directional loading
What Happens After Injury
**Inflammatory Phase**


- Begins 3-7 days after tendon injury
  - Hematoma
  - Platelet activation
  - Migration of cells from fascicles, epitenon, endotenon
Formative Phase

- Begins around week 8 after injury
- Fibroblasts produce collagen (type III > type I)
  - Initially more Type III, slowly becomes more Type I
- Tenocytes become the main cell type
  - Increased traction forces
  - Requires 5-8 weeks to become mechanically solid
Remodeling Phase


  o Better organization and cross-linking
  o Complete tendon regeneration is never achieved
  o Replaced tissue remains hypercellular

1901 Waseca EACO Flour team—State Champs (MN Historical Society)
# Growth Factors in Cuff Healing


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<th>Week 1</th>
<th>Week 8</th>
<th>Week 16</th>
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| Inflammatory| bFGF
BMP
COMP
CTGF
PDGF
TGF
IGF     | BMP
CTGF
PDGF
bFGF     | BMP
bFGF
COMP
PDGF
TGF
IGF (Cont until 24 weeks) |
| Formative  |                         |                         |                             |
| Remodeling |                         |                         |                             |
Non-Operative Progression

- 25-35% of PTRCT progress to full-thickness tears with persistent symptoms
  - Kartus et al Arthroscopy 2006
  - Safran et al AJSM 2011
  - Yamanaka et al CORR 1994

- Younger patients with PTRCT more likely to progress to full thickness tear, based on increased activity level
Non Operative Treatment

- Due to Scapular Malposition or External Impingement
  - Correct mechanics, scapular position
  - Improve ROM
    - Decrease GIRD if responsive to therapy
    - Improve periscapular strength
  - Subacromial Injection/NSAIDS

- Timing to Operative Treatment
  - 3-6 months usually accepted
  - Expected RTS
  - Biology of cuff healing
    - Time needed to heal
Operative Treatment

- **Arthroscopic**
  - Better visualization
  - Better assessment of normal tension
  - Less Invasive

- Labral Tears
- RTC Articular tear
- RTC Bursal Tear
- Impingement Lesions
- Intratendinous lesions
• MRI and Exam should result in an expected treatment course

• **Arthroscopic Exam may trump all**
  o Be prepared for all options
  o Prepare athlete for all post-operative possibilities
  • *May not be a debridement only*
Rotator Cuff Debridement alone

- Relieve mechanical irritation, remove inflammatory cells
  - Wolff 2006 JAAOS

- Debridement alone ± decompression for PTRCT <50% supported by most data
  - Cordasco et al AJSM 2002
  - Andrews et al 1985 Arthroscopy 85% satisfactory
  - Snyder et al 1991 94% satisfactory

- Risk of progression to full thickness tear 15%-35%, with higher clinical failures after debridement for tears >50%
  - Kartus et al Arthroscopy 2006

- Mazoue/Andrews AJSM 2009
  - 9/11 (81%) pitchers progressed to full thickness tear within 20 months of debridement
Takedown and Repair

• Results (>50% initial tear)
  o Deutsch JSES 2007 41 pts avg 49yo, 38 month f/u
    • 98% satisfied, 40/41 returned to previous level
  o Liem et al AJSM 2008
    • 21 overhead athletes, amateur, avg f/u 25 months
      o RTS 92% previous level
  o Itoi, Weber, Lewis, Miller show similar results
PASTA Repair
PASTA Repair

- Ide et al, AJSM 2005 avg 42yo, 39 month f/u
  - 16/17 good results
  - Only 2/6 overhead athletes returned to sport

- Castagna et al, AJSM 2009 avg 57yo, 24mos
  - 98% good outcomes
  - 41% pain on occasion with ABD/ER

- Sang-Jin Shin Arthroscopy July 2011 (Level 2)
  - PASTA vs takedown and repair for >50% PTRCT
  - 92% success in both groups
  - PASTA
    - Slower recovery, more pain, better integrity w/ f/u MRI
Posterior Release

• Posterior capsular release
  o Burkhart, Kibler, Morgan
  o Consider when athlete is a “Stretch non-responder”
  o May consider when GIRD present w elbow pathology
  o Allows humeral head to sit more inferior and posterior, decreasing abrasion with Internal Impingement
  o Aggressive post operative PT
• How Long Doc?

• What are the chances of being 100% Doc?

• Have you seen anyone come back from this Doc?
Return to Sport

- Based on outcome measure
  - Level of play
  - Age

- Levy et al 2010 AJSM Partial Thickness cuff tears with concomitant type II SLAP repairs
  - <50yo, no elite athletes
  - 53% incidence of cuff tear with type II SLAP
  - Similar UCLA scores, 92% returned to previous level
Return to Sport

- Neri et al. AJSM 2011 (Level 3)
  - 23 Elite overhead athletes
  - Kerlan-Jobe scores
  - PTRCT debrided <50% thickness
  - SLAP repaired if >5mm labral detachment from the glenoid rim
Return to Sport

- Neri et al. AJSM 2011 (Level 3)
  - 23 Elite overhead athletes
  - Overall 57% return to previous level

- Labral repair only – 80% return to previous level

- Labral repair and PTRCT – 12.5% return to previous level
Return to Sport - MLB

- Rothman Institute, Philadelphia
- Level 4 Study

  - Cohen et al, SportsHealth 2011
  - 4 seasons 2003-2006 for one professional baseball club
  - f/u 2 years minimum
  - 28 Shoulder surgeries on 27 players
    - 19 pitchers
    - 8 position players
  - Average draft position 15th round
    - 4 major league players
Return to Sport - MLB

- 22 Type II labral repairs
  - 7 returned to previous level (32%)

- 1 Labral debridement
  - Returned to previous level (100%)

- 1 Rotator Cuff repair – full thickness
  - Returned to higher level (100%)

- 1 Rotator Cuff debridement
  - Returned to previous level (100%)

- 1 Posterior Capsular Release
  - Returned to higher level (100%)
What we know

- Partial thickness tears are likely to progress to full thickness tears in the young athlete.
- The etiology for the tear should be addressed within reasonable limits and corrected if possible.
- MRI/MRA is not 100% sensitive or specific, so be prepared for all options.
- Small partial thickness tears do well with debridement +/- decompression.
- Symptomatic Tears >50% may benefit from repair.
Important Points

• Return to sport for high level athletes improves with less pathology

• There is no consensus on chances of returning to sport at or above previous level for elite athletes with current data

• Do not overlook need for posterior capsular release
Surgical Recommendations

- Articular PTRCT <50% = debridement +/- SAD
- Bursal PTRCT <50% = debridement, likely SAD
- PTRCT >50% = takedown and repair
- PASTA repair less predictable with current literature
- Posterior Capsular Release when unresponsive GIRD
Thank you