Evaluation & Treatment of Overhead Shoulder Injuries

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Disclosure

- No conflicts to disclose
Objectives

- Review anatomy/pathology of common causes of shoulder pain associated with overhead activities
- Impingement syndrome, RTC tears, and SLAP lesions
- Diagnostic exam and workup
- Treatment options
- When to refer to orthopedist
Objectives

- Sport specific causes of shoulder pain in the overhead athlete
- Throwing athlete - baseball
- Scapular dyskinesia - volleyball, swimming
Impingement Syndrome

- Epidemiology
  - 6.6-25 cases/1000 patients
  - 4th-6th decade
  - 2nd most common orthopedic referral
  - 3rd most common complaint
  - 8-13% of athletic injuries
  - 3.9% of new ER visits
Impingement Syndrome

- Compression of supraspinatus
  - Anterior acromion
  - CA ligament
  - AC joint

Resulting in inflamed thickened bursa and tendonopathy
Anatomy

- **Bursa**
  - Synovium lined
  - Free nerve endings
  - Lines anterior half of acromial undersurface
Hooked Acromion

- **Type I**
  - Normal – 17%

- **Type II**
  - Curve – 43%

- **Type III**
  - Hook – 40%

- Evaluate on Scapular Y outlet view
AC Joint DJD

- Acromioclavicular joint
  - Inferior osteophytes
Impingement Syndrome

- **Stage I**
  - Edema and hemorrhage
  - <25 yoa

- **Stage II**
  - Fibrosis and tendonitis
  - 25-40 yoa

- **Stage III**
  - Partial and complete tears
  - >40 yoa
History

- Chief complaint
- Age
- Hand dominance
- Sport or work activity
- Onset of symptoms
- Rate pain
- Instability
- Stiffness
- Mechanical symptoms
History

- Swelling
- Exacerbating factors
- Remitting factors
- Nocturnal pain
- Rest pain
- Radiation
- Multiple joints
- Functional losses
- Prior treatment
- Trauma
Presenting signs and symptoms

- Generally insidious onset
- Pain with forward flexion or abduction
- Strength- no significant deficit with RTC testing
- Can have night symptoms
- Absence of mechanical symptoms
Physical Examination

- Inspection
- Palpation
- Range of motion
- Neurovascular exam
- Cervical spine exam
- Rotator cuff
- AC joint
- Biceps tendon
- Superior labrum
- Instability
Exam

- Inspection
  - Muscle atrophy
  - Scapular dyskinesia
  - Scapular winging
exam

- Palpation
  - AC joint
  - Cuff insertion
  - Anterior shoulder
  - Biceps tendon
  - Supraspinatous infraspinatous muscle belly
Range of Motion

- **Forward flexion**
  - Plane of scapula
  - Normal 150-170°
- **Abduction**
  - Normal 90-120°
Range of Motion

■ External rotation
  - Full adduction
  - Elbow @ 90°
    ■ Normal 50-70°
  - 90° abduction
    ■ Normal 80-100°
Range of Motion

- Internal rotation
  - Highest spine level
    - Normal T5-T10
  - 90° abduction
    - Normal 50-70°
Range of Motion
Range of Motion

- Cross body adduction
  - Elbow across chin
  - Normal >2 cm
  - Pain at AC joint?
Neer’s test

- Impingement signs
  - Neer’s impingement sign
    - Passive elevation
    - Internal rotation
    - Painful arc 60-120°
    - Greater tuberosity
    - Acromion
  - 88% sensitive
  - 51% specific

Neer, CORR, 1983
Hawkin’s Test

- Impingement signs
  - Hawkin’s impingement sign
    - Passive elevation
    - Forced internal rotation
    - Greater tuberosity
    - CA ligament
  - 88% sensitive
  - 43% specific
  - More consistent
Rotator Cuff

- Strength testing
  - Supraspinatus
    - Jobe’s Test
    - Empty-can test

Table 6. Standardized Motor Examination Rating Scale.

<table>
<thead>
<tr>
<th>Score</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Total paralysis</td>
</tr>
<tr>
<td>1</td>
<td>Palpable or visible contraction</td>
</tr>
<tr>
<td>2</td>
<td>Active movement through full range of motion with gravity eliminated</td>
</tr>
<tr>
<td>3</td>
<td>Active movement through full range of motion against gravity</td>
</tr>
<tr>
<td>4</td>
<td>Active movement through full range of motion against resistance (but weak)</td>
</tr>
<tr>
<td>5</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Rotator Cuff

- Strength testing
  - Infraspinatus/Teres minor
    - Large RTC tears
Rotator Cuff

- Strength testing
  - Subscapularis
    - Belly-press test
    - Lift off test
Impingement Test

- Impingement test
  - Diagnostic
  - Therapeutic
- Lidocaine/cortisone
- 21 gauge 1.5 inch needle
Impingement test

- Impingement test
  - Diagnostic
  - Therapeutic
- Re-exam in 5-10 minutes
- Pain relief with impingement, RTC pathology
- No improvement if intra-articular pathology is primary cause of symptoms (biceps, SLAP, glenohumeral DJ D, AC joint DJ D)
imaging

- True AP (Grashey)
  - DJD, superior migration of head, calcification of tendon/ligament
- Scapular- Y outlet
  - Acromion morphology
- Axillary lateral
  - Os acromiale, subluxation, glenoid wear
Differential Diagnosis

- Os Acromiale
- Bursitis
- Coracoid impingement
- Internal impingement
- Capsular tightness
- Scapular winging
- Malunion
Os Acromiale
Differential Diagnosis

- Bursitis
  - Rheumatoid arthritis
  - Gout
  - Impingement syndrome
Differential Diagnosis

- Coracoid Impingement
  - Coracoid and lesser tuberosity
  - Separate entity
  - Medial component of impingement syndrome
Differential Diagnosis

- Internal Impingement
  - Intra-articular impingement
  - Undersurface of posteropsuperior RTC
  - Glenoid & greater tuberosity

Walch et al, JSES, 1992
Differential Diagnosis

- Malunion
  - Proximal humerus
    - Humerus varus
  - Greater tuberosity
Treatment

- NSAI Ds
- Injections
- PT
  - RTC strengthening, stabilization
  - ROM
  - Modalities

Activity modification
MRI

- Failure to improve
- High suspicion of RTC tear (persistent cuff weakness)
- Traumatic onset
- Age (are they a surgical candidate)
- Evaluate for RTC pathology, labrum, biceps, occult fracture, OA
Referral

- Surgical tx
  - 3-6 months of failed conservative treatment

- Arthroscopy vs open acromioplasty
  - Level I and II studies show no difference in reduction of pain long term
  - Arthroscopic subacromial decompression
    - Better cosmesis, lower morbidity, earlier return to function, evaluation of the glenohumeral joint
Subacromial and Coracoid Decompression
Rotator cuff tears

- Pathogenesis
  - Insidious onset
    - Decreased vascularity at cuff insertion
    - Abnormal regulation of apoptosis (no inflammatory findings on histopath)
  - Impingement
  - Cyclic strain (Tissue injury → Functional deficits/muscle imbalance → further strain)
- Traumatic tear
Presentation

- Similar presentation as impingement
  - Pain (activity, rest, night)
  - Limited motion
  - +/- weakness

- Continuum of injury
  - Impingement
  - Partial RTC tear
  - Full thickness RTC tear
Exam

- Strength testing
- Lag signs
- Impingement signs
- Impingement test
Rotator Cuff

- Lag signs
  - Supraspinatus
    - Jobe’s sign
    - Drop arm sign
Rotator Cuff

- Lag signs
  - Infraspinatus
    - External rotation sign
    - Large RTC tears
Rotator Cuff

- Lag signs
  - Teres Minor
    - Horn Blower’s sign
    - Massive RTC tears
Rotator Cuff

- Lag signs
  - Subscapularis
    - Internal rotation lag sign
MRI

- RTC tears in asymptomatic patients
  - 34% in all age groups
  - 54% of patients > 60 yoa
  - Zero in patients 19-39 yoa

- RTC tears in shoulder injury
  - <1% in persons <30 yoa
  - ~35% in persons >45 yoa

Matsen et al, 1994
Timing of MRI

- $$$
- Delay in necessary surgical tx vs unnecessary cost
- Trauma, age, weakness, duration
- Full thickness tears- recommend repair within 3-6 months
  - Retraction, muscle atrophy
Full Thickness Tear

- Retraction
Full Thickness Tear

- Atrophy

Moderate

Severe
Full Thickness Tear

- Atrophy
treatment

- NSAID’s
- Injections? EBM- may improve pain/motion but no long term change to pathology “little evidence to support or refute efficacy”
- PT- strengthen surrounding rotator cuff musculature to compensate
- Surgical Repair
Prognosis

- 54% over 60 have asymptomatic tear
  - Who should we operate on? Who will become symptomatic?
- Approximately 50% of full thickness tears will progress in size
- 10-40% of partial tears will convert to full thickness tears
- Size of tear correlates to tear progression and pain
- Massive tears will progress to RTC arthropathy with degenerative changes to joint.
Surgical Repair

- Arthroscopic vs mini-open
  - No difference in failure rates
- Lengthy rehab
  - PROM weeks 0-6
  - AROM weeks 6-10
  - 10-12 begin resistive exercises
Arthroscopic repair
SLAP Lesions

- Superior labral anterior-posterior tears
- Dr. Andrews in 85
- Involves superior labrum at biceps anchor
Pathogenesis

- Forceful traction loads to the arm
- Direct compression loads
- Repetitive overhead throwing
- Shoulder instability
Synder Classification
Presentation

- Symptoms may be similar to RTC tendonopathy
- Pain (nonspecific pattern)
  - Painful arc, weakness, easy fatigue
  - May have mechanical symptoms- popping, clicking, sliding, and dead arm
- Overhead activities
- Weakness “dead arm syndrome” in throwers
- High association with articular-sided cuff injury
Exam

- Non-specific tests

No specific test that is reliable or accurate for dx of SLAP by itself

<table>
<thead>
<tr>
<th>TYPE II SLAP LESIONS: THREE SUBTYPES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE 3. Sensitivity and Specificity Data for Physical Examination Tests with 81 Type II SLAP Lesions by Location Subtype</td>
</tr>
<tr>
<td>Test</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>+Jobe</td>
</tr>
<tr>
<td>+Speed</td>
</tr>
<tr>
<td>+Bicipital groove pain</td>
</tr>
<tr>
<td>+O’Brien</td>
</tr>
</tbody>
</table>
Speed’s test

- Forward flex shoulder against resistance with elbow maintained in extension and forearm in supination
- Pain in bicipital groove with maneuver
- Positive for biceps pathology, SLAP
Obrien’s Test

- Resisted shoulder flexion with shoulder flexed to 90, slight adduction and arm in internal rotation
- Positive test if painful in internal rotation and pain decreased in external rotation
SLAP AND LOAD/ SHIFT (CRANK) TESTS

Fig. 2 The SLAP test. The thumb of the left hand of the examiner is pushing the humeral head in a superior direction as the patient resists the downward force on the abducted and supinated forearm.

Fig. 5 The load and shift maneuver to evaluate the superior labrum.
Associated Pathology

- Partial Rotator Cuff Tear – 26%
- Full thickness Cuff Tear – 15%
- Anterior Instability – 15%
- AC Arthritis – 11%
- Humeral Head Chondromalacia / Hills Sach Lesion – 11%
Imaging

- MRI vs MRI arthrogram - subject of debate
- Indications - persistent pain, mechanical symptoms, h/o trauma
Treatment

- Most lesions with mechanical type symptoms will require operative treatment
- Inciting cause (muscular imbalance, weakness, contractures, poor throwing mechanics) can be corrected with therapy
- Associated pathology (RTC tears, instability) should be corrected at time of surgical procedure
- Generally > 3 months non-operative tx before considering surgery
Surgical treatment

- **SLAP repair - anchors**
  - <25 yo or throwing athlete
  - Healing rates

- **Biceps tenotomy vs tenodesis**
  - Remove traction force
  - Age 50+
  - Popeye deformity
Biceps tenodesis
Type IV Variant
Spinoglenoid notch cyst

- Always associated with a Labral tear
- May develop Suprascapular n. palsy secondary to direct nerve compression
Spinoglenoid notch cyst
Pitching

- 200,000 teams in little league baseball
- Young age, skeletally immature
- Single sport athletes
- Year round sports
Developmental changes and adaptations

- Open proximal humeral physis
  - 8-15 yo 55% asymptomatic and 62% symptomatic pitchers have physeal widening
  - 17° increased humeral head retroversion in professional pitchers
Little League Shoulder

- Diffuse shoulder pain
- Pain with resisted abduction, TTP
- X-ray/MRI findings
Little League Shoulder

- Treatment
  - 2-3 months rest
  - Progressive throwing program

- Failure to treat/rest
  - Premature physeal closure
  - Length discrepancy/angular deformity
  - Salter-Harris fractures
Developmental changes and adaptations

- Increase in Glenohumeral external rotation/decrease in internal rotation
  - Capsular contracture vs posterior cuff contracture vs osseous adaptation

- Increased capsular laxity
  - Posterior/inferior shift
  - Leads to internal impingement
  - Increased labral stress
GIRD

- Glenohumeral internal rotation deficit
  - Measure with scapula stabilized
  - Compare to contralateral shoulder

- Study by Wilk, >5° difference had 2.5x greater risk of shoulder injury
Developmental changes and adaptations

- MRI of asymptomatic elite overhead athlete
  - 79% labral abnormalities
  - 40% partial/full rotator cuff tears
### Prevention

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Maximum Pitches per Game</th>
<th>Maximum Games per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>11-12</td>
<td>65</td>
<td>2</td>
</tr>
<tr>
<td>13-14</td>
<td>75</td>
<td>2</td>
</tr>
<tr>
<td>15-16</td>
<td>90</td>
<td>2</td>
</tr>
<tr>
<td>17-18</td>
<td>105</td>
<td>2</td>
</tr>
</tbody>
</table>

*Modified pitch count guidelines from the USA Baseball Medical and Safety Advisory Committee*


### Number of Pitches

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>1 Day of Rest</th>
<th>2 Days of Rest</th>
<th>3 Days of Rest</th>
<th>4 Days of Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>20</td>
<td>35</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>11-12</td>
<td>25</td>
<td>35</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>13-14</td>
<td>30</td>
<td>35</td>
<td>55</td>
<td>70</td>
</tr>
<tr>
<td>15-16</td>
<td>30</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>17-18</td>
<td>30</td>
<td>40</td>
<td>60</td>
<td>90</td>
</tr>
</tbody>
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*Modified pitch count guidelines from the USA Baseball Medical and Safety Advisory Committee*

prevention

- Avoid breaking pitches (sliders, curve balls) until skeletal maturity (16)
- 2-3 months complete rest from throwing per year
- Proper pitching mechanics
  - Coaching
Physical Therapy

- Sleeper stretch, scapular stabilization, core strength
Overhead athletes

- Swimming/Volleyball
  - May have subacromial or internal impingement
  - Frequently have strength imbalances in opposing muscle groups
  - Frequent scapular dyskinesia
  - Tx- PT to restore scapular mechanics, rest, variation in training
Thank you