Examination of the Shoulder

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Goals

1) Briefly review shoulder pain / problems in the pediatric and adolescent population
2) Highlight red flags in patients shoulder pain / problems that indicate urgent work up / referral
3) Review the musculoskeletal examination of the shoulder with emphasis on practical instruction of general exam techniques and special tests/maneuvers.

The Pediatric Shoulder

• The pediatric musculoskeletal system differs greatly from the adult
• Pediatric bone contains large amounts of cartilage and collagen compared to adult bone
• Reduced tensile strength so pediatric patients are more likely to have bony injuries with mechanisms that would cause ligamentous injuries in adults


Shoulder injury background

• Significant increase in youth sports participation over last three decades
• Female involvement has increased 5-fold
• Majority of injuries are overuse injuries with increased specialization, playing on multiple teams year round
• Kids are not little adults


The Pediatric Shoulder

• Physeal injuries are unique to children – 25% of all fractures
• 30% cause growth disturbance, 2% functional deformity

**Differential**

**Acute/Traumatic Injuries**
- Clavicle fracture
- Humerus fracture
- Acromioclavicular sprain
- Glenohumeral dislocation
- Brachial plexus injury
- Rotator cuff tear

**Overuse Injuries**
- Recurrent glenohumeral subluxation/dislocation
- Rotator cuff tendinitis
- Impingement syndrome
- Physiolsis of proximal humerus
- Osteolysis of distal clavicle
- Thoracic outlet syndrome
- Effort thrombosis

**Other**
- Leukemia/Lymphoma
- Bony tumor
- JRA

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**What not to miss**

**Acute/Traumatic Injuries**
- Humerus fracture
- Glenohumeral dislocation
- Brachial plexus injury
- Rotator cuff tear

**Overuse Injuries**
- Physiolsis of proximal humerus
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**Other**
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**Red Flags**

- Signs of fracture
  - Significant trauma, swelling, pain, bruising
- Significant weakness
  - Rotator cuff tear, neurologic injury, significant trauma
- B symptoms / Systemic symptoms
  - Fever, night sweats, unintentional weight loss, fatigue, joint pains
- Unexplained neurologic symptoms
- Vascular symptoms
  - 6 p’s (pain, pallor, pulselessness, paralysis, paresthesia, perishingly cold)

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**History**

- Importance of history in examination of the shoulder

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**History**

- Age
- Hand dominance
- Which shoulder
- Onset? Traumatic/atraumatic
- Did you seek treatment?
- When did it occur?
- Where is the pain?
- Does it radiate?
- What makes it worse?
- What makes it better?
- Night pain?
- Is it worsening or getting better?
- Any sense it may dislocate?
- Any treatment yet?
- Prior history of shoulder problems?
- NV complaints?

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**History**

- Traumatic vs. atraumatic
- Sudden onset vs. gradual
- Location
- Association with neurologic symptoms?
History

Occupation/sport

Instability
- Atraumatic vs. traumatic
- Direction
  - Anterior vs MDI
- Frequency

Mechanical Symptoms
- Catching, locking, clunking
- May/may not indicate pathology
- Association with pain

Weakness
- True weakness vs. weakness secondary to pain
- Association with trauma?
- Association with neurologic symptoms?

Exam

Inspection
- Undress the patient
- Deformity
- Swelling
- Atrophy

Palpation
- Sternoclavicular joint
- Clavicle
- A/C Joint
- Biceps tendon
Exam: Range of Motion

Neurologic testing:
- Always consider cervical pathology

Passive and Active ROM
- Adduction and internal rotation (Appley scratch)
  - Should be able to reach to inferior border of scapula – about T7
- Abduction and external rotation
  - Most able to reach to about C7

Exam

Exam Strength

Internal and external rotation strength:
- Arm held at side with 90° flexion

Exam Special tests

- Rotator cuff testing
- Jobe test (empty can test)
- Lift off
- Belly press
- Drop arm
- Neer impingement sign
- Hawkin’s sign
- AC Joint
- Biceps pathology

Exam Neurologic testing:
- Always consider cervical pathology

Exam Special tests

- Speed’s test
- Active compression (O’Brien’s test)
- Yergason’s test

Specialized PE testing of the shoulder: How useful is it?

Limitations of specialized testing:
- Tests are often described without sufficient validity evaluation
- Tests are rarely compared with a diagnostic gold standard
- Often times tests are described by inventor, may not be studied or reproduced by others.

McFarland EG Br J Sports Med. 2010
Specialized PE testing: How useful is it?

- Very few level I evidence based studies assessing clinical utility of physical exam of the shoulder
- Most studies reporting specialized tests were done in tertiary/quaternary care centers
- Most studied in older adults 40-50 years and older

Example of specialized testing for SLAP tears

- SLAP lesions have been important diagnosis since their initial classification in 1990
- MRI and arthroscopy are costly and arthroscopy has surgical risk
- Many authors have published specialized PE tests with high sensitivities and specificities
- Many studies unblinded, uncontrolled etc

Example of specialized testing for SLAP tears

- Journal of clinical epidemiology 2009:
  - Diagnosis of SLAP lesions through PE has widely been reported in literature with high sensitivities, specificities, claims to be accurate and reliable
  - Critically evaluated all relevant studies

  "The current body of literature used as a resource for teaching in medical schools and for continuing education of physicians treating upper extremity problems lacks the validity necessary to be useful. There are no good physical examination tests that exist for effectively diagnosing a SLAP lesion of the shoulder."


Sensitivity and Specificity

\[
\text{Sensitivity} = \frac{\# \text{True Positives}}{\# \text{True Positives} + \# \text{False Negatives}}
\]

The probability of a positive test given the patient has the injury

\[
\text{Specificity} = \frac{\# \text{True Negatives}}{\# \text{True Negatives} + \# \text{False Negatives}}
\]

The probability of a negative test given the patient is normal

Sensitivity, Specificity

"Spin" – Specificity rules in
Test with 100% specificity -> 100% positive predictive value

"Snout" – Sensitivity rules out
Test with 100% sensitivity -> 100% negative predictive value

Injury Prevalence affects on usefulness of test

Drug test – 99% sensitive 99% specific
  - Only 0.5% population is using

Only 33% of positives in this scenario are truly positive
Injury Prevalence affects on usefulness of test

Drug test – 99% sensitive 99% specific
- 5% population is using

82% of positives in this scenario are truly positive

Specialized Testing: Apprehension test

Procedure:
- Examiner palpatates the humeral head through soft tissue
- Shoulder passively abducted and slowly put into maximal external rotation

Assessment:
- Shoulder pain with reflexive muscle tensing is a positive test
- Indicates anterior instability

Sensitivity: 80%
Specificity: 99%


Relocation test

Procedure:
- After apprehension test
  examiner applies posterior force to head of humerus

Assessment:
- Positive test is loss or decrease of apprehension or pain

Sensitivity: 81%
Specificity: 92%

Sensitivity: 30%
Specificity: 90%


Specialized PE testing of the shoulder: How useful is it?

Usefulness in our population:
- Often times tests are described by inventor, may not be studied or reproduced by others
- Most studies reporting specialized tests were done in tertiary/quaternary care centers
- Most studied in older adults 40-50 years and older

Sensitivity: 41%
Specificity: 89%

Sensitivity: 30%
Specificity: 90%

McFarland EG Br J Sports Med. 2010

Jobe test (empty can test)

Procedure:
- Elbow extended, arm 90° abduction
- 30° horizontal flexion, thumbs down

Assessment:
- Test – severe pain and unable to abduct against gravity or sig weakness
- Indicates tear of supraspinatus tendon or muscle, or neuropathy of suprascapular nerve

Sensitivity: 100%
Specificity: 98%

**Neer impingement sign**

**Procedure:**
- Patient sitting, examiner standing
- Arm is raised in forced forward elevation (between flexion and abduction)
- Greater tuberosity impinges acromion causing pain

**Assessment:**
- Positive test is when pain occurs with maneuver
- Test also causes pain with many other conditions – stiffness, instability, arthritis, calcium deposits, bone lesions


**Lift off test**

**Procedure:**
- Patient places dorsum of hand on back with arm in internal rotation
- Hand is lifted away from back
- Examiner applies load pushing hand toward back

**Assessment:**
- Inability to lift hand indicates tendon rupture or insufficiency of the subscapularis
- If pain limits lift-off test, belly press test may be performed


**Hawkin’s impingement sign**

**Procedure:**
- Humerus is forward flexed to 90°
- Arm then forcibly internally rotated

**Assessment:**
- Pain indicates positive test
- Indicates impingement pain


**Belly press / Abdominal compression**

**Procedure:**
- While standing, patient’s forearm lies along abdomen with elbow flexed
- Patient continues to forcefully pressing arm against abdomen

**Assessment:**
- If subscapularis is torn or weakened there is loss in internal rotation
- Elbow deviates laterally/posteriorly as patient compensates with latissimus dorsi and teres major
- Normal if internal rotation is maintained and elbow does not drop back/laterally


**Drop arm**

**Procedure:**
- Patient passively abducts arm to 90°
- Patient slowly lowers arm

**Assessment:**
- Dropping of arm or weakness with or without pain suggests rotator cuff lesion
- Most often supraspinatus
- Painless drop can indicate neurologic disorder


**Speed’s test**

**Procedure:**
- Patient’s arm is extended in supination at 90° of abduction and 30° of horizontal flexion
- Patient attempts to maintain position or to abduct and pronate the arm against downward pressure

**Assessment:**
- Positive test elicits tenderness in bicipital groove
- Indicative of bicipital tendon pathology

Active compression (O’Brien’s test)

**Procedure:**
- Patient stands with elbow extended
- Arm moved to 90° flexion, 10° adduction
- Examiner presses down with shoulder in max internal and external rotation

**Assessment:**
- Positive test is pain with internal rotation phase that resolves in external rotation phase
- Pain within shoulder points to SLAP
- Pain over ac joint may be from ac pathology


**EBM review of clinical use of specialized testing**

- The apprehension and relocation tests both appear to be diagnostic of anterior instability
- Most conditions of the a/c joint can be accurately diagnosed
- Symptomatic full thickness rotator cuff tears can successfully diagnosed, lesser forms or RC disease are more difficult to distinguish
- Biceps and SLAP lesions are difficult to distinguish on examination


**Bibliography**


**Conclusions**

The pediatric shoulder:

1. History

2. Understand utility and limitations of physical exam tests:
   - Vary significantly depending on test
   - Interpretation in pediatric population