Management of Shoulder Instability in the Young or Adolescent Athlete

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Disclosure
- Consultant - Tornier

OVERVIEW
- Definition(s)
- Anatomy / Pathoanatomy
- Epidemiology
- Natural History
- Evaluation
- Treatment

BACKGROUND
- Most mobile major joint in body
- Some translation is normal
- Motion extremes required / preferred in many sports
- Hypermobility may even be protective (sport specific)

BACKGROUND
- However, gains in motion, translation may come at a price

BACKGROUND
- Spectrum of instability
  - Underlying tissue features
  - Magnitude of trauma
  - Presence of structural injury
- Many factors to consider
  - Sport
  - Position
  - Hand dominance
  - Timing of injury
    - In season
    - Off season
    - Multiple sports

BACKGROUND
- Adolescent athletes may demonstrate features of both
**Epidemiology**
- 20% of dislocations occur in patients under age 20
- Vast majority are anterior
- Majority in male athletes
- US Military Academy (West Point, NY)
  - 117 shoulder instability events
  - 80% anterior
  - 10% posterior
  - 10% multidirectional
  - Clavien et al. 4800/3837

**Definition(s)**
- Pathologic translation of humeral head relative to glenoid
  - Partial (subluxation)
  - Complete (dislocation)
- Traumatic
- Atraumatic
- Adolescent / young
  - High school
  - Middle school
  - Skeletally immature

**Bone Anatomy**
- Increasing interest in bone injury
- Humeral head
  - Comparable to 1/3 of sphere
  - More spherical centrally
  - More elliptical peripherally
- Glenoid
  - Small surface area in comparison to humeral head
  - Articular match within 3 mm of HH
  - Congruent
  - Cartilage (thicker peripherally) and labrum contribute to congruency
- Golf ball – tee analogy

**Bone Anatomy**
- 3 ossification centers
- Typically coalesce between age 5-7
- Fuse with proximal humeral shaft between 14-17
CAPSULE / LIGAMENT ANATOMY

- Capsule thin (< 5 mm)
- Reciprocal function
- Midrange: generally lax
- Extremes of motion: become taut
- Material properties variable
  - Stretch before failure
  - May function dynamically in conjunction with cuff

CAPSULE / LIGAMENT ANATOMY

- Adolescent:
  - Proximal humeral physis primarily extra-articular
  - Exception on medial side, where attaches distally
  - Ligaments relatively stronger
  - Fracture potential (including avulsions) in the skeletally immature

LABRUM

- Anchors glenohumeral ligaments
- Deepens glenoid concavity
  - Resists translation
  - Increases surface area
- Stability ratio
  - Dislocating force v. load compressing head into glenoid
  - Chondral-labral defects: 65% reduction
  - Is labral injury enough to cause dislocation?
    - Debatable
    - May require further capsular injury

PATHOANATOMY

- Determined by direction of injury
  - Labral detachment (Perthes-Bankart)
  - 97% incidence with 1st time dislocation
    - Taylor / Arciero, AJSM 1997
    - Owens et al., JBJS-A, 2010
  - May have bony or chondral injury
    - Glenoid
    - Humeral head injury
    - Hill-sachs / reverse hill-sachs
  - Variable contribution of capsular laxity
  - Atraumatic cases generally have less impressive structural findings!

NATURAL HISTORY: ADOLESCENTS

- Best understood with documented anterior dislocations
  - More common = more data
- 15-20 yrs:
  - Similar to reported data on college age subjects
  - Recurrence rates high (40-100%)
  - FTRSD concept
  - Pathoanatomy well understood
  - Early arthroscopic management
  - Alter natural history
NATURAL HISTORY: ADOLESCENTS

- Under age 14:
  - Mariani et al, JBJS-A 1992
  - AV: 1 yrs
  - Mean age 13 yrs
  - 100% recurrence
  - Detch et al, AJSM 2003
  - < age 13 = 92%
  - Skeletally mature = 88%
  - Cordeschi et al, Ortho 2009
  - < 14 yrs
  - No discrete lateral injuries
  - 2.1% recurrence rate
  - Lambert et al, Eur J Trauma 2002
  - < 14 = 8.9% recurrence
  - > 14 = 70% recurrence

NATURAL HISTORY

- Multidirectional instability
  - Misamore et al, JSES 2005
    - 64 pts
    - Longitudinal study
    - 20 eventually underwent surgery
    - 50% of those without surgery still rated their shoulders as “poor”
    - Not as good as we thought!

- Altered scapulothoracic function

  - Update: shoulder, AANM 2007

  - No specific reports in adolescent, athletic population

INITIAL EVALUATION

- Active range of motion
  - Limited in acute/subacute setting after first time event
  - Often maintained or regained quickly following a recurrent event

- Assess rotator cuff function
  - Internal rotation (subscapularis)
  - Elevation (supraspinatus)
  - External rotation (infraspinatus/teres minor)

- Generalized laxity assessment
  - Elbow hyperextension
  - MP hyperextension
  - Thumb to forearm
  - Suicides
  - Common features in young adolescents

INITIAL EVALUATION

- Inspection
  - Deformity
  - Locked dislocation
  - Typically anterior
  - Rarely posterior
  - Bruising
  - Swelling

- Neurological examination
  - Axillary nerve (deltoid)
  - Peripheral function

- Vascular examination

JOINT REDUCTION (ON SITE)

- Indicated:
  - OBVIOUS anterior dislocation
  - ATC, MD, or other trained provider comfortable with techniques
  - Remote field location when circumstances dictate
  - Various maneuvers
    - Traction
    - Stimson
    - Hemepin county method

- Not indicated:
  - Dislocation NOT obvious clinically
  - Younger age (<13-14 yrs)
  - Higher risk of fracture
  - Consider initial radiographic evaluation
IMAGING
- Plain radiographs
  - Mandatory!
  - True AP/outlet (lateral)
  - Axillary when able
- MRI
  - Not mandatory
  - May be helpful diagnostically
  - Assist with prognosis / guide treatment
- CT
  - Assess bone loss in recurrent setting
  - Rarely necessary in skeletally immature

EXAMINATION: RECURRENT INJURIES
Anterior apprehension
- 90/90 Ab/ER
- May vary amount of FE
- Reproduces "apprehension"
- +/- pain
- Augment with anterior force

EXAMINATION: RECURRENT INJURIES
Jobe relocation test
- 90/90 Ab/ER
- Anterior apprehension maneuver
- Posterior force
- Apprehension relieved

EXAMINATION: RECURRENT INJURIES
Anterior release test
- 90/90 Ab/ER
- Relocation maneuver
- "Release" posterior pressure
- Apprehension reproduced

EXAMINATION: RECURRENT INJURIES
Posterior apprehension (jerk test)
- FE 90°
- Neutral rotation
- Posterior force
- Pain reproduction

IMMOBILIZATION
- Value of sling immobilization debated
  - Comfort
  - Behavior modification
  - No evidence of treatment benefit
- No conclusive benefit of external rotation bracing
  - Patient compliance
  - Practicality
  - Success rates mixed
REHABILITATION
- Phased, progressive
- Differ primarily in early, protective phase
  - Avoid apprehension positions
  - Anterior
  - Posterior
- As inflammation, apprehension subsides, programs similar
  - ROM
  - Core strength
- Final phase of sport specific activity
- Duration is patient dependent

IN-SEASON MANAGEMENT
- 30 contact athletes
- Mixed injury severity / acuity
- Brief rehab, rest
- Return to play avg 10 days
- 19/30 used braces
- 90% returned
- 37% recurrent lax
- Subjective measurement
- No other injuries
- 53% underwent surgery at season conclusion [Rass et al. 2009] [2014]

SURGICAL TREATMENT: Anterior
- Most common surgical indication
- Anatomic labrum repair (bankart)
  - Arthroscopic
  - Open
- Nonanatomic repair
  - Coracoid bone transfer
  - Latarjet
- High success rates with appropriate selection ages 20-25 yrs (85-95%)

SURGICAL TREATMENT: Anterior
- Trend towards earlier, arthroscopic treatment
  - FTACD
  - Preferred in adolescents
- Potential limitations
  - Bone less
  - Tissue laxity
  - Age
  - Type of sport [Baker, 2005; Yowell, 2005]
- Patient selection key

SURGICAL TREATMENT: Anterior
- Adolescent population
  - Jones et al, J Ped Ortho 2007
  - 32 pts
  - Avg age 15 yrs (range 11-18)
  - 16 = initial rehab/monsurg mgmt
  - 16 = initial surgery
  - All underwent arthroscopic labral repair
  - Recurrent group = 18% recurrence
  - Initial surgery = 12% recurrence
  - Avg follow up 25 months

SURGICAL TREATMENT: Anterior
- Adolescent population
  - Shymon et al, J Ped Ortho 2015
  - 99 pts
  - Mean age 16
  - 28 open surgery, 71 arthroscopic surgery
  - 21% recurrence rate
  - No difference between groups
- In general:
  - Higher recurrence rate in younger ages following surgery
  - Tissue type
  - Developing proprioception / musculature
  - Increased exposure / risk over time
**SURGICAL TREATMENT: Posterior**
- Recent meta-analysis
- 90-95% success rate
- Return to sports better with arthroscopic methods
- Return to collision/contact sports better than overhead sports
- Open surgical methods not as successful (rotator cuff weakness)
- No specific focus on young/adolescents

**SUMMARY**
- Shoulder dislocations relatively common
- 20% occur under age 20
- Majority are anterior
- Plain radiographs in all cases
- Consider MRI, occasionally CT
- Labral injury most common. However,
  - Younger adolescents may more likely have:
    - Humeral sided injuries (HAGL or reverse HAGL)
    - Fractures (lesser tuberosity avulsions)
    - Absence of significant labral injury due to tissue elasticity

**SUMMARY**
- Rehabilitation is appropriate treatment for many adolescents
- Surgical indications:
  - Prevent recurrence
  - Restore function when rehab is inadequate
  - Arthroscopic treatment preferred for:
    - Young adolescents
    - Posterior injury patterns
    - Initial anterior injuries in older adolescents
  - Open surgical treatment may be required
    - Bone loss
    - Long standing recurrent injuries, particularly in older (16+) adolescents