Proximal Humeral Epiphysiolysis (Little League Shoulder)

Background

1. "Little Leaguer's Shoulder" (LLS)
    - A shear or stress injury of epiphyseal cartilage of proximal humerus
2. Initially described by Dotter in 1953[1]
    - Fracture through proximal humeral epiphyseal cartilage (baseball pitching)
    - Adams was the first to describe as an osteochondrosis in 1966[2]
3. Terms also used to describe
    - Proximal humeral epiphysiolysis[3]
    - Osteochondrosis of proximal humeral epiphysis
    - Stress fracture of proximal humeral epiphyseal plate
4. General information
    - Epiphyseal plate-cartilaginous plate located in metaphyseal end of each long bone
        - Allows for growth of long bone
    - Two types of epiphyses are found in extremities: traction and pressure
        - Traction epiphyses (or apophyses) located at site of attachment of major muscle tendons to bone and are subjected primarily to tensile forces
        - Pressure epiphyses are situated at end of long bones and are subjected to compressive and rotational shearing forces
    - LLS is a overuse injury to epiphyseal plate
        - Due to excessive strain placed on plate typically from repetitive overhead activities (throwing)
    - Can significantly reduce incidence of this injury by
        - Monitoring pitch counts
        - Not throwing when shoulder hurts
        - Attention to proper mechanics

Pathophysiology

1. Pathology of disease
    - Proximal humeral epiphysis
        - Derived from four growth centers
            - Head, shaft, greater tubercle, lesser tubercle[4]
        - Cone shaped with apex pointing superiorly, posteriorly, and medially in relation to shaft[4]
        - Proximal humeral physis usually fuses b/n ages 14 and 20 yrs
        - Contributes about 80% of longitudinal growth of humeral shaft
            - Growing immature articular cartilage is more susceptible to injury than mature adult cartilage[5]
            - Caused by repetitive stress (especially repetitive rotational stress) placed on epiphyseal plate from overhead activities such as throwing, swimming, tennis, volleyball[6]
2. Incidence/prevalence
    - Exact incidence is unknown

- Many athletes do not seek treatment
- May wait to seek treatment until pain has been present for months or when notes decreased throwing velocity

3. Risk factors
   - Between ages 11-16 (average 14)
     - Age when proximal humeral physeal growth is at its peak
   - Overhead sports (baseball, tennis, volleyball, swimming)
   - Pitchers-especially if high pitch counts or improper rest b/n pitching
   - Position players w/ poor throwing mechanics
   - Playing in multiple leagues during the year-no breaks from throwing during the year
     - Of 23 competitive baseball players w/ LLS: 2/3 pts played baseball year round, 26% played on 2 teams at the same time
       - 21 reported gradual onset of pain, average duration of 7.7 months[7]
4. Morbidity / mortality:
   - These injuries can cause significant pain and limit activities of daily living
   - If not recognized and treated appropriately can lead to premature physeal closure
     - Limb length discrepancy
     - Osteonecrosis of epiphysis

Diagnostics

1. History
   - Insidious onset of lateral shoulder pain that occurs w/ throwing
   - Pain usually begins w/ hard throwing
   - As progresses, any throwing produces paid[1,2,7]
   - Usually associated w/ high pitch counts[7]
   - May be associated w/ throwing breaking pitches[2,9,10]
2. Physical exam
   - Tenderness to palpation of proximal humerus
     - Especially lateral aspect of humerus inferior to head[7,9]
   - May have pain or weakness w/ resisted rotation[7]
3. Diagnostic testing
   - Laboratory evaluation rarely needed
   - Imaging
     - AP in internal and external rotation, lateral view
     - Comparison view of unaffected shoulder (to compare physis) should be obtained[2,3,6,7,9,12]
       - Classic finding is widening of affected physis when compared to contralat side
       - Associated findings in about half of pts may include demineralization, sclerosis, cystic changes, and lateral fragmentation of the prox humeral metaphysis[3,7]
       - Further imaging is usually not necessary
       - If highly suspicious with neg X-Ray findings, MRI may be considered[9]
4. Neer and Horwitz classification of proximal humeral epiphysiolysis[8]

- Displacement
  - Less than 5 mm (Grade I)
  - Less than one third of shaft width (Grade II)
  - Two thirds of shaft width (Grade III)
  - More than two thirds of shaft width (Grade IV)

Differential Diagnosis

1. Key ddx:
   - Rotator cuff tendonitis/tear
   - Biceps tendonitis
   - Impingement syndrome
   - Labral tear (Superior Labrum Anteroposterior Lesion- SLAP)
   - Glenohumeral instability
   - Humeral fracture
2. Extended ddx:
   - C5 radiculopathy
   - Thoracic outlet syndrome
   - Infection
   - Tumor

Therapeutics

1. Acute treatment
   - Remove athlete from play
   - Evaluate injury
   - Ice
   - Compression
   - Analgesic for pain, avoid NSAID d/t theoretical risk of impeding healing
2. Further management
   - Rest affected arm
   - Splinting/casting not necessary
     - Sling only necessary for comfort if significant pain (Use should be limited)
   - Ice PRN
   - Pain control PRN
3. Long-term care
   - Rest from throwing/overhead activities for 8-12 wks[7,9,11]
   - Continue general conditioning (cardiovascular)
   - Start rotator cuff strengthening/capsular stretching exercises when no pain at rest or w/ full active range of motion (AROM)
   - Resume throwing based on lack of sxs and normal exam, not radiographic findings
   - Widening of epiphysis may take several months to remodel[7]
   - When resuming throwing begin slow w/ interval throwing program[7]
   - Focus on proper mechanics
   - Return to play when athlete is pain free w/ normal throwing

Follow-Up

1. Return to office

- After initial visit, 3-4 week f/u
- F/u earlier if symptoms worsen
- Serial radiographs to monitor resolution of fx
  - 4-6 wks after initial imaging
  - Remodeling of epiphysis may take several months to occur
  - Player may resume throwing in 8-12 wks if asymptomatic[7]
- Refer to a sports medicine specialist if unsure of dx or uncomfortable w/ management

Prognosis

1. Most athletes return to pre-injury level activity
   - Need adequate rest from throwing
   - When starting to throw, need progressive return to throw program
2. Complications
   - Growth plate abnormalities such as
     - Early physeal closure, osteonecrosis of the humeral head and subluxation of the glenohumeral joint are rare but may occur[7]

Prevention

1. Recommendation
   - Little League Baseball has detailed recommendation regarding pitch counts based on age, 12 but these can be applied to any league (http://www2.massgeneral.org/sports/pdf/Injury%20Prevention/Baseball%20Tips/Little%20League%20Pitch%20Count%20Regulation%20Guide.pdf)
   - Preseason condition program emphasizing strengthening of periscapular, rotator cuff, core musculature and capsular stretching[12]

Patient Education

1. Players and coaches should be educated on limiting pitch counts (Little League Pitch Counts)
2. Players should be taught proper pitching mechanics
3. Players should not continue to pitch and notify their parents, coaches, or trainers if they develop shoulder pain with throwing

References

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