Shoulder and Elbow Injuries in the Pediatric Athlete

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Introduction

• Overuse injuries and traumatic injuries
• The changing anatomy of the adolescent athletes make them prone to specific injury patterns
• Proper training and understanding of the growing athlete can be protective of some of the injuries seen in the pediatric athlete

Epidemiology

• 2 million sports related injuries annually
• Single season
  – 50% of all players complain of shoulder and elbow pain
  – Pitchers complain of pain in shoulder or elbow in 15% of their appearances
Anatomy and Development

• Upper extremity growth
  – 80% comes from the proximal humeral physis
• Proximal humeral epiphyseal ossification center appears by age 6 months and fuses between ages 14 – 18 years
• Elbow has 6 ossification centers, earliest appears at 1 yr and fuses around age 12 yrs

Anatomy and Development

• Static shoulder stabilizers
  – Glenohumeral ligaments
  – Capsule
  – Rotator interval
  – Labrum
• Dynamic shoulder stabilizers
  – Rotator cuff
  – Surrounding shoulder muscles and tendons

Anatomy and Development

• Elbow stabilizers
  – Bony articulations
  – Medial and lateral ligament complexes
    • Ulnar collateral ligament
    • Lateral collateral ligament
Proper Training

• Guidelines from: American Sports Medicine Institute USA Baseball Medical and Advisory Committee:
  • Pitch Counts
    – Per game
    – Months per season
  • Rest days
  • Arm fatigue
  • Pitch velocity
  • Type of pitch

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Maximum Pitches Per Game</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8</td>
<td>50</td>
</tr>
<tr>
<td>9-10</td>
<td>75</td>
</tr>
<tr>
<td>11-12</td>
<td>85</td>
</tr>
<tr>
<td>13-16</td>
<td>90</td>
</tr>
<tr>
<td>17-18</td>
<td>100</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pitch Counts</th>
<th>Days Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-20</td>
<td>No calendar day</td>
</tr>
<tr>
<td>21-40</td>
<td>1 calendar day</td>
</tr>
<tr>
<td>41-60</td>
<td>2 calendar days</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>3 calendar days</td>
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</tbody>
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Proper Training

• Energy generated from lower extremity thru torso to the upper extremity
• Higher level athletes, have more delayed trunk rotation → less load to the shoulder → decrease injury risk

Little League Shoulder

• Proximal humeral physis affected by repetitive rotational stresses
• Presentation:
  – Age 11 – 13
  – Pain with throwing
  – Tenderness over proximal humeral physis
• Imaging
  – Not needed, but supportive
  – Xray: widening of the physis, fragmentation of lateral metaphysis, sclerosis, cystic changes, demineralization

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Little League Shoulder

Treatment:
- Rest
- Most require 3 months of no pitching
- Rehab:
  - Rotator cuff strengthening
  - Periscapular muscle strengthening
  - Core strengthening
- Gradual return progressive throwing program

Shoulder Instability

- Can be anterior or posterior
- Can be traumatic or atraumatic
Shoulder Instability

• Mechanism of Injury
  – Force on an abducted, extended, externally rotated arm → acute dislocation
  – Repetitive microtrauma or subluxation in flexion, adduction and internal rotation → chronic posterior instability

• Associated injuries
  – Bankart: Avulsion of anterior inferior labrum with inferior glenohumeral ligament (IGHL)
  – HAGL: IGHL comes off the humeral side
  – Hill-Sachs

• Imaging
  – Xray
  – MRI in recurrent cases

Shoulder Instability

• Treatment
  – Acute: Immediate reduction
    • Traction counter traction
    • Hippocratic
    • Stimson technique
    • Milch Technique

Reduction Maneuvers

Stimson Technique
Hippocratic Method

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Shoulder Instability

- Treatment:
  - Recurrent anterior
    - Appropriate imaging includes 3D CT and MRI
    - Arthroscopic Bankart repair
    - Open HAGL repair
  - Recurrent posterior
    - Activity modification
    - Rehab
    - Posterior capsulorrhaphy

Shoulder Instability

- Who gets recurrent instability?
  - 75 – 85% recurrence after initial traumatic dislocation
  - Strong association of recurrence with male and younger age
  - Ligamentous laxity
    - Multidirectional instability
  - Hill-Sachs
  - Missed HAGL
  - Bony Bankart

Superior labral Anterior-posterior tears

- Secondary to microtrauma or acute trauma
  - Microtrauma: cocking phase of throwing cycle
  - Acute trauma: fall onto outstretched arm
- Presentation:
  - Pain in late cocking phase
  - Most common complaint is decrease in pitch velocity
- Imaging
  - X-ray: exostosis, sclerosis of GT, rounding of post glenoid rim
  - MRI: RC tears, labral tears, cysts, chondral lesions
  - MR arthrogram – most sensitive
- Treatment:
  - Conservative: posterior capsular stretching
  - Arthroscopic repair

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Glenohumeral internal rotation deficit (GIRD)

- Starts in the early athlete
- Mechanics:
  - Increased humeral retroversion
  - Loss of internal rotation
  - Tightness of rotator cuff and posterior capsule
  - The humeral head now sits in abnormal posterosuperior position during rotation
- Treatment:
  - Posterior capsular stretching program
  - Arthroscopic posterior capsule release

Fractures

- Clavicle Fractures
  - Last bone to fuse
  - Most commonly treated non-operatively
  - Return to normal activity takes 2 to 3 months
  - Surgical:
    - Absolute: open, skin compromise, floating shoulder, neurovascular compromise

- Acromioclavicular separation

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• Acromioclavicular separation

• Sternoclavicular injuries
  – Salter Harris I or II fracture of medial clavicle
  – Anterior or posterior displacement of clavicle
  – Evaluated with CT scan
  – Posterior dislocations are concerning
  – Reduction of posterior dislocation needs to be done with thoracic surgery back up

Fractures

• Proximal humerus
  – Significant remodeling capacity
  – Non-displaced/minimally displaced treat conservatively
  – Younger than age 11 can accept upto 20 degrees of angulation
  – Older or with significant displacement then closed reduction and fixation
Athletic Forces across the elbow

Medial Side: Tension

Posterior: Shear

Lateral Side: Compression

Little Leaguer’s elbow

• Medial Side
  – Epicondyle avulsion
  – Apophysitis
  – UCL insufficiency
• Lateral Side
  – Panner’s disease
  – Osteochondritis dissecans
• Posterior
  – Olecranon apophysitis

Little Leaguer’s elbow

• Medial epicondyle apophysitis
  – Flexor-pronator mass and UCL
  – Presentation:
    • Insidious onset of progressive pain
    • Flexion contracture
    • Decreased pitch velocity and distance
    • Point TTP along with swelling
    • Pain but no instability with valgus stress
  – Xray: normal, possible fragmentation
  – Treatment: pitch rest
Epicondylitis vs. epicondyle fracture

Medial Epicondyle fracture
- Immobilized for short period
- Early ROM
- Surgical vs. nonsurgical depends on fracture displacement
- Out of sports for about 6 – 8 weeks

Little Leaguer’s elbow
- UCL injury
  - Seen older adolescents
  - Due repetitive microtrauma
  - Presentation:
    - Decreased pitch velocity
    - Ulnar nerve parasthesias
  - Imaging:
    - MRI
    - Xray – stress testing
  - Treatment:
    - Rehab and rest
    - Surgery for persistent sx
      - 75% rtn to same level of play
Little Leaguer’s elbow

- Panner’s disease
  - Seen in kids age 4 – 9
  - Capitellum has tenuous blood supply
  - Presentation
    - Insidious onset lateral sided pain
    - Elbow stiffness
  - Imaging:
    - Xray: fragmentation at the capitellum

Little Leaguer’s elbow

- Panner’s disease

Little Leaguer’s elbow

- Treatment
  - Conservative
  - Rtn to normal play 1 month
  - Radiographs will normalize after 2 years

Little Leaguer’s elbow

- OCD
  - Older peds athletes
  - Presentation:
    - Point TTP, lack full extension, swelling
  - Imaging: MRI
  - Treatment:
    - Based status of physis, presence of loose body and if lesion is stable/displaced
Elbow dislocations

- FOOSH
- Posterior most common
- Immediate reduction
- Must demonstrate concentric reduction
- Treatment:
  - 7 to 10 days immobilization
  - Rtn to sports after pain, swelling resolved and with full ROM
  - Surgery with non-concentric reduction

Thank you!