Participation: Numbers in Organized Sports

  - 30 million adolescents & preadolescents

• **Little League 2007:** (www.littleleague.org)
  - 2,227,505 baseball participants
  - 366,780 softball participants
  - 2,640,285 total Little League participants

• **USA Baseball:** (www.mlb.mlb.com/usa_baseball)
  - 9 million participants aged 9 to 17
Introduction

• Children participating in sports each year: 30 million
• 3.5 million children < age 12 treated for sports injuries
  • 50% of injuries are overuse

Epidemic injury patterns in youth sports – elbow injuries in pitchers
Injury Risks

• 11,840 athletes, 5-17 years old
• 4,379,000 injuries annually
• 1,363,000 serious
  (missed school, surgery)
• Sport injuries:
  36% of all injuries for this age group
• Survey included playground equipment and skateboards

Survey 7-13 Years Old Children

- Two playing seasons
- Community organized
- Injury rates per 1000 athlete-exposures:
  - Soccer: 2.1
  - Baseball: 1.7
  - Football: 1.5
  - Softball: 1.0

Unique Properties of Growing Skeleton

- Periosteum thicker
- Cartilage thicker, more vascular
Fracture Healing

- Three stages
Remodeling

- Amount of growth
  - Patient age
  - Bone / physis involved
  - Location in bone – ie: proximity to physis
- Deformity in plane of motion
Both Bone Forearm Fractures

• Limits of acceptable reduction?
• Functional complaints rare
Displaced fractures

- Splint them as they lie
- Can apply axial traction as assistant applies splint
Stress Fractures in Adolescent Competitive Athletes with Open Physis

- Stress Fractures, 21 Athletes
  - 7 cases not satisfactory outcome
    - 4 tibial diaphysis
    - 6 athletes burst of speed
  - Early and thorough investigation
- Diagnosis Made
  - Routine x-rays + MRI scan
- 1 Surgery Olecranon

Imaging Studies

• Radiographs
  Plain
  Stress Views
• MRI Scan
• CT Scan with 3-D reconstruction
• Bone Scan

Comparison Views and Cone Views of Suspected Area Are Helpful
Unique Aspects

• Growth Plate
  • First line of failures due to stress or falls
  • Abnormal growth
  • Rotational adaptation
  • Physis / Epiphysis / Apophysis
• Articular cartilage
  • Development
  • Softness
Appearance and Closure of Secondary Ossification Centers - UPPER EXTREMITY

APPEARANCE

14-15y
17y

CLOSURE

18y
25y

14y
20y
Appearance and Closure of Secondary Ossification Centers - UPPER EXTREMITY
Contributions of individual growth regions to overall limb length.

Elbow Injuries

- Supracondylar
- Lateral condyle
- Transphyseal
- Elbow dislocation
- Medial epicondyle
- Radial neck
- Olecranon

Hyperextension injury
Supracondylar Fractures
Classification Gartland

Type I

Type III
Treatment

Types II and III

• Closed Reduction and Pinning
• Cast / Pins 3 weeks
Displaced supracondylar humerus fracture

Refer to appropriate center for emergency management...
Supracondylar Fractures

Catastrophic Results

Neurovascular injury

• Compartment syndrome
What you never want to see, but if you see it you’ll never forget it:

Volkmann’s Ischemic Contracture
Complications

Cubitus Varus

- Malunion
- Cosmetic not functional
- Corrective osteotomies = loss of fixation
Supracondylar Fractures

- Missed injury
- Cubitus varus
Elbow Dislocation

- Older Child and adolescent
- Think transphyseal, if young
- Medial epicondyle fracture?
14 YO Football Athlete

- Back of arm hit during practice
- Elbow posterior dislocation
Always get post-reduction films
17 YO Female

• RHD Catcher
• Junior high school
• Dived back into base sustaining elbow valgus loading force to outstretched hand
• Immediate swelling/pain, medial elbow
Xrays: Right elbow

Left elbow
Medial Approach
## ELBOW Differential Diagnosis

### MEDIAL

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Avulsion Fracture Medial Humeral Epicondyle</td>
<td>• Medial Humeral Epicondyle Overgrowth</td>
</tr>
<tr>
<td>• Ulnar Collateral Ligament Sprain (rare)</td>
<td>• Stress Reaction</td>
</tr>
<tr>
<td>• Ulnar Nerve Subluxation (rare)</td>
<td>• Nerve Instability</td>
</tr>
<tr>
<td>• Fracture</td>
<td></td>
</tr>
</tbody>
</table>

### Skeletally Immature

- UCL Tear and Instability
  - Previously rare, now common in younger pitchers
## ELBOW Differential Diagnosis

### LATERAL

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Osteochondritis Dissecans Capitellum</td>
<td>• Lateral Humeral Epicondylitis</td>
</tr>
<tr>
<td>• Osteochondral Fracture Capitellum</td>
<td>• Radial Head hypertrophy/overdevelopment</td>
</tr>
<tr>
<td>• Avulsion Fracture Lateral Humeral Epicondyle</td>
<td>• Loose Bodies</td>
</tr>
<tr>
<td>• Anterior Subluxation Radial Head</td>
<td>• Osteochondritis dissecans Capitellum</td>
</tr>
<tr>
<td>• Fracture Capitellum Radial Head</td>
<td>• Osteochondritis Radial Head</td>
</tr>
</tbody>
</table>

- OCD incidence appears to be decreasing, but no good epidemiologic studies in Little League
- Very common in Japan
<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Olecranon Fracture</td>
<td>• Olecranon Traction Apophysitis</td>
</tr>
<tr>
<td>• Olecranon Apophysitis</td>
<td>• Olecranon Spurs</td>
</tr>
<tr>
<td>• Olecranon Bursal Contusion</td>
<td>• Loose Bodies</td>
</tr>
<tr>
<td></td>
<td>• Posteromedial Spurs</td>
</tr>
</tbody>
</table>

Olecranon apophysitis = Osgood Schlatter’s disease of the elbow
## ELBOW Differential Diagnosis

### ANTERIOR

**Skeletally Immature**

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Distal Physeal Humerus Fracture</td>
<td>• Loose Bodies</td>
</tr>
<tr>
<td>• Capsular Sprain</td>
<td></td>
</tr>
<tr>
<td>• Hyperextended Elbow</td>
<td></td>
</tr>
</tbody>
</table>
UCL Attachment not on Medial Epicondyle
Medial Humeral Epicondyle

- **Origin of flexor pronator group**
  (FCR, FCU, FDS, PL, PT Part)
- **UCL attaches**
  - Anterior oblique band
  - Medial epicondyle/coronoid ant inf
Medial Humeral Epicondyle

- Truly an apophysis
- Ossification center
  - Appears 5 years
  - Unites 15-16 years
Medial elbow pain diagnoses in throwers

- Medial epicondyle stress fracture
- UCL tear
- Ulnar neuritis/hypermobility
- Flexor-pronator strain much less common
- Subluxating medial triceps
- Valgus extension overload
  - (elbow impingement)
- Sublime tubercle fracture proximal ulna
Elbow

Appearance and fusion of secondary ossification centers of the elbow in females and males

Lateral Forces = Compression
Medial Forces = Tension

© 2007 Kentucky Sports Medicine
Medial epicondyle fracture

- Controversial
  - Displaced extra-articular fractures

To Fix, or Not to Fix?
12 year old medial elbow pain for 4 months
Pitcher and Quarterback

1 mo.

3 mos. healed
12 year, 11-mo. Old RHD Pitcher

- 3 week history, medial elbow pain
- Kept throwing
- Little League, now in All-Stars

**PE:**
- Height 6’2”, Weight 190 lbs.
- Medial elbow pain
- No instability

Case courtesy of Dr. Adam Smith
Elbow initial x-rays

Medial epicondyle displaced fracture
UCL tear complete vs. partial
Follow up:

2 week:

4-week:

6-week:

4 month:
BB Bullet Appearance to medial epicondyle fracture

- May heal if you don’t allow pitching too early
- May take long time to heal, but UCL is intact
BB Gun

• Don’t allow to fire too soon
14 YO Pitcher, medial elbow pain for a year, open medial humeral epiphysis torn UCL

Stress Views

UCL reconstruction performed, baseball career ended
Risk Factors

- Overuse
- Fatigue
- High Pitch Velocity
- Showcase Participation
- Age Groups – Age Matched Case Control Study
  - 95 pitchers surgery / 45 adolescent no surgery
  - Multivariant Analysis, Injury Risk Pitching:
    - >8 months/year 5-fold
    - >80 pitches/game 4-fold
    - >85 mph 2.6X
    - Arm fatigue 36X

Dr. Andrews: “. . . the speed gun is the worst invention in the history of Little League baseball.”

UCL Reconstruction

- 27 Patients, with avg. 35 month followup
- Risk factors (6)
- Patient results:
  - Avg. 3 risk factors
  - Fastball velocity 83 mph
  - 67% threw breaking pitches < age 14
- 50% increase in UCL reconstructions in high school players
  - J.R. Andrews UCL reconstructions
    1988-1994: 8% high school (7 / 85)
    1995-2003: 13% high school (77 / 609)

Unable to straighten elbow out for 2 months
Referred for UCL sprain
Loose Bodies
Olecranon stress fracture

- 5 baseball players
  - Persistent olecranon physis
  - Underwent ORIF bone graft
- Mechanism
  - Extension forces – triceps
    - Gymnasts, divers
  - Combined – valgus extension overload
    - Overhead throwing athletes

Charlton J Shoulder Elbow Surg 2003
14 YO WM

- RHD baseball player, wrestler, and football player
- Right elbow hyperextension sprain with impingement of the lateral synovial band
Initial presentation
Shoulder Injuries
Adolescent (< Age 16)

- No epidemiological Studies

Trends:
  - Acute
    - Football Defensive
    - Extreme Sports
      - Skateboarding
      - Diving - Sky
Shoulder Injury
Sports
Epidemiology

1978 Older study

2 Year Rate: Top 3 Sports Injuries per 100 participants

Males
Football 82
Wrestling 75
Basketball 32

Females
Softball 43
Gymnastics 40
X-Country 35
16 YO WM
Epiphyseal displaced fracture of the medial clavicle at the level of the sternoclavicular joint
1 year post injury
Must Rule Out Fractures
Nolan Ryan didn’t start pitching until he was in high school.
Shoulder

• Little Leaguer’s Shoulder
• Definition: proximal humerus stress fracture
• Symptoms: Diffuse shoulder pain, reproducible while throwing
• Signs: pain proximal humerus, posterolateral and with ER
• Radiographs: 4 views
  - Comparison Stryker views
Distal radial growth arrest

Little Leaguer’s Shoulder
Little Leaguer’s Shoulder

• 23 patients
  • Age: average 14 years
    • 19 of 23 were pitchers
  • Pain while throwing
  • Symptoms: average duration 7.7 months
  • Treatment: rest for average 3 months
  • Follow up: average 9.6 months
  • 21/23 (91%) returned to baseball

Physeal and ROM Changes

- 79 youth baseball players
  - Age 8 – 15 years
- Increased physeal width on dominant side
- Increased ER dominant side


Little Leaguer’s Shoulder
Diaphyseal Humerus Fracture in a Thrower
Think pathologic fracture – simple bone cyst

1½ months

2½ months

Initial

15 YO Baseball Outfielder
12 Y, 6 mo. old, broke left wrist. One week later, fell onto R upper extremity.

Humerus Fracture Through Simple Cyst
Pathologic – Abnormal Bone
~ 3 years after fracture
Complete filling in of cyst
Prevention is Key

• Pitchers are at high risk
  • No speed guns
  • Less showcases
  • Do training other than baseball
  • Little League pitchers do not become big league pitchers
Conclusion:
13 YO “Big Pitcher” Syndrome

- Skeletally and mentally immature
- Fast growth phase
- Poor pitching mechanics
- Hip weakness = UE overuse injury

Protect our young athletes
- Reduce rate of Rotator Cuff and UCL tears in young pitchers
Little League pitchers do NOT become Big League pitchers.
STOP Elbow Injuries in Youth Baseball: Youth Sports Injury Prevention

STOP Sports Trauma and Overuse Prevention

Powerpoint

www.stopsportsinjuries.org
CONCLUSION

• Protect our young athletes from harm

• UCL tears in young baseball pitchers occur too often

• Educate athletes, parents, and coaches in injury patterns and prevention
Which is Safer?

Organized Sports or Free Play?
“Adults are obsolete children.”

— Dr. Seuss
I Am Invincible!