Objectives

- To be able to diagnose some of the most common pediatric overuse injuries by:
  - History
  - Physical
  - Imaging - Role?

- To be able to treat some of the most common pediatric overuse injuries
- To be able to discuss with your athletes and their parents, viable prevention strategies

Introduction

- Pathophysiology of Overuse Injuries:
  - Decreased Recovery time
  - Lack of natural healing process to the stress of
    - Bones
    - Cartilage
    - Muscles
    - Tendons
    - Ligaments
  - Result - microtrauma --------- macrotrauma
  - Combine with poor mechanics, training mistakes, inadequate equipment, poor environment

Overview

1. Proximal Humeral Physeal Stress Injury – Little Leaguer’s Shoulder
2. Medial Epicondylar Apophyseal Avulsion Fractures – Little Leaguer’s Elbow
3. Osteochondritis Dissecans of the Capitellum
4. Spondylolysis
5. Distal Radial Physeal Stress Injury – Gymnast Wrist

Introduction

- Epidemiology
  - Hard to determine – under reported
  - Fluctuating symptoms
  - May or may not result in loss time from sport
  - More common in older children (13-17yo)
  - More common in females
  - Sports played
  - Differences in training, and neuromuscular/biomechanical changes during growth
  - Variations in bone structure, flexibility and strength
  - Hormonal influences
**Introduction**

- Physical and skeletal immaturity cause unique injuries in children
  - Growth plates
  - Thicker, more metabolically active periosteum and more porous
  - Tolerates greater degree of deformation
  - Faster remodeling and healing
  - Delayed and nonunion are rare
  - Low incidence of stiffness with immobilization

**LITTLE LEAGUER’S SHOULDER**

- **Prevalence in overhead sports**
  - Baseball – 11-14 y/o
  - Swimming
  - Gymnastics
  - Wrestling
  - Volleyball
- **Definition**
  - Chronic, repetitive microtrauma of the proximal humeral physis
  - Causes physeal widening and epiphysiolysis

**LITTLE LEAGUER’S SHOULDER**

- **On exam**
  - TTP over lateral, proximal humeral physis
  - Strength testing may be NL, but may have pain with resisted IR/ER, and/or abduction
  - ROM is usually NL.
  - Edema is uncommon
- **Imaging**
  - AP and lateral necessary with internal and external views.
  - Novel coronal-aligned shoulder view for comparison
  - Dx = physeal widening
  - May also see metaphyseal sclerosis, cyst formation, and/or fragmentation

**LITTLE LEAGUER’S SHOULDER**

- **Treatment**
  - Rest from offending activities
  - Evaluate athlete’s throwing mechanics and correct
  - Stretching and strengthening program – prevention of deconditioning
  - Gradual reintroduction of a throwing program (multiple protocols)

**LITTLE LEAGUER’S SHOULDER**

- **Prevention/RTP**
  - Strengthening and stretching of the shoulder girdle and core muscles
  - Addressing poor throwing mechanics
  - Limitations on pitches — new rules in place from the 2014 Little League International Board of Directors — have seen 50% reduction in overuse injuries
  - Problem:
    - 45% of youth baseball pitchers pitched in a league with no pitch counts;
    - 43.5% of youth baseball pitchers pitched on consecutive days
    - 30.4% of youth baseball pitchers pitched with multiple teams
    - 19% of youth baseball pitchers pitched multiple games in one day; and
    - 13.2% of youth baseball pitchers pitched year-round.
Little Leaguer's Shoulder

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Little Leaguer's Elbow

- 9-14 y/o athletes involved in throwing and racket sports.
- Chronic overuse injury
- Inflammation due to repeated valgus stress on the medial epicondylar apophysis
- Can progress to avulsion fx of the medial epicondyle

Little Leaguer's Elbow

- Exam
  - Edema over medial epicondyle
  - Decreased ROM
  - Possible damage to sensory and/or motor function of the ulnar nerve
  - TTP of the medial epicondyle

Little Leaguer's Elbow

- Imaging
  - AP – best for small displaced fragments, Lateral
  - Oblique views of affected and contralateral elbow
  - Role of MRI?

Little Leaguer's Elbow

- Treatment
  - Nondisplaced and Displaced fractures less than 3mm
  - Immobilization in a posterior splint – pain and edema
  - Active ROM 5-7 days later to prevent contracture
  - ICE/NSAIDs
  - Splint discontinued after pain and edema have diminished
  - Displaced fractures greater than 3mm
    - Referral for surgical evaluation

Little Leaguer's Elbow

- Prevention/RTP
  - Aggressive strengthening and ROM – 4-6 weeks
  - Gradual return to throwing
  - Evaluation and correction of throwing mechanics

Osteochondritis Dissecans (OCD)

- JOCD
  - “Is and acquired condition of the joint that affects the articular surface and subchondral bone”
  - Etiology:
    - Trauma?, Ischemia?, Genetics?
  - Male to female ratio 2:1 – exact incidence unknown
  - Many cases go under or misdiagnosed
  - Lack of uniformity of classifying lesions
  - Rare before 10, and after 50yo
  - Highest incidence in teen years – 19 per 100,000 in females and 29 per 100,000 in males
  - Ratio may change due increased female sport participation
OCD of the Capitellum

• Common in sports with repetitive upper extremity use
  • Throwners, Gymnasts, weightlifters
• Usually 10 - 17 y/o
• Etiology - microtrauma
  • Exact etiology unknown
  • Believed to be repetitive valgus stress and shear forces during acceleration phase of throwing

OCD of the Capitellum

• Subjective findings
  • Pain with activity
  • Decreased ROM
  • Dull aching at rest
  • Catching and locking
• Objective findings
  • Effusion
  • Tenderness over the ant. radiocapitellar joint
  • Decreased ROM – especially extension > flexion

OCD of the Capitellum

• Differential Diagnosis
  • Panner’s Disease
  • Lateral ligament injury or tendinosis
  • Capitellum or radial head fracture
  • Loose body of other etiology – i.e. following an elbow dislocation

OCD of the Capitellum

• Panner’s Disease
  • Often used synonymously with OCD of the capitellum
  • Angular necrosis of the developing osseous nucleus within the entire chondral epiphysis
  • Analogous to Legg-Calve-Perthes Disease of the hip
  • Similar presentation to Capitellar OCD
  • Typically age – 6-10 y/o
  • Symptoms resolve with rest and activity modification
  • Deformity can occur if necrosis prolonged and collapse occurs

OCD of the Capitellum

• Imaging
  • X-ray
    • May be negative
    • May show rarefaction or radiolucency within the capitellum
    • May show angular ossification and cysts next to the articular surface
  • MRI
    • Helps determine the integrity of the articular cartilage

• Classification
  • Type 1 – No displacement of lesion and no fracture of the articular cartilage
  • Type 2 – Evidence of fracture of the articular cartilage or (3a) partial displacement of the lesion
  • Type 3 (3b/4) – Complete detachment of lesion with resulting loose body

OCD of the Capitellum

• Treatment
  • Type 1
    • No weight-bearing activities or upper extremity strengthening activities until radiographs show evidence of healing and pain resolves completely
    • Splint may be necessary for pain not relieved by rest – or to guarantee compliance
  • Type 2
    • Treatment controversial
    • Ranges from conservative to surgical intervention
  • Type 3
    • Surgical removal of loose body, curettage of fibrous and granulation tissue
    • +/- subchondral drilling, bone grafting with or without internal fixation, and periosteal transplantation
OCD of the Capitellum

- Surgical treatment depends on:
  - Location
  - Size
  - Stability of the fragment
  - Preference of the surgeon

Goal of Treatment

- Return to play to previous activity level
- Prevent the occurrence of Osteoarthritis
- Age of onset and size, progression, location, and stability of lesion
- Girls < 11y/o, boys < 13y/o – best prognosis
- > 20y/o poorer prognosis
- Prevent the occurrence of flexion contractures
- Brown et al. - 40% of pts with open arthrotomy of the elbow had 10° contracture at f/u
- Improved Outcomes with:
  - Early AROM using localized extension cast

SPONDYLOLYSIS

- Common cause of LBP in athletes
- Greatest prevalence: 10-15y/o
- Higher incidence in sports associated with periods of hyperextension
- Rate before the age of 5y/o
- Genetic predisposition: 33-50%

Exam

- Usually c/o unilateral low back pain insidious onset, without neuro c/o
- Occasional c/o buttocks pain
- Pt. may be able to pinpoint activity when pain began
- Pt. often will be in a lordotic stance
- Single leg extension test +
- TTP over affected Pars

SPONDYLOLYSIS

- Represents stress reaction/fix of the Pars Interarticularis
- Differs from other stress fix
- Develops at an earlier age
- Heals with much less callus formation
- Much more likely to form a fibrous nonunion

Imaging

- X-Ray – AP, Lateral, Oblique
  - Looking for “Scottie Dog” collar
  - 45° caudal at 1.5
  - 15° caudal at 1.4
- SPECT/CT Scan – more sensitive
- If + may go on to do CT scan
- Experts agree better chance of bony healing if NL x-rays
**SPONDYLOLYSIS**

- Treatment – controversial
  - Literature varies on degree, duration and indication for activity restrictions and bracing
  - Restriction of painful activity is agreed
  - Hamstring and gluteal stretching
  - Core strengthening

- Some experts argue in favor of antilordotic bracing
- Duration of activity restriction varies from 6wks to 6 months
- Some argue stage and site of fx determines healing not type of treatment
- Surgery very controversial
  - L4-L5 and Unilateral-Bilateral
  - Most clinicians will restrict activity until the pt is pain free
  - Slow gradual RTP with review of mechanics

**SPONDYLOLYSIS**

- Complications
  - RL spondylolyis can progress to Spondylolisthesis = slipping of one vertebra on another
    - I<25%, II<50%, III<75%, IV >75%. Best seen on Lateral.
    - Often asymptomatic, but may have LBP with or without leg pain
    - Surgery +/- for Grade II or more, progressive slip, development of neuro sx
  - Nonunion
  - Chronic LBP

- Prevention
  - Core and Flexibility training
  - Awareness of high risk sports and early Dx

**DISTAL RADIAL PHYSEAL STRESS FX**

- Sometimes referred to as “Gymnast wrist”
- 12-14 y/o females
- Heavy training schedules (>35hours/wk)
- Prevalence – 8-42%
- Bilateral 1/3 of the time
- Due to repetitive dorsiflexion and axial loading of the upper extremities

**GYMNAST WRIST**

- Exam
  - TTP over dorsal and volar radial physes
  - Painful ROM – especially in extreme active and passive dorsiflexion
  - +/- edema
  - NL strength
GYMNAST WRIST

• Imaging
  - Bi-lateral wrist radiographs
  - Widening/irregularity of the distal radial physis
  - "Beaking" of the epiphysis
  - Haziness of the physis
  - Cystic changes of the metaphyseal side of the physes

GYMNAST WRIST

• Treatment/RTP – recommendations made on Staging criteria
  - Stage 1 – clinical Dx without radiographic confirmation
    - Avoidance of axial compressive loading of the upper extremity. After 2-4 weeks, if pain free and ROM, may RTP
  - Stage 2 – Radiographic physeal widening, irregular and cystic changes of the physis, beaked distal epiphysis, and indistinct physeal appearance
    - Cast Ts may be necessary to prevent axial loading
    - May take 4-6 weeks to resolve
    - May RTP after resolution of sx

GYMNAST WRIST

• Stage 3 – late presentation
  - Has stage II radiographic changes, BUT with + ulnar variance
  - Often causes additional wrist pain due to ulnocarpal impingement
  - Must be addressed for successful Tx
  - Cast Tx may be necessary to prevent axial loading
  - May take 4-8 weeks to resolve
  - May RTP after resolution of sx

GYMNAST WRIST

• Complications
  - Ulnar positive variance sets up for:
    - Ulnocarpal impingement
    - Tear of the TFCC
    - Dysfunction of the articulation of the radius and ulna
    - Degenerative changes of the triquetrum, lunate, and ulna
  - Unclear though if loading of the ulnocarpal and radiocarpal joint causes growth acceleration of the Ulna or growth retardation of the radius

Sources

- Elite Sports Medicine. Proximal Humeral Epiphysiolysis. Web Based