Review of Common Pediatric Orthopaedic Problems for the Non-Orthopaedic Provider

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Learning Objectives:

At the end of this session participants will be able to identify the characteristics, initial diagnostic study findings and initial treatment for:

- Pediatric Proximal Humerus fracture
- Common Pediatric Elbow injuries
- Pediatric Slater-Harris Fractures Distal Radius
- and Scaphoid fractures
- Common Pediatric Hip pain
- Pediatric Knee Pain
- Common Pediatric Hind foot Injuries
Faculty Disclosures

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Proximal Humerus Fracture
Pediatric Proximal Humerus Fracture

• Fx defined as Physis or Metaphysis
• **Good prognosis healing due to high remodeling potential**
• More common adolescent fx peak @ 15 yrs age
  – SH II: > 12 yrs age
  – SH I: < 5 yrs age
  – Metaphysis: 5-12 yrs age
• Mechanism
  – Blunt trauma
  – Overuse: growth plate injury 2nd to throwing motion

www.orthobullets.com/pediatrics/4004/proximal-humerus-fracture--pediatric
Pediatric Proximal Humerus Fracture

Physical Exam

• Inspection:
  – Swelling shoulder, Arm tucked into side

• Palpation:
  – Tenderness globally Shoulder/Proximal Humerus

• ROM/Strength:
  – Limited ROM & increased pain

• Neurovascular: Usually no deficits

• Ortho Test:

  www.orthobullets.com/pediatrics/4004/proximal-humerus-fracture--pediatric

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Pediatric Proximal Humerus Fracture

Radiographs
- Standard views: AP & lateral shoulder, Axillary, Scapular Y
- Proximal Humerus Physis closes: predicts remodeling
  - Girls - 14-17 yrs old
  - Boys - 16-18 yrs old
- Bone displacement
  - Proximal Fragment Epiphysis
    - ABDucted - External rotated: 2\textsuperscript{nd} RTC musclea
  - Shaft Fragment
    - Anterior - ADDucted - Short: 2\textsuperscript{nd} to Pectoralis & Deltoid
- Treatment
  - Based on amount of Head/physis displacement on Shaft
  - Acceptable angulation based on remaining growth

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Pediatric Proximal Humerus Fx

Photo courtesy TGocke, PA-C

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Pediatric Proximal Humerus Fracture

Treatment

• Most respond well to non-operative therapy

• **Acceptable angulations**
  – <10 yrs age - any amount angulation
  – 10-13 yrs age - < 60° angulation
  – > 13 yrs age - <45° & < 2/3 shaft displacement

• Immobilization
  – Sling vs Shoulder Immobilizer
  – Coaptation Splint & Sling

• Surgery
  – > 2/3 displaced, > 45° angulated & < 2 yrs growth left - remodeling
  – Open Fx or Intra-articular fx
  – Vascular Injuries

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Elbow Pain

https://radiopaedia.org/articles/paediatric-elbow-radiograph-an-approach
www.orthobullets.com/pediatrics/4007/supracondylar-fracture--pediatric
Elbow Pain

General

- **Supracondylar Humerus fx** most common Pediatrics
- Radial head fx - most common Adults
- Mechanism of injury:
  - Fall out stretched hand (FOOSH)
  - Elbow Hyperextended
- Peak age 5-7 yrs old
- **Nursemaids elbow - Radial head dislocation**
  - 5% of all pediatric elbow injuries
  - typically seen in infancy and childhood
  - *mechanism*: isolated traumatic injury
  - the radial head is dislocated anteriorly
Elbow Pain

Physical Exam

• Inspection:
  – Swelling Elbow joint /radial side proximal forearm

• Palpation:
  – tenderness globally Elbow joint/ radial head

• ROM/Strength:
  – Limited ROM & increased pain w/ pronate/supinate & Elbow flex/ext

• Neurovascular:
  – Anterior Interosseous Nerve (AIN - Median) - “OK” sign
  – Radial Nerve - Wrist/Finger extension
  – Brachial artery: spasm can mimic loss pulse

• Ortho Test:

www.orthobullets.com/pediatrics/4007/supracondylar-fracture--pediatric
Elbow Radiology

- X-ray views
  - AP, Lateral, Oblique
- Elbow injuries have characteristic appearances
- Fat Pad sign key to suspected elbow trauma
- An awareness of normal elbow anatomy important to injury detection
Elbow Radiology

- Medial Epicondyle
- Lateral Epicondyle
- Olecranon
- Fossa
- Radial head
- Humerus
- Ulna
- Radius

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Radiology

Fat Pad Sign

NORMAL

Synovial space

Fat pad

ABNORMAL

Effusion

Fat pad

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Pediatric Elbow Radiology

- Normal **anterior fat** pad -small
- The **posterior fat pad** is not visible - soft tissue of the triceps muscle is not separated from the posterior edge of the humerus
- More than one third of the capitellum lies in front of the anterior humerus line
- “**True Lateral**” Elbow X-ray
  - hourglass sign or ‘figure-of-eight’
Non-displaced Supracondylar Humerus fx
Elbow Pain

Treatment

- **Initial recognition important**
  - Suspect fx pattern/Nondisplaced fx pattern
  - Posterior Splint vs. Sling:
    - **immobilization helps with pain control**
      - < 8 yrs old consider Long arm cast/sling
      - >8 yrs old consider Posterior splint/sling
  - F/U 10-14 days
  - Minimal Increased stiffness with prolonged immobilization
  - Good long-term results majority cases identified early

- **ALL displaced fx need to be seen same day**
Take Home message

• Positive Fat Pad sign Kids: think Supracondylar Humerus fracture

• Positive Fat Pad sign Adults: think Radial Head fracture

• Immobilize kids in splint or cast

Picture courtesy TGocke, PA-C
Medial Epicondylitis
Medial Epicondylitis

- Medial elbow pain w/ or w/o neuro changes
- Occupational hazards
  - Grounding golf club (TFCC)
  - Power tools/drills
  - Gripping
  - Throwing
- Pain usually radiates down forearm
- Active & resistive wrist flexion contribute to medial elbow pain
- Prolonged ME 2nd to failure of tendon healing
Medial Epicondylitis

- Increased stress medial elbow
  - Ligament laxity
    - Ulnar collateral ligament & capsule
  - Ulnar nerve stretched
    - Exhibit peripheral neuropathy symptoms
  - Muscle weakness CFT
    - 2nd to overuse
    - Peripheral ulnar neuropathy

- Physical Exam
  - General elbow exam
  - Ulnar collateral stress test
  - Ulnar nerve Tinel – look for associated cubital tunnel symptoms
Medial Epicondylitis

- **Diagnostic Studies**
  - X-ray not always indicated
  - U/S can look at tendon integrity
  - MRI – not necessary to make diagnosis

- **Treatment**
  - RICE
  - Support strap CFT region elbow
  - NSAIDS
  - Physical Therapy
  - Corticosteroid Injection
  - Surgery
    - Recalcitrant tendonitis that has failed conservative therapy
Pediatric Fractures Wrist/Forearm

Flynn JM, Wilson RH: Overtreatment a cause of complications with pediatric distal radius fractures
Orthopedics Today, September 2007

www.orthobullets.com/pediatrics/.../distal-radius-fractures--pediatric

www.orthobullets.com/pediatrics/.../both-bone-forearm-fracture--pediatric

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Distal Radius Fractures

General:

• Distal Radius & Ulna fx: 40% all pediatric fxs
  • Younger patients - high energy (sports)
  • Peak occurrence
    – Girls 10-12 yrs
    – Boys 12-14 yrs

• Injury Mechanism:
  – Most common: Fall On Out Stretched Hand
  – Abuse fx:
    • Hx inconsistent with Mechanism
    • Multiple Injuries/bone healing various stages
    • Child affect
    • Patterns of Ecchymosis
Distal Radius Fractures

Fracture - Bone location

- **Physis:** Slater-Harris growth plate fx
- **Metaphysis - Distal Radius**
  - Colles fx: apex volar
  - Smith’s fx: apex dorsal
  - **Torus/Buckle fx:** Unicortical bone deformity
- **Diaphysis- Shaft**
  - Both bone Forearm fx
  - **Radius/Ulna fxs:** distal 1/3 shaft

Flynn JM, Wilson RH: Overtreatment a cause of complications with pediatric distal radius fractures
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www.orthobullets.com/pediatrics/.../distal-radius-fractures--pediatric

www.orthobullets.com/pediatrics/.../both-bone-forearm-fracture--pediatric
Distal Radius Fractures

**Fracture - Bone location**

- Diaphysis
  - Both Bone Forearm Fracture
  - Radius Shaft - mid-shaft
  - Ulna Shaft: mid-shaft ("night stick")
- **Plastic/Greenstick fx**
  - Plastic deformity: deforming force reshapes bone (no fx)
  - Greenstick: bending deformity of bone with bone fracture
- Monteggia - Ulna shaft fx with Radiocapitellar joint dislocation
- Galeazzi - Distal 1/3 Radius fx with DRUJ injury

Flynn JM, Wilson RH: Overtreatment a cause of complications with pediatric distal radius fractures
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www.orthobullets.com/pediatrics/.../distal-radius-fractures--pediatric
www.orthobullets.com/pediatrics/.../both-bone-forearm-fracture--pediatric
Salter-Harris Fracture Classification

S 1 - Separation physis
A 2 - Fx ABOVE physis
L 3 - Fx BELOW physis
T 4 - Fx THRU physis
R 5 - Fx CRUSH physis

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Pediatric Physis Fractures

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Pediatric Physis Fractures

- Salter-Harris 1 vs 2

[Images of bone fractures showing physis and epiphysis]
Pediatric Physis Fractures

Salter-Harris 2

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Pediatric Physis Fracture

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Pediatric Physis Fracture

Salter-Harris 4

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Pediatric Metaphysis Fractures

Torus Fracture

- Aka: “Buckle fx”
- Skeletally immature
- FOOSH mechanism
- Same symptoms adult fx
- Often overlooked on x-ray
- Unicortical Bone deformity
  - Radius and/or Ulna

pubs.rsna.org/doi/pdf/10.1148/rg.342135073

X-ray courtesy Tom Gocke, PA-C Library
Pediatric Diaphysis Fractures

Diaphysis

Epiphysis

Physis

Diaphysis
Distal 1/3 Radius Fractures

Treatment: **Non-displaced fx**
- No closed reduction required
  - Extra-articular, non-displaced
  - Minimal radial shortening
  - Dorsal angulation <5°
  - Well padded sugartong vs. volar splint vs. Commercial splint
  - Arrange for same day or next day F/U Ortho appt

**Displaced Fx - Reduction**
www.orthobullets.com/pediatrics/.../distal-radius-fractures--pediatric
www.orthobullets.com/pediatrics/.../both-bone-forearm-fracture--pediatric

Picture courtesy T Gocke, PA-C
Carpal Scaphoid Fracture

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Carpal Scaphoid Fracture

- Carpal bones have no periosteum
- NO periosteal reaction seen with bone injury/Fx
- **Anatomic Snuff box tenderness hallmark clinical sign**
- Mechanism of injury - **FOOSH**
  - Crush/compression injury distal radius and proximal pole Scaphoid
- Peds Scaphoid fx
  - Distal pole fx most common location kids
  - Waist fx becoming more prevalent 2\textsuperscript{nd} to higher BMI kids
- Blood supply
  - Solitary dorsal & volar branch from Radial artery
- Complications:
  - Nonunion fx healing vs. Avascular necrosis

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Anatomic Snuff Box

Radial side Wrist

• Borders
  – ABD Pollicis longus
  – Extensor Pollicis Brevis
  – Extensor Pollicis longus
Carpal Scaphoid Fracture

X-ray
- Posterioanterior (PA), Lateral and Scaphoid view
- **Distal Pole fx most common**
- **Fx not usually seen on initial radiograph**
- MRI:
  - Most sensitive detect occult Scaphoid fx
  - Bone Contusion, TFCC & Intercarpal Ligament injury

Carpal Scaphoid Fracture

Treatment:

- **Recognition/Suspicion key treatment**
- Immobilize Thumb Spica Splint vs Thumb Spica Cast
- Initial X-ray
- MRI scan for ? Occult fx
- Needs ortho referral 1 week
- Limit sports/aggressive activity

Photo courtesy TGocke, PA-C

pubs.rsna.org/doi/pdf/10.1148/rg.342135073
Back Pain

• General
  – MSK injury: most common form back injury
  – Isolated to muscle injury
  – Complaints along various levels Thoracolumbar spine
  – Affects all ages
  – Worse with movement & better with rest
  – Sit-Stand-Lie: varied response
  – Sports & Labor job: repetitive motion
  – NO radicular symptoms (beyond gluteal)
  – NO incontinence

www.orthobullets.com/spine/.../low-back-pain--introduction
Back Pain

Treatment:

• **Musculoskeletal:**
  – 90% of low back pain resolves within one year
  – **Depends on patient response**
    • NSAIDS vs. Steroid dose pack
    • Muscle Relaxer
    • Analgesics
    • Physical therapy vs. Home Exercise Program (HEP)
    • Limit activity
      – Recreation
      – Work
    • F/U exam 1-2 weeks
  – Duration: varies 1-4 weeks

**Fragile period 6 weeks**
Common Orthopaedic Problems

Pediatric Spondylolysis/Spondylolisthesis

• Common cause Low back pain (LBP) kids
• Pars stress reaction/fracture
  • Sclerosis with incomplete bone healing vs. disputation
• Spondylolysis
  – Anatomic defect in Pars Interarticularis – bone sclerosis
  – Defects not present at birth
  – Usual injury mechanism – repetitive hyperextension
  – High prevalence in gymnasts, weight lifters, football linemen

Moore D: Pediatric Spondylolysis/Spondylolisthesis – spine – Orthobullets
Common Orthopaedic Problems

Pediatric Spondylolysis/Spondylolisthesis

• Symptoms
  – Spondylolysis asymptomatic
  – Activity onset Low Back Pain and buttock pain
  – L5 radiculopathy
  – **Hamstring tightness (Quad, Hip Flexor, Achilles)**
  – Lumbar extension exacerbates symptoms

Moore D: Pediatric Spondylolysis/Spondylolisthesis – spine – Orthobullets
Pediatric Spondylolysis/Spondylolisthesis

• Physical exam
  – Low Back Pain: worse with extension
  – Poor flexibility
  – Paraspinal muscle spasm/tenderness (unilateral vs. bilateral)
  – Frequently no neurologic deficit
    • Straight Leg Raise – positive vs. false positive (tight hamstrings)
  – Lumbar radiculopathy
    • 2nd to anterior slip or compression/traction at foramen
    • L5 most common
    • Ankle dorsiflexion weakness & L5 radiculopathy

Moore D: Pediatric Spondylolysis/Spondylolisthesis – spine – Orthobullets
Lumbar Exam

Physical Examination

- Neurologic
  - Sensory Lumbar distribution
    - L3 distal thigh
    - L4 medial low leg and ankle
    - L5 Anterior low leg & dorsal ankle
    - S1 Lateral ankle
  - Reflexes
    - Patellar: L4 distribution
    - Achilles: S1 distribution
    - Babinski:
      - negative test: down going toes
      - positive test: toes flare up
Common Orthopaedic Problems

Diagnostic Imaging

- **Spondylolisthesis**
  - PA, Lateral & Oblique
  - **Oblique image shows sclerosis/elongation Pars Interarticularis** (Scotty Dog sign)
  - Lateral measures slip angle and helps assess grade of slip
    - Grade 1 <25%
    - Grade 2 <50%
    - Grade 3 <75%
    - Grade 4 <100%
  - **Flexion & Extension views – Assess segmental instability**
    - > 4mm or 10° change slip angle

CT/MRI – further study Pars anatomy & for evaluation neurologic symptoms

Moore D: Pediatric Spondylolysis/Spondylolisthesis – spine – Orthobullets
Back Pain

Normal Anatomy

Spondylolisthesis

Picture courtesy TGocke, PA-C

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Common Orthopaedic Problems

Pediatric Spondylolysis/Spondylolisthesis

Treatment:

• **Asymptomatic Lysis/Listhesis**: NO restriction

• **Symptomatic**
  – PT & restrictions in activity
    • Hamstring flexibility
    • Core strengthening

• **TLSO bracing 6-12 weeks**
  – Acute Pars stress reaction
  – Failed conservative treatment
  – Brace & activity restrictions

• **All treatments fail - Surgery**


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Take Home Points

• Majority of LBP in adolescents is musculoskeletal

• Failure to respond to conservative care think Spondylolisthesis

• Low back pain symptoms exacerbated with extension are concerning for Pars Interarticularis injuries

• Diagnostic Imaging using X-ray, or CT scan will show changes in the Pars Interarticularis

• Activity modification, Hamstring flexibility and improved core body strength are first line treatment options
Hip Pain
Toxic Synovitis vs Septic Hip Arthritis
Toxic Synovitis vs Septic Hip Arthritis

General:
- Most common cause acute hip pain children
- Age onset: 3-10 yrs (4-8yrs typical)
- Males 2:1
- Causes:
  - Unknown
  - Viral vs. Bacterial (Post-Streptococcal toxic synovitis)
  - High Interferon concentrations
  - Trauma
  - Allergic reaction
- Pathophysiology: nonspecific Inflammatory process synovial lining
Toxic Synovitis vs Septic Hip Arthritis

Prognosis:
- Usually benign
- **Improvement 24-48hrs; complete resolution <1 week**
- **Key elements History & Exam:**
  - Site: groin-hip
  - Time onset: constant vs. intermittent
  - Mechanical Symptoms
  - Associated limp
  - Constitutional symptoms
  - Recent illness/trauma
Toxic Synovitis vs Septic Hip Arthritis

Physical Exam

- “Lots of Drama”

- **Symptoms**
  - Fever
  - Acute vs. Insidious onset
  - Worse on awaking - improves as the day goes on
  - Refuses wt-bearing affected leg
  - Muscle spasms
Toxic Synovitis vs Septic Hip Arthritis

Physical Exam

– Inspection:
  • Flexed hip, ABD, External Rotated
    – Lesser intracapsular tension/pressure
  • Non-toxic appearance

– Range of Motion
  • Restricted Hip ABD:
  • Log-roll: can detect involuntary muscle spasm
    – Painless motion: less likely septic joint

– Neuro
  • Toe Walking/Cavus Foot/Toe Clawing: neuro causes for a limp
Toxic Synovitis vs Septic Hip Arthritis

Diagnostic

- Imaging:
  - Radiographs: may show widening hip joint 2nd to fluid accumulation in joint
  - **Ultra-sound:**
    - Best choice
    - Can detect intracapsular fluid
    - Synovial lining thickening - ? Response

- Joint Aspiration:
  - Sensitive & specific
    - Elevated Nucleated cells >50,000
    - CRP > 20mg/l most predictive
    - ESR < 20mm/h
Toxic Synovitis vs Septic Hip Arthritis

Kocher Criteria - Septic arthritis

- **3 of 4 = 93% septic arthritis predictor**
  - Fever $> 38.5^\circ$
  - WBC $> 12,000$
  - Unable to wt bear
  - ESR > 40mm/hr

- Rule out Criteria
  - Ability to wt bear
  - CRP $< 20$ mg/L
Toxic Synovitis vs Septic Hip Arthritis

Treatment:

• **Suspicion:**
  – Admit vs Observe
    • Lower Clinical suspicion
    • IV vs. PO NSAIDS
    • Afebrile last 24 hrs.
    • Improving ambulation
    • Kocher score < 2
Toxic Synovitis vs Septic Hip Arthritis

Treatment:

- **Suspicion:**
  - Joint Aspiration
    - High Clinical suspicion septic joint
    - No response after NSAIDS
    - Febrile
    - Recent or Concurrent Infection (URI, UTI, OM)
    - Kocher score >2
    - US vs. MRI guided aspiration
    - Labs, Culture, empiric ABX
Toxic Synovitis vs Septic Hip Arthritis

Treatment:

- **Confirmation:**
  - Surgical I&D
    - Documented septic joint
    - Severe Systemic Infection (URI, UTI, OM)
    - Kocher score 4/4
    - Prolonged Infection will affect articular cartilage
Slipped Capital Femoral Epiphysis

Slipped Capital Femoral Epiphysis

- Most common acquired hip disorder of adolescents
  - Rare < age 9
  - Boys > Girls (2.5:1)
    - Pacific Islander/African American
    - Age: 10-15 girls & 12-16 boys
    - Heavier, Taller
    - Follows growth spurt
    - Higher incidence June-September
  - Bilateral occurrence: 25-40%
    - Girls > Boys
    - Younger & thinner
Slipped Capital Femoral Epiphysis

• Clinical presentation
  – Anterior thigh/groin pain
  – Limp
  – Wt Bear progressing to unable to wt bear

• Physical Exam
  – Abnormal gait patterns
  – Limited ROM: hip flex and internal rotation
  – Out toeing (external rotation foot)

Slipped Capital Femoral Epiphysis
Radiographic exam

AP pelvis
Frog lateral
Slipped Capital Femoral Epiphysis

- Treatment options:
  - Early diagnosis & prompt Ortho referral
  - Non-wt bearing affected extremity till F/U w/ Ortho
  - Surgery

- Complications:
  - Degenerative arthritis
  - Avascular Necrosis
    - Occurs 5-15%
    - Late finding 6-24 months
    - Loss of blood supple to femoral head
  - Varus deformity
  - Chondrolysis – loss articular cartilage
Pediatric Knee Problems

Calcaneal Apophysitis: American Academy of Foot and Ankle Surgeons
http://www.acfas.org/Content.aspx?id=1483

Patellofemoral Pain Syndrome: American Academy of Orthopaedic Surgeons,
http://orthoinfo.aaos.org/topic.cfm?topic=A00680
Osgood Schlatter's Disease

http://radiopaedia.org/articles/osgood-schlatter-disease
http://www.eorthopod.com/content/osgood-schlatter-disease
Osgood-Schlatter’s Disease

• General
  – Occurs 11-15 age group (rapid growth)
  – Boys > Girls
  – Overuse problem – increased demand on immature skeleton
  – Caused by tight hamstrings limit knee extension and increasing pull of quad/patellar tendon on tibial tubercle
  – Small area heterotopic ossification seen 2nd to microtrauma a the tibial apophysis

• Clinical Symptoms
  – Swelling tibial tubercle area
  – Pain with ambulation, stair-climbing, jumping & running
  – Pain with palpation
  – Limited ROM knee 2nd to tight hamstrings

http://radiopaedia.org/articles/osgood-schlatter-disease
http://www.eorthopod.com/content/osgood-schlatter-disease
Osgood-Schlatter’s Disease

• Physical Examination
  – General Knee exam
  – Pay specific attention to age group, flexibility and location pain
  – Tender palpate tibial tubercle
  – Pain with AROM & resistive AROM knee extension

• Differential Diagnosis
  – Jumper’s Knee
  – Avulsion fracture tibial physis
  – Synding-Larsen-Johansen Disease – connective tissue disorder

http://radiopaedia.org/articles/osgood-schlatter-disease
http://www.eorthopod.com/content/osgood-schlatter-disease
Osgood-Schlatter’s Disease

• Radiographs:
  – AP, Lateral, Sunrise
  – AP - Normal
  – Lateral
    • Bony changes noted at tibial tubercle
    • May need comparison view contralateral knee
  – Sunrise – check patella position in trochlea

http://radiopaedia.org/articles/osgood-schlatter-disease
http://www.eorthopod.com/content/osgood-schlatter-disease
Osgood-Schlatter’s Disease

• Treatment:
  – Symptomatic care
  – ICE
  – NSAIDS
  – Knee pad or sleeve: decrease pain from contact pressure
  – Immobilize for recalcitrant symptoms or poor patient compliance
  – Change activity up to 2-3 months
    • May need longer for more severe cases
  – Surgery to correction for rupture/bony fracture - rare

http://radiopaedia.org/articles/osgood-schlatter-disease
http://www.eorthopod.com/content/osgood-schlatter-disease
Patellofemoral pain


Patellofemoral pain

• Occurs for many reasons
  – Overuse
  – Poor strength
  – Poor flexibility
  – Anatomy
  – Obesity

• Affects all ages
  – Adolescent
  – Mid-Lifers vs. “Old Teenagers”

• Anterior Knee Pain
Patellofemoral pain

• Characteristics
  – Stairs/Stand/Sit/Squat Kneel & Crawl
  – Ache
    • Pain comes 2nd to soft-tissue inflammation & bone
    • Articular cartilage wears down - *Chondromalacia*
  – Swollen/Stiff
  – Vague symptoms

• Overuse
  – Repetitive activity
  – Increased frequency vs. intensity vs. duration
  – *Flexibility/strength*
  – Improper foot wear or training techniques
Patellofemoral pain

Malalignment

- Patellofemoral trochlea mismatch
  - Abnormal contact pressure patella-trochlea
  - Leads to Chondromalacia & soft tissue inflammation
  - Abnormal tracking Patella

- Contributing Factors
  - Patella Aligns lateral : lateral tethering
  - Patella Aligns medial : “squinting patella”
  - Patella too High – Alta (Baha to low)
  - **Soft-tissue Imbalance**
    - Weak Quads
    - Tight retinaculum
    - Hamstrings/Patella tendon tight
  - Improper foot wear or training techniques
Patellofemoral Pain

• Physical Exam
  – Inspection:
    • **Patella alignment**
    • Gait changes based on acuity of symptoms
  – Palpation:
    • **Lateral retinaculum tenderness**
    • **Tenderness Medial & Lateral facets**
  – Range-of-Motion (ROM):
    • **limited by pain/crepitation**
    • J move
    • Lateral tracking
  – **Strength**: weak quads/poor flexibility
  – Neuro/Vascular: no changes
  – Ortho Tests
Radiographs

- **Sunrise View**
- **Merchant View**
- **Tangential View**
  - All look at articular surface of patella
  - Position of patella
  - Compression points patella

*Picture courtesy TGocke, PA-C*
Radiographs

**Patella Alta:**

Picture courtesy TGocke, PA-C

**Patella Baja:**

Picture courtesy TGocke, PA-C
Radiographs

• Patella Height: (Blumensaat's Method)
  – Knee flexed to 30 degrees
  – Draw a line thru the roof of the Intercondylar notch
  – Line should touch the inferior pole of the patella
• Normal height - inferior pole patella touches Blumensaat’s line
• Patella Alta – inferior pole patella above line
• Patella Baja – Inferior pole patella below line

Blumensaat’s C: Die Lageabweichungen und Verrekrugen der Kniescheibe; Ergebnisse der Chirurgie und Ortho 228(31):149-223.
Patellofemoral pain

Treatment

- Recognize condition
- Assess flexibility and strength
- Modify activities
- Improper foot wear or training techniques
- ICE/Heat
- NSAIDS: Oral – Topical – Injectable
- Surgical
  - Arthroscopy
    - Chondroplasty
    - Lateral Release
  - Tibial Tubercle Transfer
    - Realign patella tendon with bone repositioning
Foot Pain
Calcaneal Apophysitis

• **AKA: Sever’s Disease**
• Ages 8-14
• Results from repetitive stress activity
• Stressors cause inflammation @ Calcaneal Physis
• Pain worse with activity better with rest
• Causes:
  – Tight Achilles
  – Obesity
  – Foot biomechanics
    • Pes Planus w/ rear-foot valgus vs. Cavus foot

Calcaneal Apophysitis: American Academy of Foot and Ankle Surgeons
http://www.acfas.org/Content.aspx?id=1483
Calcaneal Apophysitis

• Symptoms
  – Localized heel pain (pressure)
  – Gait change
    • Limping
    • Toe walking - NOT assoc with Sever’s dz
  – Pain after running/jumping
  – Swelling/redness variable
  – Avoidance of activities
  – Growth spurts – shoes and pants
Calcaneal Apophysitis

• Physical Exam
  – Inspection:
    • Variable swelling/redness
    • Gait changes based on acuity of symptoms
  – Palpation:
    • Lateral calcaneal pain/Achilles tenderness
    • Tenderness based on acuity of symptoms
  – Range-of-Motion (ROM):
    • limited by pain
    • Knee bent Dorsiflexion vs. Knee Extended Dorsiflexion
  – Strength: usually normal
  – Neuro/Vascular: no changes
  – Ortho Tests
Calcaneal Apophysitis

Radiographs

- AP- Lateral
- Harris Heel
  - Radiographs helpful in refuting other bone injuries

Typically see fissuring of Calcaneal epiphysis

Calcaneal Apophysitis: American Academy of Foot and Ankle Surgeons
http://www.acfas.org/Content.aspx?id=1483

Photo courtesy TGocke, PA-C

Orthopaedic Educational Services, Inc.
Calcaneal Apophysitis

Treatment

• **Recognition of complaints**
• Modification Activity
• Conservative care
  – RICE
  – NSAIDS
  – **Flexibility (Hamstring/Quad/Gastroc-Achilles)**
  – Heel Cushion
  – Good Shoes
  – **Immobilization - failed conservative tx & activity modification**

Ankle Sprains
Ankle Sprains

- Most common injury in athletics or physical activity
- Plantar flexion & inversion mechanism
- Limited disability
- Frequently re-injury
- Often under treated & most under rehabbed injury in non-athletic population
- Skeletally immature: Slater-Harris 1 fx more common vs. sprain
- Swelling no indication of severity
- Acute inflammatory response last 7-10 day
Ankle Sprains

• Symptoms:
  – Swelling
  – Ecchymosis: lateral heel, deltoid & MTP joints
  – Ankle & foot pains
    • 5th metatarsal base
    • Lateral Malleolus tenderness vs. Ligament tenderness
  – Ligament Laxity
  – Decreased ROM
  – Weakness 2nd to generalized ankle pain
Ankle Sprain

• Physical Examination
  – Inspection
    • Look for deformities and amount of swelling
    • Swelling is NOT an indication of severity of fracture
  – Palpation: appropriate bony landmarks
    • More tenderness over lateral malleolus vs ATFL
  – Range-of-motion (ROM) & Strength
    • limited 2\textsuperscript{nd} to pain and swelling
  – Neuro/Vascular
  – Orthopaedic Tests
    • Anterior Drawer
    • Talar Tilt Test
    • Squeeze Test
Ankle Sprains

• Radiographs: X-ray or Not?
  – AP Lateral and Mortise views
  – Location maximal tenderness guides x-ray selection
    • Lateral ankle ligaments vs. S-H fx distal fibula
    • S-H 1 fx looks normal on x-ray
    • Diagnosis of suspicion
  – Always consider foot x-ray to evaluate for base 5th MT fx
Ankle Sprains

• Treatment:
  – **RICE**
    • Rest, Ice, Compression, Elevation
  – **NSAIDS**
  – **Immobilize**
    • Ankle Stirrup device
    • Velcro ankle/foot fracture boot
  – **Crutches/Cast Scooter**
  – Physical Therapy vs. Home Exercise Program
Apophysitis 5th Metatarsal Base
Apophysitis 5th Metatarsal

- AKA: Iselin’s disease
- Traction Apophysitis at base 5th Metatarsal
- Repetitive activity pull Peroneus Brevis base 5th Metatarsal
- Peak ages 8-13 yrs  M = F
- Activity specific - Soccer, Basketball, Dancers
- Worse with activity - better Rest
- Physical Exam
  - Base 5th Metatarsal tenderness
  - Isolated swelling base 5th Metatarsal

https://www.orthobullets.com/pediatrics/4073/iselins
Apophysitis 5\textsuperscript{th} Metatarsal

- Radiographs
  - Wt bearing AP, LAT, Oblique
  - Apophysysis runs parallel to shaft 5\textsuperscript{th} MT
  - Lateral-Inferior margin of 5\textsuperscript{th} MT tubercle

- Treatment
  - Recognition
  - Rest/activity modification
  - Immobilize - symptomatic

www.orthobullets.com/pediatrics/4073/iselins

Photo courtesy TGocke, PA-C
Strayer SM: Fractures of the Proximal 5th Metatarsal; Am Fam Physician. 1999 May 1;59(9):2516-2522