Broadening the Differential: Spine and Lower Extremity Injuries in the Young Athlete

Dr. Nirav K. Pandya
Assistant Professor of Orthopaedic Surgery
Director, Pediatric Sports Medicine UCSF Benioff
Children’s Oakland
Nirav.Pandya@ucsf.edu

Goals

- Epidemiology
- Global Approach to Pediatric Sports Injuries
- Pediatric Fracture Management
- Top Sports Cases
  - Apophysitis (Osgood Schlatter / Sever’s / SLJ)
  - Pelvic Avulsion Injuries
  - SCFE
  - Anterior Knee Pain
  - Back Injuries

Disclosures

- Consultant - Orthopediatrics
- Committee Member – POSNA
Why Are Kids Different?

50% of all pediatric athletes will suffer at least 1 significant injury / year!

Key History Questions

- Insidious and dull vs. sharp and traumatic pain
- Diffuse vs. localized pain
- Pain before / after sports vs. during sport
- Normal gait vs. locking, instability, limping
Key History Questions

- Hours / week, miles / week, pitches / week
- Number of teams (club, school)
- Shoewear changes / inserts / braces
- Medications / supplements / alternative tx
- Prior MSK problems
- Family history
- Grades
- Emotional health

Key Physical Exam Maneuvers

Location of *palpable* pain will direct you to injury 99% of time!!

Imaging

ALL PATIENTS SHOULD GET AN AP AND LATERAL X-RAY OF THE AFFECTED JOINT!!

Ex. 10 y/o soccer player with 6 weeks of anterior knee pain
The vast majority of pediatric sports injuries still involve ruling out or treating fractures.

Children can mask fractures very easily and initial radiographs can be negative.

Do not feel bad immobilizing a child if you are not sure.

Fractures constitute 10% - 25% of all pediatric injuries.

Risk of fracture from birth to 16 years:
- Boys: 42%
- Girls: 27%
Why Are Children’s Fractures Different?

- Growth Plate (Physis)
- Periosteum
- Ligaments
- Physiology
- Bone Structure

Bone Anatomy

- Epiphysis
- Metaphysis
- Diaphysis
- Periosteum
- Physis

The Physis: The Difference Maker

- Many childhood fractures involve the physis
  - 20% - 25% of all skeletal injuries
  - CAN disrupt growth of bone
    - Length and/or angulation
  - Injury near but not at the physis can stimulate bone to grow more
Salter-Harris Classification

- Classification system to delineate risk of growth disturbance
  - Higher grade fractures = increase risk
  - Growth disturbance can happen with ANY physeal injury

Physeal Injuries: Growth Disturbance

- Fractures with highest rate of growth disturbance:
  - Distal femur 50% 
  - Distal tibia 25%
  - Late reduction of distal radius

Children vs. Adults

- LIGAMENTS:
  - Pediatric ligaments stronger than bone
    - More likely to get avulsion than ligament tear

Children vs. Adults

- PHYSIOLOGY:
  - More robust blood supply; less chance of non-union
  - Children tend to heal fractures faster than adults
    - Advantage: shorter immobilization times
    - Disadvantage: misaligned fragments become “solid” sooner
Remodeling Potential

Treatment Principles

1. AP and lateral x-rays of fracture site
2. AP and lateral x-ray of joint above/below
3. Kids can have occult injuries
4. If tender around growth plate, assume Salter Harris I

What do you do to treat definitively?

Kids don’t get stiff!!!
Case 1: Apophysitis

When growing pains are not growing pains

- Apophysitis = growth plate where muscle attaches
- Bone growth >> muscle growth
- Apophysitis = irritation of the apophysis due to tight muscles / overuse
Osgood – Schlatter’s

Sinding-Larsen Johansson Syndrome (SLJ)

Sever’s

Ischial Tuberosity Apophysitis
Iselin’s Disease

- Between 7 – 12 years of age (sk. immature)
- Sever’s usually younger
- OS / SLJ / IT / Iselin’s usually older
- Soccer and basketball!!
- Overuse, overuse, overuse
- Growth spurt, growth spurt, growth spurt
- Pain over bone prominences NOT tendon

Key H+ P

Osgood - Schlatter

Sever’s
Osgood - Schlatter / Sever’s:
Key H+ P

During growth spurt, bones grow faster than muscle > more tense muscles > more pull on apophysis

R.I.C.E
Avoid excessive running
Stretching / PT
Orthosis for flat feet
Patellar tendon straps

Sever’s Treatment

- R.I.C.E
- Avoid excessive running
- Stretching / PT
- Heel cups
- Minimize cleat wear

What To Worry About
Return to Play

Case 2: Pelvic Avulsion Fractures

- Full range of motion in the injured leg compared to the uninjured leg
- Regained normal strength in the injured leg compared to the uninjured leg
- Ability to jog straight ahead without pain or limping
- Ability to sprint straight ahead without pain or limping
- Ability to perform 45-degree cuts, first at half-speed, then at full-speed
- Ability to perform 20-yard figure-of-eight runs
- Ability to perform 90-degree cuts
- Ability to perform 10-yard figure-of-eight runs
- Ability to jump on both legs without pain and can hop on the injured leg without pain

Bony Injuries – Avulsion Fx’s

Pelvic Anatomy
Pelvic Anatomy

Bony Injuries – Avulsion Fx’s

- Avulsion Fractures
  - Ages 14 - 25
  - “I heard a pop”
  - Sprinters, jumpers, hurdlers, soccer, football
  - Sudden violent muscle contraction
  - Separation in cartilaginous area between apophysis and bone

Prompt diagnosis to avoid chronic pain
Bony Injuries – Avulsion Fx’s

Prompt diagnosis to avoid chronic pain

Treatment

- Rest and ice
- Protected weight bearing until pain free
- Progression to light isometric stretching and full weight bearing
- Return to full sports once full strength and pain-free range of motion is achieved

Case 3: Slipped Capital Femoral Epiphysis (SCFE)

Slipped Capital Femoral Epiphysis (SCFE)
SCFE – Epidemiology

- Common problem with serious consequences
- Annual incidence - 2 to 13 per 100,000
- Increased risk in certain groups
  - Male
  - Obese
  - Peripubertal
  - Polynesian

SCFE – Etiology

- Mechanical insufficiency of the proximal femoral physis to resist the load across it due to:
  - Endocrine factors
  - Previous radiation therapy
  - Renal osteodystrophy
  - Obesity

SCFE – Etiology

- Mechanical insufficiency of the proximal femoral physis to resist the load across it due to:
  - Decreased femoral anteversion
  - Decreased neck-shaft angle
  - Deeper acetabulum
  - Acetabular retroversion

Pathoanatomy

- Proximal femoral metaphysis impinges against acetabulum
  - Cartilage + labral damage
  - Posteromedial callus also develops over time
  - Long term risk of FAI and DJD
Why do we care?

AVN and DJD

Presentation and Workup

• Complaints of groin or thigh pain + / - trauma
• May or may not be ambulating
• May complain of knee pain!!
• AP and frog pelvis x-ray
• MRI of hip if not sure
Classification

- Functional
  - Stable: able to bear weight
  - Unstable: unable to bear weight

AVN risk in unstable slips can range from 10% to 60%, and is higher in younger patients with a shorter duration of preceding symptoms

Radiographs

Initial Treatment

- Prevent further slip progression
- Restore proximal femoral anatomy

Wheelchair and ED

Goals of Treatment
### Treatment Options

1. Wheelchair / crutches until 6 weeks post-op
2. Full-weightbearing @ post-op week 6
3. Return to sports at 3 months post-op
4. X-Rays every 6 months until 2 years post-op
5. Watch out for FAI

### Case 4: Anterior Knee Pain

**What is PF Syndrome?**

- Patella tendinopathy
- Patellofemoral arthritis
- Patellar stress fracture
- Patellar tendinitis
- Patellar instability
- Patellofemoral pain syndrome
- Pes anserine bursitis
- Plica synovitis
- Pseudopatellar bursitis
- Quadriceps tendinitis
- Referred pain from the lumbar spine or hip joint pathology
- Saphenous neuritis
- Sinding-Larsen-Johansson syndrome
- Symptomatic bipatellar patella

**Irritation Behind Patella**
Patellofemoral Syndrome: Key H + P

- No trauma
- Dull pain around knee cap or “deep inside”
- “Feels like sandpaper underneath kneecap”
- Playing sports all the time
- Stairs and sitting for long time = pain
- Benign exam
- Lack flexibility and core strength

Assess Single Leg Squat

Assess Popliteal Angles
Core Stability

Imaging

- AP, lateral, notch, and merchant x-rays (r/o OCD, fractures, etc)
- MRI only if does not improve with 6 – 12 weeks of PT

Patellofemoral Pain Syndrome

- Treatment
  - Rest
  - Pharmacologic
    - NSAID’S
  - PT
    - Core / Hip Strengthening
    - Stretching
    - Orthosis
Can I Play Through the Pain?

• Consequences of Playing:
  • *No structural damage but pain will last longer*
  • Minor risk of structural damage
  • Major risk of structural damage

Surgery: Is It Ever Indicated?

Case 5: Back Pain

Back Pain in Pediatrics

• Uncommon CC, but common occurrence
  • 7% of 12yo with >1 episode LBP
  • 50% of 18yo F, 50% of 20yo M

• Most not definitively diagnosed
• Most benign etiologies
• ~Half of episodes musculoskeletal (ER)
  • *Remember, backpacks <15-20% of weight!*
Back Pain in Pediatrics: Differential Diagnosis

**Causes of Back Pain in Children**

- **Musculoskeletal**
  - Neoplastic (neuromuscular, spinal pain)
  - Spondylolysis/spondylolisthesis
  - Scoliosis
  - Degenerative disease
  - Infection and/or sepsis
  - Osteopenia
  - Idiopathic adolescent idiopathic scoliosis
  - Congenital absence of pedicle
  - Lumbar spondylosis/osteoarthritis
  - Acute/chronic pain syndrome
  - Idiopathic juvenile osteoporosis

- **Infectious**
  - Enzymes
  - Vertebrae osteomyelitis
  - Mycobacteriosis/postdisease
  - Sepsis disease
  - Septic arthritis/postdisease
  - Neuro-osteomyelitis
  - Osteomyelitis
  - Rare inflammatory disease
  - Enchondromatosis
  - Vacuolar disease

- **Inflammatory**
  - Ankylosing spondylitis
  - Psoriatic arthritis
  - Rheumatoid arthritis
  - Scleroderma
  - Vasculitis

- **Neoplastic**
  - Sarcoma or lymphoma
  - Solitary bone tumors, primary or metastatic
  - Other bone tumors
  - Neurofibroma
  - Vascular malformation

- **Other**
  - Spinal congenital anomalies
  - Synotospondylosis
  - Chiari
  - Osteopetrosis
  - Chronic recurrent multifocal osteomyelitis
  - Psychosomatic illness

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**Red Flags**

- **Infectious, Neoplastic, Rheumatologic**
  - Severe disability
  - Young age (<4yo)
  - Bowel / bladder

- **Spondylolisthesis**
  - Anterior slippage of vertebral body over next lowest body

- **Spondylolysis**
  - Defect (separation) in pars interarticularis
Who Is At Risk?

- Athletes with repetitive hyperextension
  - Gymnasts
  - Divers
  - Football offensive linemen
  - Pole vaulters
  - Weight lifters
  - Wrestlers
  - LAXers!

Spondylolysis: H and P

- Low back pain without radiation
- Insidious onset
- Worse with activity
- Rarely radiating
- Usually no hx trauma
- Usually no neuro deficits

Spondylolysis: H and P

- Pain with hyperextension
- +/- “Step-off” at L5
- +/- Facet joint tenderness
- Hamstring spasm – classic in adolescents!
- Phalen-Dickson sign
  - hip-flexed, knee-flexed gait

Radiographs: Scottie Dog
Radiographs: Scottie Dog

If not sure, then order CT, MRI, etc

Treatment

- Depends on SLIPPAGE and SYMPTOMS and SKELETAL MATURITY
- Activity restriction
- NSAIDs
- Physical therapy
  - Abdominal/back strengthening
  - Hamstring stretching
- Bracing/Casting
  - Symptomatic / Acute pars fx
- Surgery

Pediatric Sports Top 10 List

1. Pediatric sports injuries are at an epidemic level
2. Kids have hard time verbalizing and have multiple pressures
3. Location of palpable pain will lead you to injury 99.0% of time
4. Pediatric fractures are most common sports injuries
5. Kids don’t get stiff and heal faster; watch out for growth issues
6. Bony tenderness in athlete = apophysitis
7. Pop and pelvic pain = avulsion fracture
8. Thigh pain = rule out SCFE
9. Look at mechanics and core strength for anterior knee pain
10. Pain with hyperextension = spondy

Thank You