Evaluation and Triage of Five Adolescent Diagnoses

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Objectives

By the end of this presentation you will be able to accurately assess for the following pediatric diagnoses:

- tibial spine avulsion fractures
- salter-harris fractures
- OCD of the knee
- SCFE
- pediatric bone and soft tissue tumors
Tibial Spine Avulsion Fractures

- involves the medial spine of the intercondylar eminence
- incompletely ossified tibial eminence fails prior to the ACL
- fx can also encroach into the medial tibial plateau
Tibial Spine Avulsion Fractures: Who is at Risk?

- Most common in children aged 8-14 years
- Ossification of the proximal tibia is not complete, surface of spine is cartilaginous
Tibial Spine Avulsion Fractures: When to be Suspicious??

- any MOI which you would suspect ACL injury
- fall from bike on outstretched leg is most common
- painful hemiarthrosis often preventing further accurate assessment
Tibial Spine Avulsion Fractures: Triage

- AP and lateral views of knee are essential; oblique and tunnel views may be needed depending on location of fragment
Tibial Spine Avulsion Fracture Classification and Treatment

- Type I: nondisplaced
- Type II: partially displaced or hinged
- Type III: completely displaced
- Type IV: comminuted fx

Type I-II typically treated with closed reduction
Type III often treated with ORIF
Case Study: “Tony”

- 11 y.o. male
- MOI: riding bike and lost control with back tire sliding out from under him
- immediate pain and swelling
- ER imaging concerning for tibial spine avulsion fx; placed in immobilizer
- appt with Dr. Noonan; placed in straight leg cast x 6 weeks
- Presented to PT 7 weeks s/p injury in ELS locked at 15 degrees knee flex
- d/c brace at 11 weeks and progressed per ACL rehab guidelines
Salter-Harris Fractures

- Injuries to growing bones at the growth plate/physes
  - *Pressure physes* (Epiphyseal growth plates): at ends of long bones, responsible for longitudinal growth
  - *Traction physes* (Apophyseal growth plates): present where large tendons insert to bone
Salter-Harris Fractures

- Pressure physis injuries may disturb growth of long bones thereby resulting in limb length or deformity
- “Salter Harris” is best known fx classification system to rate probability that fx will cause growth disturbance
- Type I fx has low likelihood of causing growth disturbance, Type V fx has very high likelihood of growth disturbance
SALTER Mnemonic for Classification

- **I-S=Same.** Fracture of cartilage of the physis
- **II-A=Above.** Fx lies above physis (in metaphysis)
- **III-L=Lower.** Fx is below the physis (in epiphysis)
- **IV-T=Through.** Fx is through metaphysis, physis, and epipysis.
- **V-ER=Erased** (crushed). Physis has been crushed.
Salter Harris Classification System

Figure 18.3  Salter Harris classification system.
Adolescent Fractures

- Fractures constitute 5-6% of all musculoskeletal sports-related injuries
- Most adolescent fx’s occur in the extremities
- 15-20% of pediatric fx involve the epiphyseal region, therefore up to 1/5 has potential for interrupted growth if undetected
Salter Harris Fractures: Who is at Risk??

- Adolescents
  - may be due to biomechanical and structural weakness of physeal cartilage during rapid musculoskeletal growth
  - long-bone growth surges, inflexibility increases in muscle mass and torque-generating capacity of muscle may also contribute

- Males incur more physeal injuries than female counterparts
  - greater propensity for impact sports
  - higher overall rate of traumatic injury
  - greater % of increase in muscle mass
  - growth plates remain open longer than do females
Salter Harris Fractures: Where??
Salter Harris Fractures: Why Suspicious??

- Likely hx of trauma
- Concomitant soft tissue injury (pain, tenderness, deformity, edema, ecchymosis)
- Loss of mobility and function
Salter Harris Fractures: Triage

- Refer for appropriate imaging
Osteochondritis Dissecans of the Knee

- A condition in which subchondral bone becomes avascular.
- If healing doesn’t occur, bone-cartilage complex can become loose.
- Can cause pain, loss of motion, articular cartilage destruction, and mechanical sx.
OCD of the Knee: Who is at Risk?

- prevalence rate of 15-20 cases per 100,000 (0.02%)
- primarily occurs between 10-20 y.o.
- if physis is open, the term juvenile OCD (JOCD) is used
- male:female ratio is 2:1
- frequently, cause is idiopathic
- Etiologic factors may include: trauma, endocrine-related pathology, vascular insult or insufficiency, genetic factors
OCD of the Knee

Where??

- although most common in the knee, also can affect elbow (capitellum), shoulder, ankle (talar dome) and hip
- typically unilateral, but can be bilateral (15-30% of cases)
- In the knee, most commonly affected sites:
  - #1 lateral aspect of medial femoral condyle
  - #2 lateral femoral condyle
  - #3 patella
Figure 1. Illustration showing the typical distribution of osteochondritis dissecans lesions around the knee.
OCD of the Knee
When to be Suspicious??

- Clinical presentation may vary
- Initially may report vague, poorly localized pain around affected condyle or ant knee?
- Sx may become mechanical if a stable lesion becomes unstable
- Effusion may be present depending on severity and stability of lesion (may be intermittent and based on activity)
- ER of affected extremity during gait to unload lesion
- Quad atrophy secondary to relative disuse
OCD of the Knee: Clinical Exam Technique

- **Wilson test**: (evaluation of medial lesions)
  - performed with examiner holding pt’s foot in IR with knee flexed to 90
  - pt extends leg against resistance
  - test is considered (+) when pt feels pain at 30 degrees of flexion (from impingement of tibial spine against the lesion)
  - pain relieved when leg comes out of IR
OCD of the Knee: Triage

- WB A-P, P-A tunnel views (at 45 knee flex), lateral and Merchant views
- tunnel view permits best visualization of femoral condyles
- Comparison views in skeletally immature individual may be useful
Slipped Capital Femoral Epiphysis (SCFE)

- Progressive displacement of femoral head relative to neck through open growth plate
SCFE
Who is at Risk??

- Pre growth-plate closure
- More common in males (males 13-16 y.o. are 2-5x more likely affected than females 11-14 y.o.)
- Overweight
- 25-33% bilateral (in boys <12 y.o.)
- More common in African Americans
SCFE
Why Suspicious??

- Diffuse/vague groin, buttock, thigh or knee pain/stiffness (frequently begins as pain surrounding knee)
- Insidious onset
- Antalgic gait
- Hx recent growth spurt or trauma
- Groin aching exacerbated with WB
- Involved LE held in ER (and sometimes flex and abd)
- hip IR and ABD ROM limitations
SCFE
Triage

- AP and lateral views helpful; frogview is definitive
- If this is significant concern, should be NWB
- MD consult
Pediatric Cancer: Who is at Risk?

- Incidence of Childhood Cancer
  - 15-19 y.o.
  - under 5 y.o.
  - 10-14 y.o.
  - 5-9 y.o.

- Highest
- Lowest
Pediatric Cancer: Where

- 7 Top Adolescent Cancers
  - **Hodgkin’s disease:** cancer of lymphoid tissue
  - **Germ cell, trophoblastic, and gonadal tumors**
  - **Central Nervous System Tumors**
  - **Rhabdomyosarcoma:** soft tissue carcinoma
  - **Non-Hodgkin’s lymphomas:** solid tumors arising from cells of lymphatic system
  - **Carcinomas and other malignant epithelial neoplasms:** cancer of thyroid, melanomas, adenocarcinomas, nasopharyngeal carcinomas, other skin carcinomas
  - **Leukemia:** cancer of blood forming cells
Pediatric Bone and Soft Tissue Tumors: Rhabdomyosarcoma

- Most common soft tissue sarcoma in children
- Derived from unsegmented mesoderm
- 2 peaks: 2\textsuperscript{nd} during adolescence
- Can occur at any site where striated muscle exists
- Common primary sites: head/neck > genitourinary tract > extremity > trunk > retroperitoneum
Pediatric Bone and Soft Tissue Tumors

- **#8= Osteosarcoma**
  - primitive bone-forming mesenchymal cells
  - first peak of incidence in 10-14 y.o.; coincides with pubertal growth spurt
  - males > females
  - long bones of extremities near metaphyseal growth plates most common (femur > tibia > humerus > skull/jaw and pelvis)

- **#9= Ewing sarcoma**
  - Characterized by morphologically similar round-cell neoplasm and presence of common chromosomal translocation
  - Affects young children and adolescents (5-20 y.o.)
  - Males > females
  - Axial skeleton, diaphysis or metaphysis of long bone
Pediatric Bone and Soft Tissue Tumors: Subjective Info

- **General Health Checklist**
  - weight loss/gain
  - nausea/vomiting
  - fatigue
  - unusual weakness
  - fever/chills/sweats
  - numbness or tingling
Pediatric Bone and Soft Tissue Tumors: Triage

- Presenting features usually non-specific and mimic common pediatric illness (fever, pain, HA, vomiting)
- Palpable tenderness and mass (Ewing’s)
- Pain and swelling (rhabdomyosarcoma)

- Lag time for dx is longer as number of consulted doctors/healthcare providers increases
- Greatest lag time in brain tumors, epithelial tumors, and bone tumors
Case Study: “Bryan”

- 15 y.o. male, sophomore at MG HS
- Landry’s clinic Dec 2009
- 2-year h/o R post/lat prox calf pain, worsened in past couple months (also occasional weakness)
- No specific MOI but recalls someone stepping on his calf with cleat while playing QB in football season
- Sx 1-2/10 at rest, worsen by end of day. Can wake him at night, 7-8/10 at worst.
Case Study: “Bryan”

- Sx not worsened with any specific activity
- Sx improved with ibuprofen
- Originally tx with crutches, boot for sleeping, PT at Dean
- Plain film imaging of tibia, fibula, ankle and calcaneous (-)
- (-) GHC, N&T, LBP
- PMH: migraines, ear tubes (child)
Case Study: “Bryan”

- PE: no redness/swelling, tenderness in prox fibula just inf to fib head, intact sensation, normal ROM at knee/ankle, full painfree strength, (-) lig testing at knee/ankle, (-) meniscal testing, unremarkable gait and squat

- Radiographs reviewed and (-)

- MRI indicated “0.4x0.5x1.2cm osteoid osteoma within post cortex of mid tibial diaphysis with associated cortical thickening”
Case Study: “Bryan”

- Admitted to UWHC 2/11/10, underwent cryoablation by MS radiology team
Another Resource for Tumors

http://www.radiology.wisc.edu/people/schreibman/files/Schreibman_BoneTumors.pps
More atypical presentation = lower tolerance for tx without further work up

Consider if pt is skeletally mature... if not, what dx need to be considered?

What precautions, limitations, or restrictions are appropriate?
THANK YOU!!!!
References