Pediatric Bone and Joint Infections

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MUSCULOSKELETAL INFECTIONS OF CHILDREN

• 1. Osteomyelitis
• 2. (Pyomyositis)
• 3. (Discitis)
• 4. (Subperiosteal abscess)
• 5. Septic arthritis & non-bacterial arthritis

USUAL OSTEOMYELITIS IN CHILDREN

ACUTE
STAPHYLOCOCCAL
HEMATOGENOUS
METAPHYSEAL (LONG BONE)

Acute vs. Chronic Osteomyelitis

• Osteomyelitis in children is nearly always acute
• Chronic osteomyelitis may the late result of progressive infection in the absence of antibiotic treatment
• Chronic osteomyelitis may occur in adults with penetrating trauma, IV drug use, etc., may involve atypical organisms or locations

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Staphylococcus aureus
USUAL OSTEOMYELITIS IN CHILDREN

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PATHOGENESIS OF OSTEOMYELITIS

1. Disruption of blood vessels in bone (trauma?)
2. Introduction of bacteria (Staphylococcus aureus or others) into the bloodstream (trauma?)
3. Seeding of bone, Staph adhesins produced, other virulence factors promote infection
4. Sustained Staph survival/resistance in osteoblasts.
5. Progression to necrosis, osteoporosis, etc.

WHY THE METAPHYSIS OF LONG BONES?

• The complex vascular network of the metaphysis may be disrupted by trauma.
• Growth criteria for Staphylococcus aureus present
• Children with sickle-cell anemia have more vascular disruption in the absence of trauma

Is it Osteomyelitis?

Location, location, location

Sites of Childhood Osteomyelitis

Experimental Osteomyelitis

Rabbit model provided early insights into pathogenesis of human osteomyelitis
Minor trauma followed by IV Staph aureus infusion created osteomyelitis in metaphysis
Management of Osteomyelitis: Key Decisions

• Surgery or no surgery:
  – Usually diagnostic gain > therapeutic gain
  – Orthopedics vs. interventional radiology

• Empiric antibiotic choice:
  – Vancomycin?
  – Clindamycin?
  – Beta lactam?

I.V vs ORAL ANTIBIOTIC THERAPY

INTRAVENOUS ANTIBIOTIC
• All children with proven osteomyelitis begin with IV
• May transition to home IV
• Compliance is nearly assured with home care personnel
• Tissue levels of antibiotic are higher, more predictable
• Home IV cost much less than hospital, but still substantial

ORAL ANTIBIOTIC
• Oral antibiotic almost never given at time of diagnosis
• Older literature established efficacy and adequacy if criteria for transition are met
• Compliance is more difficult to measure
• Convenience for school-aged child and family is greater

Osteomyelitis: Special Circumstances

• Unusual location – e.g. vertebral body
• Unusual age – neonatal osteomyelitis
• Unusual pathogenesis – stepping on a nail
• Unusual host – e.g. sickle-cell anemia

Case example

• Steven is a 17-year old male from northwest Iowa with progressive upper back pain and low grade fever for the past week.
• Social hx – high-school senior, works on farm
• Exam – Temp = 37.8 C and focal tenderness near lytic change on X-ray in T4 vertebral body
• Labs – WBC = 13,700, ESR = 63
• What is the next step in management?

Vertebral Osteomyelitis: Subsequent Course

• Aspiration of lesion performed by interventional radiology
• Culture grew Salmonella choreasuis.
• Initial treatment failed, followed by successful prolonged IV + PO chloramphenicol.

Case Example

• Joshua is a 4-week-old who presents with several days of irritability, possible fever, and reduced movement of right lower extremity
• Past Med Hx – 35 week gestation, short NICU stay, brief resp. support, umbilical art. Catheter
• Exam--pain on leg movement, tender shoulder
• X-ray –shoulder bone/joint abn., Tc99 scan showed 6 foci of osteomyelitis
**Neonatal Osteomyelitis**

1. More diverse microbiology – Staph aureus, but also group B strep, E. coli, etc.
2. Much more likely to be multi-focal
3. More likely to involve both bone and joint
4. Often associated with iatrogenic manipulations, especially vascular catheters
5. Needs long IV therapy (no oral options)

**Pyomyositis**

- C.K. is a 13-year-old boy presenting with vague pelvic pain.
- Exam shows pain with left hip rotation
- WBC = 11,800, CRP = 9, ESR = 55
- MRI shows piriformis muscle inflammation

**Stepping on Nail Wearing Tennis Shoe**

- Deep injury to bone by nail through tennis shoe may result in osteomyelitis.
- Plain film may suffice in identifying bone focus.
- Surgery is indicated.
- *Pseudomonas aeruginosa* is usual pathogen
- IV 2-drug treatment is usual. 4 weeks may suffice.

**Pseudomonas osteomyelitis of foot**

**Discitis**

- May occur in any intervertebral disc
- May occur in any age
- Staph aureus if predominant pathogen
- May co-exist with contiguous osteomyelitis
- Important pediatric stereotype = preschool child, lumbar disc, Staph aureus is pathogen, enabled by vascular access unique to this age, self-limiting (?), spontaneous fusion may occur

**Subperiosteal Abscess**
Case Example

- Ben is a 15-month-old boy who presents in 1985 with inability to walk, irritability, fever. Previously healthy, fully immunized
- Physical exam: T 102 F., irritable, apparent pain with R lower extremity movement. No joint swelling, limited ROM with right hip.
- Labs: WBC 13,800, left shift, ESR = 52
- Imaging: Tc99 scan? Plain film? Ultrasound?

Case Example (cont.)

- Plain film demonstrated substantial widening of joint space in right hip
- Procedure: orthopedic service aspirated right hip -- 4+ WBC's, pleomorphic, Gram neg rods.
- Drain is placed, removed at ~48 hours
- More labs: Latex agglutination test is positive for H. influenzae type b (beta lactamase neg.)
- Treatment: Cefotaxime IV, then oral amoxicillin. Total course 3 weeks

Septic Arthritis: General Observations

- Different pathogenesis than osteomyelitis
- More diverse group of pathogens than in osteomyelitis
- Joint aspiration is usual, blood culture more likely to be positive.
- Empiric therapy can be tailored to findings on joint fluid Gram stain

THE HIP IS DIFFERENT

- 1. In other joints, visual inspection, palpation, range of motion evaluation is very helpful
- 2. Diagnostic aspiration/drain placement is performed by orthopedic team.
- 3. In the hip, there is urgency to decompress pus under pressure to avoid joint injury.
- 4. Differentiation from non-bacterial tenosynovitis is more of an issue in the hip

Transient (Toxic) Tenosynovitis

- Perhaps the most common cause of hip pain in young children. Exam similar to septic hip?
- Ultrasound shows hip joint effusion, usually small
- Peak age 3-10 years of age, boys 2X > girls
- History of antecedent viral illness? Trauma?
- More modest WBC, CRP, ESR elevations
- Joint aspiration may be avoidable in some
- Risk of osteoarthritis, Legg-Calve'-Perthes?

Case Example:

Jimmy is a 19-month-old boy who presented with a 3 day history of not using his right upper extremity, irritability

Exam – pain, reduced shoulder range of motion

Plain X-ray – minimal effusion in shoulder

Empirically started on cefazolin IV.

Shoulder aspirate later grew Gram negative rods, identified as Kingella kingae
Kingella kingae

Kingella is an important cause of septic arthritis/osteomyelitis/discitis, derived from respiratory tract, associated with attending day care, susceptible to many antibiotics. Grown readily in culture since 1990’s, may resist decolorizing on Gram stain. Optimized by putting specimen in B/C bottles.

Case Example: A Day in May

J.B. is an 18 y.o. male with history of 2 days of knee pain. May have had a low-grade fever. Exam -- mild left knee swelling and erythema

Social history – 12th grade, hockey player (done), sexually active, no travel, lives near woods.

Review of Systems – recent malaise, dysuria, mild pain in right wrist

Labs – WBC = 16,800, CRP = 6.3, diagnostic knee aspirate performed, slightly cloudy fluid

Gonococcal Arthritis

Culture grew Neisseria gonorrhoeae

I.V. ceftriaxone treatment begun

Blood culture negative, later CH50 normal

GC arthritis may occur with multiple joints, less likely to produce destructive changes in joint, can be tenosynovitis (neg culture) with bacteremia. Partners need treatment.

QUESTIONS?