Bone and Joint Infections in Children

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Topics

- Acute Hematogenous Osteomyelitis
- Subacute Osteomyelitis
- Septic Arthritis
- Discitis
- Lyme Disease
- Foot Puncture Wounds

I. Osteomyelitis

A. Acute Hematogenous

Etiology

- Trauma – increases risk of osteo with concomitant bacteremia
  - Explains higher rate in males
    - Morrissy 1988
- Illness (rarely)
- Malnutrition
- Immune deficiency (rarely)

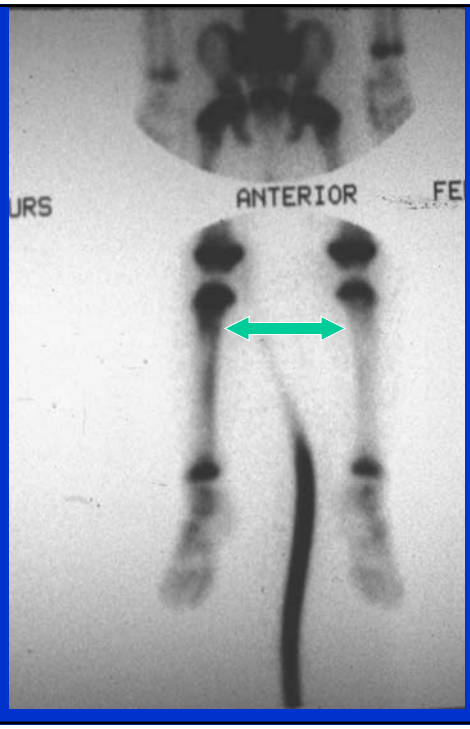
Etiology
-local factors

- Flow changes in metaphyseal sinusoids
- Absence of tissue macrophages there

- Organisms
- Neonate:
  - S. Aureus
  - Group A & B. Strep
  - E. Coli
  - S. Pneumoniae
- Child < 4:
  - S. Aureus, K. Kingae, HIB
- Older Child:
  - S. Aureus

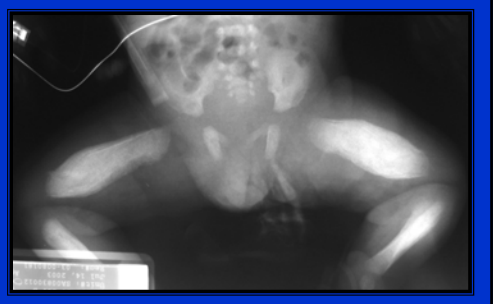
Diagnosis

- ESR elevation: 95%
- + Blood Culture: 50%
- Bone scan: if difficulty localizing
- Aspiration:
  - marrow needle
  - ?ultrasound



Differential Diagnosis

- Caffey's Disease
- Sickle Cell Infarct
- Fracture
- Tumor
- Syphilis
- Eosinophilic Granuloma



MRI in Osteo

- Decreased Marrow T1
- Unchanged or increased T2 uptake
- Sensitivity equal to bone scan
- Specificity greater than bone scan
- Most useful in spine, pelvis
- Gd can help

MRSA

- CA more frequent
  - mecA type IV factor;
  - PVL is main toxin
- At risk groups:
  - Recent antibiotics
  - Contact sports
  - Crowded living situations
  - Many others!
- Culture!

CA-MRSA
-effective antibiotics

- Clindamycin
- Cipro
- Erythromycin
- TMP/SMZ
- Tetracycline
- Rifampin
- Vanco
- Linazolide

Treatment Principles

- Identify Organism
  - May be empiric
- Select antibiotic
- Deliver sufficient amount, duration

Treatment Principles

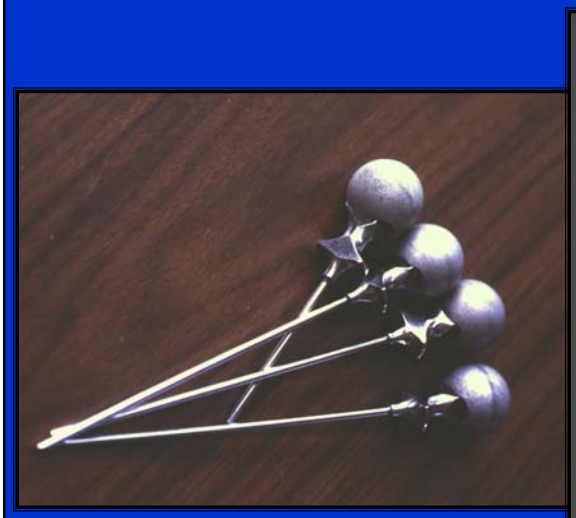
- Early (cellulitic) phase:
  - Anttbiotics alone
- Late (destructive) phase:
  - debridement

Aspiration- bone

- Bone marrow needle
- Send for aerobic, anaerobic, pathology

Needle aspiration

- Does not change bone scan results
  - Green 1988



Empiric antibiotic selection
(cultures negative or pending) (Copley 2009)

- Neonate < 1mo: augmentin + gent
  - 1-3mo: Ceftriaxone + vanc
- Child < 4: clinda or vanc + rifampin
- Duration:
  - Clinical response
  - ESR
  - CRP

Oral Therapy

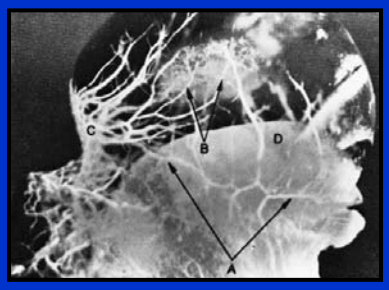
- Organism
- Oral drug available
- Compliance
- ?Serum Cidal Levels

Indications for surgery

- Pus on aspiration
- Bone destruction
  - Drain, drill, debride
  - Close unless extensive infection

Osteomyelitis in the Neonate

- Vessels cross physis
  - Permit septic arthritis



- Temp, WBC, ESR may be up or normal

Osteomyelitis in the Neonate

- 40% have multiple sites
- Sequelae:
  - Osteonecrosis
  - Physeal arrest
  - Dislocation
- …Long-term follow-up needed

II. Subacute osteo

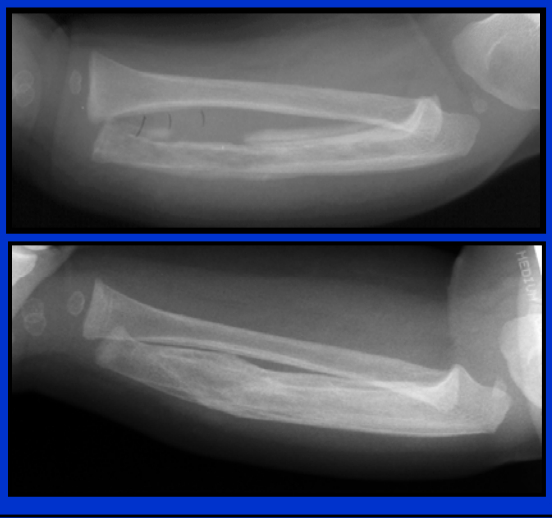
- Distinctions
  - Insidious onset
  - Mild symptoms
  - ESR, WBC, BC may be normal

DDx

- EOG
- Ewing's
- Osteoid osteoma

Treatment- Subacute osteo

- Currettage
- Antibiotics

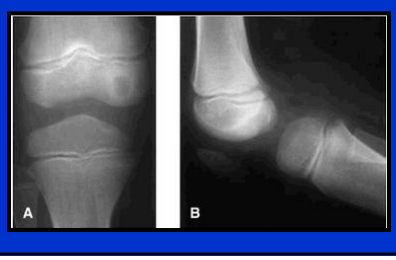


Subacute Osteo

- 4 y.o. with limp, CRP = 2
- Empiric Rx Clinda 4 weeks
- Repeat x-rays 6 months later

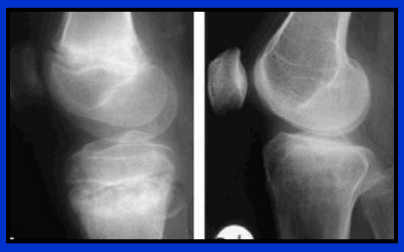
Epiphyseal Osteomyelitis

- Transphyseal or hematogenous spread
- Commonest in infants/young children
- Distal Femur most common
- Treatment: IV antibiotics



Chronic Recurrent Multifocal Osteomyelitis

- Multiple lesions
  - May be symmetrical
- Disappear slowly/recur
- Cultures negative



- Treatment: observe; supportive

Question

- Which of the following is a toxin responsible for the virulence of community-acquired methicillin-resistant Staphylococcus aureus?
- beta lactam
- Panton-Valentine Leukocidin
- oxazolidine
- mecA
- streptolysin

Preferred Response: 2

Panton-valentine leukocidin (PVL) is a toxin which produces necrosis of tissue and white blood cells. It is much more common in community – acquired than in hospital acquired MRSA

- **Reference: Marcotte AL: Community-Acquired Methicillin-resistant Staphylococcus Aureus: An emerging pathogen in Orthopaedics. J Am Acad Orthop Surg 2008 2008; 18: 98-105**

Question

- A five-year-old seen in the emergency department has obturator muscle infection seen on magnetic resonance imaging without abscess formation. She has no clinical evidence of sepsis. Aspiration yields Methicillin-resistant Staphylococcus aureus. What antibiotic is recommended?
- Vancomycin
- clindamycin
- Rifampin
- tetracycline
- linezolid

Preferred response: 2

- **Discussion:** Clindamycin is the drug of choice.
  Vancomycin- not recommended for uncomplicated MRSA
  Rifampin- not recommended alone (rapid resistance)
  Tetracycline- not recommended under age 8 (stains teeth)
  Linezolid- used only after ID consultation because of thrombocytopenia (in 3.5% of patients) and expense
- Another option for this patient would be trimetoprim/sulfamethoxazole.
- **Reference: Marcotte AL: Community-Acquired Methicillin-resistant Staphylococcus Aureus: An emerging pathogen in Orthopaedics. JAAOS 2008; 18: 98-105**

III. Septic Arthritis

- Characteristics
  - Younger children
  - Hip> knee> ankle, elbow
  - Blood cultures + in 40%

Differential Diagnosis

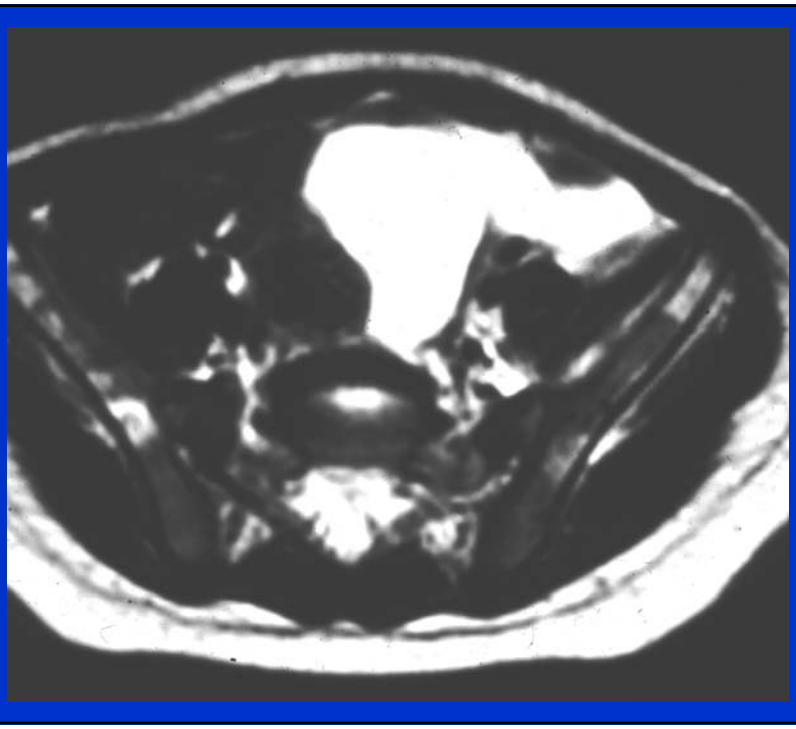
- Transient synovitis
- JRA
- Rheumatic fever
- Hemophilia
- Lyme disease
- SI, vertebral or psoas infection

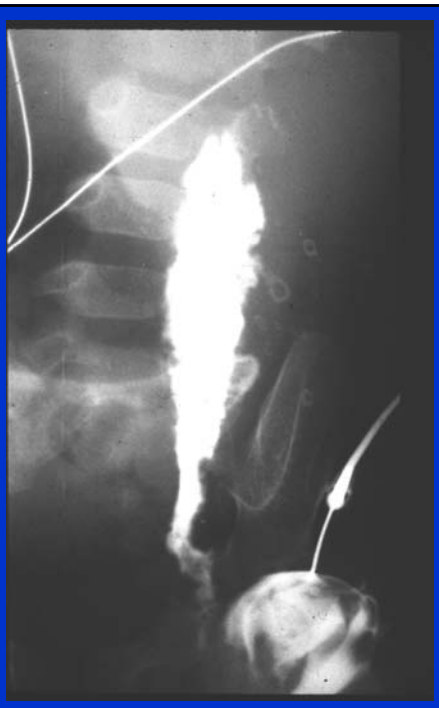
Transient Synovitis

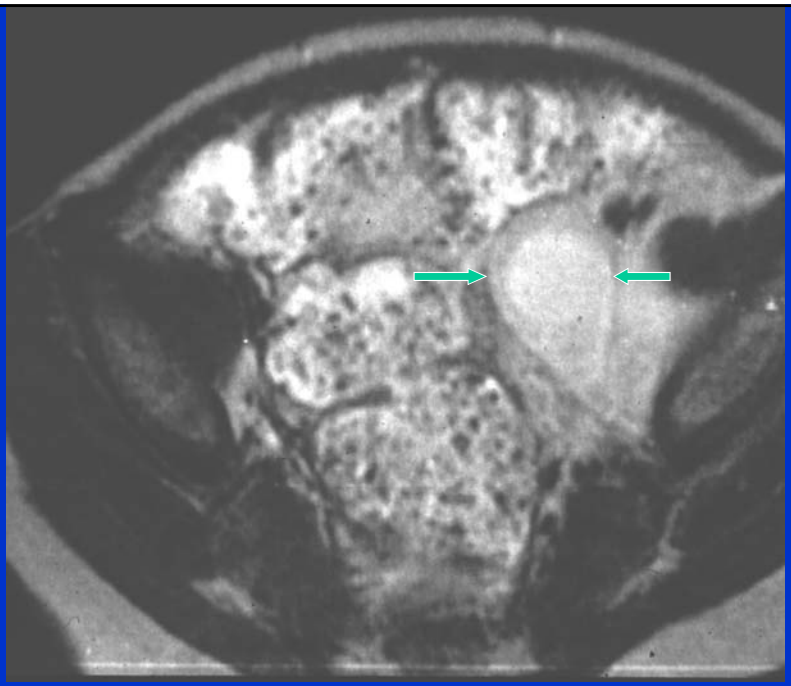
- ROM allowed gradually
- Monitor day-to-day
- Usually dramatic improvement with rest

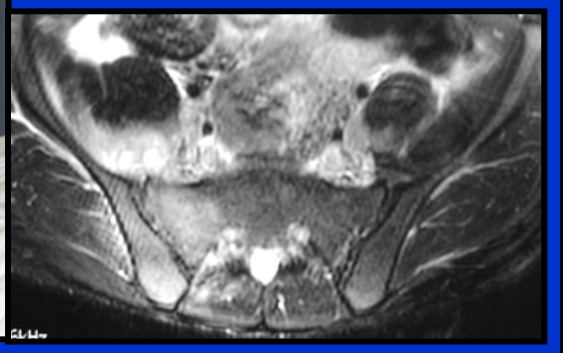
Septic Arthritis
-Clinical Predictors

- Fever
- Non weightbearing
- ESR >40
- Peripheral WBC>12,000
  - 93% if three
  - 99.5% if four









Diagnosis

- Aspiration
  - (+ arthrogram- hip)
  - WBC > 50K
  - >90% PMNS
- Culture neg in 30%
- Bone scan +/-

Hip aspiration-techniques

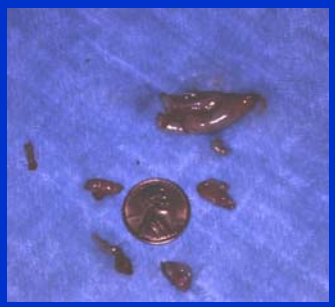
- Fluoroscopically guided-confirm with arthrogram
- Ultrasound guided
- In OR vs radiology suite- personal preference for latter
  - Long time for cell count, gram stain
  - Otherwise may push to open

Organisms

- Similar to list previously described
- HIB rare in vaccinated children
- Older children: consider GC

Treatment

- Begin antibiotics after blood, aspiration, ± CSF cultures
- Large joints: debride within 4 days



Hip Arthrotomy - controversies

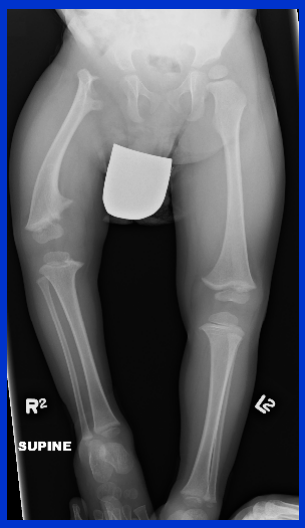
- Anterior approach- less dependent drainage
- Posterior approach- concern about vascularity
  - No difference in results (Emans 1993)

Empiric antibiotic selection

- Same as for osteo

Sequelae of Septic Arthritis

- Subluxation/dislocation
- Avascular necrosis
- Growth disturbance
- Chondrolysis



IV. Discitis

- "Pyogenic spondylitis"- a spectrum
  - -always bacterial?
- Findings:
  - Hip, abdominal pain
  - Stiff back
  - ESR mildly up
  - + Blood cultures, acutely

Diagnosis

- Bone scan / MRI early
- Plain films + at 2-4 weeks
- Aspiration + in 60%
  - Usually unnecessary

Treatment

- Antistaph antibiotics for 6 weeks
- Bedrest, cast, brace prn

V. Lyme Disease

- MD borders on endemic area
- 3 stages
  - Rash: erythema migrans
  - Carditis, neuritis, rash
  - Arthritis: acute, polyarticular or migratory
    - Minimally painful
    - Resembles JRA

Diagnosis

- ELISA /Western blot
- Clinical pattern
- Treatment:amoxicillin, doxycycline
  - Latter not before age 8
  - Treat only if disease presents, not prophylactic
  - 4 weeks
  - 98% cure

VI. Tuberculosis

- More common because of
  - Drug resistant strains
  - Immune deficiencies
- Extrapulmonary TB more common in kids

Tuberculosis

- Treatment:
  - 3 drugs for 6-9 months
  - Spinal debridement for most infections > 1 vertebra

    -prevent or treat myelopathy, deformity

VII. Sickle Cell Anemia

- Dilemma:
  Infection vs Infarction

Sickle Cell Anemia

- Infections represent ~2% of fevers
- Get blood culture acutely
- Imaging nonspecific (?Ultrasound)
  - Sequential bone marrow & bone scan (Skaggs)
    - Nl /abnl= infection
    - Dec/abnl=infarct

Sickle Cell Anemia
-treatment

- Rehydration, analgesics acutely
- Infection:
- Salmonella> Staph> Gm-
  - Infections more difficult to treat



VIII. Foot Puncture Wounds

- Acute: irrigate, tetanus
  - No antibiotics
- Late (< 1%): explore; esp. joints
- Pseudomonas more frequent


References:

- Carr AJ et al: Chronic Multifocal Osteommyelitis. JBJS 75B: 582-591, 1993
- Kocher MS: Differentiating between Septic Arthritis and Transient Synovitis of the Hip: JBJS 81A: 1662-1664, 1999.
- Lundy DW et al: Increasing Prvalence of Kingella Kingae in osteoarticular infections in young children. J Ped Orth 18: 262-267
- Kocher MS: Pediatric Ortho Infections Chapter 6 in OKUPeds-3

Thank You

Serum Bactericidal Levels

- Customary among pediatricians when switching to oral therapy
- Less often used by orthopaedists
- Value now questioned
  - Delay in obtaining and acting upon results
  - Cumbersome
  - Expensive

…Bactericidal titers

- Syracuse study (1986)
- 118 patients- septic arthritis or osteo
- Only 46% got SBCTs
- Changes made in 20%
- All patients did well