



Providence Virtual Pediatric Grand Rounds: Pediatric Musculoskeletal infections - Septic Joints and Osteomyelitis

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Conflicts of interest


- I have no financial relationships with commercial interests to disclose.



Learning Objectives:

- What is transient synovitis?
- Why is timely diagnosis of musculoskeletal infections important?
- Understand how unique pediatric anatomy results in susceptibility to disease
- Clinical and laboratory tests to differentiate transient synovitis from Septic Arthritis/Osteomyelitis (Kocher+ Criteria)
- When to refer?

Agenda:

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- Background
 - Cases
 - Etiology
 - Kocher + CRP Criteria
 - Anatomy
 - Summary

Background:

- Most pediatric infections are easily diagnosed and treated
- Musculoskeletal infections are the exception
- 1:2500 septic joint, 1:5000 children osteomyelitis <13 yo
- Outcome poor in 27% septic joint, 40% if hip
- Uniquely, organisms have changed over time – greater gram-positive infection

Background - advancements



- Prior to abx, mortality 50%, now <1%
- H flu vaccine nearly eliminated most common organism
- PCR testing, Ultrasound



Case 1

- 4yo M
- URI x 5 days, woke up with limp
- Intermittently fussy, prefers to be carried
- Limp worsens over next 3 days, localizing to hip
- No history of trauma



Case 2

Differential?

Infectious:	Septic arthritis Fungal infection (29) Tuberculosis (29) Lyme disease (9) Osteomyelitis (9,29,35,42,47) Pyomyositis (4,5,9,27,42) Appendicitis (42)
Inflammatory:	Transient synovitis (8,9,20,23-26,28,30,42,46,50,53) Juvenile rheumatoid arthritis (9,29,42) Ankylosing spondylitis (9) Reiter syndrome (9) Rheumatic fever (29,42)
Traumatic/mechanical:	Fractures (9,29,42,44) Cartilage problems (29) Muscle injuries (9) Contusions (9) Slipped capital femoral epiphysis (9,26,29,42,44)
Vascular:	Legg-Calvé-Perthes disease (9,26,29,42,44) Osteonecrosis (9) Haemoglobinopathies (haemophilia, sickle-cell disease) (9,29,42) Purpura Schonlein Henoch (29)
Neoplastic:	Benign tumours with impending fractures (9,29,42,44) Benign aggressive tumours (9,29,42,44) Malignant tumours (9,29,42,44) Leukaemia (9,42) Lymphoma (9)

Next Steps...

- Temp 99.3 F
- Labs
 - WBC 9
 - ESR 15
 - CRP 2.2

 - Consider xray?
 - Consider ortho consult if worried

Next steps...

- Discharge on ibuprofen
- no weight bearing restrictions, but advise “one foot on the ground activities”
- Follow up 1 week for clinical check
- Limp improves with scheduled ibuprofen
- Symptom free on day 10

Three decorative circular icons in the top left corner: a purple circle with a white flower, an orange circle with a white sun, and a green circle with a white dragonfly.

What is Transient Synovitis?

- Non-specific inflammation and hypertrophy of synovial lining/membrane of major joint
- Most common cause of hip pain in peds
- 3% between 3-10 yo
- 20% recurrence rate

Eitology:

- Exact cause unknown (post viral, post strep, trauma, allergy)
- “Walking on sore throat”

Transient Synovitis:



Diagnosis:

- “irritable joint”
- Non-toxic appearance
- Reassuring Kocher Criteria

Treatment:

- discharge home
- supportive: rest, NSAIDS
- self-limited without antibiotics

Outcome:

- Benign
- Marked improvement with NSAIDS 24-48 hrs
- Resolution of symptoms 1-2 weeks



Case 2

- 7yo F
- Vague left hip pain x ~1 wk
- Fever/malaise overnight (101.5 F)
- Woke up unable to bear weight on left side



Next Steps...



- Labs
 - WBC 10.6
 - ESR 83
 - CRP 24
- Xrays
- Hip = AP pelvis



Case 2

Differential?

Infectious:	<p>Septic arthritis</p> <p>Fungal infection (29)</p> <p>Tuberculosis (29)</p> <p>Lyme disease (9)</p> <p>Osteomyelitis (9,29,31,42,47)</p> <p>Pyomyositis (4,5,9,27,42)</p> <p>Appendicitis (42)</p>
Inflammatory:	<p>Transient synovitis (8,9,20,23-26,28,30,42,46,50,53)</p> <p>Juvenile rheumatoid arthritis (9,29,42)</p> <p>Ankylosing spondylitis (9)</p> <p>Reiter syndrome (9)</p> <p>Rheumatic fever (29,42)</p>
Traumatic/mechanical:	<p>Fractures (9,29,42,44)</p> <p>Cartilage problems (29)</p> <p>Muscle injuries (9)</p> <p>Contusions (9)</p> <p>Slipped capital femoral epiphysis (9,26,29,42,44)</p>
Vascular:	<p>Legg-Calvé-Perthes disease (9,26,29,42,44)</p> <p>Osteonecrosis (9)</p> <p>Haemoglobinopathies (haemophilia, sickle-cell disease) (9,29,42)</p> <p>Purpura Schonlein Henoch (29)</p>
Neoplastic:	<p>Benign tumours with impending fractures (9,29,42,44)</p> <p>Benign aggressive tumours (9,29,42,44)</p> <p>Malignant tumours (9,29,42,44)</p> <p>Leukaemia (9,42)</p> <p>Lymphoma (9)</p>



What is Septic Arthritis?

Definition: Infection
within a joint

Treatment:

- hospital admission
- operative drainage
- antibiotics IV, oral

Outcome:

- uncomplicated if
treatment prompt

Delayed diagnosis:

- sepsis
- dislocation
- growth arrest
- osteonecrosis
- chondrolysis

Differentiating Between Septic Arthritis and Transient Synovitis of the Hip in Children: An Evidence-Based Clinical Prediction Algorithm*†

BY MININDER S. KOCHER, M.D.‡, DAVID ZURAKOWSKI, PH.D.‡, AND JAMES R. KASSER, M.D.‡, BOSTON, MASSACHUSETTS

Investigation performed at Children's Hospital, Harvard Medical School, Boston

- Retrospective review of 282 cases of “acutely irritable hip”
- Significant overlap for any one variable made prediction difficult
- BUT, when combined, diagnostic performance improved
- Multivariate analysis identified 4 factors independently predictive of septic arthritis:

1. Fever
2. Non-weight-bearing
3. ESR > 40 mm/hr
4. WBC > 12k/mm³

No. of Predictors*	Transient Synovitis (N = 86) <i>(no. of patients)</i>	Septic Arthritis (N = 82) <i>(no. of patients)</i>	Predicted Probability of Septic Arthritis <i>(percent)</i>
0	19 (22.1%)	0 (0%)	<0.2
1	47 (54.7%)	1 (1.2%)	3.0
2	16 (18.6%)	12 (14.6%)	40.0
3	4 (4.7%)	44 (53.7%)	93.1
4	0 (0%)	25 (30.5%)	99.6



VALIDATION OF A CLINICAL PREDICTION RULE FOR THE DIFFERENTIATION BETWEEN SEPTIC ARTHRITIS AND TRANSIENT SYNOVITIS OF THE HIP IN CHILDREN

BY MININDER S. KOCHER, MD, MPH, RAHUL MANDIGA, BS, DAVID ZURAKOWSKI, PHD,
CAROL BARNEWOLT, MD, AND JAMES R. KASSER, MD

	No. Factors	Rate of SA
• Prospective study of 154 patients with acutely irritable hip	4	93%
	3	72.8%
• Same 4 prediction rules applied	2	35%
	1	9.5%

FACTORS DISTINGUISHING SEPTIC ARTHRITIS FROM TRANSIENT SYNOVITIS OF THE HIP IN CHILDREN

A PROSPECTIVE STUDY

BY MICHELLE S. CAIRD, MD, JOHN M. FLYNN, MD, Y. LEO LEUNG, MD,
JENNIFER E. MILLMAN, BA, JOANN G. D'ITALIA, CWOCN, CRNP, AND JOHN P. DORMANS, MD

Investigation performed at the Division of Orthopaedics, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania

- Crp added to the mix...

TABLE IV Predicted Probability of Septic Arthritis

No. of Factors	Septic Arthritis (N = 34) (no. [%])	Transient Synovitis (N = 14) (no. [%])	Predicted Probability of Septic Arthritis (%)	
			Current Study	Study by Kocher et al. ¹
0	1 (3)	3 (21)	16.9	0.2
1	3 (9)	6 (43)	36.7	3
2	3 (9)	2 (14)	62.4	40
3	9 (26)	2 (14)	82.6	93.1
4	15 (44)	1 (7)	93.1	99.6
5	3 (9)	0	97.5	

“Kocher plus CRP Criteria”



- Fever (>100.3F/38 C)
- Non-weight-bearing
- ESR>40 mm/h
- Serum WBC > 12
- CRP > 20 mg/L



• **Caird Study,**
4/5 = 93.1%

• **Kocher Study,**
3/4 = 93.1%

Steps in Work up of ?Septic Hip?

- Draw labs: stat CBC, SED rate, CRP, consider blood cultures x 2 if “toxic”
- hold antibiotics
- Keep patient NPO
- Consider ultrasound if resource available
- Xrays (hip = AP Pelvis)
- Consult orthopaedics

Case 2

- POD 1 CRP 5/afebrile, walking with limp, discharged POD 3 on PO clindamycin
- Doing well at last follow up (1 yr postop)
- No radiographic or clinical sequela
- Back to all activities



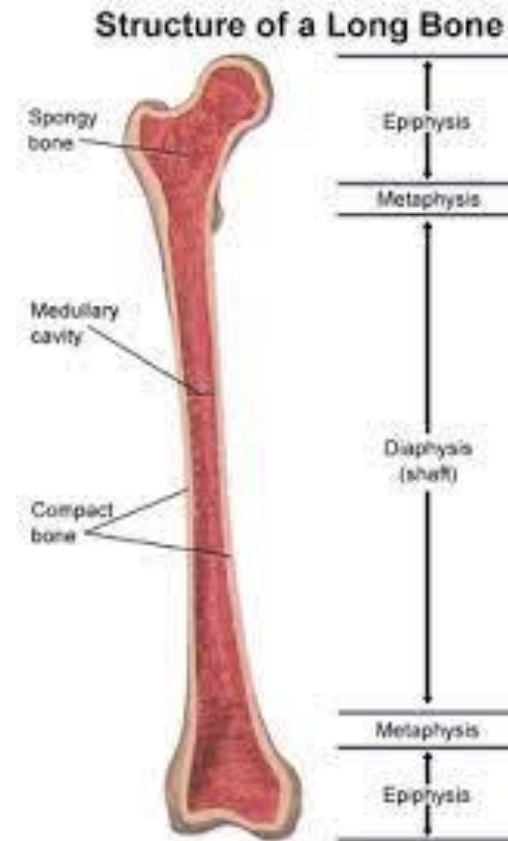
Case 3

- 5 yo boy
- 1 wk of progressive limp
- Had a fall at cousin's house 10d ago
- On exam, he is tender about the knee
 - No effusion
 - Ranges easily but doesn't fully extend (-20 deg)
- Temp 99.8
- Labs
 - WBC 15K
 - ESR 50
 - CRP 4.5




Pediatric Osteomyelitis

- Most often result of hematogenous seeding of bacteria to the metaphyseal region of bone
- Treatment usually antibiotics with or without surgical drainage



Epidemiology

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- Osteo: Worldwide incidence ranges from 1:1,000 to 1:20,000.
 - 50% in children < 5 years
 - boys > girls
 - Fulminate infection now less common; subacute rising in frequency

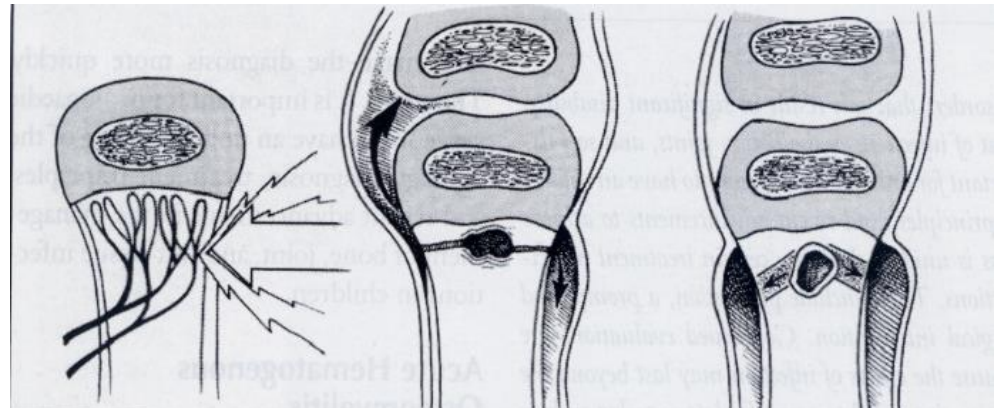
- Most common organisms:
 - Neonates:
 - Group B strep, *S. aureus*, GN bacilli
 - Older than Neonate:
 - ***S. aureus*** 40-90%
 - *Coag-neg. Staph.*
 - Group A β -hemolytic *Strep*
 - *Strep. pneumo.*
 - Group B strep.
 - *Salmonella* (think *Salmonella* in Sicklers)
 - H. flu* has virtually fallen off map with immunizations;
IF *H. flu* must check CSF.
 - highest risk for meningitis

Epidemiology

- Community-acquired MRSA (CA-MRSA)
- Increasing incidence
- Some strains encode for Panton-Valentine Leukocidin (PVL)
- PVL CA-MRSA frequently associated with worse infections
 - More myositis, pyomyositis, multi-focal infections, subperiosteal/intra-osseous abscesses, chronic osteo, and DVT

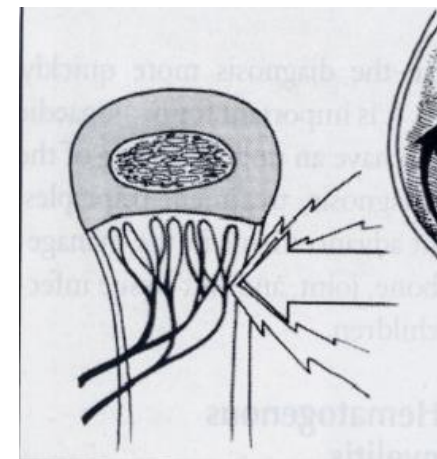
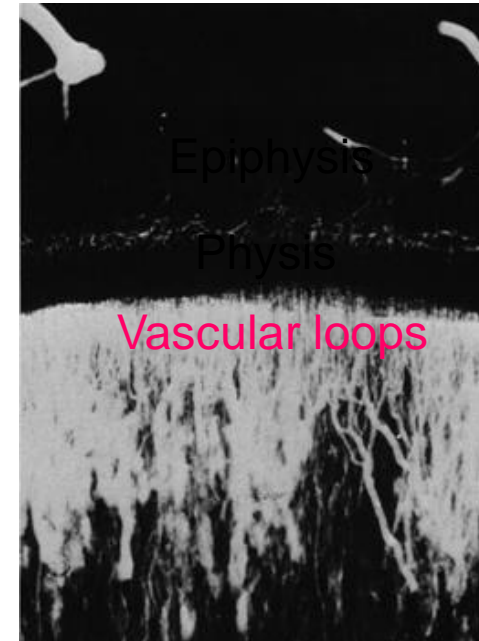
Epidemiology: Anatomy

- Hip/Knee most common locations of septic arthritis/osteomyelitis
 - Blood supply to chondroepiphysis predisposes to infection
 - More so in joints where metaphysis lies within the joint.
 - » Proximal Femur
 - » Proximal Humerus
 - » Distal lateral Tibia
 - » Proximal Radius



Osteomyelitis Pathophysiology

- Metaphyseal bone next to growth plate = most common location
- Vascular loops emptying into venous lakes around growth plate = set-up for infection.
 - low number of macrophages in this region
 - “lazy river” theory



Imaging

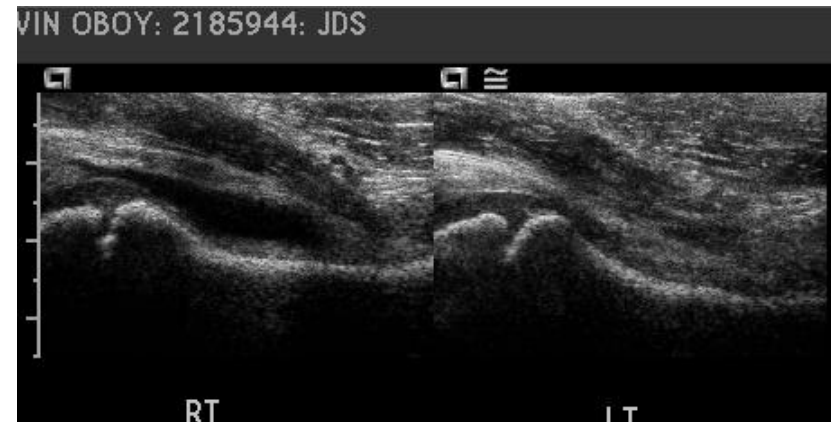
- Radiographs
 - Starting point
 - Sensitivity 43-75% ; Specificity 75-83%
- Bone Scan Technetium-99 mdp
 - Sensitivity 89%; Specificity 94%
- CT
 - Added utility in that more readily available and less cost compared to MRI
- MRI
 - Sensitivity 88-100%; Specificity 75-100%
 - Adding Gad can differentiate infarct from osteo.
 - Good for assessing abscess/soft tissue infection/tumor
 - NOT automatically used for Dx





Imaging

- Ultrasound
 - Low cost, relative good availability (depends on center), non-invasive, no radiation
 - Best use is guiding hip tap
 - Can't differentiate types of infection
 - Limited value in osteo assessment – may be able to see subperiosteal abscess



Case 3

- Treatment:

- Acute – Antibiotics alone unless abscess then drain in OR
- Chronic – Surgical drainage/debridement + Abx
- Duration Abx – ~3 weeks IV/PO unless chronic, then 6-8 weeks

Summary

- Transient synovitis is relatively common
- Use Kocher criteria + CRP to help differentiate transient synovitis from septic arthritis
- Consider xray of anything that hurts
- Unique pediatric anatomy traps bacteria near growth plate
- U/S, MRI, Bone scan can be useful tools
- Don't hesitate to call pedi ortho when concerned



When to Refer

- Patient with >1 -2 Kocher criteria
- Unilateral joint pain/swelling
- Whenever you are concerned



E

ive



Questions?

Providence Pediatric Orthopedics in Collaboration with Shriners Hospitals for Children – Portland

- Phone number: 503-216-6050
- Fax: 971-282-0103
- Epic code for internal referrals: REF62RR
- Include name, MRN, reason for referral and any labwork/imaging