



**Journal Club:** 6 March 2012

**Organiser:** Mr Matthew Barry

**The Royal London Hospital, London, UK**

**Theme:** Paediatrics

**Presented Papers:**

1. **Belthur MV, Birchansky SB, Verdugo AA, Mason EO, Hulten KG, Kaplan SL, Smith EO, Phillips WA, Weinberg J.**  
Pathologic fractures in children with acute *Staphylococcus aureus* osteomyelitis.  
J Bone Joint Surg [Am] 2012;94-A:34-42.
2. **Johnson DP, Hernanz-Schulman M, Martus JE, Lovejoy SA, Yu C, Kan JH.**  
Significance of epiphyseal cartilage enhancement defects in pediatric osteomyelitis identified by MRI with surgical correlation.  
Pediatric Radiol 2011;41:355-61.
3. **Paakkonen M, Kallio MJT, Kallio PE, Peltola H.**  
Sensitivity of erythrocyte sedimentation rate and C-reactive protein in childhood bone and joint infections.  
Clin Orthop Relat Res 2010;468:861-6.
4. **Hung NN.**  
Cortical bone fenestrations with continuous antibiotic irrigation to mediate hematogenous tibial osteomyelitis in children.  
J Pediatr Orthop 2010;19:497-506.

**Belthur MV, Birchansky SB, Verdugo AA, Mason EO, Hulten KG, Kaplan SL, Smith EO, Phillips WA, Weinberg J.**

Pathologic fractures in children with acute Staphylococcus aureus osteomyelitis.

J Bone Joint Surg [Am] 2012;94-A:34-42.

**Reviewer: Shah Arghandawi**

### **Background & Purpose**

The purpose of this study was to evaluate the risk factors associated with pathological fractures in children with Staphylococcus aureus osteomyelitis.

### **Methods**

A retrospective analysis of children who had been treated for Staphylococcus aureus osteomyelitis and who had sustained a pathologic long-bone fracture were identified at a tertiary-care pediatric hospital between January 2001 and January 2009. This study group was matched on the basis of age, sex, site of infection, and antibiotic sensitivity with a control group of children treated for Staphylococcus aureus osteomyelitis who did not sustain a fracture.

### **Results**

Seventeen patients in the fracture group and 49 in the non fracture group were identified and followed up for a mean of 22 and 10 months respectively.

The duration of hospitalisation, number of surgical procedures, duration of antibiotic treatment, and total number of complications differed significantly between the two groups. MRI studies at the time of admission demonstrated a significantly greater prevalence of subperiosteal abscess and greater circumferential size of such an abscess in the patients with a fracture. A sharp zone of abnormally diminished enhancement of the marrow was also more common in these patients. The USA300-0114 pulsotype was more commonly associated with an elevated likelihood of fracture.

### **Conclusions**

Staphylococcus aureus osteomyelitis is a serious infection that may predispose children to pathologic fractures. Protected weight-bearing and activity restriction are recommended in children with Staphylococcus aureus osteomyelitis who have the risk factors demonstrated in this study.

### **Critique – positive points:**

- Important subject
- Common infection
- Good number of pathological fractures associated with Staph aureus osteomyelitis
- Good global analysis:
  - Clinical, radiological and microbiological factors
  - Identifies important risk factors

**Critique – negative points:**

- Retrospective study
- No risk reduction carried out
- Shorter follow up in non-fracture control group (10 vs 22 months)
- Prospective statements – unsubstantiated
  - “Full weight bearing is recommended once inflammatory markers have returned to normal”

**Relevance**

- Is the question asked relevant, important and valid?  
Yes it is a relevant question, although pathological fractures with staph aureus osteomyelitis are not common
- Is the study design valid?  
The study does identify important risk factors, but their conclusions are not drawn from their research. For example their comments included: “Risk factors will potentially aid in avoiding these fractures” “Risk may be reduced by: recommending protected weight bearing activity restriction and full weight bearing once inflammatory markers have returned to normal”
- Will it change my practice?  
It is unlikely to change current practice as their conclusions don’t have any firm basis. We may review risk factors on MRI with Panton-Valentine leukocidin (PVL) toxins more closely.

**Johnson DP, Hernanz-Schulman M, Martus JE, Lovejoy SA, Yu C, Kan JH.**

Significance of epiphyseal cartilage enhancement defects in pediatric osteomyelitis identified by MRI with surgical correlation.  
Pediatric Radiol 2011;41:355-61.

**Reviewer: Denis Kosuge**

**Background & Purpose**

The aim of this study was to evaluate the incidence and clinical impact of epiphyseal cartilage enhancement defects (ED) in paediatric epiphyseal osteomyelitis.

**Methods**

A retrospective case-control study of 13 patients ≤ 5 years of age who were diagnosed with osteomyelitis and underwent contrast-enhanced MRI and surgical exploration yielding 14 study epiphyses were compared to 17 age-matched children without evidence of infection who underwent contrast-enhanced MRI in the same period yielding 28 control epiphyses. Images were reviewed for focal/global (i.e. when 50% or more of the epiphyseal cartilage showed a lack of enhancement) ED, correlated with cartilage abscesses and compared with surgical reports.

## Results

Study and control ED were respectively present in 10/14 (71.4%—6 global, 4 focal) and 6/28 (21.4%—0 global, 6 focal),  $P=0.0017$ . An analysis of ED patterns between study and control patients showed significant difference for global ( $P=0.0006$ ), but no difference for focal ED ( $P=0.71$ ). For the six study epiphyses with global ED, epiphyseal abscesses were present in two (33.3%). For the four study epiphyses with focal ED, epiphyseal abscesses were present in two (50%). For the controls, no abnormalities were found on follow-up of epiphyses with focal ED.

## Conclusions

- ED is a frequent finding in preschool-age children with epiphyseal osteomyelitis compared to normal controls (71% v 21%)
- Overlap with normal epiphyses
- ED may resemble an abscess on MRI (30% of EDs in the study group resembling an abscess were confirmed to be abscesses surgically)

## Critique

- ED significance? – occult injury; pressure effect
- Retrospective case-control study – small numbers
- Age  $\leq 5$  – arbitrary
- No details of microbiological diagnoses
- Case-control ratio 2:1
- Controls – no infection/trauma but one MRI was for ‘brachial plexus injury’
- Heterogeneity
- Cases –  $n=13$  (Knee 38%, Hips 23%, Elbows 23%, Ankle 7.5%, TMTJ7.5%); 14 epiphyses
- Control –  $n=17$  (Knee 41%; Hip 35%; Elbow 12%; Shoulder 6%; Wrist 6%); 28 epiphyses

## Relevance

- Interesting study which evaluated, with surgical correlation, the incidence and clinical impact of epiphyseal cartilage enhancement defects identified on contrast-enhanced MRI in the setting of epiphyseal osteomyelitis
- Will bear in mind during practice but not alter practice
- Presence of ED/abscess in osteomyelitis and long-term prognosis
- Growth arrest; osteonecrosis; arthritis

**Paakkonen M, Kallio MJT, Kallio PE, Peltola H.**

Sensitivity of erythrocyte sedimentation rate and C-reactive protein in childhood bone and joint infections.

Clin Orthop Relat Res 2010;468:861-6.

**Reviewer: Sophie West**

### **Background & Purpose**

The benefits of ESR/CRP for monitoring patients with infections have been described, but owing to the rarity of septic osteoarticular infections, the study sizes tend to be small. Therefore, the authors calculated the sensitivity of ESR and CRP in paediatric osteoarticular infections (osteomyelitis, septic arthritis or both) in a large prospective series of patients.

### **Methods**

Two hundred and sixty five children at ages 3 months to 15 years with culture-positive osteoarticular infections with a predetermined series of ESR, CRP, and leukocyte count measurements were included.

### **Results**

On admission, ESR exceeded 20 mm/hour in 94% and CRP exceeded 20 mg/L in 95% of the cases, the mean ( $\pm$ standard error of the mean) being  $51 \pm 2$  mm/hour and  $87 \pm 4$  mg/L, respectively. ESR normalised in 24 days and CRP in 10 days. Elevated CRP gave a slightly better sensitivity in diagnostics than ESR, but best sensitivity was gained with the combined use of ESR and CRP (98%). Elevated ESR or CRP was seen in all cases during the first 3 days.

### **Conclusions**

Measuring ESR and CRP on admission can help the clinician rule out an acute osteoarticular infection. CRP normalises faster than ESR, providing a clear advantage in monitoring recovery.

### **Critique – positive points:**

- Prospective study over a long period of time and using different centres
- Large age range, therefore results applicable to majority of paediatric population
- Although Staph. Aureus commonest there were other infections and therefore results applicable across a range of infections
- Long follow-up period

### **Critique – negative points:**

- No comparison of ESR/CRP levels in negative culture patients thus cannot state a level at which CRP and ESR can be used to help make a diagnosis (admittedly not their research question)
- No indication of whether the CRP and ESR influenced length of antibiotic treatment
- Research funded by company that makes CRP machines
- 10 self references
- Timeline from hospital presentation – NOT from onset of signs and symptoms

- They have not stated where in the CRP/ESR trend the antibiotics were started, was it day 1, 2, 3 or later. They state that day 3 is when 100% of patients had raised levels, but had any treatment been already started?
- No comparison of CRP/ESR in relation to gram stain which can be made available much quicker than a culture result

**Relevance:**

- Better to use CRP to monitor response to treatment
- If CRP static or increasing need to look for a potential complication or other source/ antibiotic resistance etc.
- Likewise if fever prolonged
- CRP and ESR could be taken on admission (only 1.5% patients had both <20)
- ESR could be repeated on Day 3 if diagnosis still uncertain as 100% patients culture positive had levels >20 at this point.
- If it looks like it, smells like it and feels like it – it probably is. Clinical situation is still fundamental, especially in cases which may have already had antibiotics

**Hung NN.**

Cortical bone fenestrations with continuous antibiotic irrigation to mediate hematogenous tibial osteomyelitis in children.

J Pediatr Orthop 2010;19:497-506.

**Reviewer: Hilary Bosman**

**Background & Purpose**

The objective of this study was to evaluate the results of drainage and continuous antibiotic irrigation of the medullary canal to mediate hematogenous osteomyelitis of the tibia in children.

**Methods**

A retrospective study including 376 patients (388 tibiae) with hematogenous osteomyelitis of the tibia diagnosed from January 1982 to December 2004 by compatible symptoms and signs and confirmed by imaging studies. Treatment included two groups: (i) group I [from January 1981 to September 1984 in 108 patients (112 tibiae)] who were operated on according to traditional surgical procedure (pus drainage), (ii) group II [from October 1984 to December 2004 in 268 patients (276 tibiae)] who were operated on according to cortical bone fenestrations with continuous antibiotic irrigation. Postoperative antibiotic therapy was given to both groups with intravenous antibiotics for 2 weeks followed by oral antibiotics for another 4 weeks. Additionally, the patients in group II had antibiotic irrigation for 7 days.

**Results**

There were 152 (40.4%) female and 224 (59.6%) male patients. Both tibiae were involved in 12 (3.2%) patients. The average age at the time of operation was 5 years 9 months (range: 22 days–13 years, 7 months). All patients were classified as having a mediate stage (presenting within 30 days after onset of symptoms) of osteomyelitis. The average duration of follow-up was 8 years and 9 months (range: 3 –22 years). We attained good results in 50.9% of the patients in the group I,

fair results in 7.1%, and poor results in 42% with pathologic fracture in eight tibiae. In group II, there were good results in 77.9%, fair results in 21.4%, and poor results in 0.7% tibiae with the development of chronic osteomyelitis and without pathologic fracture.

### **Conclusions**

The authors conclude that this technique is generally safe and effective. They suggest that similar management might also be applied for hematogenous osteomyelitis of femur and humerus.

### **Critique – positive points:**

- Large number of patients
- Large age range, therefore results applicable to majority of paediatric population
- Although Staph. Aureus commonest there were other infections and therefore results applicable across a range of infections
- Long follow-up period
- Improved results using the proposed technique by reducing pathological fractures, chronicity of the disease, rates of additional operations (58 vs 2 cases) and length of hospitalisation (38.4 vs 28.4 days)

### **Critique – negative points:**

- Retrospective study
- No comparison of the study findings with other studies implementing similar techniques as cortical bone fenestrations with different modalities of antibiotic delivery for treatment of osteomyelitis has been previously described in the literature
- Prospective statements – unsubstantiated
  - ‘We agree that risk factors for a worse outcome in children with acute osteomyelitis were age, antibiotic treatment, days of symptoms before admission, high increase of leukocyte and neutrophil, inflammatory parameters (CRP and ESR), and anemia on admission’
  - ‘This management should also be considered for hematogenous osteomyelitis of the femur and the humerus’

### **Relevance:**

- Important and relevant subject
- Need to compare results with other modalities of treatment from different studies and possibly conducting a systematic review to investigate best available treatment before considering any change to current practice