

Primary acute haematogenous osteomyelitis of an isolated metatarsal in children

Acute haematogeneous osteomyelitis of an isolated metatarsal is a rare condition in childhood. Fourteen children diagnosed with this condition were followed up for an average of 3 years. Organisms responsible were found to be either *Staphylococcus aureus* or *Streptococcus pyogenes*. Growth disturbances of the metatarsal were seen in the majority, but the radiographic features were not serious in the long term, and no child was subsequently disabled. Since these children often present with symptoms akin to trauma, a better recognition of the condition is required to avoid misdiagnosis.

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In the past, scant attention has been paid to primary osteomyelitis of individual metatarsals, although papers dealing with osteomyelitis in general mention it (Dich et al. 1975, Gilmour 1962, Morse & Pryles 1960, Pyrah & Pain 1933, Trueta & Morgan 1954, White & Dennison 1952 and Wilson & McKeever 1936). The association between secondary osteomyelitis of the metatarsals and puncture wounds is well known (Lang & Petersen 1976). At our hospital about 30 new cases of acute osteomyelitis are seen each year (Blockey & Watson 1970). Over the 20-year period, 1962-81 inclusive, only 14 children had clinically proven acute haematogenous osteomyelitis of an isolated metatarsal. This paper reviews these cases with a twofold aim: firstly to review the presentation, treatment and outcome of the condition as seen at a regional paediatric centre; and secondly to illustrate how an erroneous diagnosis can be made and avoided.

Diagnostic criteria

For the diagnosis, three absolute criteria were necessary: (a) clinical signs of local infection, (b) subsequent radiographic changes consis-

tent with infection, and (c) a clinical response to antibiotics, with or without surgery. One of the following criteria was also necessary for the diagnosis: (d) positive bacteriological culture from pus or blood, (e) raised erythrocyte sedimentation rate (ESR) on admission, or (f) pyrexia on admission.

Observations

There were eight girls and six boys aged 1-10 years (Table 1). Follow-up ranged from 2 months to 10 years. All patients had only one metatarsal affected, and in all but four, it was the first metatarsal.

History

There was no history of trauma or puncture wound in any of the patients. Five patients presented with a history of pain and swelling and an inability to walk on the affected foot of less than 48 h duration, and four patients had had symptoms for more than 10 days. Three patients had had a painful foot for 12 h only, but presumably the prodromal illness was longer.

Table 1. Clinical details of the 14 children with metatarsal osteomyelitis.

| Patient | Sex | Age (years) | Duration of symptoms (days) | ESR on admission (mm/h) | Interval before positive radiograph (days) | Organism | | Treatment | | |
|---------|-----|-------------|-----------------------------|-------------------------|--|---------------|---------------------------------|---|-------------------|-----------------|
| | | | | | | Blood culture | Pus | Antibiotic | Dose* (mg/kg/day) | Duration (days) |
| 1 | F | 1 | 14 | 6 | 21 | Sterile | — | Tetracycline | 10 | 14 |
| 2 | M | 5 | 1 | 10 | 16 | Sterile | — | Penicillin V ⁺ | 50 | 14 |
| 3 | M | 9 | 2 | — | 22 | — | Strep. pyogenes | & Tetracycline Penicillin V ⁺ | 10 50 | 14 21 |
| 4 | F | 6 | 4 | 31 | 10 | Sterile | — | Cloxacillin | 50 | 21 |
| 5 | M | 10 | 10 | 112 | 10 | — | Staph. aureus | Flucloxacillin | 25 | 21 |
| 6 | M | 5 | 1 | 48 | 14 | Staph. aureus | — | Ampicillin & Flucloxacillin | 62.5 25 | 21 21 |
| 7 | F | 1 | 7 | 68 | 19 | Sterile | Strep. pyogenes | Cephadrine | 25 | 21 |
| 8 | M | 2 | 14 | 10 | 14 | Sterile | — | Flucloxacillin | 25 | 21 |
| 9 | F | 4 | 60 | 7 | 21 | — | Strep. pyogenes from Sequestrum | Methicillin | 100 | 21 |
| 10 | M | 1 | 1 | 80 | 10 | Sterile | — | Erythromycin & Fucidin | 30 30 | 21 21 |
| 11 | F | 7 | 2 | 44 | 18 | Sterile | Sterile | Erythromycin & Fucidin, then Cloxacillin | 30 30 50 | 14 14 14 |
| 12 | F | 8 | 12 | 35 | 25 | Staph. aureus | Staph. aureus | Penicillin V ⁺ & Cloxacillin | 20 50 | 21 21 |
| 13 | F | 4 | 3 | 14 | 21 | Sterile | Staph. aureus | Flucloxacillin | 25 | 38 |
| 14 | F | 4 | 7 | — | 12 | — | Staph. aureus | Cloxacillin | 50 | 21 |

* The antibiotics were given daily in four divided doses.

+ Penicillin was given intravenously for 48 h as Benzyl Penicillin 10 mg/kg/day.

Radiographic changes

Radiographic changes became apparent 17 (10–25) days following onset of symptoms. Radiographs were taken on admission and then usually weekly thereafter until typical changes occurred. Follow-up radiographs were taken in the outpatient department at about 3-monthly intervals until healing appeared radiographically. Those patients who developed complications seen radiographically had annual radiographs taken until the clinician was satisfied that either no further deterioration occurred or the complication had resolved.

Bacteriological findings and antibiotic treatment

Positive bacteriological cultures from blood, pus or bone were obtained in eight patients (Table 1). Anaerobic cultures were not performed. The organisms responsible were *Staphylococcus aureus* in five patients and *Streptococcus pyogenes* in three patients. The

variation in antibiotics used reflects the individual surgeon's choice, and in the earlier years, Penicillin, Tetracycline and Methicillin were used. Tetracycline is no longer recommended because of potential tooth problems. More recently, either a combination of Fucidin and Erythromycin or Flucloxacillin alone was used. Initial antibiotic treatment was given on the "best guess" principle, but was not modified in any case following the bacteriological antibiotic sensitivity results, although one child became intolerant of oral Fucidin, which was changed to Cloxacillin. All patients received parenteral antibiotics for 48–72 h, after which the antibiotics were given orally, with the exception of patient no. 9 who received parenteral Methicillin for 21 days. Routine aspiration of the affected area of the foot was not undertaken, but those patients who developed an abscess underwent incision and drainage.

Surgery

Surgery was undertaken on eight patients. Three who had been misdiagnosed earlier (patients no. 5, 7, and 14) underwent immediate incision and drainage of a discharging abscess or multiple discharging sinuses. Patient no. 9 had symptoms for 10 days before being treated elsewhere with an inadequate antibiotic regime, and she attended our hospital 7 weeks later because of a discharging sinus and sequestrum formation within the metatarsal which required sequestrectomy. The remaining four patients underwent incision and drainage because of failure to settle after routine doses of parenteral antibiotics (patients no. 3, 11 and 12), or because of a localised abscess (patient no. 13).

Complications

Pathological fractures occurred in patients no. 2 and 11 2 months after the onset of the illness. Growth disturbance occurred in eight patients; all but two of these had had surgery. Mild shortening of the metatarsal was seen radiographically in four patients, and obvious shortening of the hallux was seen in three patients: 1 cm in two and 2.5 cm in one. Hallux valgus developed in one patient, split epiphyses in three, and widening of the metatarsal shaft in three. Of the six patients who did not undergo surgery, one had slight shortening of the metatarsal and one slight widening of the metatarsal shaft; in both cases these radiographic findings were clinically insignificant.

Discussion

All children in this review were seen initially in the Casualty Department. Three were misdiagnosed, treated with elastoplast strapping and returned later with pus discharging from underneath the strapping. Trauma is a common cause of a painful foot, but in the absence of a clear history of injury, infection should be considered, particularly as radiographs are normal in the earlier stages of infection. The duration of symptoms, varying from less than 12 h to 21 days, suggests that there may be

two forms of the illness – an acute and an indolent one, although bacteriological findings in the two groups were similar.

The diagnosis of osteomyelitis in the earlier stages is often difficult. Technetium bone scans are now accepted as an accurate method of diagnosing acute osteomyelitis, provided the findings are reviewed with the clinical problem in mind (Howie et al. 1983). None of the children in this review had a bone scan performed. After the introduction of bone scans in 1971 (Subramanian & McAfee), seven children under review developed metatarsal osteomyelitis. The diagnosis was certain in six who had typical signs and either overt abscess formation or positive blood cultures or a positive radiograph on admission. The diagnosis was initially uncertain in the seventh child who had clinical signs of infection, a negative blood culture and an ESR of 31 mm in the hour, and a normal radiograph on admission. Bone scans are now used in our hospital for patients with suspected osteomyelitis, but in whom the diagnosis is uncertain.

Residual bony deformity occurred in most patients and the majority of these had undergone surgery. However, surgery cannot be considered to be the sole cause of the deformity, as this could have been caused by the severity of infection and its subsequent interference with growth.

Growth disturbance was a common finding, but the radiographic changes were not as serious in the long term as might have been expected from the earlier radiographs. None of the patients was disabled as a result of the illness. The ability of the metatarsal to regenerate and restore its contour has been noted by Wilson & McKeever (1936), who found shortening of 1–2 cm in two patients. The sequence of growth disturbance, fragmentation of the epiphysis, and remodelling and residual shortening is shown in Figure 1.

The treatment of this condition should initially be non-operative, surgery being reserved for those patients who do not improve after initial, adequate, parenteral antibiotic treatment, or who develop a localised abscess (Nade 1983). Two patients were treated with antibiotics for 14 days only and nowadays would be considered to have been undertreated due to

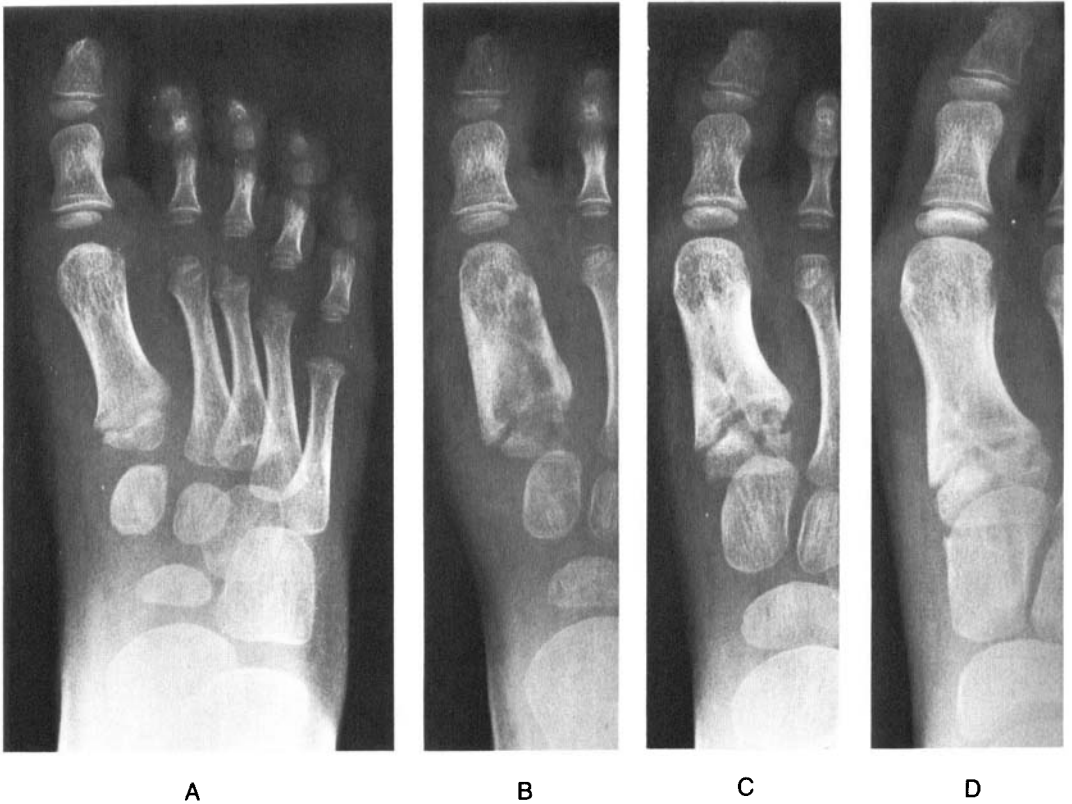


Figure 1 A-D. Serial radiographs of patient no. 13, a girl who developed osteomyelitis of the first metatarsal at age 4 years.
 A. Initial radiograph.
 B. Four months later, showing widening of shaft.
 C. Sixteen months later, showing remodelling and fragmentation of epiphysis.
 D. Four years later, showing residual widening of shaft and mild hallux valgus deformity.

the length of the treatment and antibiotics used (Penicillin and Tetracycline in one case and Tetracycline alone in the other). Later, a policy evolved of treating patients with osteomyelitis with antibiotics for 21 days only and this accounts for two patients stopping antibiotic therapy before a positive radiograph was obtained; however, none relapsed as a result. Patients are now treated initially with either a combination of Erythromycin and Fucidin, or with Flucloxacillin alone until the results of the bacteriological culture are known. If appropriate, this regime continues for 21 days (Blockey & McAllister 1972).

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