FUNGAL OSTEOMYELITIS OF THE FOOT

A REPORT OF AN UNUSUAL CASE

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Mucormycosis is an opportunistic infection that very occasionally causes osteomyelitis and avascular necrosis of bone. The infection may prove fatal if not diagnosed promptly. If early treatment is instituted the prognosis is good.

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A 54-year-old white man developed what at first appeared to be an area of cellulitis on the dorsum of his right foot. He had received a renal transplant approximately five months earlier and was still on immunosuppressive therapy with prednisolone, azathioprine and cyclosporin. He was in hospital when the cellulitis developed, recovering from a partial resection of the ileum for perforation secondary to a cytomegalovirus infection. The cellulitis appeared at first to respond to treatment with flucloxacillin and benzyl penicillin, but two local abscesses appeared and discharged. Culture of the pus grew *Pseudomonas* and the antibiotic was changed to ciprofloxacin. Despite this, more abscesses developed (Fig. 1).

Radiographs of the foot were normal but a technetium bone scan showed a zone of reduced activity in the midfoot surrounded by an area of increased activity (Fig. 2). This was interpreted as a focus of avascular necrosis. MRI of the foot confirmed avascular necrosis of the cuboid (Fig. 3) and demonstrated a sinus and several abscesses in the overlying soft tissues.

Under general anaesthesia, the abscesses were drained and an open biopsy of the cuboid was performed. Bacterial culture was negative, but histology showed that the avascular bone contained fungal hyphae (Fig. 4). The irregular

branching of the hyphae identified the fungus as a form of *Mucor*. Treatment with amphotericin was started and at a second operation the remainder of the cuboid was excised. Culture of the tissue eventually enabled the organism to be identified as *Rhizopus rhizopodiformis*, the commonest of a number of fungi capable of causing mucormycosis.

The wound was left open to granulate. It healed without complications and the patient could walk normally within three months. There was no evidence of fungal infection elsewhere.

DISCUSSION

Mycotic infection of bone is rare. Many fungi can cause bone destruction, the commonest being species of *Coccidioides* and *Blastomyces*. These fungi reside in the soil and are acquired by inhalation, the initial disease being a mild respiratory infection. A small percentage of these infections

Fig. 1

The dorsum of the affected foot shortly before biopsy, with several abscesses pointing in the skin.

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Fig. 2

Technetium bone scan of the affected foot (late phase). A zone of reduced uptake in the midfoot is surrounded by an area of increased activity.

progresses to a systemic disease; this may lead to granulomatous lesions of cancellous bone and sometimes to death.

Maduromycosis is a form of fungal osteomyelitis found in tropical and subtropical zones, and may be caused by different species of fungi. The foot is the commonest site of infection (Madura foot), usually in unshod agricultural workers. Fungal invasion may occur after an often trivial injury, and the first stages often go unobserved. By the time of initial presentation the foot may already show numerous discharging sinuses with extensive underlying necrosis. Early lesions require antibiotic therapy but severe destruction requires amputation.

The term mucormycosis (phycomycosis) refers to an infection caused by fungi of the order Mucorales, usually *Rhizopus*, *Mortierella*, *Absidia* or *Mucor*. There have been only a few reports of mucormycosis in healthy people (Majid and Yii 1991; Prevoo, Starink and de Haan 1991) and in most cases the infection had been opportunistic. The commonest predisposing condition was diabetes (Simon, Hoffman and Harding 1964), but in recent years immunosuppressed renal transplant patients and those on continuous

Fig. 3a

Fig. 3b

T1-weighted MRI of the affected foot: a) The sagittal section shows avascular necrosis of the cuboid. The rest of the foot appears to be normal; b) The coronal section demonstrates a sinus track into the cuboid and several fluid-filled areas in the overlying soft tissues.

peritoneal dialysis have also been at risk (Budreau et al 1989; Branton et al 1991). Boelaert, Fenves and Coburn (1991) reported that osteomyelitis was rare in their international registry of renal patients developing mucormycosis infections.

The commonest site involved in mucormycosis is the rhinocerebral region, but pulmonary, gastrointestinal and cutaneous forms have also been described. Only four cases of osteomyelitis of an extremity have been reported in the last 30 years (Foley and Shuck 1968; Hennessy and Mosher 1981; Maliwan, Reyes and Rippon 1984; Kerr et al 1988). All four patients had some predisposing condition such as renal failure or burns, and the disease arose after minor skin trauma. According to Gartenberg et al (1978), airborne

Fig. 4

Photomicrograph of the biopsy specimen from the cuboid (haematoxylin and eosin $\times 50$). An area of acellular necrotic bone is seen, with an infiltrate containing fungal hyphae.

spores are rare in a hospital environment, but can be isolated in large numbers in the immediate vicinity of patients with active rhinocerebral disease. Our patient had been in close proximity to a patient with rhinocerebral mucormycosis for several days.

Because the fungus excites little tissue reaction, local infiltration and vascular invasion readily occur, hence the occurrence of avascular necrosis. The frequently fatal outcome of inadequately treated infection shows how important it is to make an early diagnosis, usually by demonstrating the hyphae in a biopsy specimen. The Mucoraceae are very difficult to culture, even from infected tissue, and it may take several weeks for results to be obtained. In our case MRI was useful; it has been previously employed in the investigation of rhinocerebral infections (McDevitt, Brantley and Cawthon 1989; Yousem et al 1989).

Before effective anti-fungal therapy was available, mortality rates of 50% were reported. Today, treatment with amphotericin B combined with radical surgical excision (Ochi et al 1988) is the treatment of choice. Amphotericin B must be used with caution, however, in patients with renal failure (Winter et al 1975) and so few cases of mucormycosis

have been diagnosed before death that the relative contributions of surgery and anti-fungal treatment are difficult to assess.

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