

Radiology for the surgeon

Musculoskeletal case 40

Presentation

A 35-year-old male patient was referred to the orthopedic clinic complaining of right foot swelling. Clinical examination revealed diffuse nontender foot swelling associated with multiple discharging sinuses. Plain radiographs of the foot (Fig. 1) demonstrated diffuse sclerosis, lysis and undulating periosteal reaction involving the metatarsal bones of the second, third, fourth and the base of the first metatarsal. The fifth metatarsal is completely destroyed. In addition, diffuse erosions and destruction involve the midfoot bones and anterior calcaneus and talus. Diffuse soft tissue swelling is identified.

Magnetic resonance imaging was performed. T_1 -weighted pre- and postcontrast images are shown in the sagittal (Fig. 2) and axial (to the forefoot) (Fig. 3) planes. A large mass is present, engulfing and destroying the bony structures and encasing tendons. The lesion is of low signal and enhances diffusely with contrast. A sagittal T_2 -weighted spin-echo image shows the mass to be inhomogeneous (Fig. 4). The fat planes are obliterated. Multiple track-like sinuses are seen over the foot dorsal and the planter skin. Bone edema is seen along the anterior half of the talus and calcaneus. Bone scintigraphy of the foot (Fig. 5) shows diffuse increased uptake over the tarsal and the first metatarsal bones. Very intense gallium uptake (not shown) was also demonstrated over these areas.

According to the clinical and image findings, what is the diagnosis?

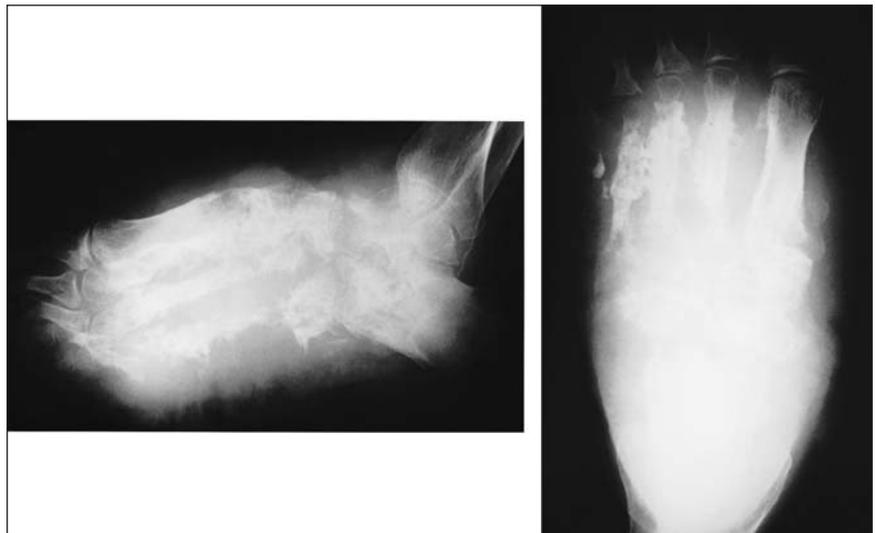


FIG. 1. Plain radiographs of the foot.

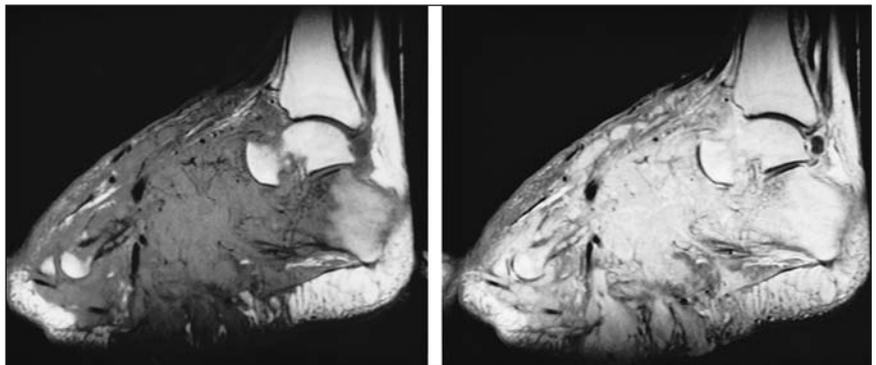


FIG. 2. T_1 -weighted pre- and postcontrast images, sagittal plane.

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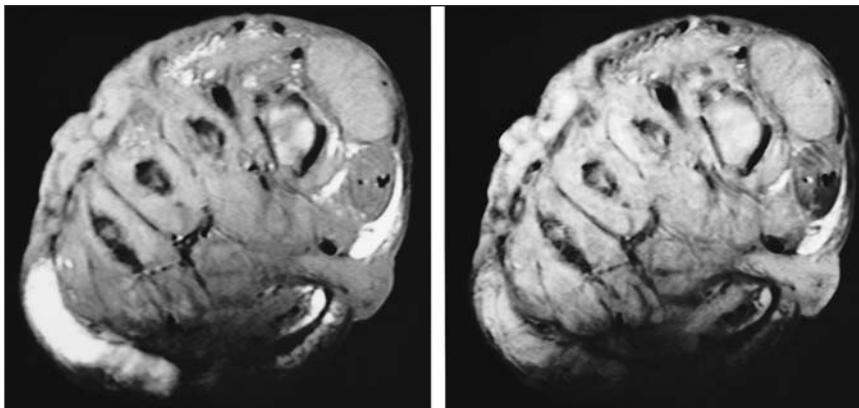


FIG. 3. T₁-weighted pre- and postcontrast images, axial plane.

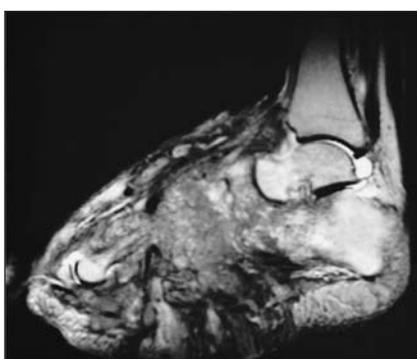


FIG. 4. T₂-weighted spin-echo image, sagittal plane.



FIG. 5. Bone scintigraphy of the foot.

Diagnosis

Madura foot (mycetoma)

Mycetoma is a chronic infection caused by actinomycetes or fungi, or both. This infection results in a granulomatous inflammatory response in the deep dermis and subcutaneous tissue, which can extend to the underlying bone. Mycetoma is characterized by formation of grains containing aggregates of organisms that may discharge through the skin surface via multiple sinuses. This disease was described first in 1842 and initially named Madura Foot, after the region of Madura in India, where it was first identified.

More than 20 species of fungi and bacteria can cause mycetoma. About 60% of mycetoma is caused by bacteria (actinomycetomas), and 40% is caused by true fungi (eumycetoma). This condition is endemic to Africa, Mexico and India. The disease also can be found in areas of Central and South America as well as in

the Middle East or Far East between latitude 15°S and latitude 30°N. No particular risk based on race has been described. The male-to-female ratio is 5:1. It most frequently is found in patients aged 20–40 years.

With the dramatic increase in international travel in the last 30 years as a result of migration, international tourism and foreign aid, and with an increasing number of immunocompromised patients owing to AIDS and chemotherapy, physicians trained in the West are increasingly faced with the challenge of diagnosing and treating these infections.¹

Infection of the foot (and less commonly the hand, arm, leg or scalp) results from posttraumatic soft tissue invasion by organisms that live in the soil.¹ A neutrophilic response initially occurs, followed by a granulomatous reaction. Spread occurs through skin facial planes and can involve the bone. Hematogenous or lymphatic spread is uncommon. The disease causes disfigurement but is rarely fatal.

The lesions are usually painless unless secondary bacterial infection or bone expansion occurs. In advanced cases, deformities or ankylosis, or both, can appear. The disease typically follows a slow, relentless course. Osseous fusion and multiple infected sinuses eventually produce an amorphous loss of joint definition and confluent irregular mass develops. The destroyed bone is often described as having the appearance of melting snow. Over a period of months or years, a swollen, deformed foot with multiple discharging, interconnecting fistulas develops. The differential diagnosis of these radiographic features includes other types of osteomyelitis, neuropathic arthropathy and neoplasm.¹

Plain radiographic classification of the pattern, extent and severity of bone involvement in mycetoma of the foot can be used in planning and monitoring treatment response.² In this classification, stage 0 indicates the presence of only soft tissue swelling without bone involvement. Stage 1 refers to the extrinsic pres-

sure effects on the intact bones in the vicinity of an expanding granuloma. Stage 2 reflects periosteal reaction of the bone without actual intraosseous invasion. Cortical erosion and medullary invasion occurs in stage 3. If the disease spreads longitudinally along a single ray, this is defined as stage 4. Horizontal transverse spread along a single row represents stage 5. Multidirectional spread due to uncontrolled infection is classified as stage 6.²

Microscopy and culture of exudates as well as skin biopsy for pathology are necessary to identify the causative organism. Plain x-rays are used to assess evidence of bone involvement. CT scan or MRI may be more sensitive in the early stages.

Owing to the slow, relatively pain-free progression of the disease, mycetoma is often at an advanced stage when diagnosed.

Surgical debridement followed by prolonged appropriate antibiotic therapy for several months is required for actinomycetoma.³ Eumycetomas are only partially responsive to antifungal therapy but can be treated by surgery because of their normally well-circumscribed nature. More recently, successful treatment with itraconazole has been reported.⁴ Surgery usually consists of removing the mass and a portion of the surrounding tissues. If the infection is extensive, amputation is sometimes necessary.

Recovery from mycetoma may take months or years, and the infection recurs after surgery in at least 20% of cases. Drug therapy can reduce the chance of a re-established infection. The extent of the deformity or disability depends on the severity of infection: the more deeply entrenched the infection, the greater the damage.

Competing interests: None declared.

References

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3. Davis JD, Stone PA, McGarry JJ. Recurrent mycetoma of the foot. *J Foot Ankle Surg* 1999;38:55-60.
4. Lexier R, Walmsley SL. Successful treatment of Madura foot caused by *Pseudallescheria boydii* with *Escherichia coli* superinfection: a case report. *Can J Surg* 1999;42:307-9.

Essential reading

from the Canadian Medical Association

- *CMAJ*
- *Canadian Journal of Surgery*
- *Journal of Psychiatry & Neuroscience*

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