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Case Report

Imaging of Madura foot: Case report ☆

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ABSTRACT

The case presented illustrates a very rare chronic granulomatous disease called the Madura foot or also called mycetoma. It is a chronic granulomatous disease, caused by a contained infection that penetrates the subcutaneous tissues and spreads to the nearby bone by damaging the affected area's vascularization. Early diagnosis is greatly aided by clinical history and imaging, especially if the "dot-in-circle" sign—a pathognomonic marker of mycetoma—is seen on the MRI. Compared to ordinary radiographs, computed tomography offers a more accurate study of changes in the bone. In order to apply the appropriate course of treatment, it is critical to identify the causal species, which can be caused by either a true fungus (eumycetoma) or a bacterium Actinomyces (Actinomycetoma). Treatment can be extremely challenging and can even result in amputation, particularly if the diagnosis is delayed.

Introduction

Madura foot is a chronic granulomatous contamination of the dermis and epidermis due to either true fungus (eumycetoma) or the bacteria Actinomyces (Actinomycetoma) [1]. The Madura District in India is the source of the pathology's name, it is called Madura in reference to the Indian city (Madurai), having been first described there by Gill in 1842 [2]. In tropical and subtropical areas, particularly in Sudan, India, and South America, it is a widespread health issue [3]. However, it is still an exceptional condition in European and North African nations such as Morocco. It classically shows in farmers who go barefoot in dry, dusty conditions [4]. Pathogens can penetrate the skin from the soil with minimal trauma, causing the formation of discharging granulomas that eventually lead to the destruction of the underlying bones [4]. Up to 70% of cases involve the foot [5]. The wounded tissue usually affects the body parts with unprotected skin, such as the hands, arms, lower leg regions and feet. Mycetoma is more common in men than in women, with a gender ratio of 3.7:1 [3].

Case presentation

We present a case of a 57-year-old woman, farmer living in a rural area, with no significant medical record, except a plan-

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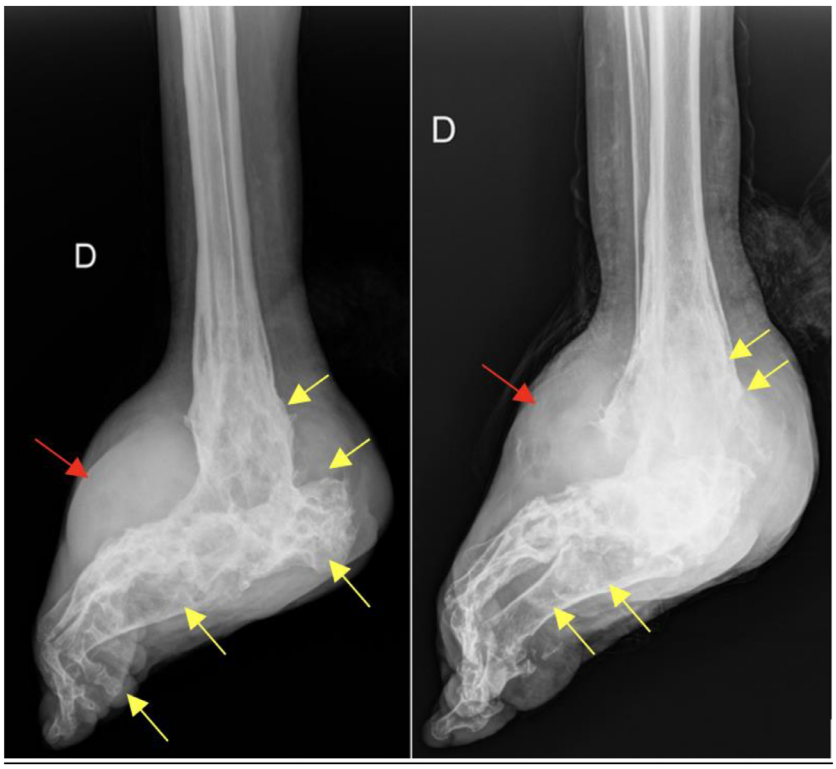

Fig. 1 – Radiographs of the right foot showing soft tissue enlargement (red arrows) and bone deformity with erosions and osseous destructive changes extensively involving the distal tibia, hindfoot, and midfoot bones (yellow arrows).

tar tear in the right foot that was neglected 43 years ago. She developed afterwards a swelling of the foot that progressively increased in size, for which she used several traditional treatments. The patient was otherwise in good health and displayed no signs of immunosuppression. The clinical examination revealed painless swelling and foot deformity. It was of hard consistency, polyfistulized, with discharge of pus and blood, as well as multiple whitish grains from the fistula, covered in places by meliceric and hemorrhagic crusts.

Differential diagnosis

The leading diagnosis for chronic infected foot, especially in the country of Morocco, is tuberculosis, where we have an endemic problem. Other potential causes for a massive bone destruction would be chronic osteomyelitis.

Imaging findings

A radiograph of the foot was first performed showing multiple erosions and exostosis with a significant right foot deformity. It also demonstrated soft tissue enlargement, bone sclerosis and a continuous solid periosteal reaction (Fig. 1).

The MRI showed a massive bone destruction of the metatarsus, tarsus, phalanges and lower extremity of the tibia and fibula, which were replaced by masses invading the adjacent soft tissues, causing severe foot deformity, enclosing well-limited ovoid lesions. These lesions were described on T2-weighted images as high signal intensity lesions, with a peripheral border in low signal intensity and a hypointense point in the middle characterizing the "dot-in-circle" sign. They were intensely enhanced after administration of Gadolinium (Fig. 2).

Treatment

The procedure involved a percutaneous biopsy. The pathological results were in line with mycetoma. Based on microbiological analysis, the mycetoma was caused by branched aerobic actinomycetes. It was decided to undergo drastic surgery, which required amputation, due to massive bone deterioration.

Discussion

Physiopathology and clinical findings

The 3 distinct clinical features of a mycetoma are enlarged tissue, draining sinuses, and grains visible in the discharge [6]. At first, some people might describe pain or discomfort at the location, while others might not remember any specific trauma [6]. A painless, slowly spreading subcutaneous nodule develops after inoculation [6]. Because of dermal sclerosis, diseased skin displays wooden fibrotic induration [7]. Next, the fistulae appear, which may release a purulent fluid. Moreover, it may cause osteomyelitis, draining sinus tract, and abscess development [1]. Mycetoma progresses slowly and painlessly, yet it can affect deep structures such deep fascia, muscles, bones,

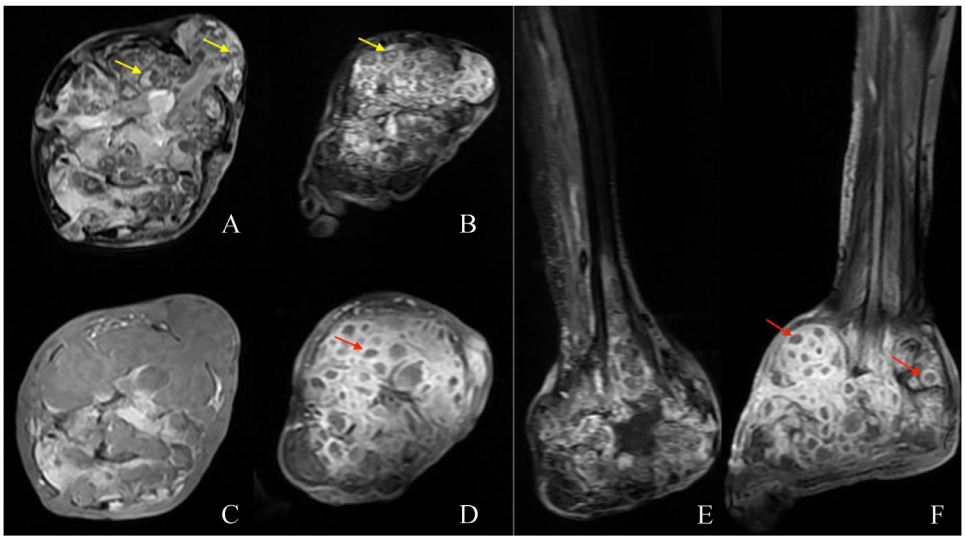

Fig. 2 – Axial (A) and sagittal (B) T2 FAT SAT, axial T1 (C), coronal T2 FAT SAT (E) demonstrate massive destruction of the right foot with numerous little dispersed and adjoining lesions, intruding the foot's soft tissue and reaching the bones. The lesions are characterized as high-signal intensity lesions, having a low-signal dot in the middle and a peripheral low-signal rim, which together describe the "dot-in-circle" sign (yellow arrow). Following gadolinium injection, axial and sagittal T1 FAT SAT (D and F) display peripherally enhanced lesions and the persistence of tiny, central, low-signal foci encircled by high-signal-intensity tissue (red arrow).

and joint tendons [7]. Multiple foci of osteolysis and grains replace the osseous tissue in the bone as a result of invasion [2]. When treatment for foot mycetoma is not received, the condition might result in limb deformity and amputation [3].

Mycetoma foot can imitate a tumor or a chronic bacterial or tuberculous infection clinically when it lacks the usual symptoms of leaking sinuses [8].

Histology

Histologically, the lesion is composed of microabscesses containing bacteria or fungal hyphae "grains" within a granulomatous fibrous-tissue response [8]. It is challenging to make an early test diagnosis before the sinuses and grains show up. Even while the final diagnosis is typically obtained through biopsy (with evidence of the diagnostic characteristics) or staining and microbiological culture of the lesion's discharge, both procedures take a lot of time, and the diagnosis may not always be made, particularly when dealing with fastidious organisms [1].

Imaging

Early on, radiographs might be normal. On the other hand, in more advanced phases, it could exhibit osteoporosis, periosteal reaction, soft tissue enlargement, bone sclerosis, bone cavities, extrinsic cortical scalloping, and fanning of the rays [2]. Unlike bacterial osteomyelitis, the bones are nearly always attacked from the outside [2]. Actinomycetoma and eumycetoma can be distinguished from one another using a few radiographic bone alterations that have been reported [2]. Actinomycetes frequently create smaller but more numerous cavities in bone, leading to a moth-eaten appearance, whereas eumycotic lesions typically form a few ≥1 cm diameter cavities [2]. Especially in the early phases, a computed tomography (CT) scan allows for a more accurate delineation of bone abnormalities than radiography [1].

The appearance on MRI of conglomerates of small (2-5 mm) round hyperintense lesions, indicating the granulation tissue, surrounded by low-signal-intensity ring, representing intervening fibrous septa, may be explained by the constitution of aggregates of mycetoma identified as "grains". Fungal grains induce a susceptibility effect, which is shown by the central low-signal-intensity dot. When recognized, this distinct appearance is immediately identifiable and seems to strongly suggest mycetoma. The "dot-in-circle" indication was initially identified by Sarris et al. in 2 cases of mycetoma affecting the soft tissues of the foot. They further conjectured that this aspect is a reflection of the distinct pathological characteristics of mycetoma [8]. Later reports on it appeared in 2007 and 2009 and 2010 [2].

The Ultrasonographic (USG) manifestations were first reported by Fahal et al. [9], who established that the hyperreflective echoes on in vitro imagery of the mycetoma lesions corresponded to the grains; fine hyperechoic foci are formed by actinomycetomas, and they usually settle at the bottom of the spherical lesions, whereas eumycetoma grains produce sharp hyperechoic foci. The MRI and USG "dot-in-circle" signs are comparable in that they both have many spherical hypoechoic lesions with hyperechoic foci [1].

The primary differential diagnosis for Madura foot includes nonspecific chronic osteomyelitis, tuberculosis and Charcot foot, a rare complication for diabetes-related neuropathy. The definite diagnosis may only be made by microbiological culture of the discharge released from the sinus or lesional tis-

sue, along with a biopsy that demonstrates typical characteristics. Both, meanwhile, could be challenging, particularly when dealing with fastidious organisms [5].

Conclusion

Foot of Madura, also called mycetoma, is a chronic granulomatous infection of the deep subcutaneous soft tissues, which affects the foot in 80% of the cases. The tropical regions are where this infection is most commonly seen and is caused by either bacterial or fungal organisms. Imaging findings, using radiography, computed tomography, and specifically MRI, which displays a particular sign: the “dot-in-circle” sign, are very beneficial for the diagnosis; but the decisive diagnosis can only be provided with the results of a biopsy and histology. Delivering an early diagnosis is very important, since a delayed identification can induce an amputation of the affected region.

Patient consent

Informed written consent was obtained from the patient for publication of the case report and all imaging studies.

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