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Radiology

Imaging Features in the Exploration of Pedal Mycetoma (Madura Foot): About Two Cases

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Abstract | **Case Report**

Madura foot or pedal mycetoma is a chronic cutaneous fungal infection that is endemic in tropical countries but rare in temperate climates. If left untreated, this condition progresses to the destruction of soft tissues and adjacent bony structures with deformation of the affected limb, hence the importance of an early diagnosis. The aim of this work is to emphasize, through two cases of pedal damage observed in Morocco, the contribution of imaging in the diagnosis of this entity.

Keywords: Mycetomas, Madura foot, foot, imaging.

INTRODUCTION

Mycetoma or Madura's foot is a fungal skin infection that causes inflammatory pseudotumors, often polyfistulized, discharging fungal or actinomycosic granules. It is quite rare outside of tropical areas where it is endemic. If left untreated, this condition progresses to the destruction of soft tissues and adjacent bony structures with deformation of the affected limb.

Based on two cases of patients living in Morocco, we propose to describe the conventional radiological, scannographic, ultrasonographic and MRI manifestations of mycetoma as well as a review of the literature.

PATIENTS AND OBSERVATIONS

Patient 1

A 34 years old fisherman from Essaouira, with no particular pathological history, presented with complaint of long-standing swelling over the posterior region of his left ankle, without any notion of trauma, that had been developing for 36 months and progressively increasing in size with multiple sinus tracts, and the discharge of pus with both black and white granules.

The physical examination (Figure 1) revealed a swelling of the posterior region of the ankle with papulonodular lesions, some of which were polyfistulized on the skin, causing a seropurulent fluid to emerge on pressure.

Standard X-ray front and profile of the left ankle (Figure 2), initially showed infiltration of soft tissues, creating a pseudo-mass appearance on the posterior surface of the ankle with a continuous unilamellar periosteal reaction. The patient had been lost of view for 2 years. The evolution was marked by the appearance of an osteolytic lesion of the distal extremity of the leg and foot bones with a spiculated periosteal reaction and a significant infiltration of the soft tissues, creating an appearance of chronic osteitis (Figure 3).

Ultrasound (Figure 4) showed significant soft tissue infiltration of the lower third of the leg, the ankle and the left foot, with multiple anechoic collections that were fairly well limited, not vascularized on Doppler, and describing fistulous paths to the skin.

The computed tomography (CT) (Figures 5, 6) showed soft tissue swelling with multiple periosteal and peritendinous collections fistulated to the skin and extending intraarticularly to the inferior tibioperoneal and tibio-astragalar joints, with discrete lamellar periosteal reaction giving the appearance of chronic osteitis.

The microbiological study was in favor of an actinomycotic bacterial mycetoma.

MRI (Figure **7**) was performed a year after the start of treatment, showed significant infiltration of soft tissues, several fistulous paths on the posterior surface, a subcutaneous collection on the anterior surface and bone marrow signal abnormality in the distal fibula, appearing in hyposignal T1, hypersignal T2 and STIR associated with erosions, cortical thickening, irregular periosteal reaction and posterolateral subperiosteal collection of the lower end of tibia.

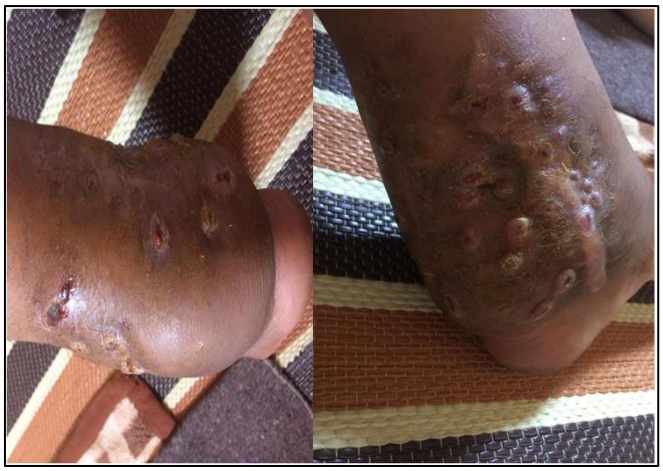

Figure 1: Image of the left ankle: Swelling of the distal third of the leg extended to the ankle, polyfistulized with discharge of seropurulent fluid

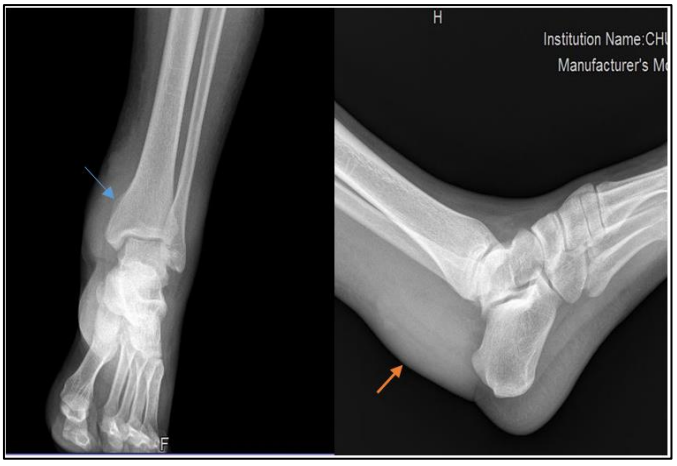

Figure 2: Radiography of the left ankle infiltration of the soft tissues creating a pseudo-mass appearance (Orange arrow), with a continuous unilamellar periosteal reaction (Blue arrow)

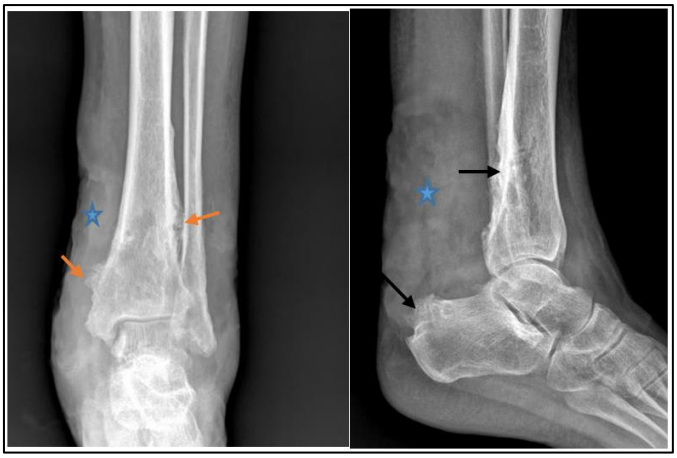

Figure 3: Standard X-ray of the left ankle with an evolution of 2 years without treatment, showing an osteolytic lesion of the distal extremity of tibia, fibula and foot bones without marginal sclerosis, classified as Lodwick type II (Black arrow), with a spiculated periosteal reaction (Orange arrow) and a significant infiltration of the soft tissues, creating an appearance of chronic osteitis (Asterix)

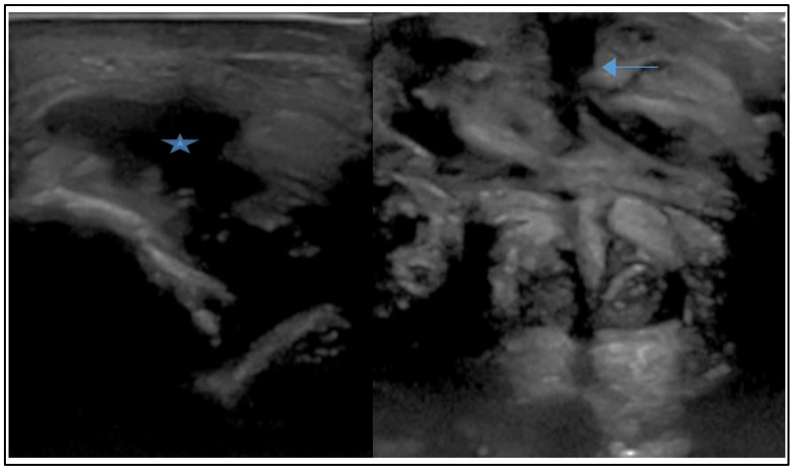

Figure 4: Ultrasound of the ankle showing significant soft tissue infiltration with the presence of anechoic collections (Asterix), some of which are fistulous to the skin (Arrow)

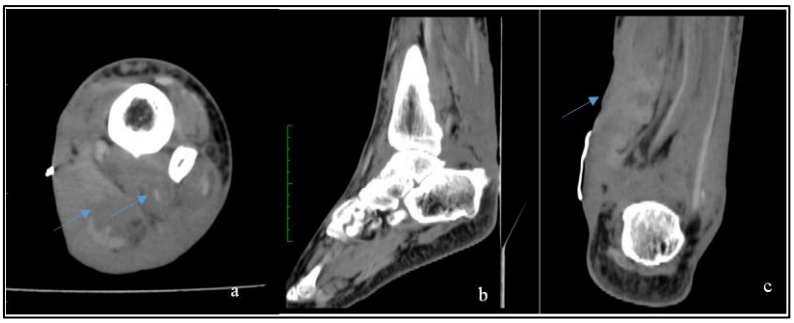

Figure 5: Computed tomography (CT) in parenchymal window, showing significant infiltration of the soft tissues of the foot, the ankle and the lower third of the left leg, with multiple hypodense collections enhanced in the periphery after contrast injection (Arrows)

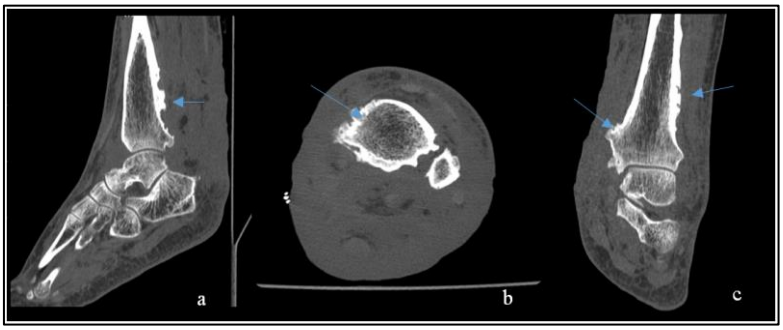

Figure 6: Computed tomography (CT) in bone window showing irregular cortical thickening with a solid periosteal reaction of the tibia and fibula

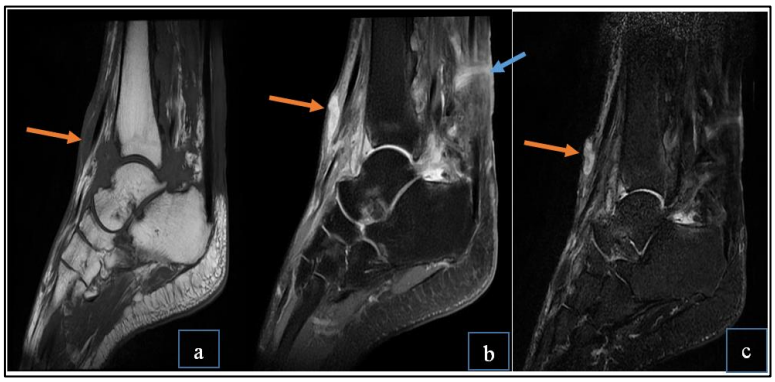

Figure 7: MRI weighted T1, T2, and STIR, showing significant infiltration of soft tissues associated with several fistulous paths on the posterior surface (Blue arrow) and a subcutaneous collection on the anterior surface (Orange arrow), appearing in hyposignal T1 and hypersignal T2 and STIR

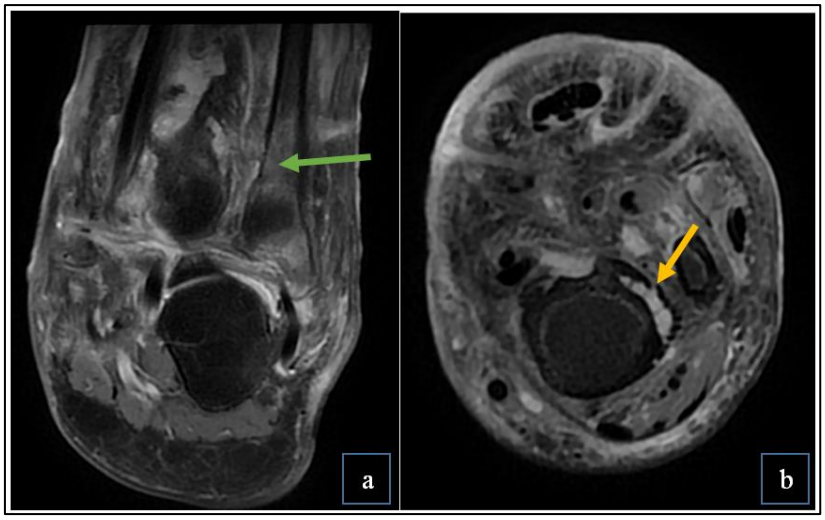

Figure 8: MRI weighted T2, showing bone marrow signal abnormality in the distal fibula appearing in hyposignal T1, hypersignal T2 and STIR (Green arrow), associated with cortical thickening, irregular periosteal reaction and posterolateral subperiosteal collection of the lower end of tibia (Yellow arrow)

Patient 2

A 47 years old man, farmer, living in a rural area near Marrakech, without any significant medical history and no records of travelling to tropical areas comes to the consultation with a painless swelling in his left foot. The swelling first occurred, after an injury to the sole of his left foot and has been getting worse ever since for the past 12 months, with the release of liquid containing whitish grains.

Physical examination revealed several sinus tract formations and a large swollen indurate mass palpable on the top of his left foot (Figure 8).

Standard X-rays front and profile of the left foot showed a large soft-tissue infiltration associated with multiple well-circumscribed osteolytic lesions that were delimited by a fine border of marginal sclerosis seen at the level of metatarsal diaphysis, causing a blowing of the cortical bone with a continuous periosteal reaction, a diffuse demineralization of the tarsal bones and a pinching of the tarsometatarsal and intermetatarsal joints realizing ankylosing tarsitis.

Ultrasound with high frequency linear probe at local site (Figure 9), demonstrates multiple hypoechoic well-defined lesions with hyperechoic centers, consistent with "Dot-in-circle" sign, some of which were fistulized in the skin with irregularity of the bone cortex in some places.

The microbiological study was in favor of an actinomycotic bacterial mycetoma.

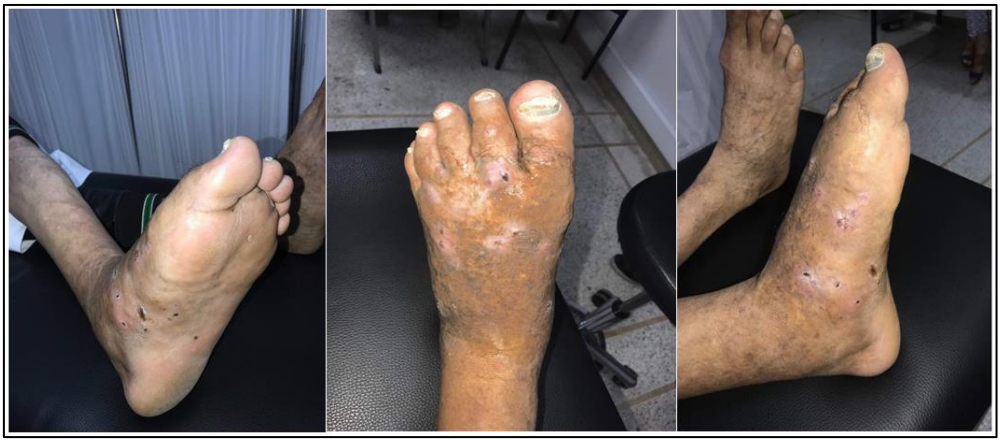

Figure 9: Image of the left foot: Dorsal swelling of the foot, dotted with papulonodular lesions, polyfistulized to the skin and encrusted sinuses

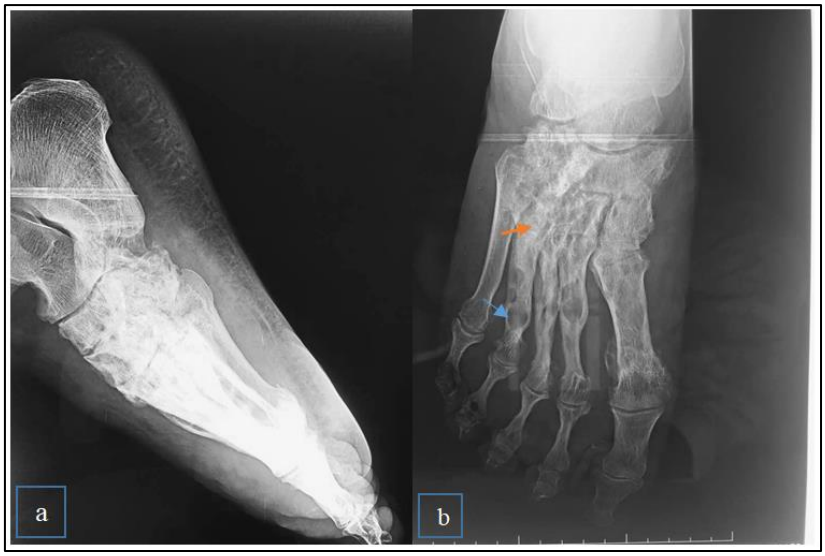

Figure 10: Radiography of the left foot, frontal and lateral film, showing multiple lytic lesions of the cuneiform, navicular and metatarsal bones (Blue arrow), well circumscribed, with a thin peripheral bone shell sclerosis and an endosteal scalloping associated to a diffuse demineralization of the tarsal bones with effacement and pinching of the tarsometatarsal and intermetatarsal joints resulting in ankylosing tarsometatarsitis (Orange arrow)

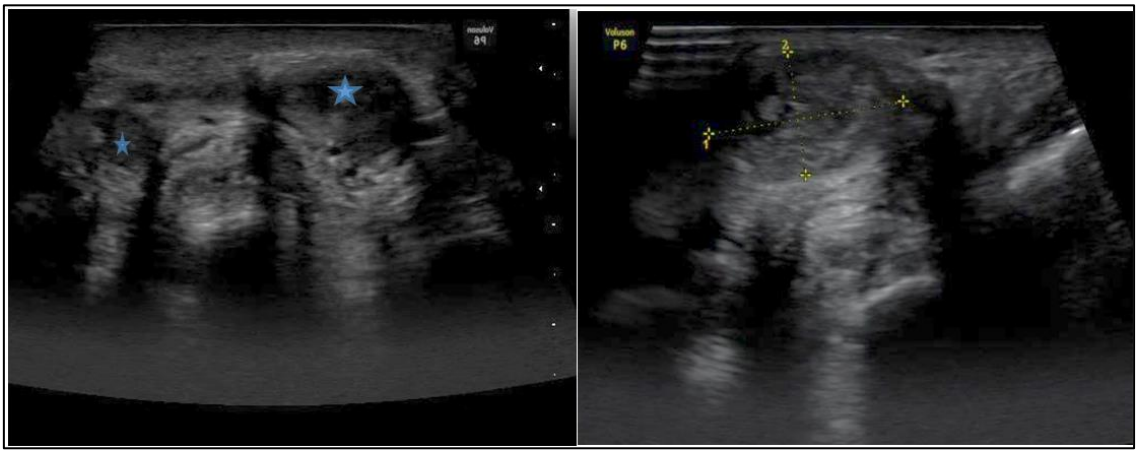

Figure 11: Ultrasound of the foot, demonstrates multiple hypoechoic well-defined lesions with hyperechoic centres, consistent with "Dot-in-circle" sign, some of which were fistulized in the skin with irregularity of the bone cortex in some places

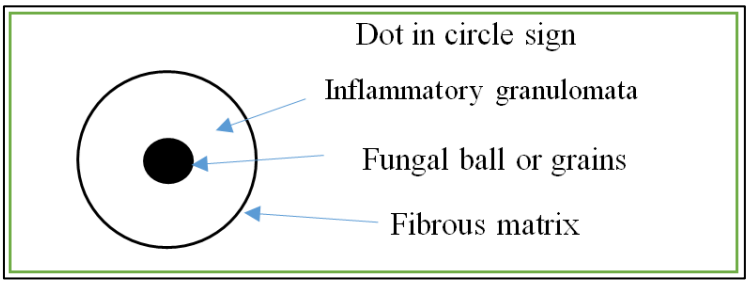

Figure 12: Components forming dot in circle on imaging

DISCUSSION

Madura foot is a podal localization of a mycetoma. It is a frequent occurrence in tropical and subtropical countries (India, Yemen, Mexico, Senegal) [1]. In Morocco, this condition is rare. It classically affects people of rural origin, particularly farmers who got infected through injuries following generally minor trauma on a barefoot that goes unnoticed or neglected by the patient, allowing the inoculation of the telluric pathogen, fungic (eumycetoma) or actinomycotic bacteria (actinomycetoma) that lives as a saprophyte in the soil producing mycelial filaments.

The diagnosis of mycetoma is often easy in endemic areas in front of a swelling developing over several years, indolent, poly fistulized, letting out grains of variable size and color depending on the germ(s)

involved. More rarely, painful phenomena, suggestive of superinfection or bone involvement, will appear.

Mycetomas behave as locally infiltrating and recurrent tumors. Tendons and nerves are usually resistant to infection, whereas bone is rapidly invaded and destroyed [2]. Indeed, bone involvement is the most dreadful complication; its existence worsens the prognosis and constitutes the predominant factor in the choice of treatment, sometimes making amputation inevitable.

Imaging is essential for the diagnostic approach, for the establishment of a pre-therapeutic lesion assessment of both bone and soft tissue involvement, and for monitoring the evolution of the disease.

Radiographs may be normal or demonstrate soft tissue enlargement, bone sclerosis, bone cavities, periosteal reaction, bone expansion, extrinsic cortical scalloping, fanning of the rays or osteoporosis. The bones are almost always attacked from the outside, in contrast to bacterial osteomyelitis [3]. A few radiographic bone changes have been described that help distinguish between actinomycetoma and eumycetoma. Eumycotic lesions tend to form a few cavities in bone that are ≥1 cm in diameter, while actinomycetes often form smaller but more numerous cavities, leading to a moth-eaten appearance [4].

Ultrasound is especially interesting in countries where the disease is endemic. It shows multiple

Cavities circled by thickened walls, without posterior reinforcement, with multiple hyper-reflective echoes corresponding to the mycetoma grains. The examination is more precise in the case of lesions without sinus tracts, because fibrosis of these tracts can make interpretation difficult [5].

CT is of a major interest and it is more sensitive than standard radiographs for assessing osteoarticular damage. It shows a mass isodense to muscle, heterogeneous, which can contain denser rounded nodules that infiltrate the skin and the subcutaneous fat tissues. The affected muscles are thickened or partially destroyed. Enhancement is heterogeneous and moderate. CT is more sensitive than MRI for detecting osteoperiosteal damage and for early visualization of small cortical lesions, which can be sought more easily by visualizing the hyperdense granules in direct contact with the bone.

MRI is the most helpful examination for a positive diagnosis and for staging mycetoma, which appears, in comparison to muscle, as a discrete hyperintense signal with T2 weighting and as a hypo- or iso-intense signal with T1 weighting. Contrast uptake after gadolinium injection is moderate and heterogeneous; the signal from the mycelial granules remains clearly hypointense. The characteristic appearance is that of an infiltrating mass made up of small cavities, hyperintense on T2 weighting, and circumscribed by hypointense fine partitions containing central dots, hypointense on all sequences and creating a nearly pathognomonic sign, called the ‘‘dot-in-circle’’, especially useful when clinical, microbiological and histological findings are not determinative. This dot-in-circle sign is correlated with the histology: the primary hypointense point corresponds to the mycelial granule, the surrounding hyperintense signal to the inflammatory granuloma, and the hypointense partitions to the fibrous matrix (Figure 10) [6].

Although MRI is relatively insufficient, compared with CT, for the detection of early cortical bone involvement, it is very sensitive for the diagnosis of spongious bone involvement on T1-weighted sequences where the hyperintense marrow fat signal is replaced by the hypointense mycetoma and especially on the fat-suppressed T2 weighted sequences, where the hyperintense signal is clear. MRI is superior to CT in the etiological approach, in the evaluation of soft tissue involvement and in the preoperative assessment, especially in extrapodal localizations. It can easily distinguish between mycetoma and other lesions such as soft tissue tumors, chronic osteomyelitis, or osteoarticular tuberculosis [2].

In all cases, certainty is provided by mycological or anatomopathological examination of a biopsy or surgical excision specimen. Indeed, the distinction between eumycetoma and actinomycetoma is fundamental for the choice of treatment, which also depends on the localization and the degree of lesion extension, particularly in the bone [7]. Recent findings localized actinomycetoma that involves the skin without affecting underlying organs is treated with trimethoprim/sulfamethoxazole for 3 to 12 months. Duration of treatment depends on clinical response, development of adverse effects, and patient comorbidities. If available, an antibiogram should guide antimicrobial therapy. Eumycetoma treatment includes itraconazole, voriconazole, posaconazole, and terbinafine. Surgery is indicated depending on disease extension, antifungal clinical response, and localization [7].

CONCLUSION

Madura foot or pedal mycetoma is a mycelial soft-tissue infection with the potentially severe complication of osteoarticular extension that can result in amputation of the affected bone segment. Imaging allows a specific assessment of the osteoarticular damage and can thus guide therapeutic management.

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