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# Sonographic presentation and differential diagnosis of mycetoma (Modura foot)

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## Abstract

In this multicentre study 50 cases of mycetoma were included, clinically diagnosed at the Faculty of Radiological Sciences, Alzaeim Alazhari University, Khartoum Sudan and at the Faisal Specialist Hospital, Khartoum, Sudan. All patients were scanned by at least two of the researchers and their sonographic presentation was recorded in order to establish a criteria for the sonographic appearance of both principal types of mycetoma

**Key words:** mycetoma, ultrasonography

## Rezumat

In acest studiu multicentric au fost incluşi 50 de pacienţi cu *mycetoma*, diagnosticaţi clinic la Universitatea Alzaeim Alazhari şi la Spitalul Faisal, Karthoum, Sudan. Toţi pacienţii au fost investigaţi ecografic de cel puţin doi dintre autori iar rezultatele lor au fost înregistrate cu scopul de a stabili criteriile de diagnostic ecografic în ambele tipuri de *mycetoma*.

**Cuvinte cheie:** *mycetoma*, ecografie

Mycetoma is a chronic, specific, granulomatous, progressive inflammatory disease; it usually involves the subcutaneous tissue after a traumatic inoculation of the causative organism.

Mycetoma may be caused by true fungi or by higher bacteria. Tumefaction and formation of sinus tracts characterize the disease. The sinuses usually discharge purulent and seropurulent exudates, containing grains. It may spread to involve the skin and the deep structures resulting in destruction, deformity and loss of function; very occasionally it could be fatal.

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## Types of mycetoma

The two forms of mycetoma are bacterial and fungal (table I). The bacterial mycetoma is known as *actinomycetoma* and the fungal form is called *eumycetoma*.

**Tabel I** Causative species of mycetoma

| **Bacteria** |
|---|
| *Nocardia veterana.* |
| *Nocardia transvalensis.* |
| *Actinomadura madurae.* |
| *Actinomadura pelletieri.* |
| *Streptomyces somaliensis* |
| **Fungus** |
| *Exophiala jeanselme.* |
| *Madurella grisea.* |
| *Madurella mycetomatis.* |
| *Leptosphaeria senegalensis.* |
| *Scedosporium apiospermum.* |
| *Pseudallescheria boydii* |

Even at the level of electron microscopy the two forms of mycetoma are difficult to distinguish one from the other.

## Epidemiology

The disease is endemic in the tropics and subtropics and is named after the region of India where it was first described in 1842.

The African continent seems to have the highest prevalence. It prevails in what is known as the mycetoma belt, stretching between the latitudes of 15° south and 30° north. The belt includes Sudan, Somalia, Senegal, India, Yemen, Mexico, Venezuela, Colombia, Argentina and others. Areas where mycetoma prevails are zones with a short rainy season with a relative humidity.

Although currently uncommon in temperate regions, it does occur in the southern USA, and cases have been found in the homeless and AIDS patients.

The organisms are usually present in the soil in the form of grains. The infecting agent is implanted into the host tissue through a breach in the skin produced by trauma caused by sharp objects such as thorn pricks, stone or splinters.

## Pathogenesis

The disease is usually acquired while performing agricultural work and it generally afflicts men between 20 and 40 years old.

The disease is acquired by contacting grains of bacterial or fungal spores that have been discharged onto the soil. Infection usually involves an open area or break in the skin. *Pseudoallescheria boydii* is one of many fungi spp. that causes the fungal form of madura foot. Infections normally start in the foot or hand and travel up the leg or arm.

## Clinical presentation of disease

The disease is characterized by a yogurt-like discharge upon maturation of the infection. Haematogenous or lymphatic spread is uncommon.

Following the initial injury, the disease typically follows a slow chronic course over many years with painless swelling and intermittent discharge of pus. There may be a deep itching sensation. Pain may occur due to secondary bacterial infection or bone invasion.

After some years, massive swelling of the area occurs, and within this period, skin rupture and sinus tract formation follows (fig 1).



**Fig 1.** Picture of a patient with yellowish white pustules and redness of the area. Fungal type of myectoma.

As the infection spreads, old sinuses close and new ones open. The exudates are typically granular.

Diagnosis of mycetoma is usually accomplished by radiology, ultrasound or by fine needle aspiration of the fluid within an afflicted area of the body.

## Differential diagnosis

The main differential diagnoses are chronic bacterial osteomyelitis, tuberculosis, or the early phase of Buruli ulcers.

Other deep fungal infections such as blastomycosis or coccidomycosis, leishmaniasis, yaws and syphilis should be considered.

## Investigations

Microscopy and culture of exudates, and skin biopsy for pathology are necessary to identify the causative organism.

Serology can be helpful with diagnosis or follow-up care during medical treatment.

DNA sequencing has been used for identification in difficult cases.

Plain x-rays are used to assess the evidence of bone involvement.

A CT scan may be more sensitive in the early stages.

MRI scans can provide a better assessment of the degree of bone and soft tissue involvement and may be useful in evaluating the differential diagnosis of the swelling.

## Complications

The disease causes disfigurement but is rarely fatal.

In advanced cases, deformities or ankylosis may occur.

Chronic neglected infection may necessitate amputation.

Immunocompromised patients may develop invasive infection.

Lymphatic obstruction and fibrosis may cause lymphoedema.

Complications may result also from toxicity due to prolonged antimicrobial or antifungal therapy.

**Prognosis**

Actinomycetoma can be cured with the appropriate antibiotic therapy but eumycetoma has a high rate of recurrence and can require amputation [1,2,3,4].

## Material and method

The 50 patients included 18 female and 32 males, age ranging from 20 to 70 years. From these patients 16(32%) had pustules at back and the lateral side of the abdomen while 30 (60%) had involvement in the limbs (upper or lower limbs) and 4 (8%) had involvement of extremities as well as the back.

All the patients were scanned on GE Logic-9 and Shamadzo's Color Doppler using convex as well as linear high frequency transducers with color and power Doppler. Images and real time video clips were saved.

## Results

After ultrasound guided aspiration, the pathological material from all 50 patients was sent for cytological examination. The lab tests confirmed the diagnosis of 46 (92%) cases as mycetoma. Our accuracy for diagnosis of bacterial type was 94% and for fungal type 90%.

Sonographic presentation (fig 2-10)

1. Jelly like hypo to anechoic mass with rounded or oval hyperechoic granular structures which move/float at real time scanning.
2. In fungal type fluid contents are as compared to other type; in some types we can see the halo around the hyperechoic sticks (granules) in the fungal type.
3. In bacterial types, in most cases a capsule like outline is seen around the lesion whereas in all cases diagnosed as fungal, no capsule is seen
4. On color Doppler, signs of hyperemia are present. More flow is seen in bacterial types as compared to fungal types.

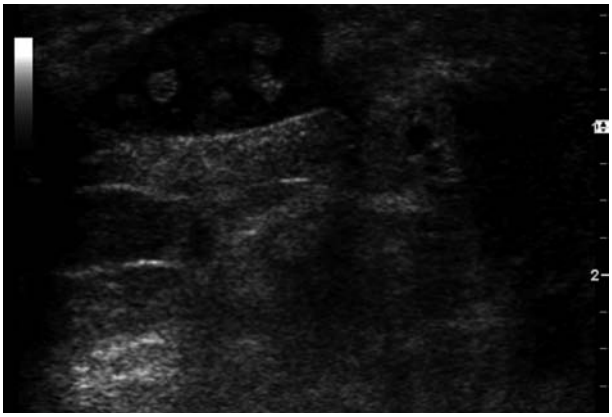


**Fig 2.** The lesions contains more fluid (hypo to anechoic area) around the hyperechoic granules (thin rod like solid white structures).

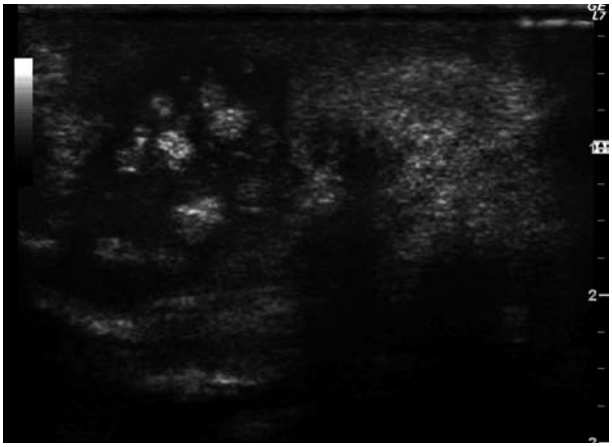


**Fig 3.** Fungal type of mycetoma (eumycetoma). The patients had multiple pockets on back and right anterior abdominal wall, there were multiple hyperechoic granules with hypoechoic areas around it which appear hazy and were around the white granules.

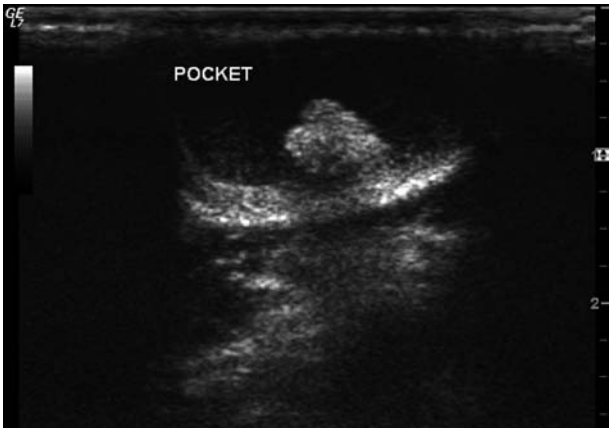



**Fig 4.** Fungal type of mycetoma (eumycetoma). The patients had multiple pockets on back only, there were multiple hyperechoic granules with hypoechoic areas around it which appear hazy and were around the white granules.

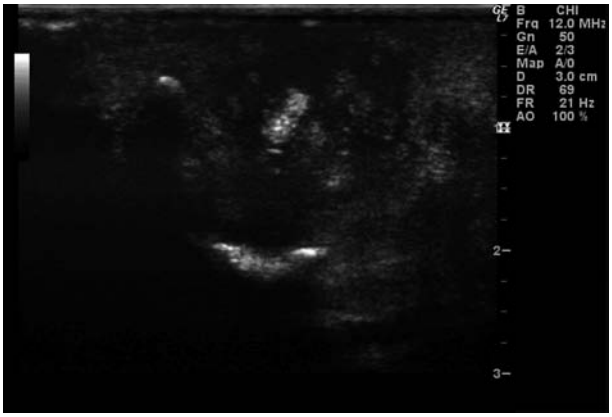



**Fig 5.** Bacterial type of mycetoma (actinomycetoma) - a large lesion on back with multiple granules, less fluid contents, outline more prominent.

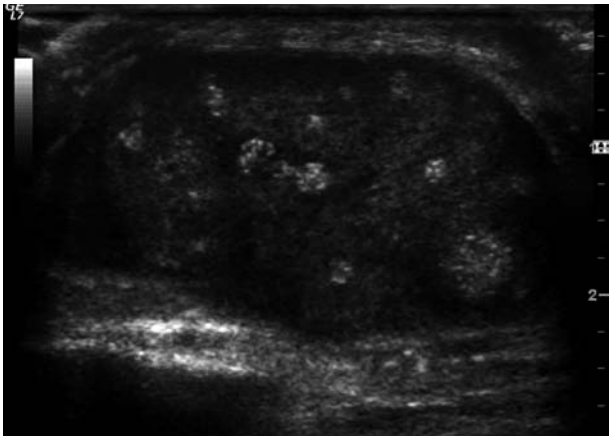


**Fig 6.** Bacterial type of mycetoma (actinomycetoma)- a lesion on left foot with multiple granules, less fluid contents, outline more prominent.

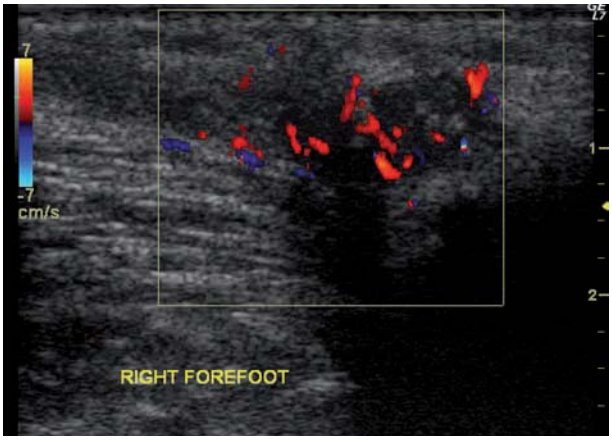



**Fig 9.** Bacterial type of mycetoma (actinomycetoma)- a lesion on right fore- foot with multiple granules, less fluid contents, outline more prominent.

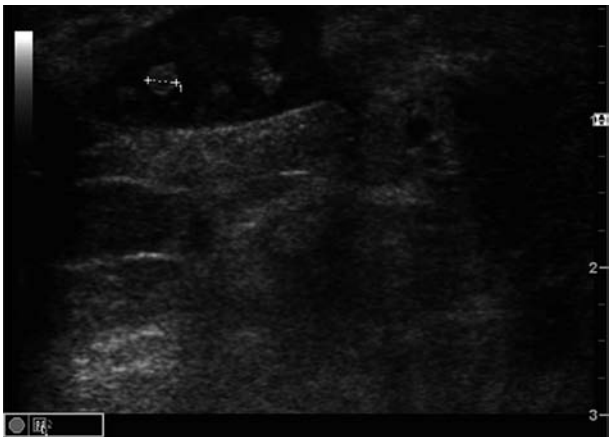


**Fig 7.** Fungal type of mycetoma (eumycetoma). The patients had multiple pockets on right hand and forearm, there were multiple hyperechoic granules with hypoechoic areas around it which appear hazy and were around the white granules.

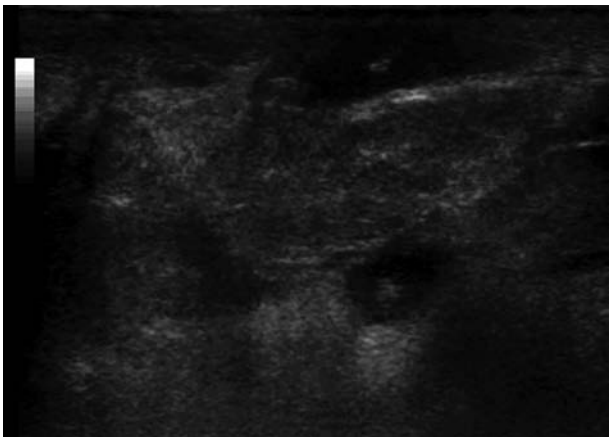


**Fig 10.** Bacterial type of mycetoma (actinomycetoma) a lesion on right hand dorsum which was diagnosed a fungal type on ultrasound but cytology favoured bacterial type.

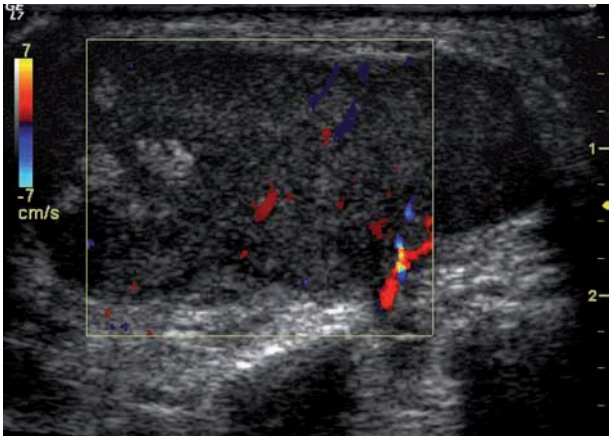



**Fig 8.** Bacterial type of mycetoma (actinomycetoma)- a lesion on the posterior right shoulder with multiple granules, less fluid contents, outline more prominent.

## Discussion

This is the first ever sonographic study on the diagnosis and differential diagnosis of mycetoma which is a widespread fatal disease and very common in Africa. The accuracy of our study suggests a prime role of ultrasound in the diagnosis of this disease with usually results in amputations or deaths.

As the results indicate the accuracy of ultrasound diagnosed 92% cases as mycetoma. and the accuracy of the diagnosis of bacterial types was 94% and for fungal types was 90%.

## Conclusion

Ultrasound is very accurate in the diagnosis of mycetoma and even in differential diagnosis of its types.

## Recommendations

Ultrasound with color Doppler and high frequency transducer is very effective and accurate; it must be used as a first diagnostic tool.

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