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## **CLINICALLY SPEAKING**

### **18 and 70 MHz Ultrasonography of Actinomycetoma of the Foot Correlated with Clinical and Histological Findings**

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We present the ultrasonographic morphology of an actinomycetoma of the foot at 18 and 70 MHz (high-frequency and ultra-high frequency ultrasound, respectively), and describe an ultrasonographic sign that may help to discriminate between eumycetoma and actinomycetoma called the "bright hyperechoic halo." To date, this is the first report on the

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morphology of mycetoma at 70 MHz with a clinical, ultrasonographic, and histological correlation of the images, which provides ultrasound images that are very similar to the lower magnification of histology.

**Keywords:** mycetoma ultrasound; actinomycetoma ultrasound; dermatologic ultrasound; ultrasound dermatology

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Mycetomas are chronic inflammatory, granulomatous, and suppurative cutaneous lesions caused by fungi (eumycetoma) or bacteria (actinomycetoma) <sup>1</sup> The differential diagnosis between a fungal or bacterial origin is difficult to assess only with the clinical examination, and the treatment is entirely different. The possibility to predict the cause of the mycetoma may support a prompt treatment. Mycetomas are more common in subtropical climates; nevertheless, with the high rate of global travel, awareness of this condition should be made. <sup>1,2</sup>

Mycetomas can clinically present as nodules, abscesses, fistulous tracts, and swellings that involve dermis, subcutaneous tissue, bones, and joints. <sup>2</sup> The lower extremities and particularly the feet are common sites of involvement<sup>3</sup>.

Ultrasonography is growingly used for studying dermatologic diseases <sup>4,5</sup>, including for ruling out mycetomas <sup>6,7</sup>. The recent release of 70 MHz probes working on color Doppler ultrasound devices has opened the possibility to explore cutaneous pathologies with a much higher axial resolution up to 30  $\mu\text{m}$ , which is a closer view to the lower magnification of histology. <sup>8</sup>

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Ultrasound devices operating in the range of upper frequencies that goes from 15 to 22 MHz as well as MRI have reported the presence of hypoechoic or hypointense nodules with a "dot-in-circle" sign, both in eumycetomas and actinomycetomas<sup>6,7</sup>. However, it would be difficult to discriminate between these entities only based on imaging<sup>9</sup>. Moreover, neither a correlation of this sign with histology nor reports of this condition using ultra-high frequencies such as 70 MHz are available.

We present a 60-year-old male Chilean patient, who lives in an urban region and without a history of recent trips abroad or trauma that consulted for a painful swelling that started three years ago in the lateral aspect and sole of the right foot. The clinical and ultrasound examinations followed the Ethical Principles for Medical Research of Helsinki and the published guidelines for performing dermatologic ultrasound examinations<sup>10</sup>. The devices used in this examination were: Logiq E9 XD Clear (General Electric Health Systems, Waukesha, WI; 18 MHz) and Vevo MD (VisualSonics, Toronto, Canada; 70 MHz). Besides, the patient signed informed consent for the publication of his images. On the physical examination, there were indurated areas with erythematous nodules that discharged serosanguineous material. On dermoscopy, there were pink nodular lesions surrounded by a white scaly collar and a yellowish plug that resembled previous dermatoscopic descriptions<sup>11</sup> and presented a "rainbow pattern like" <sup>12</sup> in some regions, probably due to the chronic inflammation with granulation tissue.

Greyscale ultrasound with an upper frequency of 18 MHz showed multiple epidermal, dermal and hypodermal hypoechoic pseudonodular subcutaneous structures that conformed

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clusters. In several pseudonodular areas, the "dot-in-circle sign" was observed. On color Doppler, there was increased vascularity in the periphery of these pseudonodules (Fig 1). On 70 MHz, there were epidermal and dermal hypoechoic nodules that presented an eccentric darker hypoechoic dot with a bright and well-defined hyperechoic halo sign (Fig 2).

On histology (hematoxylin and eosin stain), the "bright hyperechoic halo sign" of the eccentric dots exactly corresponded to the location of the bacterial colonies of actinomyces and correlated with the morphology detected at 70MHz. The colonies were conglomerates of irregular eosinophilic bacilli with a basophilic peripheral reinforcement. Besides, there was compact hyperkeratosis, papillomatosis, hypergranulosis, and inflammation with polymorphonuclear cells (neutrophil), plasma cells, and mature lymphocytes. Gram's and Grocott's stainings were positive, and the anaerobes, atypical mycobacteria and fungal tests, as well as Ziehl Neelsen's staining, were negative.

Treatment with trimethoprim 160 mg and sulphamethoxazole 800 mg every 12 hours for 24 weeks was indicated, and a clinical and ultrasonographic follow-up at six months demonstrated a marked regression of the lesions.

Among the differential diagnoses of mycetoma are granulomas secondary to foreign bodies, and soft tissue tumors<sup>9</sup>. Importantly, ultrasonography can support the differential diagnoses of mycetomas with other soft tissue conditions<sup>4</sup>. The use of 70 MHz, in this case, provides a "bright hyperechoic halo" sign that may be useful for discriminating between a

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fungal and a bacterial origin. Thus, as presented, ultrasonography can be a potent tool for supporting the diagnosis and, therefore, the management in actinomycetomas.

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**Conflict of Interest:** None reported.

## References

1. Nenoff P, Van De Sande WWJ, Fahal AH, Reinel D, Schöfer H. Eumycetoma and actinomycetoma - An update on causative agents, epidemiology, pathogenesis, diagnostics and therapy. *J Eur Acad Dermatology Venereol*. 2015;29(10):1873-1883. doi:10.1111/jdv.13008
2. Emmanuel P, Dumre SP, John S, Karbwang J, Hirayama K. Mycetoma: A clinical dilemma in resource limited settings. *Ann Clin Microbiol Antimicrob*. 2018;17(1). doi:10.1186/s12941-018-0287-4
3. Salim AO, Mwita CC, Gwer S. Treatment of Madura foot: A systematic review. *JBI Database Syst Rev Implement Reports*. 2018;16(7):1519-1536. doi:10.11124/JBISRIR-2017-003433
4. Wortsman X. Common applications of dermatologic sonography. *J Ultrasound Med*. 2012;31(1):97-111. doi:10.7863/jum.2012.31.1.97

*This Clinically Speaking has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.*

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5. Wortsman X. *Atlas of Dermatologic Ultrasound*. First Edit. (Wortsman X, ed.). New York, NY: Springer International Publishing; 2018. doi:10.1007/978-3-319-89614-4
6. Laohawiriyakamol T, Tanutit P, Kanjanapradit K, Hongsakul K, Ehara S. The "dot-in-circle" sign in musculoskeletal mycetoma on magnetic resonance imaging and ultrasonography. *Springerplus*. 2014;3(1):1-7. doi:10.1186/2193-1801-3-671
7. Neelakantan S, Babu AAS, Anandarajan R. "Dot in circle sign": a characteristic finding in ultrasound and MR imaging of soft tissue mycetomas. *BMJ Case Rep*. 2016;2016:1-3. doi:10.1136/bcr-2016-216502
8. Wortsman X, Carreño L, Ferreira-Wortsman C, et al. Ultrasound Characteristics of the Hair Follicles and Tracts, Sebaceous Glands, Montgomery Glands, Apocrine Glands, and Arrector Pili Muscles. *J Ultrasound Med*. December 2018. doi:10.1002/jum.14888
9. van de Sande WWJ, Fahal AH, Goodfellow M, Mahgoub ES, Welsh O, Zijlstra EE. Merits and Pitfalls of Currently Used Diagnostic Tools in Mycetoma. *PLoS Negl Trop Dis*. 2014;8(7). doi:10.1371/journal.pntd.0002918
10. Wortsman X, Alfageme F, Roustan G, et al. Guidelines for performing dermatologic ultrasound examinations by the dermus group. *J Ultrasound Med*. 2016;35(3):577-580. doi:10.7863/ultra.15.06046
11. Ankad B, Beergoudar S, Nikam B. Dermatoscopy in actinomycetoma: An observation. *Indian Dermatol Online J*. 2019;10(3):330. doi:10.4103/idoj.idoj\_268\_18

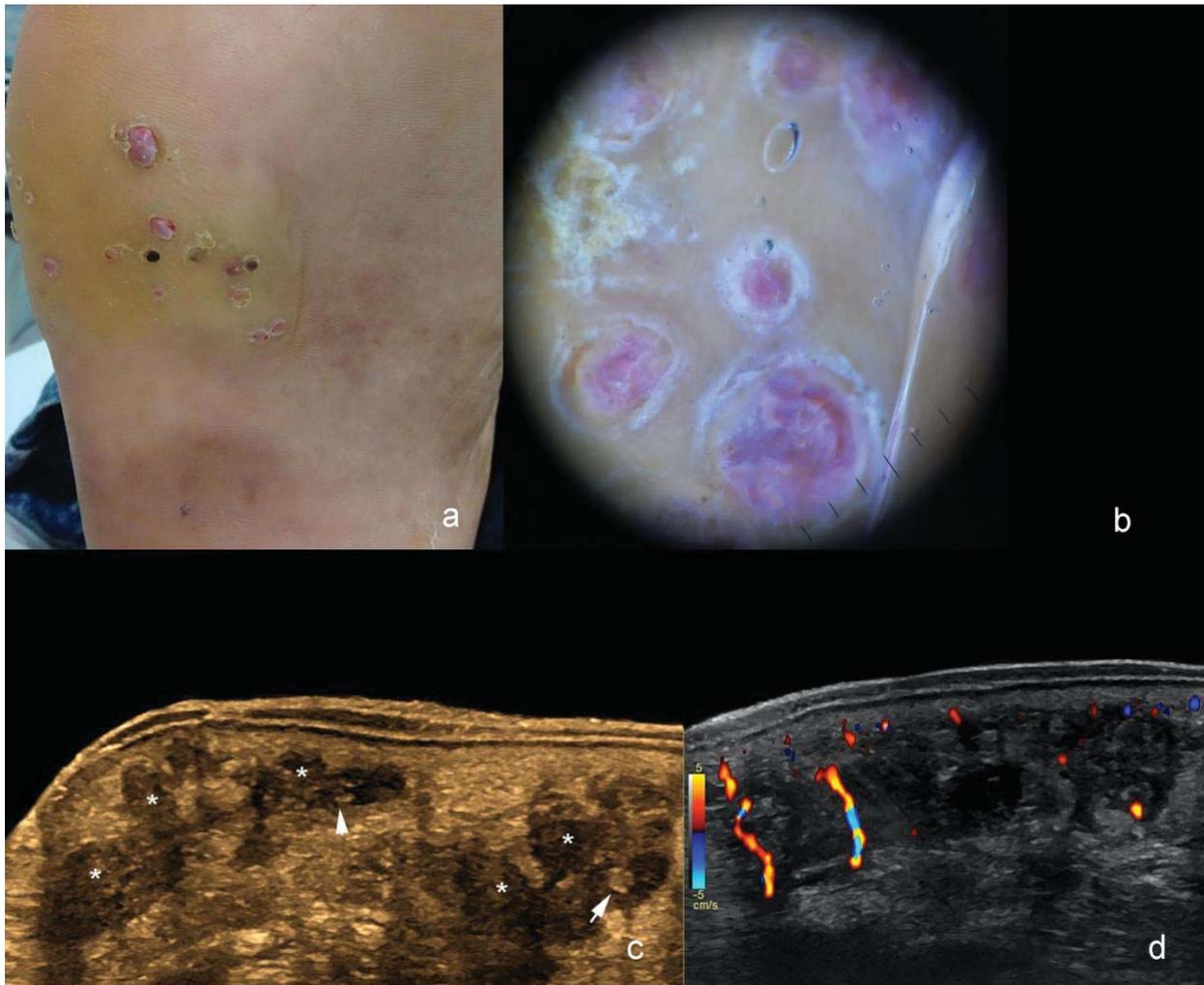
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12. Kelati A, Mernissi FZ. The rainbow pattern in dermoscopy: A zoom on nonkaposi sarcoma skin diseases. *Biomed J.* 2018;41(3):209-210. doi:10.1016/j.bj.2018.04.004

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**Figure 1 (A-D). Actinomycetoma with clinical and ultrasonographic correlation at 18 MHz.** A. Clinical and B. Dermoscopic images. C. and D. Ultrasound images (transverse views; c, greyscale with a color filter and D, color Doppler) show multiple dermal and hypodermal pseudonodular hypoechoic structures (\*). Notice the "dot-in-circle" sign (arrow and arrowhead) in C and the hypervascularity in between the pseudonodular structures in D.



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**Figure 2. Actinomycetoma with ultrasonographic and histologic correlation at 70 MHz (A-F).** A. and B. show the ultrasound image of an epidermal and dermal hypoechoic nodule with an oval-shaped hypoechoic eccentric nodule that presents a bright hyperechoic halo sign (arrow). C-F. Histology (Hematoxylin and Eosin 2x in D and 10x in E) shows a nodule with peripheral colonization of actinomyces at the edge (double arrows) in D that correlates with the location of the bright hyperechoic halo on ultrasound. Part F (Gram stain 40x) demonstrates a zoom of the colonies of bacillus.

