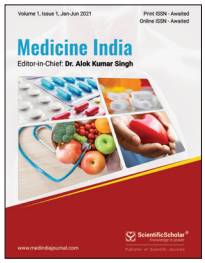
ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

https://medindiajournal.com

Medicine India



Case Series

"Dot-in-circle sign:" An ultrasound and magnetic resonance imaging sign for mycetoma

Anushruti Aggarwal[1], Sharang Gupta[1], Dimple Chopra[1], Amandeep Riyat[2]

[1]Department of Dermatology, Government Medical College, Patiala, [2]Department of Dermatology, Civil Hospital, Kapurthala, Punjab, India

***Corresponding author:**
Sharang Gupta,
Department of Dermatology,
Government Medical College,
Patiala, Punjab, India.

drsharanggupta97@gmail.com

Received : 28 April 2022
Accepted : 16 September 2022
Published : 06 October 2022

DOI
10.25259/MEDINDIA_4_2022

Quick Response Code:

ABSTRACT

Mycetomas are chronic infections of the skin, underlying soft tissues, and sometimes extending up to the bones. They can be actinomycetoma or eumycetoma. Mycetoma is more frequent in tropical and subtropical regions. The definitive diagnosis is made by histopathology and culture in most cases, but these procedures are invasive and time consuming. "Dot-in-circle sign" is an important sign present on both ultrasound (USG) and magnetic resonance imaging (MRI) which imply the presence of distinct hypoechoic lesions surrounding a hyperechoic center. The use of these imaging modalities can help in the early diagnosis and preventing complications. We report two cases of eumycetoma affecting the feet, with characteristic USG and MRI features.

Keywords: Dot-in-circle sign, Magnetic resonance imaging, Mycetoma, Ultrasonography

INTRODUCTION

Mycetoma is a localized, chronic, granulomatous infection affecting the skin, subcutaneous tissue, and bones, mainly of the feet.[1] It is characterized by a triad of localized swelling, underlying sinus tracts, and production of grains. Some of the predisposing factors include low socioeconomic status, occupations such as farming, and lack of protective clothing.[2] Mycetoma can be caused by either bacteria or fungi. Actinomycotic mycetoma is caused by *actinomycetes* belonging to the genera *Actinomadura, Nocardia, and Streptomyces.* Eumycotic mycetoma is of fungal origin, the most common agent being *Madurella mycetomatis*.[3] Early diagnosis is important in view of therapeutic implications. Although definitive diagnosis is by biopsy and microbiological culture, these are time-consuming procedures. USG and magnetic resonance imaging (MRI) may allow for non-invasive as well as early diagnosis, thus helping in avoiding complications arising from late diagnosis.[4,5]

CASE REPORTS

Case 1

A 60-year-old female, resident of Punjab, came with a history of swelling about 8 × 10 cm in size on the plantar aspect of her right foot, which was occasionally painful. The swelling started 15 years back and there were multiple papules and pustules over its surface which would break down to form draining sinuses [Figure 1]. There was a history of discharge of black grains. The patient was non-diabetic. USG showed multiple hypoechoic lesions with echogenic foci having

"dot-in-circle" appearance [Figure 2]. MRI showed round hyperintense nodules in calcaneum with central hypointense dot (dot-in-circle sign) [Figure 3].

Case 2

A 50-year-old male, farmer by profession, presented with the complaints of irregular swelling over the right foot present for 10 years. The swelling was gradually increasing in size and was painful [Figure 4]. The patient did not give any h/o trauma before the onset of lesion. X-ray foot showed soft-tissue swelling. USG showed the characteristic "dot-in-circle" sign [Figure 5].

For both the cases, the clinical differentials were mycetoma, cutaneous tuberculosis, and benign soft-tissue lesions. Routine laboratory investigations, including a complete hemogram, hepatic profile, and renal profile, were done. Gram stain of the grains revealed no significant findings. Punch biopsy on hematoxylin and eosin (H and E) stain showed suppurative granulomas (composed of neutrophils), surrounding characteristic grains which were present in the subcutaneous tissue.

Figure 1: Swelling on the right foot with discharging black grains (Case 1).

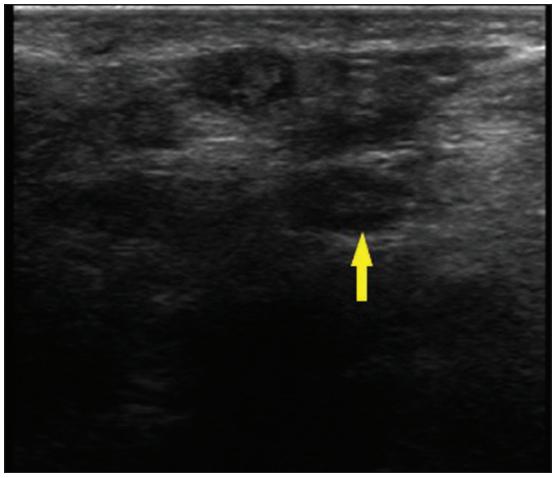


Figure 2: Multiple round hypoechoic lesions containing hyperechoic foci in the center on USG (Yellow arrow) (Case 1).

DISCUSSION

Eumycetoma is a chronic subcutaneous fungal infection of the skin and soft tissue, most often affecting the lower extremity. The disease has been included in the World Health Organization's list of neglected diseases.[6] Most cases of eumycetoma occur among individuals living in the developing countries in tropical and subtropical regions.

Eumycetoma begins with traumatic inoculation of the organism into cutaneous and/or subcutaneous tissues.

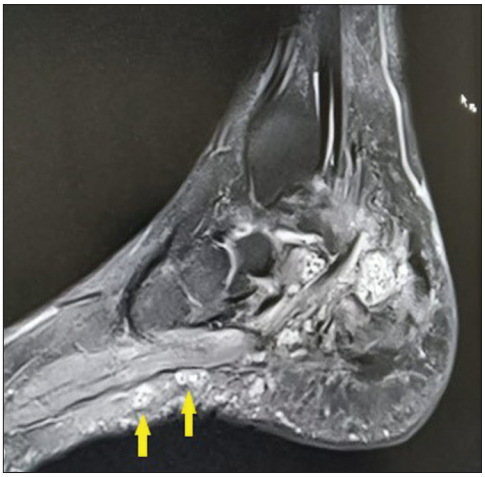


Figure 3: On T2W magnetic resonance imaging "dot-in-circle" lesions are seen in the soft tissue (hyperintense nodules in calcaneum with central hypointense dot) (Yellow arrow) (Case 1).

Figure 4: Skin sinuses over the right foot with hyperpigmentation and soft-tissue swelling (Case 2).

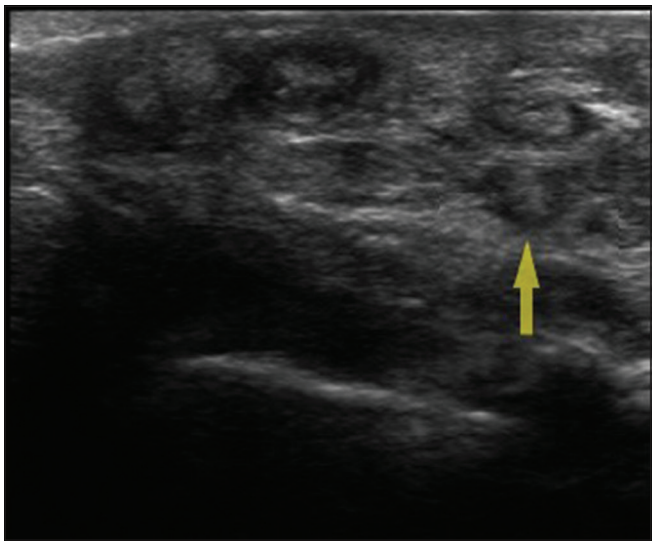


Figure 5: "Dot-in-circle" sign on ultrasound (Yellow arrow) (Case 2).

Trauma may be minor (due to thorns, splinters, or other objects), and patients may not recall a specific injury. Grains (which are the colonies of the infecting organisms) are deposited in infected tissues and partially broken down through a neutrophil-mediated inflammatory reaction. Their remains perpetuate an inflammatory response. An epithelioid granuloma develops through recruitment of macrophages and multinucleated giant cells, which clear dead neutrophils and grain fragments.

Eumycetoma may extend beyond the skin and subcutaneous tissues to adjacent structures including muscle, bone, and lymphatic vessels. Bone involvement indicates a poor prognosis and requires a longer course of therapy. Complications include fibrosis, ankylosis, and lymphedema caused by lymphatic obstruction.

The presence of the characteristic triad of tumor, sinus tracts, and macroscopic grains is useful for establishing a clinical diagnosis of mycetoma. Black grains definitely indicate a fungal etiology, establishing a diagnosis of eumycetoma, while white to yellow grains may indicate fungal or bacterial infection.[7] In the absence of sinus tracts or macroscopic grains, a biopsy is needed to evaluate for presence of grains in the tissue. Histopathological findings of eumycetoma consist of a chronic granulomatous reaction with purulent center. The histopathology evaluation should include hematoxylin and eosin as well as periodic acid-Schiff or Gomori methenamine silver staining.

Mycetoma is often diagnosed at an advanced stage where permanent deformity of affected part has already occurred. Hence, there is a need for non-invasive diagnostic modalities which can help in diagnosis at an early stage. Ultrasonography is simple, non-invasive imaging modality which is also acceptable to the patients. Mycetoma has characteristic findings on ultrasonography. Furthermore, ultrasonography delineates the extent of mycetoma more accurately than clinical examination alone. The USG appearances were initially described by Fahal *et al*. who demonstrated on *in vitro* imaging of the mycetoma lesions that the hyper-reflective echoes corresponded to the grains.[8] The USG "dot-in-circle" sign is similar to the MRI sign. The "dot-in-circle" sign, seen as tiny hyperintense foci within hypointense spherical lesions, was initially described by Sarris *et al*., on T2W, STIR, and T1W fat-saturated gadolinium-enhanced images.[9] Correlating the MRI and histological findings, they suggested that the high signal areas seen on MRI represented inflammatory granulomata, the low-intensity tissue seen surrounding these lesions represented the fibrous matrix, and the small central hypointense foci within the granulomata represented the fungal grains. MRI is helpful for the early diagnosis of mycetoma, even in the absence of discharging sinuses, and for a better determination of severity and extension of soft-tissue involvement.[10] USG and MRI also differentiate mycetoma from osteomyelitis or tumor.[11] Hence, the "dot-in-circle" sign can be used as a specific and consistent sign for the diagnosis of mycetoma.

CONCLUSION

To conclude, "Dot-in-circle" sign on both USG and MRI can serve as a non-invasive sign for musculoskeletal mycetoma. It has been found to be specific and sensitive for mycetoma even in the absence of the typical clinical features. It can help to diagnose the condition early, thus helping to prevent complications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Lichon V, Khachemoune A. Mycetoma: A review. Am J Clin Dermatol 2006;7:315-21.
2. Mycetoma. Atlanta: Centers for Disease Control and Prevention; 2017. Available from: https://www.cdc.gov/fungal/diseases/mycetoma/index.htm [Last accessed on 2019 Sep 02].
3. Van de Sande WW. Global burden of human mycetoma: A systematic review and meta analysis. PLoS Negl Trop Dis 2013;7:e2550.

4. Saad ES, Fahal AH. Broncho-pleuro-cutaneous fistula and pneumothorax: Rare challenging complications of chest wall eumycetoma. PLoS Negl Trop Dis 2017;11:e0005737.
5. Scolding PS, Abbas MA, Omer RF, Fahal AH. *Madurella mycetomatis*-induced massive shoulder joint destruction: A management challenge. PLoS Negl Trop Dis 2016;10:e0004849.
6. World Health Organization. Addressing the Burden of Mycetoma. Geneva: World Health Organization; 2016. Available from: https://www.who.int/neglected_diseases/mediacentre/WHA_69.21_eng.pdf?ua=1&ua=1 [Last accessed on 2017 Aug 31].
7. Ahmed SA, González GM, Tirado-Sánchez A, Moreno-Lopez LM, De Hoog S, Bonifaz A. Nigrograna mackinnonii, not *Trematosphaeria grisea* (syn., *Madurella grisea*), is the main agent of black grain eumycetoma in Latin America. J Clin Microbiol 2018;56:e01723-17.
8. Fahal AH, Skeik HE, Homeida MM, Arabi Y, Mahgoub ES. Ultrasonographic imaging of mycetoma. Br J Surg 1997;84:1120-2.
9. Sarris I, Berendt AR, Athanasous N, Ostlere SJ, OSIRIS collaborative study group. MRI of mycetoma of the foot: Two cases demonstrating the dot-in-circle sign. Skeletal Radiol 2003;32:179-83.
10. El Shamy ME, Fahal AH, Shakir MY, Homeida MM. New MRI grading system for the diagnosis and management of mycetoma. Trans R Soc Trop Med Hyg 2012;106:738-42.
11. Relhan V, Mahajan K, Agarwal P, Garg VK. Mycetoma: An update. Indian J Dermatol 2017;62:332-40.

How to cite this article: Aggarwal A, Gupta S, Chopra D, Riyat A. "Dot-in-circle sign:" An ultrasound and magnetic resonance imaging sign for mycetoma. Med India 2022;1:10.