

# MRI findings in cranial eumycetoma

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## Abstract

Cranial eumycetoma (CE) due to direct inoculation of *Madurella grisea* into the scalp is extremely rare. We describe a case of CE caused by direct inoculation of *M. grisea* with the characteristic MRI findings of the “dot-in-circle” sign and a conglomeration of multiple, extremely hypointense “dots.”

**Key words:** “Dot-in-circle” sign; eumycetoma; *Madurella grisea*; magnetic resonance imaging

## Introduction

Eumycetoma is a chronic, relentlessly progressive, granulomatous subcutaneous disease caused by a true fungus.<sup>[1]</sup> It commonly occurs in the extremities, the foot being the most common site of involvement. Cranial involvement has only rarely been reported<sup>[2-4]</sup> and is often due to direct extension from the paranasal sinuses. Recently, characteristic MRI findings of the “dot-in-circle” sign and a conglomeration of multiple extremely hypointense “dots” have been reported in pedal eumycetoma.<sup>[5-8]</sup> We describe these characteristic findings on an MRI of the brain in a case of cranial eumycetoma (CE) that was caused by direct inoculation of the organism *Madurella grisea*.

## Case Report

A 35-year-old man presented with complaints of seizures for 1 year, slowly increasing left parietal swelling for 6 months, and sudden-onset weakness of the right upper and lower limbs and inability to speak for 6 days. He had been diagnosed elsewhere as cranial tuberculosis on the basis of imaging findings and had been on regular antituberculous treatment and steroids for the last 1 year. There was no

significant premorbid illness apart from history of trauma to the scalp on the left side.

On examination, the patient had a Glasgow Coma Scale (GCS) score of 10/15, papilledema, and right facial palsy. The right upper and lower limbs showed spastic tone, grade II–III power, and exaggerated deep tendon reflexes; there were no sensory deficits. There was a small, tender, focal scalp swelling in the left parietal region.

The blood biochemical parameters were normal. MRI of the brain done elsewhere 1 year ago showed a left parasagittal, homogeneously enhancing, dural-based mass with surrounding edema, involving the underlying cerebral cortex. CT scan [Figure 1] done in our institution at the time of presentation showed an intensely enhancing mass, with features of osteomyelitis in the adjacent parietal bone.

The patient underwent biopsy of the lesion via a left parietal flap. The lesion was located in the subgaleal plane. It was firm and yellowish, with multiple blackish granules within; it was also stuck to the calvarium. Biopsy and culture results were consistent with eumycetoma (*M grisea*). Histology [Figure 2] revealed fibrocollagenous connective tissue containing multiple microabscesses, with the central cavitory spaces containing several pigmented grains composed of hyphal mats. The abscess walls displayed granulomatous reaction, with dense infiltrates of histiocytes, foreign body-type multinucleated giant cells, plasma cells, and lymphocytes.

Postoperatively, there was some improvement in speech and right upper and lower limb power. The patient was started on the antifungal itraconazole, along with antiepileptic drugs.

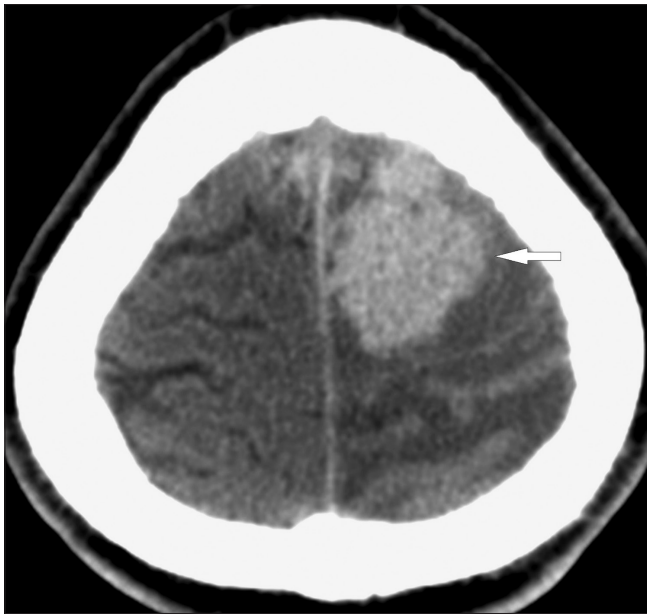
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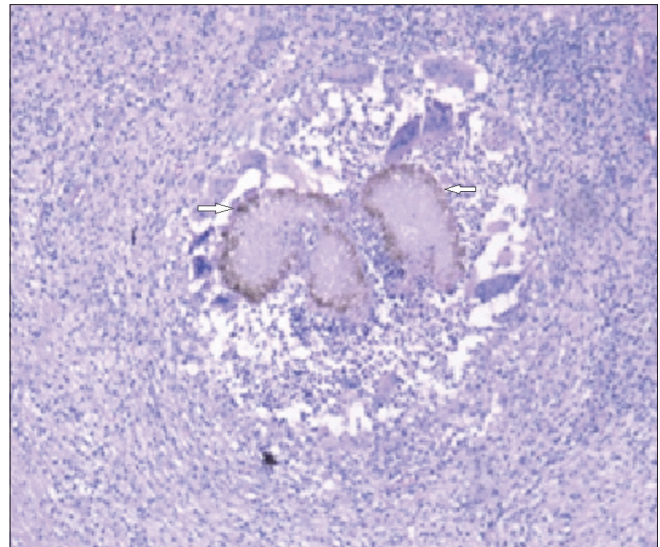


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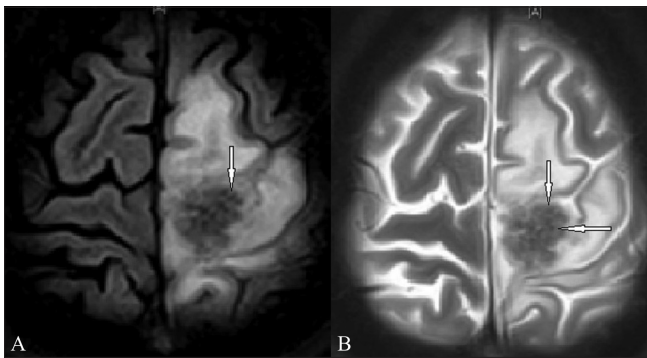
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**Figure 1:** Contrast enhanced CT scan of the brain shows an intensely enhancing mass (arrow) in the left frontal lobe with adjacent edema



**Figure 2:** Photomicrograph shows a microabscess containing pigmented grains (arrows) surrounded by an inflammatory reaction, including foreign body giant cells (H and E,  $\times 90$ )

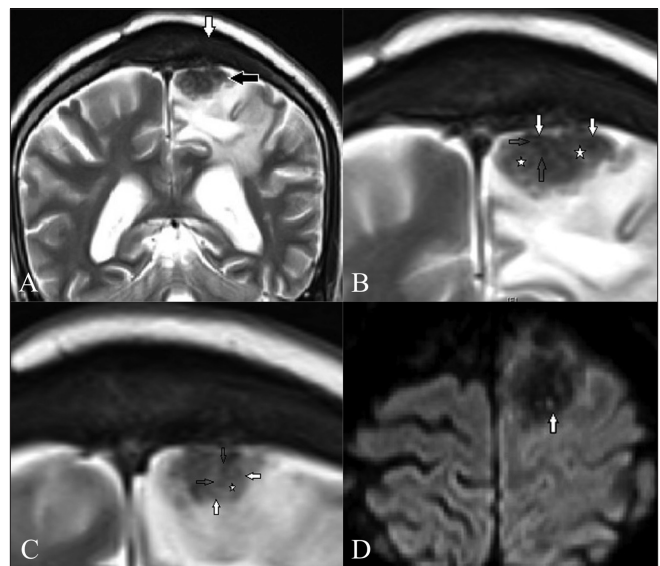


**Figure 3 (A,B):** Axial FLAIR (A) and T2W (B) MRI images show a conglomeration of multiple extremely hypointense dots (arrows) within an iso- to hypointense mass in the left parasagittal frontal lobe, involving the motor cortex

Repeat MRI after 1 year [Figures 3 and 4] revealed an iso- to hypointense mass and surrounding edema in the left frontal region on T2W and fluid-attenuated inversion recovery (FLAIR) images. There were multiple hypointense “dots” representing fungal grains and the “dot-in-circle” sign was present. When compared to the previous imaging findings, there was a slight decrease in the size of the mass and the surrounding edema. Currently, he is doing well clinically. His epilepsy is mostly controlled and he has grade 3-4 power in the limbs.

### Discussion

The recently described characteristic “dot-in-circle” MRI sign in pedal eumycetoma represents a T2-hyperintense granuloma, with central hypointense “dots” of fungal



**Figure 4 (A-D):** Coronal T2W MRI image (A) shows an iso- to hypointense left parasagittal frontal lobe mass (black arrow), with altered marrow signal (white arrow) in the overlying parietal bone. Magnified coronal T2W MRI images (B,C) show a few hypointense dots (open arrows) within the hyperintense granulomas (white stars) separated by hypointense walls (white arrows), giving the “dot-in-circle” sign. Diffusion-weighted MRI image (D) shows small hyperintense areas (arrow) of restricted diffusion, probably representing microabscesses.

grains separated by hypointense fibrous walls.<sup>[5-8]</sup> A conglomeration of multiple hypointense dots of fungal grains against the background of inflammatory granulomas was also seen.<sup>[5,7,9]</sup> The grains were identified as hypointense dots on both T1W and T2W images<sup>[5,9,10]</sup> and their MRI signal was attributed to the magnetic-susceptibility effects of the paramagnetic elements of the grains.<sup>[5,9,11,12]</sup> The present case also showed the typical conglomeration of

multiple extremely hypointense dots within the mass, correlating histopathologically with multiple fungal grains. These hypointense dots were best seen on the T2W and FLAIR images. A few of the hypointense dots within the hyperintense granuloma were seen separated by hypointense walls, giving rise to the characteristic “dot-in-circle” sign on T2W images and probably correlating histopathologically with central fungal grains surrounded by dense granulomatous inflammation and fibrocollagenous tissue. We also noted a few small areas of restricted diffusion on DWI, probably reflecting microabscesses [Figure 4D]. An isointense to hypointense mass on T1W and T2W images, with or without peripheral extremely hypointense areas and central necrosis, has been described in CE.<sup>[3,11,12]</sup>

CE may be mistaken for other dural-based masses, such as meningioma or tuberculomas, even in endemic regions. The present case was also mistaken for tuberculoma on the initial imaging done elsewhere. Both meningiomas and tuberculomas can present with a similar iso- to hypointense dural-based mass on T1W and T2W images,<sup>[13,14]</sup> but the characteristic MRI findings of CE would not be present.

Culture of the organism is considered the gold standard for confirming the diagnosis of eumycetoma. However, this takes a long time and false positive results can occur due to contamination of the sample.<sup>[1]</sup> The characteristic MRI findings can help make an early noninvasive diagnosis of CE and allow differentiation from other dural-based hypointense lesions.

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