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# A Unique MRI Presentation of Fungal Infection in the Brain

Muhammad Bilal Salman Khan<sup>1</sup>, Saad Shafqat<sup>2</sup> and Syed Ather Enam<sup>3</sup>

## ABSTRACT

Fungal infections of CNS are common in certain geographic locations. MRI with or without contrast is a useful pre-diagnostic tool. However, the findings may sometimes be misleading. In this case report, the authors present unusual imaging findings in the MRI of fungal infection in an immunocompetent host, whereby hyper-intense signals were seen on T2-weighted images and patchy post-contrast enhancement was observed with surrounding edema. These findings were suggestive of a neoplastic lesion but it was identified as aspergillosis on subsequent histopathology. This unusual MRI finding of CNS highlights the need to consider fungal infection as a differential diagnosis of all mass lesions on MRI, irrespective of their signal characteristics.

**Key Words:** Fungal infection. T2-weighted hyperintense signal. Aspergillosis. Brain.

## INTRODUCTION

In general, fungi are organisms of low pathogenicity. Most often, they are opportunistic, thriving in immunocompromised hosts;<sup>1,2</sup> however, there has been a recent surge in the incidence of fungal infections in apparently immunocompetent hosts.<sup>2-4</sup> Most of the published clinical experience about fungal infections is derived from immunocompromised patients and data on immunocompetent hosts is clearly deficient. Here, the authors present a case of fungal lesion in an immunocompetent individual with quite unusual MRI findings. It produced a hyperintense signal on T2-weighted images, thereby mimicking a neoplasm but the histopathology done later revealed its fungal nature.

## CASE REPORT

A 28 years female with no known comorbid condition presented with a one-week history of intermittent diffuse headaches and a two-day history of left-sided weakness. According to the patient, the weakness had rapidly intensified to the extent that she stopped walking and became bed-bound the day before her presentation to the clinic. On examination, she was vitally stable and afebrile with slight left-sided weakness. She displayed on the left side a power of 4/5 in all muscle groups, 3+ reflexes, and a positive Babinski response. Rest of the examination was unremarkable. While in the hospital, her condition continued to deteriorate and she became drowsy, dropping her GCS (Glasgow Coma Scale) from 7/15 to 5/15.

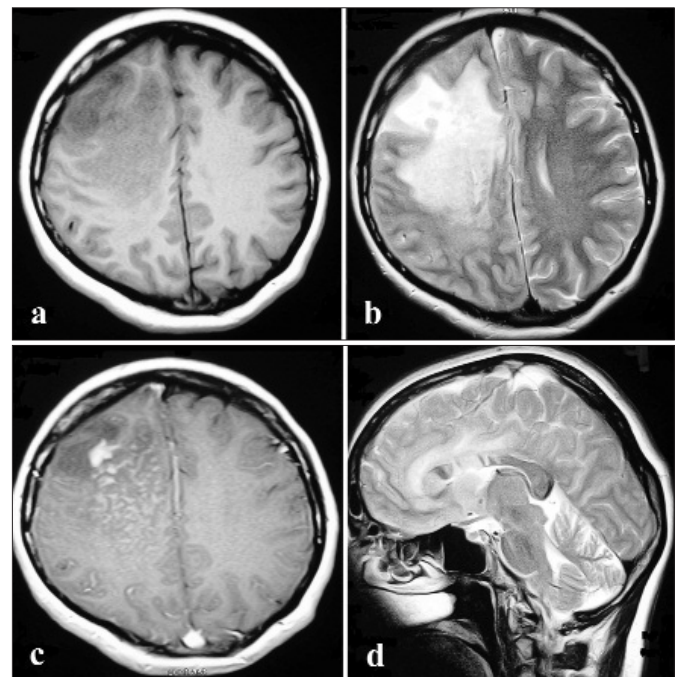
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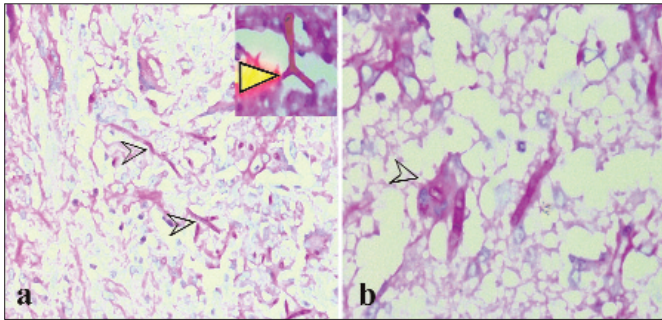
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An MRI with gadolinium contrast indicated the presence of a diffusely infiltrated mass in the right frontoparietal region predominantly involving the white matter. It was hypo- to iso-intense on T1-weighted images (T1WI, Figure 1a) and hyperintense on T2-weighted images (T2WI) with a few areas of isointensity to grey matter (Figure 1b). It showed a patchy, non-homogeneous enhancement on post-contrast sequences with surrounding edema (Figure 1c). It involved the genu as well as the anterior half of the body of corpus callosum (Figure 1d). Furthermore, there was evidence of a mass effect over the frontal horn of right lateral ventricle resulting in a mild midline shift. The MRI findings were



**Figure 1 (a,b,c,d):** MRI brain: Axial T1 (1a), T2 (1b) and post-contrast (1c) images show an area of abnormal signal intensities with predominantly low signals on T1, high on T2 and patchy post-contrast enhancement in right frontal lobe. It is associated with surrounding edema. Sagittal T2 image (1d) shows involvement of corpus callosum.



**Figure 2 (a,b):** Histopathology slides showing fungal septate hyphae (*Aspergillus*). (a): Section of brain parenchyma showing numerous septate and branching fungal hyphae. PAS, magnification: 10x. Inset: Section of brain parenchyma showing a septate fungal hyphae (arrow) shown at higher magnification. H & E, magnification: 40x. (b): Section of brain parenchyma showing chronic granulomatous inflammation. Note an intracellular fungal hyphae (arrow). H & E, Magnification: 40x.

consistent with a neoplastic lesion of the brain. The brainstem, cerebellum, sella, pituitary, vestibulo-cochlear complexes and cavernous sinuses appeared normal on MRI. However, a mucoperiosteal thickening was noted in the left sphenoid and posterior ethmoid air cells.

The patient then underwent neuro-navigation guided biopsy of the lesion. Postoperatively, the cerebral edema took a malignant course and required repeat craniotomies to decompress the swollen brain. Despite aggressive surgical decompression as well as intensive medical management for the cerebral swelling the patient died within 72 hours of initial biopsy.

Final histopathology report revealed lymphoplasmacytic and histiocytic inflammatory infiltrate with multinucleated giant cells (Figure 2). Septate fungal hyphae were identified on special stains (PAS +/-D). Findings were suggestive of *Aspergillus* infection. No evidence of malignancy was noted.

### DISCUSSION

Fungal infections of CNS almost always present as a surprise to the clinician. Their presentation is subtle, often without any specific diagnostic characteristics. Generally, MRI with and without contrast is employed as the diagnostic modality. MRI is often very useful in assessing the anatomical detail of pathological cerebral lesions. However, sometimes it may be misleading while differentiating a neoplastic lesion from non-neoplastic ones.

Three kinds of fungi are known to affect the central nervous system (CNS); *Aspergillus*, *Cryptococcus neoformans* and *Coccidioides immitis*. *Aspergillus* is saprophytic opportunistic ubiquitous fungi. It has branching septate hyphae varying from 4 to 12 µm in width, which shows dichotomous branching and produces numerous spores on the tips of long conidiophores.<sup>2</sup> The respiratory system is most commonly affected and followed by the brain, bones,

liver, kidneys and skin.<sup>2,5</sup> In nervous system, the infection can be found in the cerebral parenchyma, the meninges or the vascular system.<sup>2</sup> *Cryptococcus neoformans* is encapsulated yeast. It is the most common fungus to affect the CNS causing meningo-encephalitis, especially in AIDS patients.<sup>3</sup> *Coccidioides immitis* lives in soil and its infectious particle is the arthroconidium. The common sites affected are the lungs, meninges, bones, joints, skin and soft tissues.<sup>6</sup>

Neuroradiological diagnosis of fungal infections in the brain is not always easy. It can be easily confused with a neoplastic lesion. However, certain features make strong suggestion of fungal infection.<sup>4</sup> MRI features of fungal lesions are more characteristic compared to CT scan which may be non-specific. It provides excellent anatomical detail of normal brain structures as well as the lesion. However, MRI findings may sometimes be misleading as evident in this case. Neoplastic lesions may show-up as hyperintense signals on T2-weighted images, irrespective of the immune status of the host.<sup>7</sup> Fungal lesions, on the other hand, show-up as hypointense signal on T2-weighted images in immunocompetent individuals.<sup>4</sup> Siddiqui *et al.* have strongly emphasized that the diagnostic hallmark of an *Aspergillus* mass on MRI are extremely hypointense signals on T2-weighted images. They further mention that in their clinical practice, they even managed a few cases without histopathological diagnosis and the diagnosis in these cases was solely based on peculiar imaging features and clinical background.<sup>4</sup> Surprisingly, however, the MRI in this case showed hyperintense signals on T2-weighted images although the patient had a normal immune status, hence driving the diagnosis towards neoplasia. Moreover, the lesion involved the corpus callosum (Figure 1d), which is typical of glioblastoma multiforme, a CNS neoplasm.<sup>8</sup>

In immunocompromised individuals, non-*Aspergillus* fungal lesions may present as punctate or patchy signal hyperintensities on T2-weighted images.<sup>9</sup> Burgert *et al.* reported one such case of *Candida* brain abscess associated with vascular invasion in an immunocompromised patient which showed punctate or patchy signal hyperintensities on T2-weighted images.<sup>9</sup> Similarly, non-*Aspergillus* infection in immunocompetent patients may give hyperintense signal on T2WI. Koor *et al.* reported hyperintense signals on T2 weighted images in CNS cryptococcosis in an immunocompetent patient.<sup>3</sup> However, bright signal on T2-weighted images is unusual for CNS Aspergillosis and has not been reported yet. Here, we report an unusual MRI appearance of CNS Aspergillosis in an immunocompetent patient where hyperintense signals were noticed on T2-weighted images.

Based on these unusual MRI findings in T2-weighted images, fungal infections must be entertained as a

differential in any patient presenting with neurological symptoms with MRI sequences suggestive of a neoplastic process.

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