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# Neuroimaging Highlight

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## Cerebral Abscess Crossing Midline

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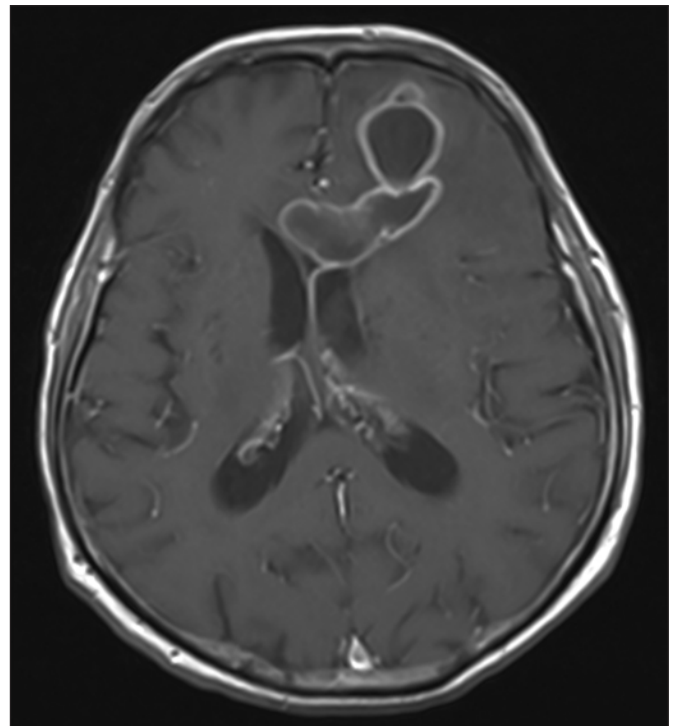
We report a cerebral *Nocardial* abscess presenting with imaging and clinical features strongly suggestive of a primary brain tumor (glioblastoma multiforme vs lymphoma). The lesion was seen to cross midline via the corpus callosum on magnetic resonance imaging (MRI). This pattern of dissemination of a cerebral abscess has not previously been reported.

### CASE REPORT

An 81-year-old right handed man presented to another institution with an episode of acute confusion. On exam he was mildly confused and complained of a headache. He exhibited no focal neurological findings. Laboratory and overall examination was non contributory.

Investigation included a computed axial tomography scan which demonstrated the left frontal mass. To further characterize the lesion an MRI was obtained. The right frontal lesion had a ring enhancing pattern after gadolinium contrast injection (Figure 1). There was a large cystic component to the mass with a significant amount of surrounding vasogenic edema that was seen to cross the midline through the rostrum and genu of the corpus callosum (Figure 2). On diffusion weighted sequences the lesion demonstrated restricted diffusion (Figure 3), commonly associated with abscess or infarction but has been well described in the setting of high grade tumors and correlates to necrosis within the tumor.<sup>1</sup> Given the location of the lesion and the pattern of transcallosal dissemination the imaging was felt to be most consistent with glioblastoma multiforme. After several conversations with the family and the patient it was decided that in order to maximize the patient's quality of life an aggressive resection was inappropriate. The family was offered the choice of proceeding directly to a course of palliative radiotherapy and / or chemotherapy or performing a stereotactic biopsy to first confirm the diagnosis.

The biopsy was undertaken using the frameless MRI needle guided biopsy using the Stealth system (Medtronic, Minneapolis, MN) and the Olivier arm (Phillips Medical Systems). There was no pus or fluid identified by the surgeon at the time of biopsy. The area of the lesion targeted was the enhancing component of the lesion in an attempt to sample from what was considered to be the most active component of the lesion. Following the biopsy



**Figure 1:** Axial MRI with gadolinium enhancement demonstrating the left frontal ring enhancing lesion.

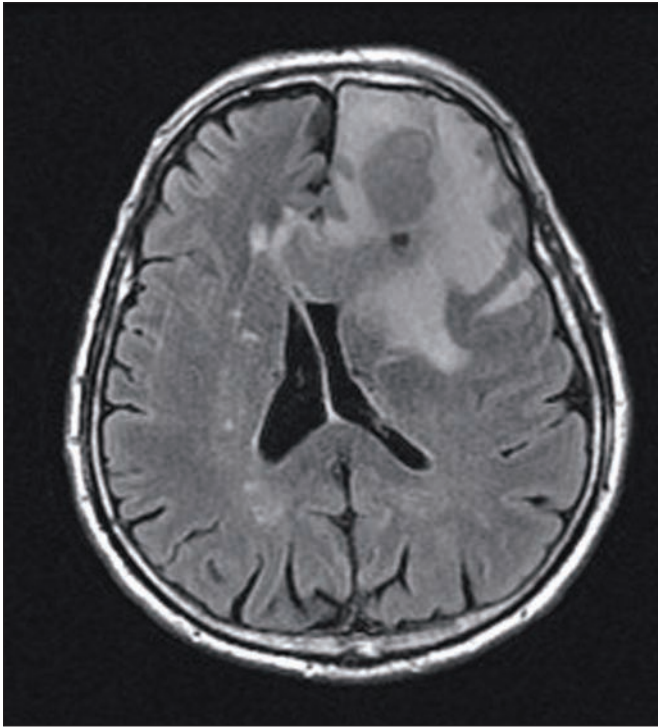
the patient was not felt to be safe for discharge and was kept in hospital while awaiting the results. The final pathological results were reported eight days after the biopsy and were consistent with cerebral tissue containing chronic inflammatory and reactive changes. Over this time the patient began to clinically deteriorate with a fluctuating level of consciousness and the development of the syndrome of inappropriate anti-diuretic hormone requiring treatment. The MRI was repeated and again demonstrated restriction of diffusion. There was frank

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**Figure 2:** Fluid Attenuation Inversion Recovery T2 sequence (FLAIR) A significant amount of vasogenic type edema is seen crossing the corpus callosum.

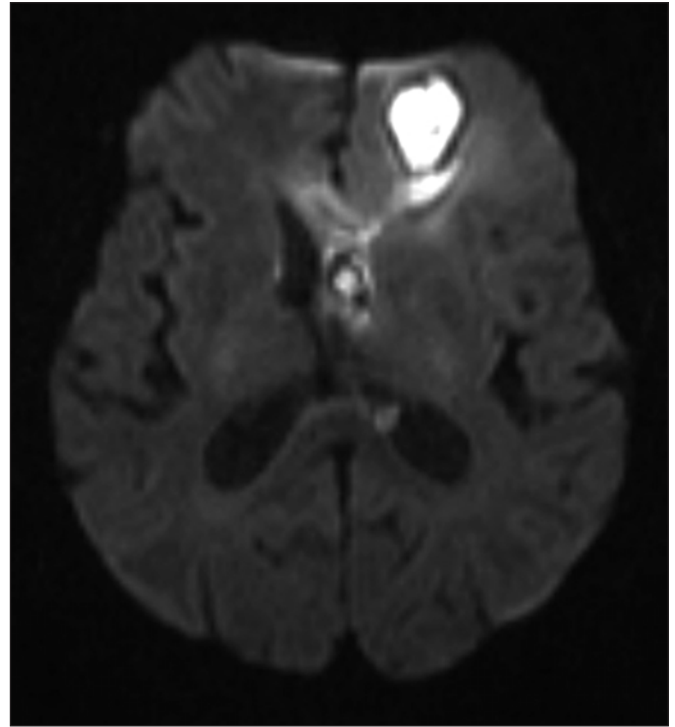
enhancement of the left lateral ventricle and less obvious enhancement of the third and fourth ventricular ependyma.

The patient was taken back to the operating room for a craniotomy and open biopsy. A biopsy needle was placed into the most superficial aspect of the cystic lesion and drew frank purulent material. A corticectomy was made and the lesion with a firm capsule was completely resected. A stat Gram's stain demonstrated branching Gram positive bacilli.

The patient was sent to the neurosurgical intensive care unit and broad spectrum antimicrobial coverage was initiated. On postoperative Day 2 the presumptive diagnosis was reported as *Nocardia*.

## DISCUSSION

The imaging characteristics of GBM are diffuse, patchy, linear or ring enhancement.<sup>2</sup> Diffusion-weighted MRI can be considered a functional technique because it provides information about functional structure at a microscopic level. Image contrast depends on the diffusion coefficient, indicative of the characteristics of the translational motion of water molecules (Brownian motion).<sup>3</sup> Typically a high grade tumor such as GBM should not demonstrate restricted diffusion and a cerebral abscess with cystic components should have restricted diffusion.<sup>4</sup> Examples to the contrary have been reported and although it is atypical for GBM, diffusion alone cannot differentiate it from a cerebral abscess.<sup>5,6</sup> The present case highlights the necessity of obtaining a tissue diagnosis when any equipoise exists. Typically a high grade tumor such as GBM should not demonstrate restricted diffusion and a cerebral



**Figure 3:** Diffusion weighted imaging is consistent with a pattern of restriction.

abscess with cystic components should have restricted diffusion.<sup>7</sup> Certainly the differentiation between GBM and cerebral abscess using diffusion is imperfect and has led to errors including with respect to *Nocardia*.<sup>8</sup>

The typical MRI characteristics of a cerebral abscess depend on the stage of the process. In the chronic phase there is usually an enhancing capsule of variable thickness surrounding a non-enhancing abscess. Most will continue to grow until a catastrophic event occurs such as rupture into the subarachnoid space or ventricular system.<sup>9</sup>

*Nocardia* is a gram positive rod-shaped bacterium that has several sub-classifications. It is thought to be ubiquitous. Most commonly it infects an immunocompromised host following inhalation of aerosolized fragments in warm dry climates with only a small percentage resulting in cerebral abscess.<sup>10</sup> Clinically much of the symptomatology relates to the location of the abscess (which are frequently multiple) within the brain.<sup>11</sup> The imaging characteristics of *Nocardia* abscesses are no different than those of abscess in general.

Glioblastoma and other high grade gliomas generally invade normal brain tissue by infiltrating as single cells into the brain parenchyma, migrating along the basement membranes and blood vessels.<sup>12,13</sup> The characteristic appearance of a ring enhancing lesion crossing the midline is virtually diagnostic of GBM. Although lymphoma and demyelination must also be considered, the differential diagnosis generally excludes abscess.<sup>14,15</sup> Many centers (including our own) advocate the initiation of specific anti-cancer treatments on the basis of neuroimaging findings and without histologic confirmation in

the elderly and those with significant comorbidities.<sup>16</sup> This can avoid the associated morbidities inherent with any surgical endeavor, particularly in the elderly and infirm. With lesions crossing the corpus callosum it is felt that a biopsy may not be required.<sup>17</sup> A cerebral abscess crossing midline is obviously a rare event but important to consider if the plan involves non operative management. Previously Lee et al reported on a patient with AIDS and a toxoplasmosis lesion in a butterfly pattern crossing the corpus callosum.<sup>18</sup> Reinnarz et al also collected a series of patients with diversified callosal pathology with no abscess and only a single case of encephalitis in a seven year-old girl in which the lesion crossed the splenium without ring enhancement.<sup>19</sup> This is the first report of a cerebral abscess crossing the midline.

This case demonstrates a ring enhancing lesion crossing the midline, via the corpus callosum, a previously unreported finding. The case highlights the need for tissue diagnosis when there is any equipoise with respect to the diagnosis before proceeding with treatment. Magnetic resonance imaging continues to improve and emerging sequences allow us to become more confident with diagnoses. At the same time there is a well founded, scientifically based movement at many centers towards less invasive treatment of high grade gliomas, particularly in the elderly population. As this case illustrates it is critical that we continue to improve our selection criteria and proceed carefully to avoid the pitfalls that can accompany mistaken identity.

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