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# Neuroimaging Highlight

*Editors: Mark Hudon, Richard Farb*

## A Patient with Neurosarcoidosis

*Submitted by: Taim Muaygil, M.S. Hussain, Maher Saqqur*

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A previously well 35-year-old male presented with a one month history of generalized progressive headaches, mental status changes, and behavioral changes in the form of aggression and somnolence. His initial physical examination was unremarkable apart from bilateral papilledema and delirium. Investigations, including complete blood count (CBC), urea, creatinine, electrolytes, erythrocyte sedimentation rate (ESR), liver function tests (LFT), thyroid stimulating hormone (TSH), EKG, and chest x-ray, were within normal limits. An immediate computed tomogram (CT) scan of the head showed acute hydrocephalus. A shunt was inserted, and a CSF sample was obtained. It showed an elevated cell count (WBC  $26 \times 10^9$  cells/L, 82% lymphocytes) and elevated protein (7.05 g/L). The CSF staining for AFB was negative, as were the bacterial and viral cultures. Cytological and fungal staining was also negative. Weighted with gadolinium, T1 and FLAIR MRI sequences displayed an extensive white matter abnormality with prominent meningeal and hypothalamic enhancement (Figure 1). Tuberculosis (TB) was the main diagnostic consideration. Sarcoidosis, lymphoma and lepto-meningeal metastasis were also considered. The CSF cytology was negative on two occasions, making a neoplastic cause less likely. Tuberculosis was felt to be the most likely etiological diagnosis, as there were no systemic findings of sarcoidosis on his initial presentation.

After an empirical six month course of treatment with anti-tuberculous agents and prednisone (started with 60mg/day then tapered), his aggressive behavior and mental status started to improve. About a month after the completion of treatment, he was again hospitalized with a relapse of his previous symptoms. On this admission, the chest X-ray revealed a reticular nodular pattern. Subsequently, a CT scan of the chest displayed bilateral hilar lymphadenopathy suggestive of sarcoidosis. A hilar lymph node biopsy confirmed the diagnosis.

He was started on prednisone 60mg/day with noticeable improvement after four months of treatment. He no longer was aggressive, and his orientation was correct to place and person.

He was able to communicate appropriately and speech was normal. Impairment was still observed for short term memory. Motor and sensory functions remained preserved. The follow-up brain MRI showed significant regression of the meningeal and hypothalamic enhancements (Figure 2). Unfortunately our patient did not return to baseline.

Sarcoidosis is a well recognized non-caseating granulomatous disease that can affect any organ. It occurs worldwide, but appears to be far more common in Northern America and Northern Europe.<sup>1</sup> central nervous system (CNS) involvement by sarcoidosis has been seen in five – 26% of cases,<sup>2,3</sup> and, as in our patient, neurological involvement has been known to precede the diagnosis of systemic sarcoidosis in 31 – 52% of cases.<sup>4,5</sup> An abnormal MRI can be expected in 82% of patients with sarcoidosis and clinical features of CNS disease.<sup>6</sup>

Most frequently, cranial nerve involvement is initially encountered in 59%.<sup>2</sup> A presentation with hydrocephalus and papilledema, as in our patient, has been seen in six percent.<sup>2</sup> Previous MRI studies have demonstrated meningeal, hypothalamic, or brain parenchymal disease in 56%, while in another series, hypothalamic and pituitary involvement was reported in 16% of neurosarcoid cases.<sup>4,7</sup> Rare presentations of neurosarcoidosis include infiltration of the cauda equina and conus medullaris,<sup>8</sup> a solitary mass lesion of the spinal cord<sup>9</sup> or dural masses mimicking meningioma.<sup>6,10</sup> In comparison, tuberculosis rarely involves the intrasellar or suprasellar lesions.<sup>11</sup>

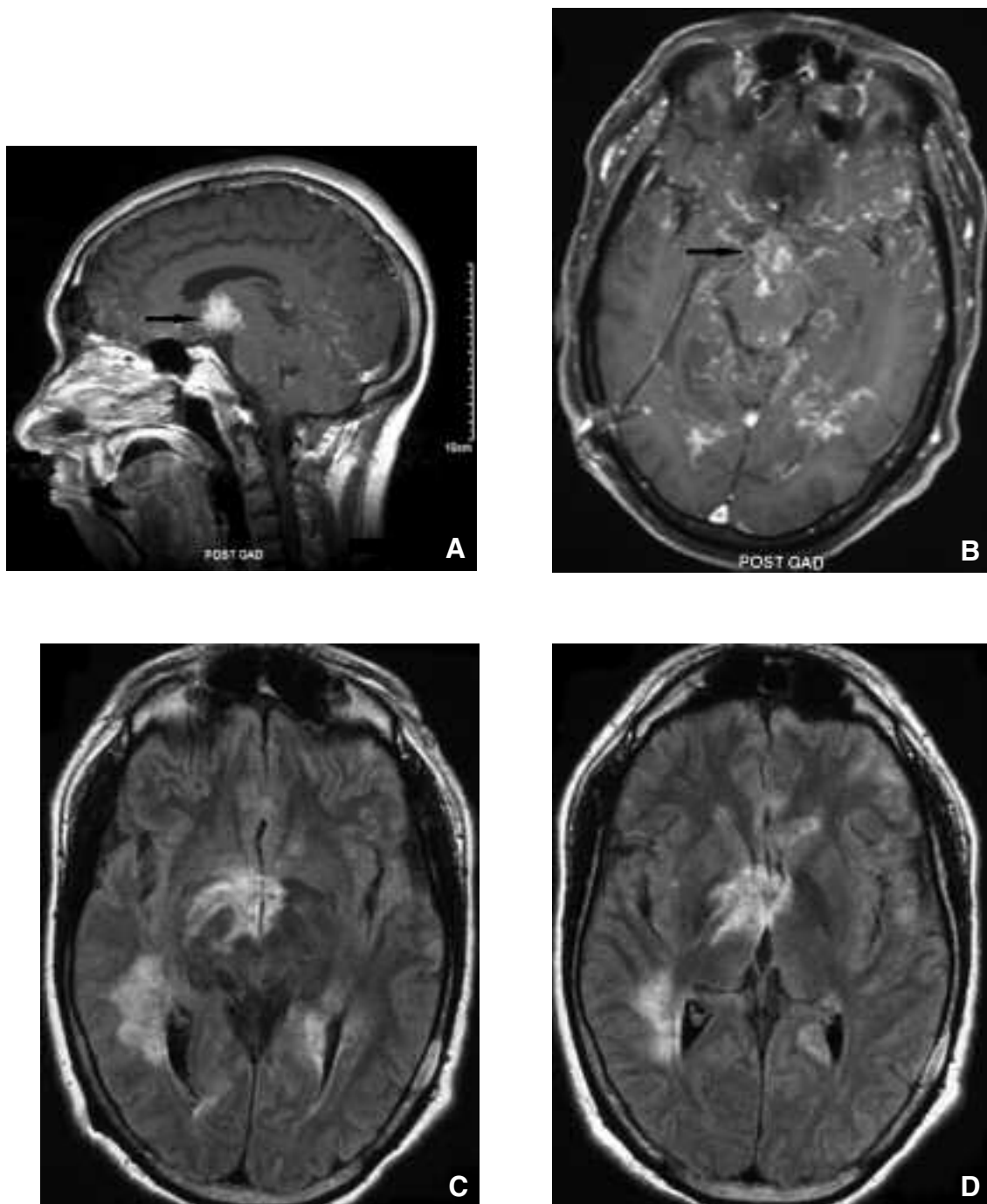
Our patient later developed asymptomatic pulmonary involvement, which helped in establishing the diagnosis, as an estimate of 78% of neurosarcoid cases have abnormal chest x-rays.<sup>12</sup> It is uncommon for neurosarcoidosis to remain isolated to the CNS. The frequency among Caucasians is reported at less than 0.2 in 100,000.<sup>13</sup> It is also uncommon for tuberculosis to recur so soon after completion of therapy.

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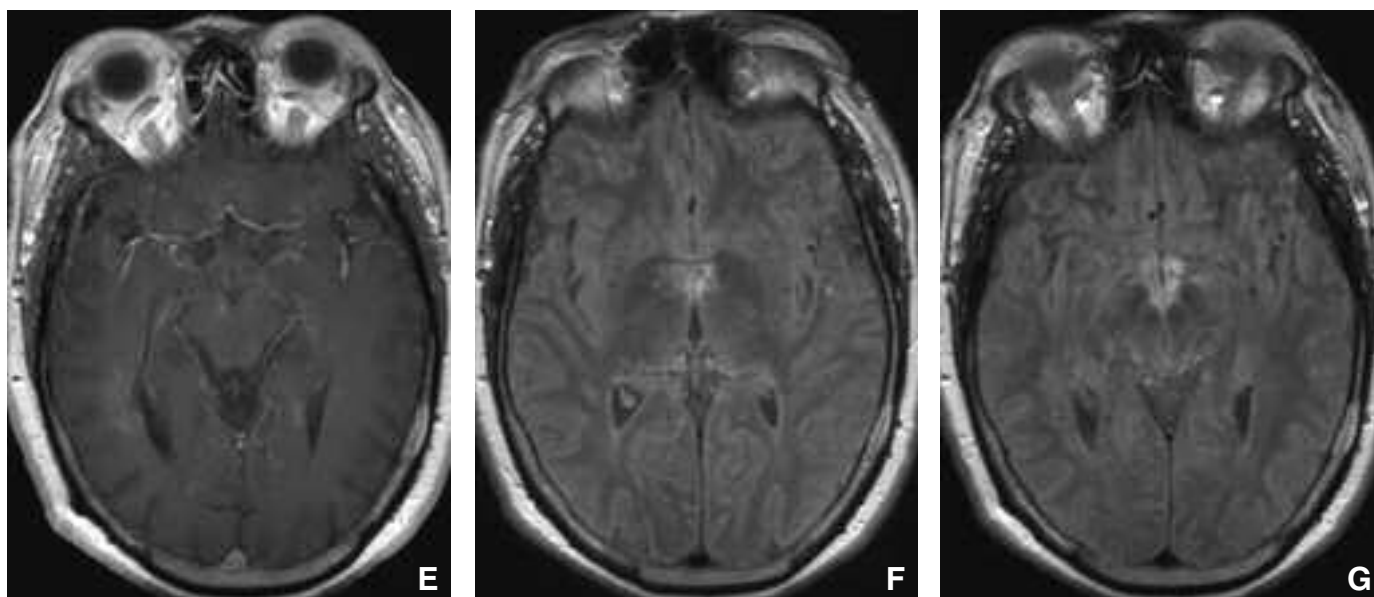
From the Department of Neurology, University of Alberta, Edmonton, AB, Canada.

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Reprint requests to: Maher Saqqur, 9335 Aberhart 1, University of Alberta, Edmonton, Alberta, T6G 2J3, Canada.



**Figure 1:** Sagittal (A) and axial (B) T1 weighted images with Gadolinium, show diffuse patchy meningeal enhancement in the frontal, temporal, parietal, and periventricular regions, and along the clivus with gyriform type enhancement. There is a markedly enhancing hypothalamic lesion (Arrows). The shunt is seen in the right temporal region (B). Fluid Attenuated Inversion Recovery (FLAIR) sequence (C & D) shows high signal intensities corresponding to the T1 weighted enhancing lesions of the hypothalamus, as well as right temporal involvement.



**Figure 2:** Images E, F, & G were taken after four months of prednisone therapy. Axial T1 weighted images with Gadolinium (E), and FLAIR sequences (F&G) all show significant reduction in enhancement and signal intensity respectively. The more confluent areas of increased signal intensity along the lateral horns of the ventricles bilaterally have essentially resolved. Subtle areas of meningeal enhancement remain and mildly increased activity persists at the hypothalamus.

According to proposed diagnostic criteria for neurosarcoidosis by Zajicek et al,<sup>14</sup> a positive histology from the nervous system is required for a definite diagnosis and a probable diagnosis is when there is a clinical syndrome suggestive of neurosarcoidosis with evidence of systemic sarcoidosis.

Generally, the prognosis is highly variable. Patients with dural based and cranial nerve lesions tend to do better than patients with leptomeningeal, parenchymal, and spinal lesions.<sup>6</sup> Approximately one-third of patients with CNS neurosarcoidosis have significant morbidity and mortality.<sup>4</sup>

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