REVIEW ARTICLE

Neurocysticercosis: Discussion Over Two Presumed Cases of Brain Lesion

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INTRODUCTION

Neurocysticercosis (NCC), one of the Neglected Parasitic Infections (NPI), is a preventable disease caused by the *Taenia solium*'s cysts. The disease represents the leading cause of new onset epilepsy worldwide and should be considered in immigrant populations coming from endemic areas such as Latin America, Sub-Saharan Africa, and parts of Asia.[1, 2] Cysticercosis is a different condition than taeniasis, a tapeworm infection of the gastro-intestinal tract, although both are caused by the same pathogen. Cysticercosis is a larval cyst infection of the tissue that can affect the central nervous system (CNS). It develops, manifests, and is managed in different ways depending on the cerebral or extra-cerebral location of the lesions.[3] In this report, we describe two patients admitted to the hospital for new-onset seizures.

Patient A is a 19-year-old Hispanic male admitted with a new onset generalized tonic-clonic seizure. The episode lasted less than a minute and occurred while the patient was sitting at his desk at school. His past medical history is unremarkable. His social history is remarkable for the fact that he came to the United States from Latin America at 5 years of age.

On arrival to the emergency department, the physical examination and vital signs were normal. Results of the first set of tests including a complete blood cell counts (CBC), comprehensive metabolic panel (CMP), and urinalysis (UA) were unremarkable. The brain magnetic resonance imaging (MRI) revealed a 7x6 mm enhancing focus in the left parietal subcortical white matter with surrounding vasogenic edema. Based on the epidemiological context and the MRI description, he was diagnosed with NCC (Figure 1). *T. solium* antibodies in plasma and a 4th generation HIV test were negative. The ophthalmologic examination ruled out cystic lesions in the eye. The patient was treated with 14 days of Albendazole and Prednisone and receives seizure prophylaxis with leviracetam. A repeat brain MRI six months later failed to reveal any improvement of the cerebral lesion or of the surrounding edema. In addition, the seizure episodes were not fully controlled. A second set of tests including serologic screening for *Trichinella spiralis*, *Entamoeba histolytica,* and *Strongyloides stercoralis* were done, and the results were negative.

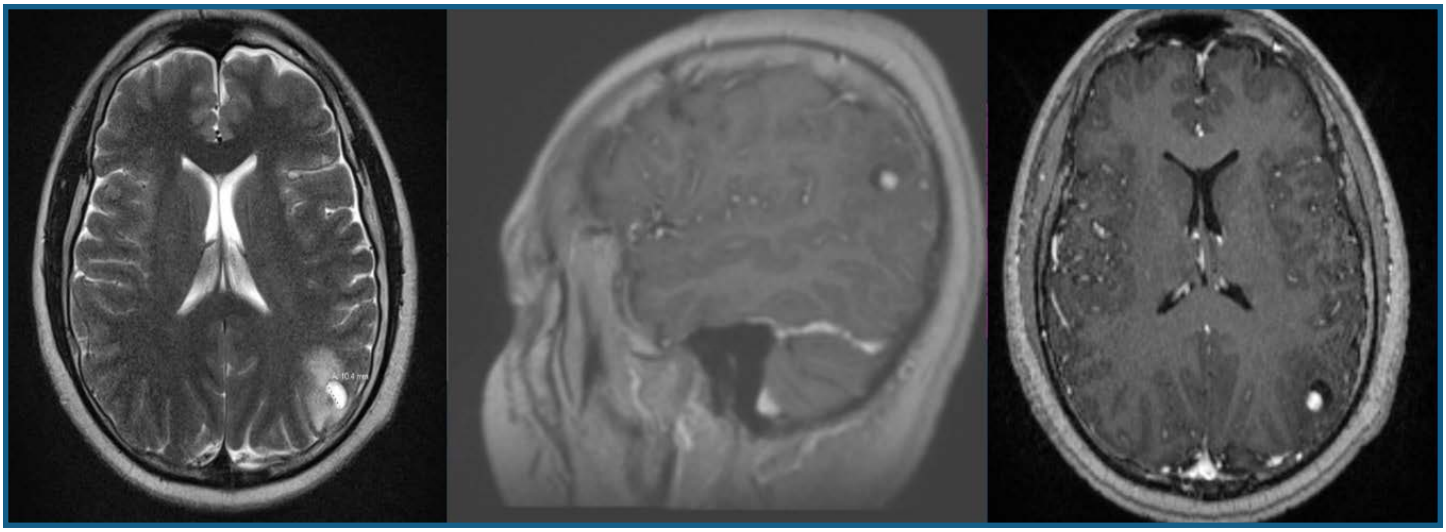

Figure 1
Patient A, Brain MRI with contrast at the time of diagnosis: Focus of abnormal enhancement is visualized in the left parietal lobe in the cortical white matter measuring approximately 0.7 x 0.6 cm with peripheral high T2 and FLAIR signal representing vasogenic edema.

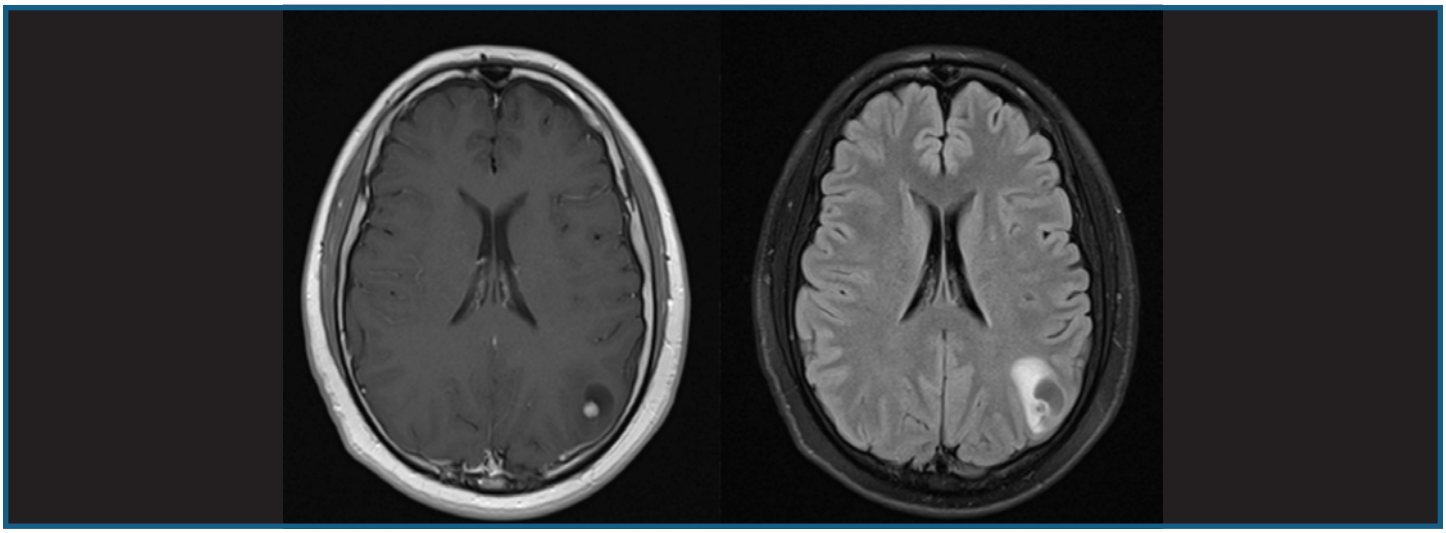

Figure 2
Patient A, Brain MRI before surgery: Left parietal lobe evolving lesion with a cystic component which measures 1.0 x 0.6 cm, with perilesional FLAIR signal hyperintensity suggestive of edema.

Failed therapy with albendazole due to non-compliance was invoked and the patient was started on combined antiparasitic therapy (albendazole plus praziquantel) for 14 days. A month later, the repeated brain MRI showed worsening perilesional edema and cystic degeneration (Figure 2). Given our concern about a possible neoplastic process, the patient underwent neurosurgical resection of the lesion. The histopathology examination confirmed the diagnosis of grade I pilocytic astrocytoma.

Patient B is a 17-year-old Hispanic male with unremarkable past medical history admitted for loss of consciousness while at work. Details about the duration and the characteristics of the episode were missing. The patient was 9-year-old when he migrated to the United States from Latin America. Physical examination and vital signs on admission were within the normal limits. Results of CBC, CMP, and UA were unremarkable. The brain MRI revealed a left parietal lobe multilobulated cystic enhancing lesion with surrounding vasogenic edema (Figure 3). Results of the initial work-up including *T.solium* antibodies, interferon gamma-release assay for *Mycobacterium tuberculosis* (MTB), a 4th generation antigen-antibody HIV test, and an ophthalmologic examination were negative. We suspected a neoplastic process; thus, patient B underwent neurosurgical resection of the lesion and the histopathology showed a non-viable cysticercal lesion. The patient subsequently completed 14 days of antiparasitic therapy and prednisone, and an uncomplicated course and resolution of the seizure episodes followed.

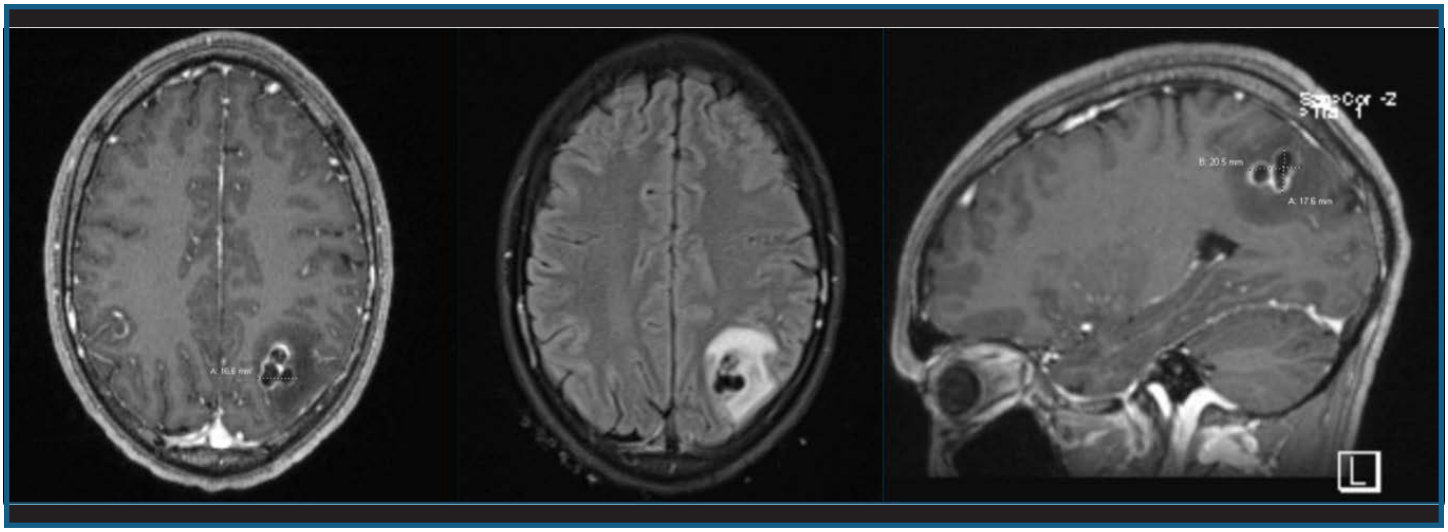

Figure 3
Patient B, Brain MRI at the time of diagnosis, before surgical excision: There is a 1.8 x 2.1 x 1.7 cm multilobulated cystic peripherally enhancing lesion with surrounding edema in the left parietal lobe.

DISCUSSION

Even though it is considered to be one of the NPI, NCC is not forgotten by the clinician and should be included in the differential diagnosis of patients presenting with new onset seizures and cerebral lesions. This differential diagnosis includes infectious versus neoplastic processes. MTB infection, brain abscesses, and different parasitic infections such as *Toxoplasma gondii, Echinococcus granulosus*, *Paragonimus* sp, *Schistosoma* sp, visceral larva migrans, malaria, and neurocysticercosis are among the infectious etiologies that could be considered and based on the history and epidemiological context.[4, 5]

The two most common presentations of NCC are new onset seizures and increased intracranial pressure associated with cysticercal encephalitis and dying cysts.[2, 3] However, the spectrum of manifestations can range from headache (frequently reported) to cognitive anomalies, cerebro-vascular accidents, spinal radiculopathy, hydrocephalus, focal deficits, and coma.[3, 5-7] The seizure disorder associated with NCC is often secondary to the degenerating cysts, but it is also reported in patients with non-enhancing calcified lesions. Today, it is well known that even the non-viable calcified cysticerci can cause surrounding edema and predispose to seizure activity.[2, 8]

The most recent guidelines published by the Infectious Disease Society of America, encourage a thorough history and physical examination along with neuroimaging when we consider NCC in our differential.[3] The computer tomography scan has a higher sensitivity in detecting calcified lesions while the MRI's sensitivity is significant for detection of the scolex, edema, and lesions in different locations throughout the parenchymal and the extra-parenchymal regions of the CNS.[3] The commercially available enzyme-linked immunosorbent assay (ELISA) uses the crude antigen to detect antibodies while the enzyme-linked immunotransfer blot (EITB) available via the Center for Disease Control and Prevention (CDC) uses the parasite glycoprotein for antibody detection. The ELISA should be avoided, given the high rate of false-negative results and low sensitivity. In addition, the ELISA result is influenced by the type of sample used (CSF vs plasma results in 71% vs 41% sensitivity, respectively) or by the number and characteristics of cerebral lesions (low sensitivity in patients with a single parenchymal or calcified lesion as compared to multiple cysts). EITB's sensitivity is close to 85% for both plasma and CSF.[7, 9] Before initiation of therapy for NCC, additional screening should be considered. Ruling-out infections with MTB and *Strongyloides stercoralis* before initiating steroid therapy is of paramount importance. The fundoscopic examination helps in visualizing the intraocular cysticerci or the cerebral edema. For the other possible viral or parasitic infections, screening should be conducted based on the clinical presentation, history, epidemiological context, and risk factors.[3]

The therapy for NCC has three major components. Albendazole is the first choice among antiparasitic drugs. It can be used alone for single or two viable parenchymal lesions or in combination with Praziquantel. Combined therapy should be considered under the following circumstances: when more than 2 parenchymal lesions are present; when surgical removal of intraventricular lesions cannot be performed; when lesions are situated in the subarachnoidal space; and when there is a lack of response after albendazole alone. The duration of the therapy is 14 days. Calcified cysts do not require antiparasitic management.[3, 7] The second component of the therapy involves anti-inflammatory drugs. A short course of Prednisone

(2 weeks), initiated the day before anti-parasitic drugs, is well-tolerated and decreases the side effects associated with the inflammatory cytokine-release response associated with parasitic death. Lastly, anti-epileptic therapy is universally indicated and should be conducted in conjunction with a neurology consultation. Surgical intervention is necessary for cases presenting with intraventricular, subarachnoidal, or intraocular lesions for management of hydrocephalus and removal of the cysts.[3] Clinical and neuroimaging follow-up are necessary to ensure regression of the lesions, suggesting a good response to the therapy, and once again, confirming the diagnosis. Most of the single, uncomplicated lesions resolve six months after the initial presentation and patients become asymptomatic.

CONCLUSIONS

When including NCC in the differential diagnosis of a cerebral lesion, one should give special considerations to the following:

1. New onset seizures in patients coming from endemic areas should include NCC in the differential diagnosis.
2. History of the present illness, epidemiological context, and neuroimaging studies are the most important initial diagnostic steps.
3. Serology is not reliable for ruling-in or ruling-out the diagnosis of NCC. If indicated for confirming the diagnosis, both the plasma and the CSF samples could be sent to the CDC for EITB assay.
4. Before initiating therapy, rule out MTB and *Strongyloides stercoralis* infection as corticosteroids could cause reactivation of a latent MTB infection or lead to catastrophic hyperinfection with *Strongyloides stercoralis*.
5. Perform a fundoscopic examination looking for intraocular cysticerscosis, since the initiation of antiparasitic therapy could lead to a massive local inflammatory response and even blindness.

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