

Case Report

Acute Psychosis with Recurrent Neurocysticercosis: A Case Presentation

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Abstract

Description

Neurocysticercosis, a parasitic infection of the central nervous system (CNS) caused by the *Taenia solium* cestode, presents clinically with a large and diverse spectrum of symptomatology, dependent upon lesion number, locale and ensuing inflammatory response. To this date, there are only two documented cases of psychosis presenting in patients with neurocysticercosis, both of which were published in India. This case presentation depicts the first documented case of Psychotic Disorder Due to Another Medical Condition: Neurocysticercosis in the United States. The authors postulate that the atypical presentation of the neuropsychiatric instability with the aberrant recurrence of neurocysticercosis is predominantly attributable to the parasitic infection itself, along with its resultant cyst formation and inflammatory response. Further research is necessary to expand upon our knowledge and understanding of the neuropsychiatric effects and optimal management of neurocysticercosis, as well as its possible recurrent nature.

Keywords

psychiatry; neurocysticercosis; neurocysticercosis/psychology; psychotic disorder due to another medical condition; psychotic disorders; psychosis; central nervous system parasitic infections; parasitic disease

Introduction

Neurocysticercosis, a parasitic infection of the CNS by the *Taenia solium* cestode, is most commonly transmitted through the ingestion of undercooked pork or fecal-orally via contaminated water (larval cysts) in endemic areas including South America, Africa and Asia.^{1,2} Following ingestion, the larval cysts are carried in the bloodstream before depositing in the brain.² Classified as a “major neglected disease” by the World Health Organization (WHO) due to the lack of information regarding its burden, transmission and diagnostic resources, the prevalence of neurocysticercosis in the United States (US) remains unknown, as only four states require its reporting.³ An estimated prevalence of 15-38% exists within Latin American countries, and an estimated 1,320-5,050 new cases of neurocysticercosis occur yearly in the United States (US). There is a higher incidence noted among Hispanic patients.³

Clinical manifestations of neurocysticercosis are dependent upon the exact location and the number of lesions present, with a multitude of diverse presentations demonstrated throughout the literature. However, the most common clinical manifestations are predominantly neurological in nature, with the most prevalent conditions reported to be epilepsy and intracranial hypertension (ICH).² To date, there are only two documented cases of psychosis presenting in patients with neurocysticercosis, both in India.^{4,5}

Case Presentation

The patient is a 21-year-old Peruvian female with a past medical history of neurocysticercosis with resultant tonic-clonic seizures and as well as migraine headaches with photophobia, presenting to the hospital for altered mental status (AMS) with orientation to person and time only. The patient has a previous history of

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neurocysticercosis in 2012 while living in Peru, with documented imaging of a single cyst in the right frontal lobe, treated with an unknown antiparasitic agent for 2 weeks and antiseizure medication for 1 month, with no follow-up care nor repeat imaging. The patient resides in the US, but reported yearly visits to Peru for about 60 days per visit since 2012. The patient denied any psychiatric history, history of substance abuse or family history of mental illness. The history below represents collateral information obtained from the patient’s family, given

the patient’s inability to answer questions. The physical and mental status exams are depicted in **Table 1**.

Events Leading to Current Admission

Forty days prior to the current admission, the patient presented to the hospital postictally, status post two consecutive seizures with left facial droop. The initial CT scan showed a ring-like hyperdensity with vasogenic edema in the periphery of the right frontal lobe with a mild local mass effect. A follow-up MRI with con-

Table 1. Physical Examination, Laboratory Findings, and Mental Status Exam.

Physical Examination and Laboratory Findings			Mental Status Exam on Current Admission	
	Previous Admission	Current Admission	General Assessment	Awake, alert x2 (person and time)
Physical Exam	Cranial Nerves intact, left facial droop noted	Unremarkable, no focal neurologic deficits	Appearance	Bizarre
Significant Labs	Hgb: 12.1	Hgb: 11.5	Mood	Dysphoric, irritable
	WBC: 18000	WBC: 6500	Affect	Blunt, labile
	Na: 137	Na: 138	Behavior	Agitated
	K: 3.7	K: 3.4	Attitude	Inhibited
	Cr: 0.5	Cr: 0.3	Suicidal/Homicidal ideation	Denies
	BUN: 16	BUN: 7	Speech	Normal rate and rhythm
	AST/ALT: 21/34	AST/ALT: 29/40	Thought processes	Disorganized, grossly impaired
	ALP: 63	ALP: 75	Associations	Loose
	Lactate: N/A	Lactate 3.3	Thought content	Bizarre, self-destructive ideation, violent ideations
	Total Bilirubin: 0.3	Total Bilirubin: 0.3	Hallucinations	Auditory and visual hallucinations
ECG	Normal sinus rhythm, QTc 410ms	No changes from previous ECG	Memory	Short term intact
Urine Toxicology	Negative	Negative	Attention	Limited/poor
Serology	Positive Antibodies for <i>Taenia solium</i>		Insight/Judgement	Limited/poor

Abbreviations: Hgb = Hemoglobin; WBC = White Blood Cell; Na = Sodium; K = Potassium; Cr = Creatinine; BUN = Blood Urea Nitrogen; AST = Aspartate Aminotransferase; ALT = Alanine Aminotransferase; ALP = Alkaline Phosphotase

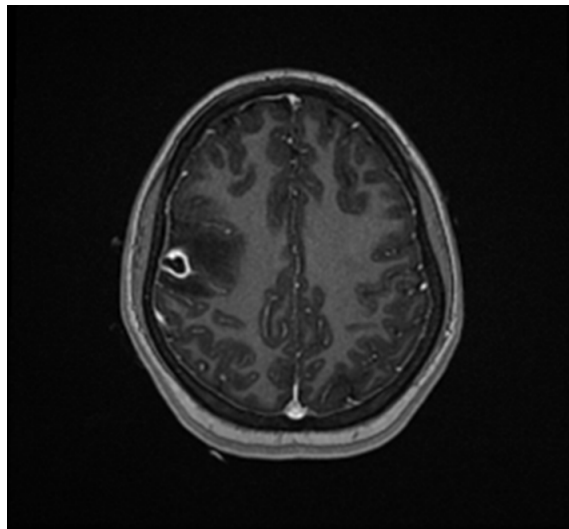


Figure 1. T2-weighted MRI with contrast taken on initial presentation.

trast showed a single cystic mass with thickened peripheral enhancement measuring 1.8 x 1.4 x 1.3 cm with surrounding vasogenic edema. (**Figures 1 & 2**) Of note, no chronic signs of previous infection were visible (i.e., calcification). Serologic testing confirmed the diagnosis of neurocysticercosis. The patient was treated with albendazole 600mg, dexamethasone 4mg and levetiracetam 500mg twice daily for 1 week in the hospital.

Upon discharge, the patient was instructed to continue treatment with albendazole, levetiracetam and dexamethasone taper. The patient maintained compliance with dexamethasone and levetiracetam as prescribed, but due to difficulty in obtaining the albendazole, the patient failed to adhere for 19 days. After 19 days from

discharge, the patient obtained albendazole from Peru and initiated a dose of 200mg twice daily (for a duration of 14 days, until current admission).

During the time from discharge to the current admission, the patient's family noted progressive waxing and waning periods of neuropsychiatric decline with no return to baseline, including episodes of depressed mood with emotional lability and tearfulness, decreased need for sleep, bizarre thought content, auditory hallucinations (derogatory content and commands of self-harm), visual hallucinations (seeing deceased family members) and paranoia. These symptoms started a few days after discharge, during ongoing outpatient treatment with dexamethasone and levetiracetam,

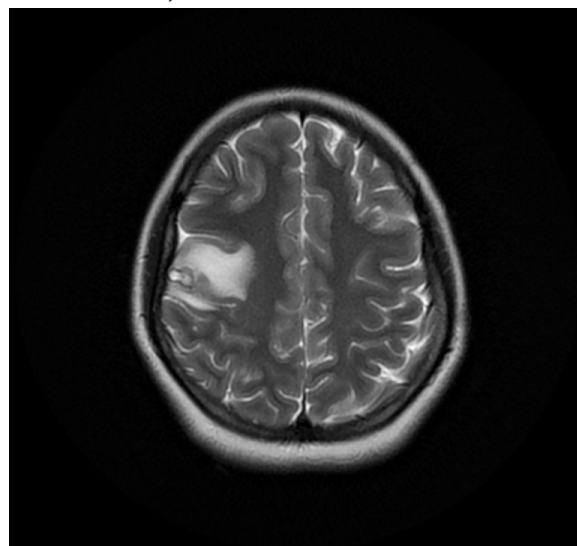


Figure 2. T2-FLAIR MRI taken on initial presentation.

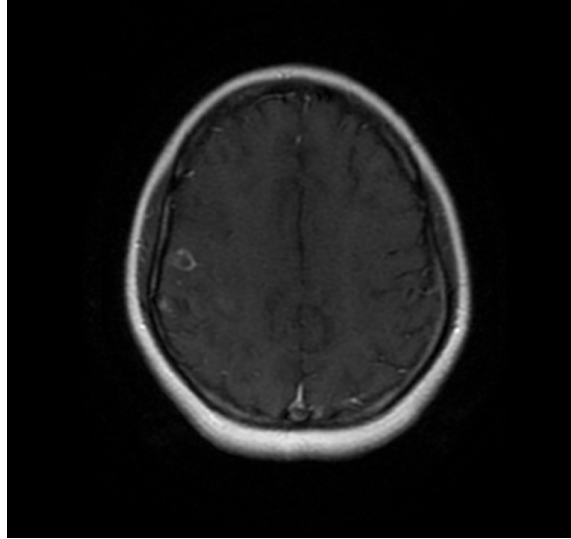


Figure 3. T2-weighted MRI with contrast taken on current admission.

and still persisted after albendazole was introduced 19 days post-discharge. In the few days leading up to the current admission, the family reported increasing agitation with physical aggression (spitting on family members) and self-destructive behavior.

Current Admission

The patient was admitted to the medical unit for AMS, with psychiatry, neurology and infectious disease following the case. A repeat MRI with contrast showed the same single cystic mass with a reduction in size, now measuring 1 x 0.8 x 0.7 cm, and a decrease in the surrounding vasogenic edema. (**Figures 3 & 4**) As per neurology, dexamethasone was discontinued the day of admission due to concerns of cor-

ticosteroid-induced psychosis. Albendazole 600mg (for a course duration of 14 days) and levetiracetam 500mg twice daily was reinitiated. Despite steroid discontinuation, the patient continued to exhibit bizarre and grossly psychotic behavior, with disorganized thought content, persistent agitation and physical aggression. Eight days later, the patient was deemed medically cleared and transferred to the psychiatric inpatient unit for further evaluation and stabilization.

Assessment and Plan

Upon further psychiatric evaluation, the patient was diagnosed with Psychotic Disorder Due to Another Medical Condition: Neurocysticercosis. The onset of the patient's symptoms (**Figure 5**)

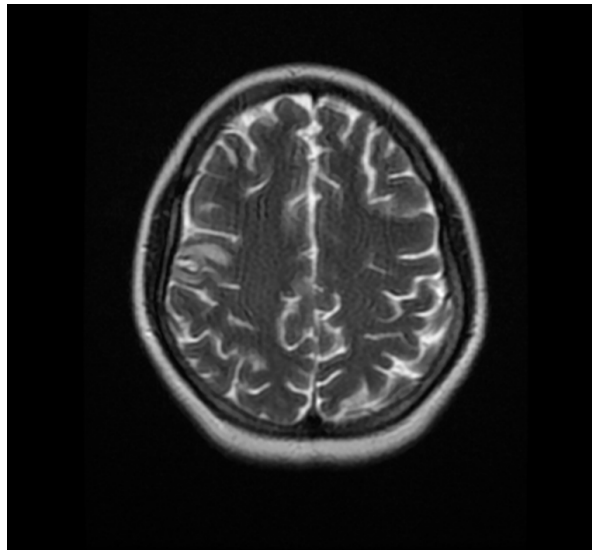


Figure 4. T2-FLAIR MRI taken on current admission.

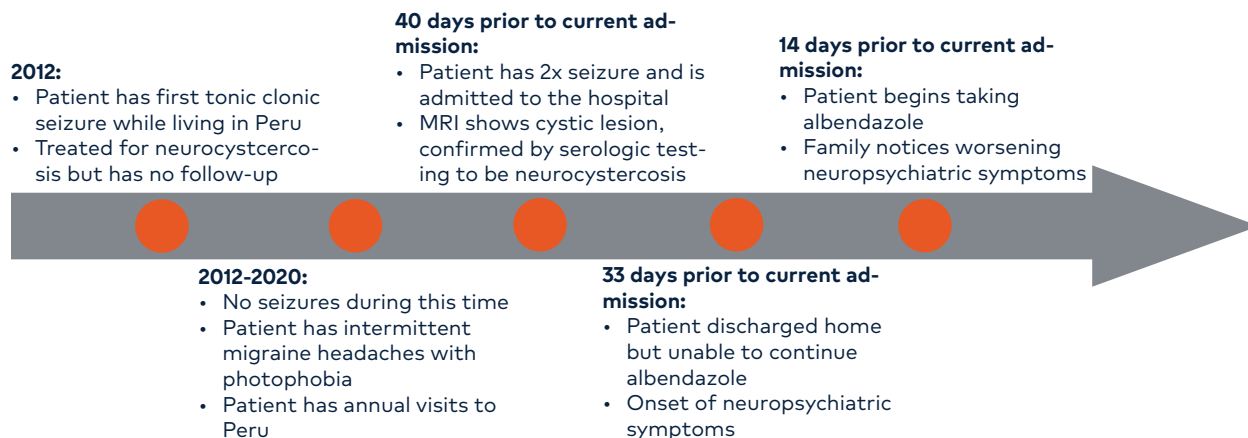


Figure 5. A timeline shows the events leading up to current admission.

correlate with the initiation of treatment of the neurocysticercosis, with MRI imaging showing persistent vasogenic edema in the right frontal lobe. Given the lack of a previous personal or family psychiatric history, the new onset psychotic symptoms could not be better explained by an underlying purely psychiatric disorder. Corticosteroid, albendazole and levetiracetam induced psychosis were also deemed less likely (rationale explored in discussion below).

Olanzapine was initiated at 5mg orally (PO) twice daily and titrated up to 10mg PO twice daily over the course of 7 days. Olanzapine was chosen for both its anti-psychotic and sedative effects, and the patient had no relative contraindications such as metabolic syndrome. Valproic acid 250mg PO two times daily was initiated on day 7 to address extreme affect lability. The patient displayed minimal improvement in thought process and lability. Aripiprazole 5mg PO daily was initiated based on the theory of augmentation with D1 activation within the mesocortical tract to assist with negative symptomatology, such as flat affect, and HT2a activation for anxiolysis. In addition, valproic acid was titrated up to 250mg three times daily on day 20. Repeat MRI showed persistence of the lesion, which remained unchanged in size, with a decrease in size of the surrounding edema on day 20. A long acting injectable of risperidone, which was the second generation long acting injectable carried on formulary by the hospital at that time, was given on day 22 to bolster outpatient compliance. The patient began to exhibit marked improvement with psychiatric stability reached on day 23. The patient was deemed stable for discharge with recommendations of continued current medi-

cation regime and follow-up care in the outpatient setting.

Discussion

In this report, the authors present a novel case of psychosis in the context of a recurrence of neurocysticercosis which, to the best of the authors' knowledge, is the first documented case within the US. During the patient's initial incidence of neurocysticercosis in 2012, the patient presented solely with seizures. However, during the second incidence, the patient also presented with seizures, but later progressed to symptoms suggestive of psychosis. Imaging studies noted a single, acute stage cyst at the same previous location after reported resolution, thus suggesting novel recurrence over chronic complications.

In addition, the prolonged, multiple-admission course of the second incidence of neurocysticercosis was complicated by previous medication noncompliance, with a delay in initiation of albendazole upon discharge. Furthermore, the discontinuation of steroids upon readmission is believed to have led to an increase in the perilesional edema. Given the lack of a previous personal or family psychiatric history, failure of symptom resolution with discontinuation of steroid adjuvant treatment, the presence of AMS and visual hallucinations (suggesting organic nature), along with the history, physical examination findings and laboratory results as reported in **Table 1**, the authors hypothesize that the presentation of psychosis was secondary to the neurocysticercosis and its local inflammatory response with surrounding vasogenic edema, with steroid-induced psychotic disorder considered less likely.

While the development of epilepsy is a well-documented complication of neurocysticercosis, fewer studies have explored its associated neuropsychiatric manifestations.⁶ In a study of 38 patients with neurocysticercosis in Brazil, psychiatric illness and cognitive decline were seen in 65.8% and 87.5% of cases, respectively.⁷ However, this study was considered an outlier with controversy due to the fact that these psychiatric manifestations were more commonly seen in those patients with epilepsy, ICH or hydrocephalus in an outpatient neurology clinic.^{8,9} Depression was the most commonly reported psychiatric complication, and while schizophrenia and mania-like episodes have been reported as initial symptoms of neurocysticercosis, such features occur in only about 4.5% of cases in the literature.^{7,10,11} Other studies on psychiatric manifestations of neurocysticercosis have documented no patients with psychotic features.^{8,12} To date, there have been only two documented cases of psychosis in the initial presentation of patients affected by neurocysticercosis, both of which occurred in India.^{4,5}

Almost all medications, substances or medical conditions affecting the CNS can present with psychiatric symptoms, including acute psychosis. Psychosis is typically defined as “any impairment in reality testing, encompasses delusions, hallucinations, thought disorder, and disorganized behavior.”¹³ Despite the existence of reliable or definitive features distinguishing primary versus secondary psychosis, comorbid medical conditions or substance use should be suspected and investigated in patients presenting with atypical psychotic features. Suggested atypical features include later age of onset, no family history of a psychotic disorder, psychosis with cognitive impairment, AMS and/or visual or multimodal hallucinations.^{14,15} According to the DSM-V criteria, a psychotic disorder due to another medical condition must have history, physical examination and/or laboratory findings to indicate that the disturbance is a pathophysiological consequence of the medical condition. In a substance/medication induced psychotic disorder, symptoms must have developed soon after intoxication or withdrawal from a substance/medication capable of causing the symptoms, and the psychotic symptoms are not better described by another psychotic disorder that is not related

to the medical condition or substance/medication use.¹⁶

The patient initially presented following a seizure, and the diagnosis of neurocysticercosis was confirmed by MRI and serologic testing. There were no other significant physical examination or laboratory findings. (**Table 1**) However, the patient’s psychotic symptoms did not begin until 1 week after beginning treatment with albendazole and dexamethasone while inpatient. The severity of psychiatric symptoms in neurocysticercosis may be correlated with the course of antiparasitic treatment due to the increase in local inflammation, however, the precise mechanism is not well understood.^{7,10} In inflammatory states, the integrity of the blood-brain barrier (BBB) is reduced.¹⁷ This allows extensive leukocyte migration into the CNS and facilitates the development of vasogenic edema.^{17,18} Research suggests that inflammation, edema and alterations in cerebrospinal fluid pressure may play a role in the development of psychotic and depressive disorders.¹⁹ As shown in **Figures 1–4**, the vasogenic edema present in the right frontal lobe continued, although with a noted decrease, in the 33 days following discharge from the hospital, following the onset of the patient’s psychotic symptoms. In addition, incomplete adherence to the albendazole may have led to incomplete degeneration of the cyst. Studies suggest that calcified or degenerating cysts are more likely to be symptomatic, but the generalizability of the data is limited due to the long-standing nature of the neurocysticercosis within the sample populations.^{8,10,12,20} Given the acute onset of psychotic features following initiation of treatment, incomplete cyst degeneration and persistence of vasogenic edema seen on the MRI, and low suspicion of a primary psychiatric disorder with no family or personal psychiatric history, the diagnosis of Psychotic Disorder Due to Another Medical Condition: Neurocysticercosis was determined.

Corticosteroid use is currently recommended alongside cysticidal medications, unless otherwise contraindicated, due to the reduction in cerebral edema alongside other anti-inflammatory effects.^{2,21} It is important to recall that corticosteroid treatment for any medical condition has been well documented as a causative agent of many neuropsychiatric effects. These

effects have been described as occurring in 30-60% of all patients receiving corticosteroid treatment for any cause, with varying severity.²²⁻²⁴ Mood disturbances such as depression and mania, with respective prevalence of up to 35% and 31%, are the most common psychiatric symptoms associated with steroid use. Other, significantly less common neuropsychiatric manifestations include psychosis, delirium and cognitive deficits.^{22,25} The majority of patients develop symptoms within 2 weeks of initiating corticosteroids, although symptoms can develop at any time.²⁴ Dose-dependent severity of symptoms is reported, which typically resolve within a week of discontinuation of steroids, either abruptly or with dose tapering.²³ Additionally, long term use of corticosteroids may lead to persistent effects with longer time to resolution.^{22,24}

In this case, the patient's clinical presentation was inconsistent with corticosteroid-induced psychosis. The patient's symptoms primarily consisted of delusions, auditory and visual hallucinations, and bizarre thought processes, with episodes of depressed mood and emotional lability. Furthermore, steroids were discontinued upon readmission, but psychotic symptoms persisted.

While the literature reports a case of albendazole inducing psychosis,²⁷ in the case discussed here, psychotic symptoms arose in the 19 days before albendazole was even initiated. Levetiracetam can also induce psychosis, as noted in the original drug trials as a rare but potential side effect.²⁸ However, during the current admission when patient was continuously maintained on levetiracetam for seizure prophylaxis, drastic improvement in psychotic and affective symptoms were still noted, making levetiracetam-induced psychosis less likely. It is theoretically possible that the initiation of anti-psychotic medication during the current admission started masking the side effects of the levetiracetam. A reemergence of psychotic symptoms in the outpatient setting when anti-psychotics were discontinued and levetiracetam maintained would push this higher on the differential. However, to our knowledge, there was no reemergence of psychosis or other psychiatric symptoms after discharge. The recurrent nature of neurocysticercosis depicted in this case remains an enigma in current

literature, with only one report of recurrent incidence in an endemic area.²⁶ Contributing factors in this particular case presentation may include a higher infection propensity with repeated visits to Peru, an area of higher disease prevalence. Additionally, immunosuppression, along with reduced efficacy of the BBB for any reason, could also play contributing roles. Further research could elucidate the recurrent and/or persistent nature and contributing progressive factors of this CNS infection, and possibly aid in the development of optimal management and preventative measures with future infections.

Conclusion

The authors describe the first documented case of Psychotic Disorder Due to Another Medical Condition: Neurocysticercosis in the context of the second recurrence of neurocysticercosis in a patient presenting with neuropsychiatric instability in the US. The authors postulate that the atypical presentation of acute psychosis during the aberrant recurrence of neurocysticercosis is predominantly attributable to the parasitic infection itself, along with its resultant cyst formation and inflammatory response. Future evaluation and investigation is necessary to expand upon our knowledge and understanding of the neuropsychiatric effects and optimal management of neurocysticercosis, as well as its possible recurrent nature.

Conflicts of Interest

The authors declare they have no conflicts of interest.

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