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RESEARCH ARTICLE

MENINGEAL TUBERCULOSIS: A DIAGNOSTIC CHALLENGE. A CASE REPORT

Erika Daniela Martinez Sanchez¹, Joaquin Angel Ortiz Abrego², Arlette Juliette Reyes Pintor² and Veronica Abrego Aguila³

1. Internal Medicine Specialist, Instituto Mexicano del Seguro Social, OOAD Tabasco.
2. Epidemiology Specialist, Instituto Mexicano del Seguro Social, OOAD Veracruz, Sur.
3. Public Health Specialist Nurse. Instituto Mexicano del Seguro Social, OOAD Veracruz, Sur.

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Abstract

A 19-year-old malnourished male student from Tabasco, Mexico, with no relevant medical history and a negative HIV test, presented with intermittent holocranial headache that progressively worsened and was accompanied by fever. He subsequently developed a generalized tonic-clonic seizure and progressive neurological deterioration, with positive Brudzinski and Babinski signs. Subarachnoid hemorrhage was initially suspected but was ruled out. Brain magnetic resonance imaging revealed findings suggestive of a central nervous system infectious process, with tuberculous meningitis and neurocysticercosis considered in the differential diagnosis. Despite initial treatment with albendazole and dexamethasone, his neurological condition continued to deteriorate, and cryptococcosis was subsequently considered. Cerebrospinal fluid analysis showed pleocytosis, and molecular testing with Xpert MTB/RIF was performed. The assay was positive for *Mycobacterium tuberculosis* and detected rifampicin resistance, establishing the diagnosis of tuberculous meningitis. Antituberculosis therapy under a directly observed treatment strategy was initiated on April 16, 2025.

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Introduction:-

Tuberculous meningitis represents the most severe form of extrapulmonary tuberculosis and constitutes a medical emergency associated with high morbidity and mortality, particularly in endemic countries and among immunocompromised patients. This condition results from invasion of the central nervous system by *Mycobacterium tuberculosis*, triggering an inflammatory process involving the basal meninges, with subsequent vascular and cerebrospinal fluid (CSF) involvement.¹⁻³ The pathophysiology of tuberculous meningitis involves hematogenous dissemination of the bacillus from a primary pulmonary focus, followed by rupture of subependymal or subpial granulomas into the subarachnoid space.⁴ This rupture induces an intense immune response mediated by proinflammatory cytokines such as TNF- α , IFN- γ , and IL-1 β , resulting in basal pyogenic arachnoiditis, cerebral vasculitis, and tuberculoma formation.⁵⁻⁶ Clinically, tuberculous meningitis usually has an insidious onset, with nonspecific symptoms such as headache, fever, and altered mental status, progressively evolving toward focal neurological signs, seizures, and coma.⁷ Diagnosis remains challenging because of the low sensitivity of

conventional bacteriological tests performed on CSF and the need for molecular diagnostic techniques, such as Xpert MTB/RIF and nucleic acid amplification assays, to improve detection.⁸⁻⁹

Neuroimaging, particularly contrast-enhanced magnetic resonance imaging (MRI), is crucial for identifying suggestive findings such as basal meningeal enhancement, hydrocephalus, ischemic infarctions, and tuberculomas.¹⁰ Treatment should be initiated empirically when there is a high clinical suspicion and should include first-line antituberculosis drugs administered for at least 12 months, together with corticosteroids to mitigate inflammatory damage.¹¹⁻¹² Despite therapeutic advances, tuberculous meningitis remains associated with persistent neurological complications, particularly when treatment is not initiated promptly. Epidemiological surveillance, implementation of rapid diagnostic tools, and strengthening of healthcare systems are essential to reduce the burden of this devastating disease.¹³⁻¹⁴

Case report:-

A 19-year-old male student, born and residing in Jalpa, Tabasco, Mexico, with no relevant past medical history, presented with progressive neurological symptoms. He lived in his own home, constructed with durable materials and equipped with basic utilities, together with six other household members. His diet was considered inadequate in both quantity and quality. He reported daily personal hygiene and occasional alcohol consumption and denied tobacco and illicit drug use. Regarding his epidemiological history, the patient was malnourished, with a body weight of 31 kg. He denied known contact with confirmed tuberculosis cases or individuals with chronic cough. Human immunodeficiency virus (HIV) testing performed on March 27, 2025, was negative. His illness began in February 2025 with intermittent holocranial headache that initially resolved spontaneously or after administration of paracetamol.

On March 22, 2025, the patient developed severe headache accompanied by unquantified fever and sought medical attention. An unspecified treatment was prescribed, without clinical improvement. He subsequently presented to the General Hospital of Jalpa de Méndez, where he was evaluated and discharged with outpatient treatment. Four days after discharge, he returned because of worsening symptoms, including severe headache rated 10/10 and persistent fever. During this evaluation, he experienced a generalized tonic-clonic seizure and was transferred to General Hospital of Zone (HGZ) No. 46 in Villahermosa because of suspected subarachnoid hemorrhage. This diagnosis was subsequently ruled out during hospitalization. On March 26, 2025, the patient was transferred to HGZ No. 2-A for further diagnostic evaluation and management. During hospitalization, his neurological status progressively deteriorated. Neurological examination revealed positive Brudzinski and Babinski signs, with no additional seizures documented.

Brain magnetic resonance imaging (MRI) performed on April 3, 2025, revealed findings suggestive of an infectious process involving the central nervous system, with tuberculous meningitis and neurocysticercosis considered in the differential diagnosis. Based on these findings, treatment with albendazole and dexamethasone was initiated. On April 7, 2025, the Epidemiology Department was consulted and recommended cerebrospinal fluid (CSF) sampling for molecular testing with Xpert MTB/RIF because of the clinical suspicion of tuberculous meningitis. CSF analysis performed on April 9, 2025, revealed a clear appearance, pH 7.51, leukocyte count of 207 cells/ μ L, erythrocyte count of 5 cells/ μ L, glucose level of 62 mg/dL, chloride level of 103 mEq/L, total protein level of 0.20 g/L, and a differential leukocyte count comprising 50% polymorphonuclear cells and 50% mononuclear cells. Despite the initial therapeutic approach, the patient's neurological condition continued to deteriorate. On April 12, 2025, he was transferred to HGZ No. 46 in Villahermosa for evaluation by the Neurology Department. Cryptococcosis was considered as an alternative diagnosis, and treatment with fluconazole was initiated.

On April 15, 2025, the Epidemiology Department at HGZ No. 46 reported a positive CSF Xpert MTB/RIF result, confirming the presence of *Mycobacterium tuberculosis* and detecting rifampicin resistance. Based on these findings, the diagnosis of tuberculous meningitis with rifampicin resistance was established. Antituberculosis treatment under a directly observed treatment strategy (DOTS) was initiated on April 16, 2025. The intensive phase was planned for two months using a fixed-dose combination containing pyrazinamide 400 mg, ethambutol 300 mg, rifampicin 150 mg, and isoniazid 75 mg per tablet (Dotbal). Based on the patient's body weight of 31 kg, three tablets were administered orally once daily in the morning on an empty stomach, from Monday through Saturday.

Figures 1-4. Brain magnetic resonance imaging

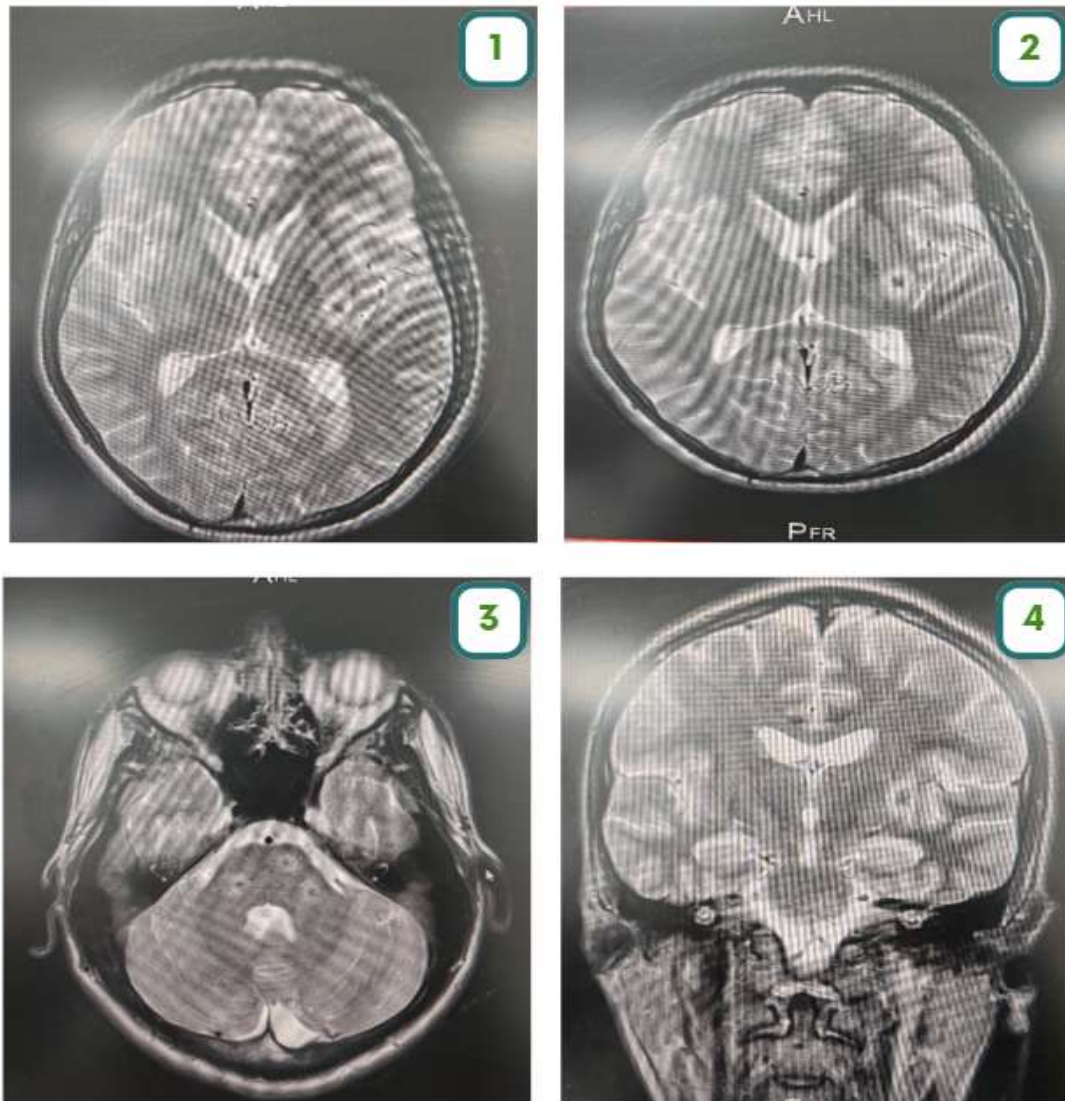


Figure 1–4. MRI: Multiple supra- and infratentorial nodular lesions with vasogenic edema and central hypointensity on T2-FLAIR sequences, associated with peripontine leptomeningeal enhancement and involvement of the interhemispheric fissure. These findings are suggestive of an infectious process and, based on the imaging characteristics described, may be consistent with tuberculosis or neurocysticercosis.

Table 1. Demographic and epidemiological characteristics and clinical timeline of the patient.

Sex		Male
Age		19 years
Residence		Jalpa de Méndez, Tabasco, Mexico
Marital status		Single
Occupation		High school student
Relevant medical history		None reported
Epidemiological history	BCG vaccination	Administered in 2006
	Housing	House constructed with durable materials and equipped with basic utilities, shared with six other household members.
	Exposure to tuberculosis	Denied known contact with confirmed tuberculosis cases or contact with individuals with chronic cough.
	HIV	HIV test (March 27, 2025): Negative.
	Weight / Height	31 kg / 1.58 m
February 2025 (Symptom onset)		Intermittent holocranial headache that resolved spontaneously or after administration of paracetamol.
March 22, 2025		Severe headache accompanied by unquantified fever. The patient sought medical attention and received unspecified treatment without clinical improvement. He subsequently presented to the General Hospital of Jalpa de Méndez and was discharged with outpatient treatment.
March 25, 2025		The patient returned to the General Hospital of Jalpa de Méndez with severe headache (VAS 10/10), fever, and a generalized tonic-clonic seizure. He was transferred to HGZ No. 46 in Villahermosa because of suspected subarachnoid hemorrhage, which was subsequently ruled out.
March 26, 2025		Transferred to HGZ No. 2-A in Cárdenas for further evaluation and management.
March 29, 2025		Positive Brudzinski and Babinski signs.
April 3, 2025		Brain MRI showed an infectious process; tuberculous meningitis versus neurocysticercosis was considered.
April 4, 2025		Treatment with albendazole and dexamethasone was initiated.
April 7, 2025		The Epidemiology Department was consulted and recommended cerebrospinal fluid (CSF) sampling for Xpert MTB/RIF testing to rule out tuberculous meningitis.
April 9, 2025		CSF: clear appearance; pH 7.51; leukocytes, 207 cells/ μ L; erythrocytes, 5 cells/ μ L; glucose, 62 mg/dL; chloride, 103 mEq/L; total protein, 0.20 g/L; polymorphonuclear cells, 50%; mononuclear cells, 50%.
April 12, 2025		Further neurological deterioration was observed.
April 13, 2025		The patient was transferred to HGZ No. 46 in Villahermosa for evaluation by the Neurology Department. Cryptococcosis was considered, and fluconazole treatment was initiated.
April 15, 2025		The Epidemiology Department reported a positive Xpert MTB/RIF result with rifampicin resistance, confirming the diagnosis of tuberculous meningitis.
April 16, 2025		Treatment with Dotbal was initiated as part of the intensive phase: three tablets administered in the morning, Monday through Saturday.

Discussion:-

Tuberculous meningitis is a severe manifestation of extrapulmonary tuberculosis that affects the central nervous system, particularly the meninges surrounding the brain and spinal cord. Despite its relatively low prevalence compared with pulmonary tuberculosis, tuberculous meningitis is among the most lethal forms of the disease and is associated with high rates of mortality and disability among survivors. It occurs predominantly in countries with a high burden of pulmonary tuberculosis and among immunocompromised individuals. The treatment of tuberculous meningitis requires an aggressive therapeutic approach and generally includes a combination of first-line antituberculosis drugs, such as rifampicin, isoniazid, pyrazinamide, and ethambutol, administered for a longer duration than that used for pulmonary tuberculosis. In addition, corticosteroids may be required to reduce inflammation and prevent further neurological damage. Strict adherence to treatment is essential to minimize the risk of drug resistance. Nevertheless, despite appropriate therapy, mortality remains considerable, and many survivors experience permanent neurological sequelae.

The present case highlights the diagnostic complexity of tuberculous meningitis because its initial manifestations may be nonspecific and may mimic other infectious or neurological diseases. In this patient, neurocysticercosis, cryptococcosis, and subarachnoid hemorrhage were initially considered as differential diagnoses. Progressive neurological deterioration and subsequent molecular testing of CSF ultimately led to confirmation of tuberculous meningitis. The detection of rifampicin resistance by Xpert MTB/RIF was particularly relevant because it indicated potential drug-resistant tuberculosis and emphasized the importance of rapid molecular diagnostic methods. Early identification of drug resistance is essential for selecting an appropriate therapeutic regimen and reducing the risk of treatment failure, disease progression, and further transmission.

Conclusion:-

Tuberculous meningitis remains a severe but treatable disease that requires a multidisciplinary approach to diagnosis and management. Early recognition and timely initiation of appropriate therapy can significantly improve survival and reduce the risk of permanent neurological sequelae; however, delays in diagnosis and treatment continue to represent a major clinical challenge. This case illustrates the importance of maintaining a high index of suspicion for tuberculous meningitis in patients presenting with progressive neurological manifestations, even in the absence of known contact with tuberculosis or HIV infection. Molecular diagnostic methods, particularly Xpert MTB/RIF testing of CSF, can play a key role in establishing an early diagnosis and simultaneously identifying rifampicin resistance. Addressing tuberculous meningitis requires not only appropriate clinical management but also an integrated public health approach involving epidemiological surveillance, timely diagnosis, adequate treatment, and interventions targeting the social and economic determinants that contribute to tuberculosis transmission.

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