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CASE REPORT

Hydrocephalus Caused by Tuberculous Meningitis in an Immunocompetent Young Adult: A Case Report

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Background: Despite improved medical management, meningeal tuberculosis mortality and other outcomes have changed slightly over time due to a delay in diagnosis and treatment. This study reports a rare case of tuberculous meningitis in an immunocompetent host, calling into question the commonly held belief that tuberculous meningitis is a disease of immunocompromised individuals.

Case Presentation: A 26-year-old male with no significant past medical history, tuberculosis, or indications of immunological compromise, was admitted to our hospital with a fever and altered mental status. He was drowsy, febrile (temperature of 38°C), had a heart rate of 110 beats per minute, and showed mild neck stiffness but no meningeal sign. A lumbar puncture on the third day of admission suggested tuberculous meningitis. He was treated for tuberculosis meningitis, and his condition slightly improved. However, the patient's condition suddenly worsened, and a repeat contrast computed tomography (CT) of the brain showed the development of ventriculomegaly and basilar enhancement. Insertion of an emergency ventriculoperitoneal shunt was performed; however, the patient died ten days after hospital admission.

Conclusion: We report a fatal case of tuberculous meningitis in an immunocompetent patient. Healthcare practitioners must be trained to identify and diagnose tuberculous meningitis promptly. Early treatment of tuberculous meningitis based on clinical diagnosis and symptoms improves clinical outcomes.

Keywords: immunocompetent, meningitis, tuberculosis

Background

In 2019, an estimated 10 million tuberculosis cases were reported globally. Of this, 1.2 million tuberculosis deaths were among human immunodeficiency virus (HIV)-negative individuals and 208,000 deaths associated with HIV-positive individuals.[1] Tuberculosis of the central nervous system (CNS), particularly tuberculous meningitis (TBM), is associated with high morbidity and mortality.[2]

Immunocompetent hosts have a small likelihood of being diagnosed with tuberculous meningitis. A few case reports and papers have discussed tuberculous meningitis in immunocompetent hosts in developing countries where the disease is endemic.[3,4] As a developing nation, Indonesia has the second-highest tuberculosis prevalence in the world.[1]

We report a challenging case of tuberculosis meningitis complicated with hydrocephalus in an immunocompetent young adult. This report focuses on the demanding aspect of prompt diagnosis and treatment.

Case Presentation

A male, 26 years old, was admitted to our hospital with a fever and altered mental status. He reported a 12-day history of fevers (38–39°C), headaches, photosensitivity, diplopia, and severe fatigue. His relatives stated that he was self-employed, a mild smoker, a non-drinker, and denied drug use. In the emergency department, he was drowsy, febrile (temperature of 38°C), and had a heart rate of 110 beats per minute. He denied having chest

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discomfort or heart palpitations. The emergency department's Glasgow coma scale score was 13. There was no evidence of rash, bruising, or petechiae. The examination of the patient's respiratory, cardiovascular, and abdominal systems was unremarkable. The neurological examination revealed mild neck stiffness but no meningeal sign.

Studies in the laboratory indicated the following: 5.8 x 10^9/L white blood cells, 11.2 g/L hemoglobin, 243 x 10^9/L platelets, 89.5% neutrophils, 3.1% lymphocytes, 126 mmol/L sodium, 4 mmol/L potassium, and 134 mg/dL glucose. Blood cultures did not detect any growth. A chest x-ray indicated no pathology or localized consolidation (Figure 1), and his brain's initial computed tomography (CT) scan was unremarkable (Figure 2). On the third day, the results of his lumbar puncture suggested tuberculous meningitis: clear appearance, increased white cell counts (40/L) with lymphocytes predominating, red blood cells (16/L), high protein (2.09 g/L), and low

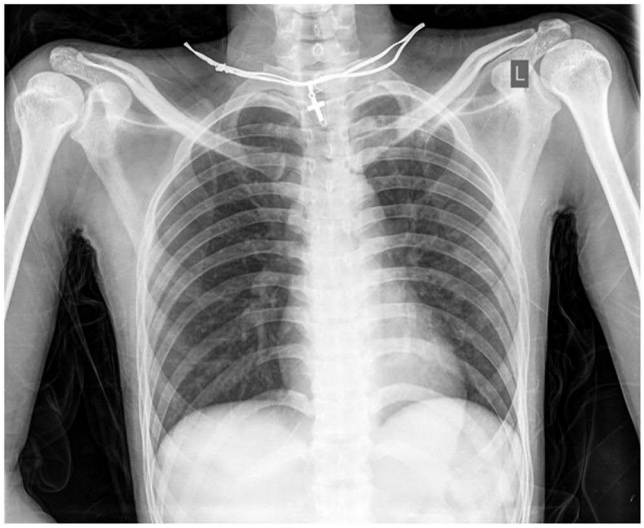

Figure 1 The patient's chest x-ray indicated no pathology or localized consolidation.

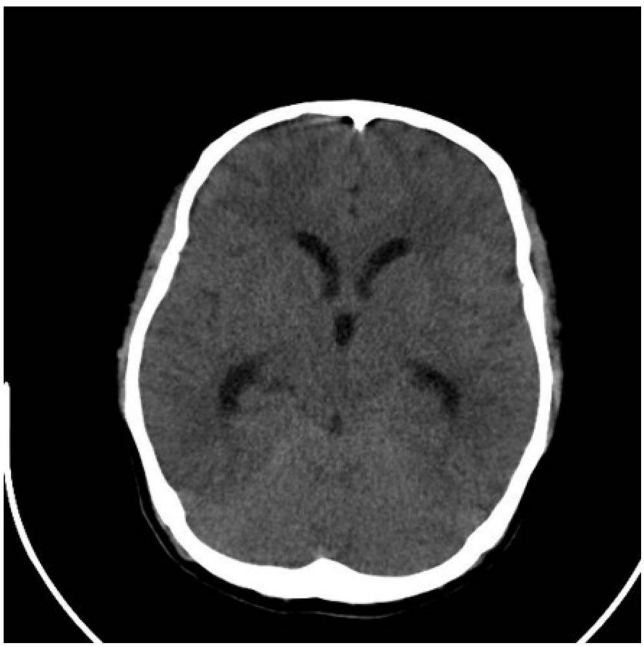

Figure 2 The initial computed tomography (CT) scan does not show any hydrocephalus and oedema.

glucose (40 mg/dL). The cerebral fluid to serum glucose ratio was less than 50%. Both were negative for cytomegalovirus (CMV), toxoplasmosis IgM, and human immunodeficiency virus (HIV) serology.

The patient was admitted to the hospital ward with meningitis and hyponatremia as his clinical diagnoses. He was initially administered 2 grams per day of ceftriaxone, 10 milligrams per day of dexamethasone injection, hypertonic saline, and paracetamol. The condition improved slightly on the second day. He was treated for tuberculosis meningitis with 10 milligrams per day of dexamethasone injection and a combination of levofloxacin infusion 750 milligrams per day and antitubercular drugs including isoniazid 300 milligrams, rifampin 600 milligrams, ethambutol 1,100 milligrams, pyrazinamide 1,200 milligrams, and pyridoxine 50 milligrams, based on the results of the lumbar puncture. The patient's condition was slightly improved, he was completely conscious, and he continued to suffer from a terrible headache and third nerve palsy. However, the patient's condition suddenly worsened considerably on day seven, manifesting as unconsciousness and seizures.

Eight days after admission, a repeat contrast CT of the brain showed the development of ventriculomegaly suggestive of obstructive hydrocephalus and basilar enhancement (Figure 3). There was an enlargement of the third, fourth, and lateral ventricles. His serum sodium levels decreased (124 mmol/L) over several days. Based on well-established case definition criteria of tuberculous meningitis research, the patient was diagnosed with probable tuberculous meningitis with a total score of 12, which includes clinical criteria (symptom duration of more than five days (4), cranial nerve palsy (1)), cerebrospinal fluid criteria (clear appearance (1), lymphocytic predominance (1), protein concentration greater than one g/L (1), absolute cerebrospinal fluid glucose concentration less than 2.2 mmol/L (1)), cerebral imaging criteria (hydrocephalus (1), basal meningeal enhancement (2)).[5] The patient was transferred to the intensive care unit (ICU) for the insertion of an emergency ventriculoperitoneal shunt. The possibility of complication after shunt insertion was observed. We did not identify complications such as infection, phlebitis, or an exposed shunt in the patient. The patient's condition worsened gradually, and he died ten days after hospital admission.

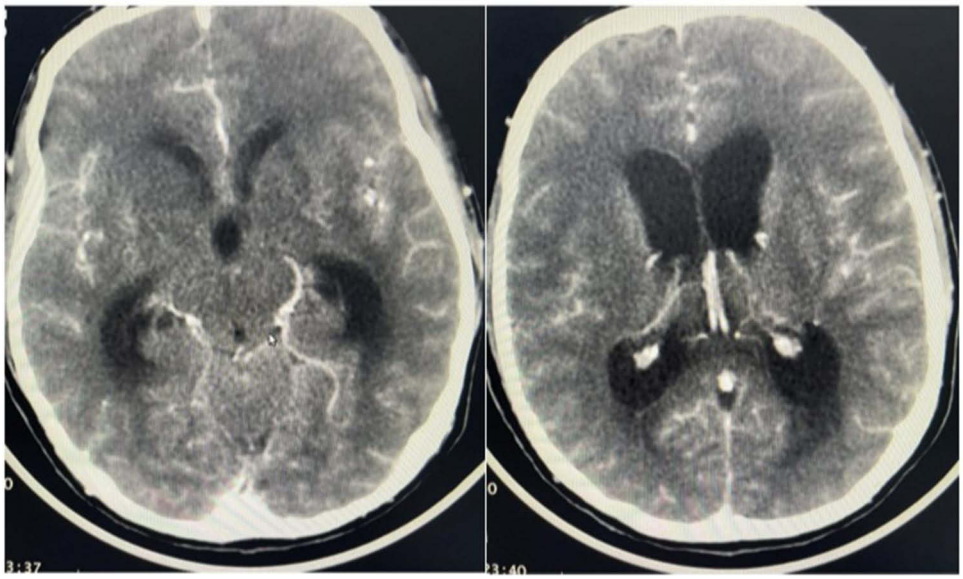

Figure 3 A repeat contrast CT of the brain showed enhancement in basal cistern and hydrocephalus.

Discussion

We report a case of tuberculous meningitis in an immunocompetent patient who was previously healthy. In this instance, the diagnosis of tuberculous meningitis is challenging. Previous studies have rarely reported tuberculous meningitis.[3,4] Our patient was classified as having stage two tuberculous meningitis based on his Glasgow coma score. The patient was categorized as stage two tuberculous meningitis if they had a Glasgow coma score of 14–10 with or without focal neurological deficit or 15 with focal neurological deficit.[6]

Without conclusive microbiologic confirmation, the diagnosis of tuberculous meningitis may rely solely on clinical and early cerebrospinal fluid findings. Several clinical features, including extended symptom duration (>6 days) and the occurrence of focal deficits, raise the likelihood of tuberculous meningitis.[7,8] The following cerebrospinal fluid findings are suggestive of tuberculous meningitis: Typically, the cell count varies from 0 to 1,500/mm3, the protein level is moderately increased, and the glucose level in cerebrospinal fluid is low; lymphocytic predominance is also typical.[9,10] A cerebrospinal fluid sample acid-fast smear has a low sensitivity of 20–40% and can require several weeks. However, a bacteriological diagnosis should be performed if drug resistance is suspected.[11]

Utilizing a contrast brain computed tomography (CT) scan or magnetic resonance imaging (MRI) will significantly assist in diagnosing tuberculous meningitis. On a brain CT scan, patients with tuberculous meningitis may have basal meningeal enhancement, prior infarcts, hydrocephalus, and tuberculoma.[12] In this report, the contrast enhancement in the basal cisterns was highly indicative of tuberculous meningitis.

In addition to the daily administration of isoniazid, rifampin, ethambutol, and pyrazinamide, we also administer levofloxacin as a combination therapy. Considering the excellent cerebrospinal fluid penetration and safety profiles of newer-generation fluoroquinolones, such as levofloxacin, fluoroquinolones appear to have promising prospects as part of first-line therapy for tuberculous meningitis. In a previous randomized, controlled trial for the treatment of tuberculosis, the addition of fluoroquinolones to the usual regimen improved anti-tuberculosis performance as evaluated by several clinical indicators.[13]

Patients with tuberculous meningitis frequently exhibit severe hyponatremia, a common finding in tuberculous meningitis affecting approximately 50% of patients. This discovery was initially attributed to "cerebral salt wasting syndrome".[14]

In this report, the patient's condition worsened due to hydrocephalus. Hydrocephalus is the most prevalent complication of tuberculous meningitis, mainly affecting young individuals.[15] Hydrocephalus is usually a late complication of tuberculous meningitis, as it is characterized by granulomatous inflammatory exudate obstructing cerebrospinal fluid flow.[9] Typically, it appears with signs of elevated intracranial pressure or can be visualized by imaging.[12] Furthermore, a dysregulated immune response is a major contributor to the morbidity and mortality resulting from tuberculous meningitis. The immunological response to *Mycobacterium tuberculosis* is mediated by macrophages, activated T-lymphocytes, activated natural killer cells, and their produced cytokines. Cytokines have been found to play a crucial function in the host's defense against *Mycobacterium tuberculosis* and in regulating inflammation. Cerebrospinal fluid cytokine tests in tuberculous meningitis patients have revealed higher levels of proinflammatory cytokines, such as interleukin (IL)-2, IL-4, IL-6, interferon γ, and tumor necrosis factor α.[16–19] There is evidence that adjunct corticosteroids decrease mortality following tuberculous meningitis, at least in the short term. Uncertainty surrounds the mechanism by which corticosteroids offer clinical benefit, but it is possible due to a diminution in intracerebral inflammation.[20]

This report describes a fatal case of tuberculous meningitis. Tuberculous meningitis is the most devastating form of extrapulmonary tuberculosis if left untreated. Even with standard anti-tuberculous treatment, the short-term mortality rate ranges from 20% to 69%.[21,22] The previous systematic review of 19 epidemiological studies involving 1,636 patients with tuberculous meningitis found a 19% mortality rate and a 54% risk of neurologic complications among survivors.[22] During hospitalization, mortality from tuberculous meningitis was highest among HIV-positive patients who were not getting antiretroviral therapy (ART) or were not adhering to ART at the time of diagnosis.[23]

Conclusion

We report a fatal case of tuberculous meningitis in an immunocompetent patient. Rapid progression of hydrocephalus necessitates a prompt diagnosis and treatment of its rapid deterioration. Enhancing the training and knowledge of healthcare professionals to identify and diagnose tuberculous meningitis at an earlier stage is crucial. Although bacteriological diagnosis is not yet confirmed at presentation, early treatment of tuberculous meningitis based on clinical diagnosis and symptoms is necessitated to improve clinical outcomes.

Data Sharing Statement

Data and materials are available upon request to the first author, Rizaldy Taslim Pinzon (drpinzon17@gmail.com).

Ethical Approval

Due to the nature of this case report, this study does not require ethical committee approval. The Bethesda Hospital Research and Development Department has granted permission for this investigation. In compliance with the Helsinki Declaration, the patient's identity was concealed.

Consent for Publication

The authors obtained the patient's written approval before publishing this case report.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors disclose that they have no competing interests.

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