



# Pediatric acute hydrocephalus developing after tubercular meningitis: a case report study

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**Background:** Tuberculosis ranks second as the most common cause of death among infectious diseases, preceded only by COVID-19, which can involve multiple organs. Tuberculous meningitis (TBM) is known to have serious and atypical complications affecting the central nervous system, especially in more vulnerable populations such as children and adolescents.

**Case presentation:** The 15-year-old female patient was admitted to the hospital with altered mental status after complaining of nausea, weakness, and cough for 3 weeks. A chest computed tomography (CT) scan showed cavitory lesions, a lumbar puncture sample had a glucose level of 15 mg/dl, and the brain CT scan revealed acute hydrocephalus. While the patient was treated with anti-tubercular medications, an external ventricular drain was placed and the patient was monitored.

**Conclusion:** This report presents acute hydrocephalus as a rare and atypical consequence of disseminated tubercular infection resulting in meningitis.

**Keyword:** acute hydrocephalus, meningitis, pediatric neurosurgery, tuberculous

## Background

Tuberculosis (TB) is a highly concerning disease that poses a significant threat to human health, particularly for children who possess more vulnerable immune systems. According to the World Health Organization (WHO), TB is the second most prevalent cause of death among infectious diseases, following closely behind COVID-19. Globally, it ranks as the 13th leading cause of death. Additionally, it is the primary cause of death for those living with HIV and contributes significantly to mortality rates related to antimicrobial resistance<sup>[1]</sup>. Worldwide, it is estimated that 1.6 million people died from TB, which is higher than both the numbers from 2019 and 2020. This includes ~217 000 child fatalities<sup>[2]</sup>. When *Mycobacterium tuberculosis* passes into the bloodstream, it has the potential to spread to multiple organs throughout the body<sup>[3]</sup>. Infection of the nervous system is one of the most disabling ones<sup>[4]</sup> and tuberculous meningitis (TBM) is the most destructive of TB in children and adolescents<sup>[5]</sup>. However, the diagnosis of TBM in pediatric patients is frequently delayed due to the presentation of atypical clinical features, resulting in elevated rates of morbidity and mortality rates<sup>[6]</sup>. In

## HIGHLIGHTS

- Tuberculosis (TB) is a significant health issue in endemic regions, particularly among more vulnerable populations such as children and adolescents.
- The Bacillus Calmette–Guerin (BCG) vaccine is the primary preventative measure against disseminated TB.
- One crucial complication of disseminated TB is the involvement of the central nervous system (CNS), specifically tubercular meningitis (TBM), which mainly affects unvaccinated individuals.
- Post-TBM hydrocephalus is a common complication in children and adolescents, which requires urgent treatment to prevent further complications.

this manner, the timely diagnosis and treatment of atypical presentations of TBM is important to prevent neurological complications such as stroke, seizure, paralysis, vision impairment, and hearing impairment<sup>[7]</sup>.

A prevalent complication in pediatric TBM cases is hydrocephalus, which can affect up to 85% of children diagnosed with the disease<sup>[8]</sup>. This condition can be classified as either communicative or obstructive, with the former being more frequently observed<sup>[9]</sup>. The principal underlying mechanisms of both pathways involve the inflammatory nature of the disease. Specifically, the inflammation of the choroid plexus results in excessive production of cerebrospinal fluid (CSF), while the accumulation of thick exudates blocks the subarachnoid spaces, resulting in the development of communicative hydrocephalus<sup>[10]</sup>.

Across the globe, the most significant method of prevention for children is the administration of the Bacillus Calmette–Guerin (BCG) vaccine, which has been reported to have an efficacy of up to 77% in certain studies<sup>[11]</sup>.

In this case study, we present the admission of a 15-year-old unvaccinated female to the hospital due to altered mental status.

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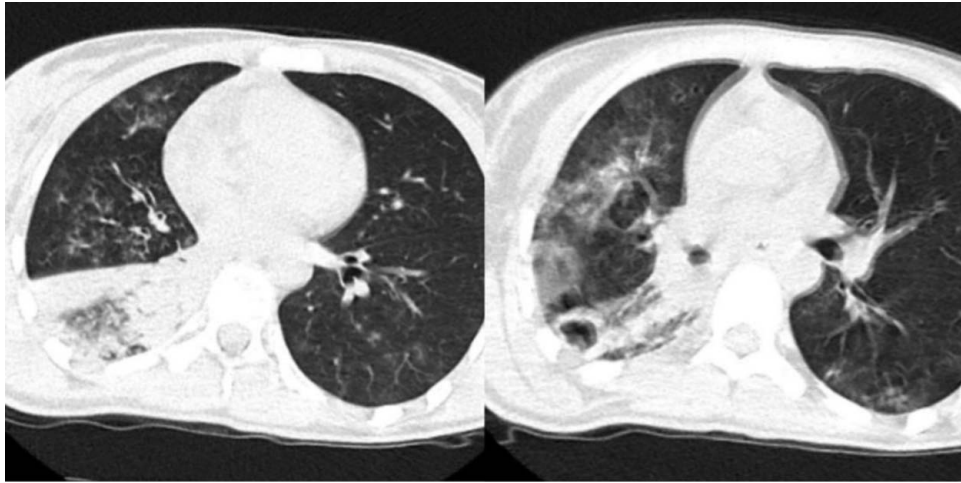
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**Figure 1.** Spiral chest computed tomography scan revealing cavitary lesions in the right lung.

Upon further examination, the patient was found to have a cavitary lesion in the lung, acute hydrocephalus, and a CSF sample that suggested a TB infection. This highlights the significance of vaccination in preventing such cases.

This report review has been done in accordance with general methods recommended by Consensus-based Clinical Case Reporting Guideline Development (CARE)<sup>[12]</sup>.

### Case presentation

A 15-year-old female, who originated from Afghanistan and recently migrated to Iran, was admitted to the emergency department due to severe headache, altered mental status, and urinary retention. According to her mother, the patient had experienced nausea, weakness, and cough for 3 weeks prior to her admission.

The patient had no pre-existing medical conditions and achieved all developmental milestones within expected norms. The BCG vaccination has not been administered. In regard to family history, the patient's mother tested positive for TB through a sputum sample and has been receiving treatment for the past 2 months. Upon admission, the patient was disoriented and uncooperative, scoring a 10 out of 15 on the Glasgow Coma Scale and was stuporous with a temperature of 38.9°C. During examination, a stiffness was noted in the neck area.

Preliminary examinations revealed a leukocyte count within normal limits. Levels of renal function, electrolytes, and liver function were also found to be within normal. The CSF sample revealed to have a glucose level of 15 mg/dl, protein level of 109.8 mg/dl, and LDH (lactate dehydrogenase) level of 443 unit/l.

The results of the spiral chest computed tomography (CT) scan showed the presence of a cavitary lesion in the right lung (Fig. 1), while the brain CT scan revealed four ventriculomegaly with CSF seepage and communicating hydrocephalus (Fig. 2).

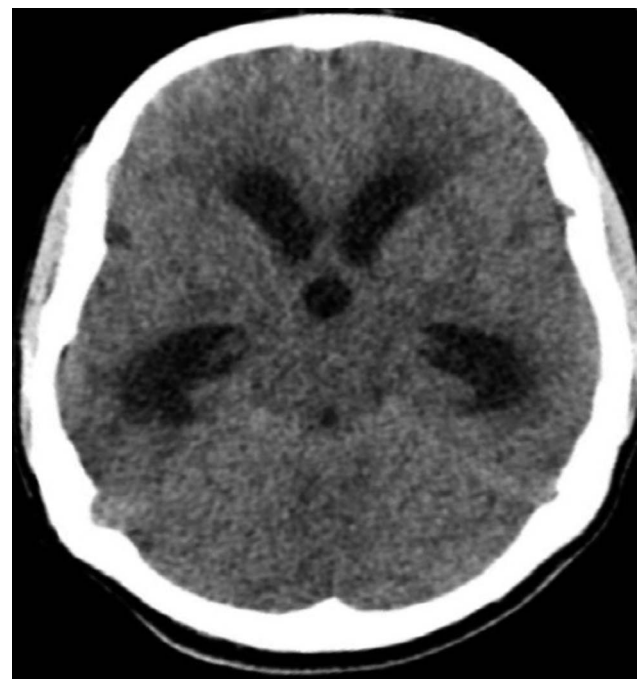
By the initial diagnosis of TB, the patient was prescribed a daily dosage of 600 mg of rifampin, 300 mg of isoniazid, and 1200 mg of pyrazinamide, along with 600 mg of amikacin, 400 mg of levofloxacin, 1200 mg of linezolid, combined with 25 mg of prednisolone.

On the second day of admission, the patient underwent a neurosurgical procedure to insert an external ventricular drain, which was eventually converted into a ventriculoperitoneal shunt (Fig. 3).

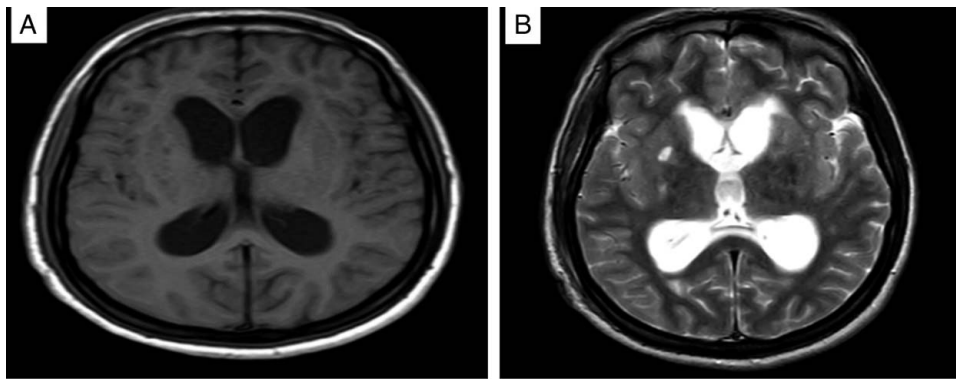
Two weeks post-surgery, the patient regained consciousness, demonstrated orientation, and was able to communicate.

### Discussion and conclusion

Disseminated TB and specially TB of the CNS is still considered a significant issue in the developing countries specifically in unvaccinated population<sup>[13]</sup>. Children, as a vulnerable group



**Figure 2.** Spiral brain computed tomography scan revealing ventriculomegaly with cerebrospinal fluid seepage.



**Figure 3.** Post-surgery magnetic resonance imaging: (A) T1 and (B) T2.

more susceptible to certain infectious diseases, are often different from adults in regard to the onset, clinical presentation, diagnosis, and treatment of TB. Infants and children infected with TB bacteria are susceptible to multi-organ involvement and subsequent hematogenous dissemination, leading to severe and potentially fatal forms such as tuberculous meningitis (TBM), a serious threat to the lives of children<sup>[14,15]</sup>.

In pediatric and adolescent patients with TBM, there may be atypical clinical manifestations, posing challenges in prompt diagnosis. Unfortunately, a significant number of these cases result in neurological complications, particularly hydrocephalus<sup>[16]</sup>.

Studies have shown that the BCG vaccine, implemented as the main and essential strategy for controlling the dissemination of TB since 1921<sup>[17]</sup>, is effective in reducing the prevalence of TB in vaccinated countries compared to those without mandatory vaccination, with a two to three times higher incidence of the disease<sup>[18]</sup>.

In numerous countries with high TB prevalence, the vaccination policy is compulsory. For example, in accordance with the Iranian policy on neonatal vaccinations, BCG is administered as a single dose to children under 6 years of age, usually shortly after birth or at initial contact with healthcare services<sup>[19]</sup>. The influx of immigration from neighboring countries has resulted in a rise in the number of unvaccinated individuals, consequently raising the likelihood of encountering and developing disseminated forms of TB.

Clinical manifestations and CSF examination are crucial components in the diagnosis of TBM. Elevated levels of protein and decreased glucose levels are characteristic findings in CSF analysis for TBM<sup>[20]</sup>. On the other hand, WHO recommends utilizing imaging techniques for the evaluation and diagnosis of TB<sup>[21]</sup>.

This study's presented case serves as a notable illustration of TBM, underscoring the significance of vaccination. Furthermore, it highlights the occurrence of atypical symptoms in various forms of TB among the pediatric and adolescent demographic. Additionally, it emphasizes the criticality of timely diagnosis and early treatment to mitigate potential long-term neurological complications that may arise from TB.

### Ethical approval

Firoozabadi Clinical Research Development Unit (FACRDU), Iran University of Medical Sciences, Tehran, Iran

### Consent

Written informed consent was obtained from the patient's parents/legal guardian for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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### Author contribution

M.K. and R.Z.: admitted the patient; Z.S., M.K., and R.Z.: planned the treatment; S.E.: gathered the data and wrote the draft; M.K. and S.E.: completed the manuscript. All authors finalized the manuscript and confirmed the final outcome.

### Conflicts of interest disclosure

There is no ethical problem (approved by the research ethics committee of Iran University of Medical Sciences) or conflict of interest in our research.

### Research registration unique identifying number (UIN)

Not applicable.

### Guarantor

Maryam Kachuei.

### Data availability statement

Not applicable.

### Provenance and peer review

The paper was not invited.

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