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Posterior fossa tuberculosis: Unusual presentations of a common disease and literature review☆

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ABSTRACT

The burden of tuberculosis is very high in our country and though the number of deaths due to tuberculosis has drastically reduced, still the associated morbidities caused by the disease can be very debilitating.[1] Central nervous system tuberculosis is a rare and serious presentation of tuberculosis, the general presentation being hydrocephalus, meningitis, and disseminated miliary lesions.[2] More often than not tuberculosis is associated with immunocompromised status and central nervous system tuberculosis in immunocompetent young individuals with no evidence of systemic tuberculosis is very rare.[3]Association of tuberculosis with ocular manifestations and even blindness is not uncommon, the causes of blindness being causes like uveitis, retinitis, interstitial keratitis, ophthalmitis, and even orbital tuberculosis.[4] Classical teaching in neurosurgery is that a posterior fossa lesion unless proven otherwise is a metastasis. Therefore, here we are discussing three cases of central nervous system tuberculosis in isolation, without any systemic involvement in immunocompetent adults in the posterior fossa region as well as a literature review of cases from across the globe of posterior fossa tuberculosis in immunocompetent adults. The first case is regarding a treatable cause like tuberculoma in an immunocompetent young adult causing blindness which is rare as well as unfortunate. The other two cases highlight the need to keep tuberculosis as a differential even when the clinical features, radiological features, and blood and other investigations are not suggestive.

1. Introduction

Tuberculosis is a great mimicker and most commonly presents as pulmonary disease however other organs can also be affected. 5–15 % of the cases are of extrapulmonary tuberculosis out of which central nervous system (CNS) tuberculosis accounts for 1% of cases.[1–5] The risk factors for developing CNS tuberculosis are pediatric age group, immunocompromised individuals either due to immunosuppressive drugs or HIV co-infection, malnutrition, and malignancy.[6] The common presentation of CNS tuberculosis is tuberculous meningitis, followed by tuberculomas, other pathological findings are cerebral abscess, cerebral miliary tuberculosis, tuberculous encephalopathy, tuberculous encephalitis, and arteritis.[7] Since the infratentorial tuberculomas behave as any other space-occupying lesion in the brainstem and cerebellum with respect to the signs and symptoms, it is difficult to diagnose especially in the absence of associated systemic symptoms or pulmonary symptoms of tuberculosis.[8] The diagnosis of central nervous system tuberculosis becomes very challenging, as apart from the symptoms which can mimic a plethora of conditions, the cerebrospinal fluid and other tests yield very little evidence towards a diagnosis and a tissue diagnosis becomes mandatory.[9,10] (see Table 1, Figs. 1–8)

2. Case reports

2.1. Case 1

A 19-year-old male presented to our department with complaints of headache for 4 years, walking difficulty for 3 years with complete loss of vision for 2 years in the right eye, the headache had worsened over the past 1 week and was associated with vomiting for the past 2 days.

On examination, the patient was drowsy, and cerebellar signs were positive with no evidence of cranial nerve involvement, pyramidal tract involvement, or signs of meningitis. On fundoscopic examination, bilateral papilledema was noticed. Vitals were stable with a pulse of 86/min and a blood pressure of 140/90 mm of mercury. The patient was seronegative and the total blood count was 11,000 mm^3, 60%

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Table 1
Review of literature concerning posterior fossa tuberculoma in immunocompetent adults.

Age/sex	Symptoms	Pulm.Tb	Investigations	Site	Hcp	Treatment	outcome
49/F	Headache Gait imbalance Cerebellar signs	No	Normal	Left cerebellar	_	Excision ATT 8 months	good
16/F	Headache Gait imbalance	No	ESR: high CSF: lymphocytosis	Right cerebellar	+	No details	good
28/M	Headache Gait imbalance Vomiting Visual disturbance	No	ESR: high CSF: lymphocytosis	NA	NA	NA	good
42/F	Headache Vomiting convulsion	No	Normal	NA	_	Excision ATT 9 months	good
35/F	Headache Ptosis	No	Normal	Bilateral cerebellar	_	Excision ATT 15 months	Good
34/F	Headache Neck pain Vomiting	No	Normal	Right cerebellar	+	Excision Ventriculostomy ATT on going	good
20/F	Fever Headache Vomiting	Yes	ESR: high	NA	NA	ATT 12 months	good
45/M	Headache Photophobia	No	Normal	NA	NA	Excision ATT 12 months	Good
59/M	Headache Gait imbalance Vomiting	No	NPCR + ve	+	+	ATT 24 months	good

Abbreviations Pulm: pulmonary; Tb: tuberculosis; hcp: hydrocephalus; ATT: anti tubercular treatment; ESR: erythrocyte sedimentation rate; NPCR; nested polymerase chain reaction; NA: not available.

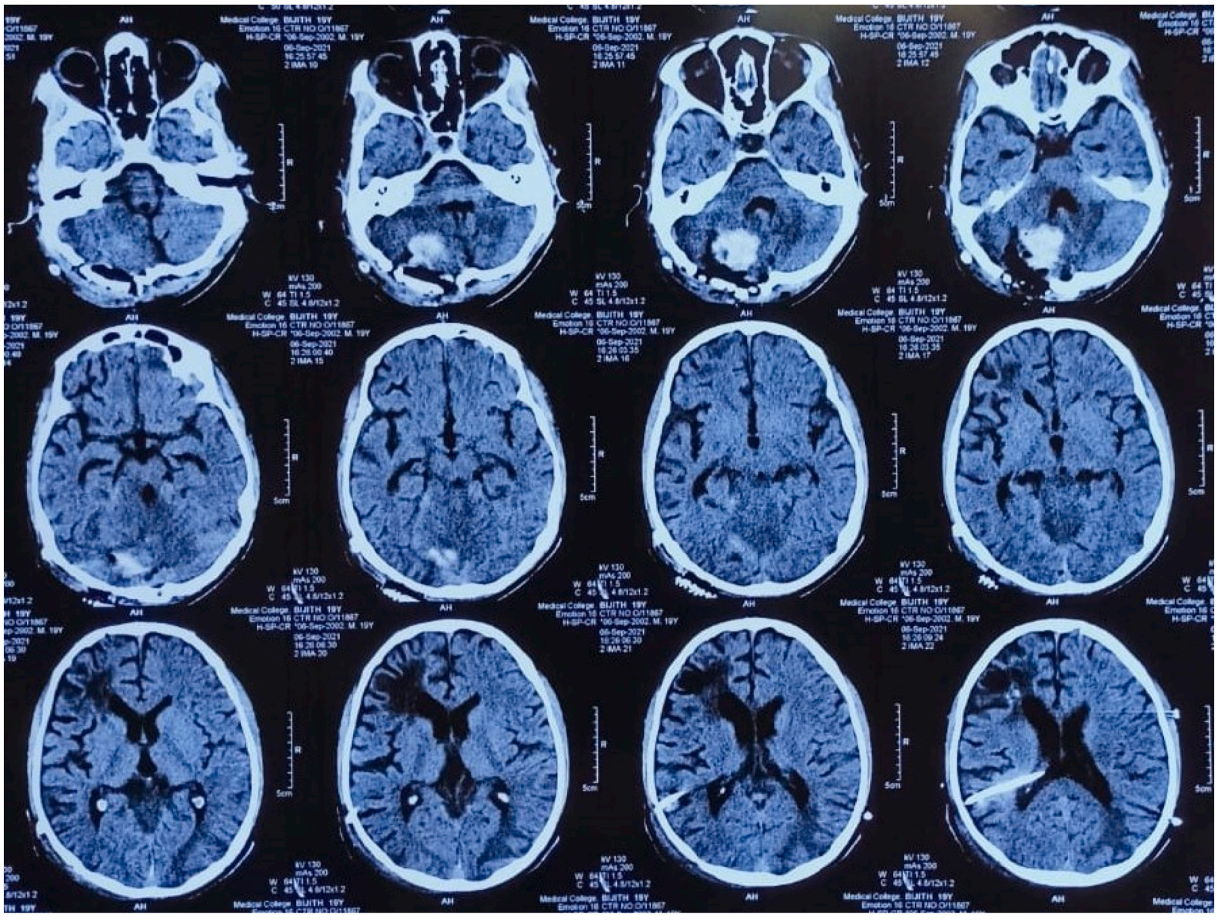

Fig. 1. non contrast enhanced computed tomography of brain, post ventriculoperitoneal shunt and craniotomy and excision of right cerebellar tuberculoma, occipital lesion and ventriculoperitoneal shunt in the right lateral ventricle.

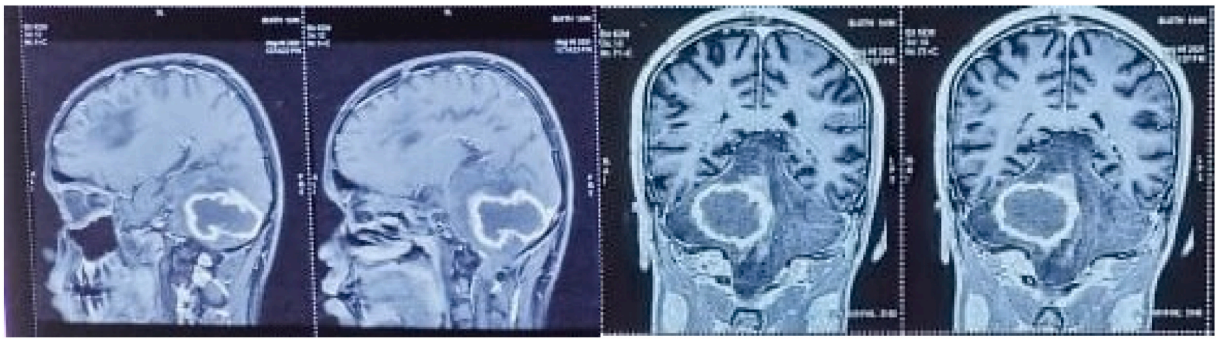

Fig. 2. contrast enhanced magnetic resonance imaging of brain showing a ring enhancing lesion in the right cerebellum.

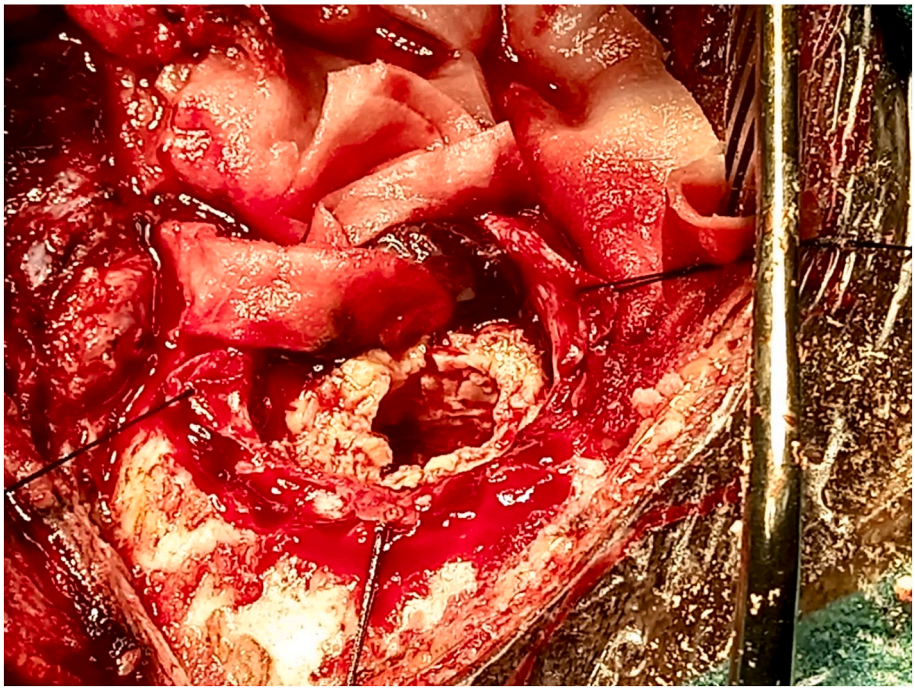

Fig. 3. intraoperative picture showing the rubbery, minimally vascular, flaky lesion suggestive of a tuberculoma.

neutrophils, and 40% lymphocytes. Haemoglobin was 13.1 gm/dl and ESR was 40 at the end of 1 h.

Computed tomography was done which showed a 4.3 × 3.9 cm lesion on the right cerebellum associated with perilesional edema, mass effect, and dilatation of the ventricles suggestive of obstructive hydrocephalus.

The patient underwent emergency ventriculoperitoneal shunt insertion and was planned for excision of the cerebellar mass after further evaluation. CSF studies showed mild pleocytosis with no evidence of tuberculosis. Further studies were done and an MRI brain was taken which corroborated the findings of the CT. Evaluation of vision showed complete and permanent loss of vision in the right eye.

The patient underwent right suboccipital craniotomy and excision of the right cerebellar. The lesion was firm to rubbery with the thick fibrous wall, minimally vascular with flakes. Near total excision of the lesion was done with good hemostasis. Specimen sent for frozen section showed granulomatous caseating lesion. Histopathology showed brain tissue with extensive areas of caseous necrosis, focal granulomatous inflammation composed of epithelioid cells, Langerhan's and foreign body giant cells and lymphocytes and CBNAAT showed the presence of tuberculosis which was sensitive to rifampicin. The patient was started on antitubercular drugs along with steroids. Post post-operative period was uneventful and the patient showed good response to the antitubercular drugs however the vision showed no improvement whatsoever. The patient tolerated the antitubercular drugs well and was on follow-up for 2 months following which the patient was subsequently lost to follow-up.

2.2. Case 2

A 47-year-old male patient presented to our outpatient department with complaints of headache, projectile vomiting, and slurring of speech for 5 days.

On examination patient was conscious and obeying with no associated weakness of upper or lower limbs, signs of meningitis, or cranial nerve involvement. Fundoscopy showed no evidence of papilledema. Vitals were stable with a pulse of 80/minute and blood pressure of 110/70 mm of mercury. Total leucocyte counts were 12,000 mm^3, ESR of 38 at the end of 1 h, Hb of 14 gm/dl, and seronegative. The patient underwent radiological evaluation and on MRI, was found to have an ill-defined irregular margined enhancing lesion involving the dura of left parietooccipital convexity and left portion of tentorium cerebelli, suggestive of an atypical meningioma, differential diagnosis of metastasis and neoplastic lesion being less likely.

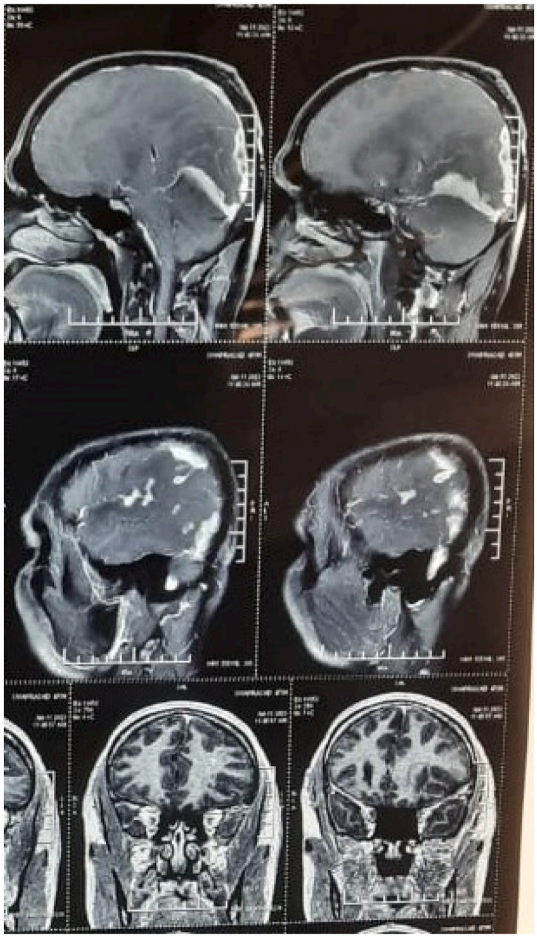

Fig. 4. are the magnetic resonance imaging of the brain showing an irregular ill-defined lesion involving the temporoparietooccipital lesion involving the tentorium cerebelli and dura with significant mass effect and edema.

The patient was prepared for surgery and underwent a left frontoparietal decompressive craniectomy and a biopsy was taken from the lesion. Along with a histopathology examination, it was also sent for CBNAAT which showed the presence of tuberculosis, sensitive to rifampicin. A histopathology report was awaited and the patient was started on antitubercular drugs. The patient showed a good response to the drug and was discharged after suture removal with advice to follow up.

2.3. Case 3

A 38-year-old male, presented to us with complaints of headache, vomiting, swaying towards his left side, and slurring of speech for 10 days. He was a known case of chronic pancreatitis and was newly diagnosed with diabetes mellitus.

On examination, the patient was conscious and oriented, and vitals were stable with a pulse of 66/minute and blood pressure of 110/70 mm of mercury over the right brachial artery. There were no signs of meningitis or raised intracranial pressure. Cerebellar signs were positive with a wide-based gait and past pointing on the left side. Blood investigations showed a total leucocyte count of 11,500 cm^3, hemoglobin of 12.5 gm %, and ESR of 45 mm at the end of 1-h, and viral markers were negative. Radiological evaluation showed a well-defined lesion in the left posterior fossa with contrast uptake and ring-enhancing lesion.

The patient underwent a craniotomy and excision and the lesion was found to be adherent to the left tentorium cerebelli and was moderately vascular and rubbery. Flakes were present with a centralized area of necrosis. On suspicion of tuberculosis, histopathology and CBNAAT for tuberculosis were sent which came back positive with sensitivity to Rifampicin. The patient was started on antitubercular drugs but unfortunately patient succumbed to postoperative cardiac events.

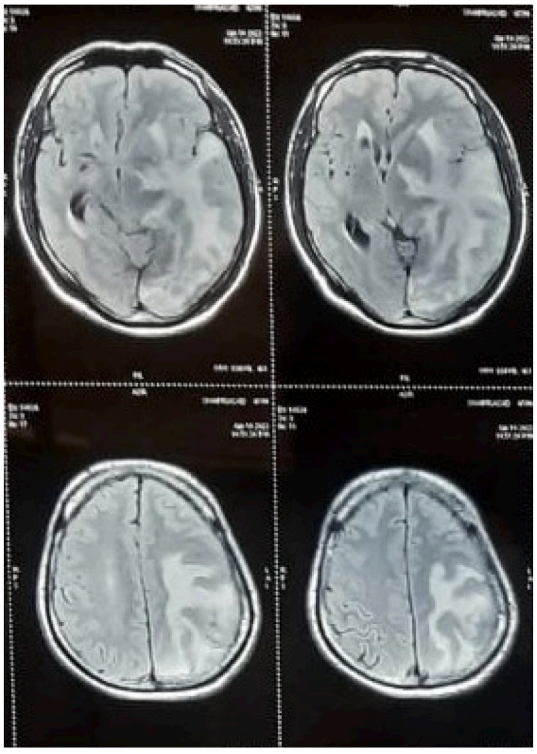

Fig. 5. are the magnetic resonance imaging of brain showing an irregular ill-defined lesion involving the temporoparietooccipital lesion involving the tentorium cerebelli and dura with significant mass effect and edema.

3. Discussion

Tuberculosis is caused by *Mycobacterium Tuberculosis* and generally affects the lung, extrapulmonary tuberculosis being less common and CNS tuberculosis is even rarer.[11] The Portal of entry of *Mycobacterium tuberculosis* in the central nervous system can be either through direct infection of endothelial cells or by the infected phagocytes followed by the formation of tubercules in either the cortex or the meninges. Tubercules that rupture into the adjacent subarachnoid space cause meningitis whereas the unruptured tubercules progress and enlarge to form tuberculomas.[12] Tuberculomas in the cerebellum in the absence of any pulmonary or disseminated tuberculosis are rare. Solitary lesions are uncommon however multiple tuberculomas may be present. Tuberculomas of the brain show a typical granulomatous reaction consisting of epithelioid cells and giant cells mixed with predominantly lymphocytes around a central area of caseating necrosis. Liquefaction of the central area of necrosis contains clear or straw-colored fluid.[13] Tuberculomas in the brain usually occur in the cerebral hemispheres, especially in the frontoparietal region and basal ganglia. They are usually supratentorial in adults and infratentorial in children.[14,15] Owing to its location, symptoms, signs, and radiological imaging, several other diseases that can produce a similar picture are malignancies like glioma or lymphoma, pyogenic abscess, toxoplasmosis, neurocysticercosis, sarcoidosis, and hydatidosis. [16–18]

Cerebrospinal fluid studies in central nervous system tuberculosis show a moderate lymphocytic pleocytosis, moderately elevated protein levels, and hypoglycorrachia which can be found in many other infectious as well as non-infectious conditions affecting the central nervous system. Some cases have also shown a normal cerebrospinal fluid study.

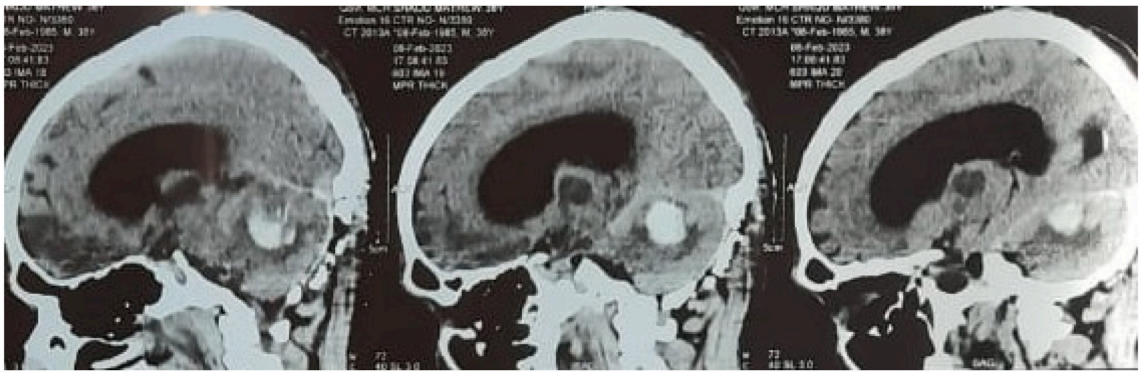

Fig. 6. are the magnetic resonance imaging of the brain showing a well-defined lesion in the posterior fossa, on the left side with contrast uptake and ring enhancement of the wall.

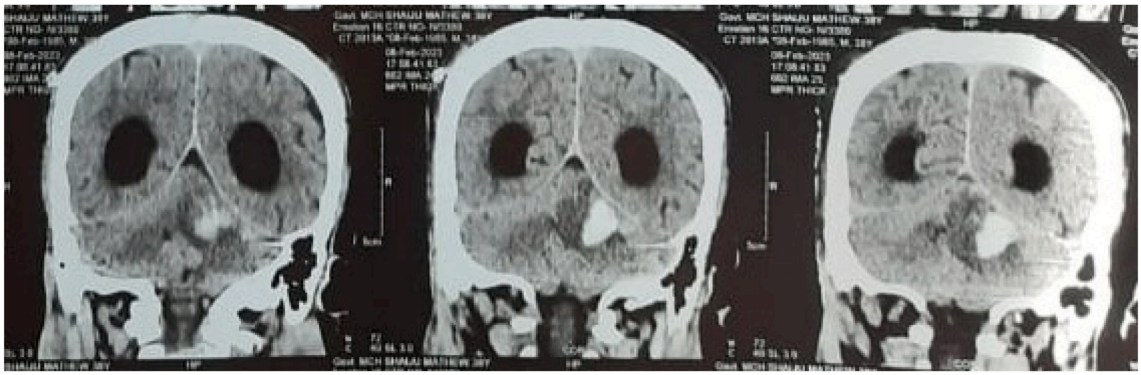

Fig. 7. are the magnetic resonance imaging of brain showing a well-defined lesion in the posterior fossa, on the left side with contrast uptake and ring enhancement of the wall.

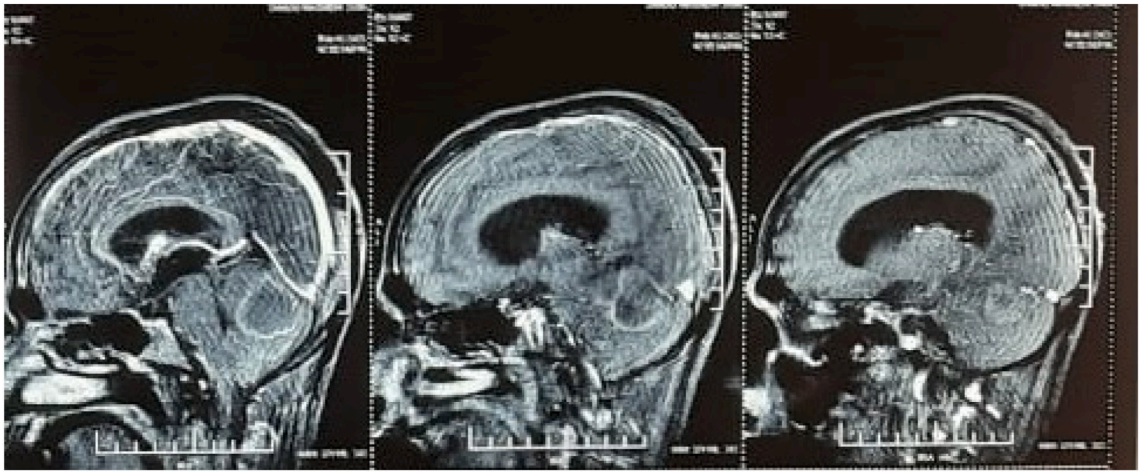

Fig. 8. are the magnetic resonance imaging of the brain showing a well-defined lesion in the posterior fossa, on the left side with contrast uptake and ring enhancement of the wall.

Therefore, cerebrospinal fluid studies cannot be reliably used to rule out the diagnosis of tuberculosis.[19–21]

Radiological examination includes computed tomography and magnetic resonance imaging, both of which do not have any pathognomic features of central nervous system tuberculosis. Tuberculomas are defined as low- or high-density, round or lobulated masses with irregular walls showing homogenous or ring-type contrast enhancement. Occurring as solitary or multiple nodules they are typically found in the frontal and parietal lobes.[22,23]

Molecular and biochemical tests are available which include nucleic acid amplification (NAA), PCR-based studies, antibody detection, antigen detection, or chemical assays such as adenosine deaminase (ADA) and tuberculostearic acid measurement. CBNAAT is cartridge-based nucleic acid amplification test, using either body fluids or tissue samples. Tissue samples are ground with saline and processed which takes approximately 2 h following which the presence of tuberculosis along with sensitivity or resistance to rifampicin can be detected, Rifampicin being the mainstay of the antitubercular regimen.[24] Xpert MTB/RIF is a

qualitative, nested real-time polymerase chain reaction in vitro diagnostic or detection for mycobacterium tuberculosis complex DNA from the prepared tissue sample. The Xpert MTB/RIFAssay also detects rifampicin resistance-associated mutations of the rpoB gene.[25,26] This is an easily available, cost-effective as well and very reliable test, the significance of which cannot be overstated. However, its value as a screening test is limited as the bacilli present in the cerebrospinal fluid is very low as well as the presence of amplification inhibitors in the cerebrospinal fluid.[27]

These things make the diagnosis of central nervous system tuberculosis challenging as there are no specific and non-invasive tests that can be reliably used as there are no pathognomic signs on either radiological or cerebrospinal fluid studies. The low yield in cerebrospinal fluid makes the molecular and biochemical tests difficult for screening central nervous system tuberculosis. Hence the importance of tissue biopsy.[28]

Tuberculosis is rightly called the great mimicker as we can see in the above three cases that the patients were young immunocompetent patients with no history of tuberculosis, exposure to tuberculosis, or evidence of disseminated tuberculosis. Two out of these three cases were of infratentorial tuberculomas, which are a very rare presentation in adults, more so in immunocompetent individuals. The usual site is supratentorial and clinically more meningitic features. Clinical, radiological, and blood investigations were not pinpointing at a diagnosis of central nervous system tuberculosis. However, an intraoperative suspicion of tuberculosis and performing a CBNAAT test for tuberculosis yielded a very benign and easily treatable diagnosis of central nervous tuberculosis which could have been not detected otherwise except for the histopathological diagnosis. Prompt treatment could be started with easily available drugs preventing further comorbidities or complications. Hence in an endemic country like ours, it is pertinent to rule out tuberculosis in even the most unsuspecting cases like the ones we have discussed. CSF studies and other blood investigations could be inconclusive as well as the radiological imaging. The role of CBNAAT cannot be stressed more in the diagnosis and prompt treatment of such a benign yet potentially dangerous disease.

A literature review was done of reported cases of posterior fossa tuberculosis in immunocompetent adults.[29–35] Interesting findings were noted. We found 9 cases in the literature, 6 patients out of the 9 were females. Headache followed by gait disturbance and cerebellar signs were the most common clinical symptoms and signs. Fever was seen in only one patient who also had concomitant pulmonary tuberculosis. In most of the patients, the blood and CSF investigations were normal except in three patients where ESR was elevated, and CSF showed lymphocytosis. Out of these three patients, one had concomitant pulmonary tuberculosis with elevated ESR. Hydrocephalus was seen in three patients. Most of the patients underwent excision with ATT ranging from 8 months duration to 24 months and had good outcomes on immediate as well as long-term neurological follow up. One patient was diagnosed with cerebellar tuberculosis based on nested PCR whereas others were diagnosed based on the biopsy findings.

Headache without fever or any infective symptoms was the most common presentation without any correlation with the presence of hydrocephalus, which could be an important factor to keep in mind while diagnosing cerebellar tuberculosis from other forms of CNS TB where meningitic signs are important giveaway clue. Excision remains the mainstay of treatment for treating as well as diagnostic reasons since CSF, blood investigations failed to give any diagnostic pointers. Ventriculoperitoneal shunt or other CSF diversion procedures were not needed before or after the excision as the excision sufficed for all the patients. Radiological evidence is supportive but not definitive to start the ATT regimen.

A study reported from China by Ning Guo et al[36] discussed posterior fossa tuberculosis in 11 patients. Microscopy for AFB and CSF cultures were negative for all the patients whereas N-PCR for MTB DNA was positive in repeated tests. Surgical intervention is not mentioned however all the patients had ATT and showed good responses to that.

4. Conclusion

Our three cases unfortunately highlight the late presentation of a very rare yet very treatable disease as well as an unusual presentation of central nervous system tuberculosis not to forget the importance of a CBNAAT test of the tissue sample, even in patients with low suspicion of tuberculosis. Hence the diagnosis of tuberculosis should be kept in mind even when dealing with a young immunocompetent patient with no history of contact with tuberculosis or history or symptoms of systemic tuberculosis even when the diagnosis of tumors of other lesions seems more favorable and CBNAAT of the intraoperative sample should be sent for routinely so that a simple diagnosis of tuberculosis should not be missed out.

According to the literature review, almost all the patients showed good outcomes after the treatment reiterating the necessity of an early diagnosis and prompt treatment to prevent any debilitating sequelae of a treatable disease.

Nested PCR for MTB DNA seems like a promising diagnostic tool and needs further studies to affirm its specificity and sensitivity, which should be pursued owing to ease as it requires a CSF sample which is minimally invasive as compared to an excision biopsy.

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CRediT authorship contribution statement

Nandita Kujur: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Satheesh Chandra Sugatha Rao:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Bijukrishnan Rajagopalawarrier:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Abbreviations

CNS	central nervous system
MRI	Magnetic resonance imaging
CT	Computed Tomography
CSF	Cerebrospinal fluid
CBNAAT	Cartridge-based nucleic acid amplification testing
NAA	Nucleic Acid Amplification
MTB	Mycobacterium Tuberculosis
Pulm Tb	Pulmonary tuberculosis
Hcp	hydrocephalus
ATT	anti tubercular treatment
ESR	erythrocyte sedimentation rate
NPCR	nested polymerase chain reaction
NA	not available

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