Multiple Parameter MRI Findings of Cerebral Tubercular Abscess: A Case Report

Shrestha Sukriti1, Zeng Daobing1, Li Zhu1, Xinxiang Zhao1* and Yang Wang2
1Department of Radiology, The Second Affiliated Hospital of Kunming Medical University, P.R China
2Department of Pathology, The Second Affiliated Hospital of Kunming Medical University, P.R China

Abstract

Tubercular cerebral abscess (TBA) is an extremely rare entity. Although tuberculosis is a common infectious disease occurring worldwide, with meningitis and tuberculoma being the commonest CNS manifestations, TBA, has been infrequently described in the literature and its MRI features have also been rarely reported. Its clinical and radiological features may simulate other infectious and noninfectious neurological diseases and cystic tumors. Hence, it is essential for every radiologist to be familiar with the imaging presentations of various forms of CNS tuberculosis for timely diagnosis and treatment, thereby reducing the morbidity and mortality of this disease. Here, we report to you a case of tubercular cerebral abscess of a 60-year-old male who presented with headache and seizures for one month with no history of pulmonary tuberculosis and negative HIV serology. We further discuss about the MRI, DWI and MR spectroscopy findings of this disease and compare with other cases reported in the literature.

Keywords: Tubercular brain abscess; Magnetic resonance imaging; Diffusion weighted imaging; Magnetic resonance spectroscopy

Abbreviations: TBA: Tubercular Abscess; MRI: Magnetic Resonance Imaging; CNS: Central Nervous System; FLAIR: Fluid-Attenuated Inversion Recovery; BP: Blood Pressure; RR: Respiratory Rate; ELISA: Enzyme-linked Immunosorbent Assay; PCR: Polymerase Chain Reaction; HIV: Human Immunodeficiency Virus; MRS: Magnetic Resonance Spectroscopy; RBC: Red Blood Cells; HCT: Hematocrit; DWI: Diffusion Weighted Imaging; TB: Tuberculosis; NAA: N-acetyl aspartate; Cho: Choline; MDR-TB: Multidrug Resistance Tuberculosis; ADC: Apparent Diffusion Coefficient; CSF: Cerebrospinal Fluid

Case Report

Clinical history

A 60-year-old man, with no significant history of past medical illness presented to our hospital with complaints of recurrent headache and seizures for one month. During the seizure episode, he experienced abnormal movement of limbs lasting for one minute, with headache and confusion in the post-ictal phase. He had history of smoking of 30 pack years. There is no history of alcohol intake. No history of pulmonary tuberculosis. No history of weight loss. On examination, he was non-febrile with normal blood pressure and respiratory rate. There was no papilledema and nuchal rigidity. Babinski sign, Kernig’s sign and Brudzinski’s sign were all negative. There was no gross neurological deficit. His RBC (4.17 × 109/L) and HCT (0.394 L/L) level were on lower side, whereas other routine full blood count with differentials, liver function and renal function tests were all normal. HIV serology was negative. Preoperative cranial MRI found solitary ring-enhancing lesion with marked edema and was diagnosed as metastasis. After admission, surgical resection of left frontal lobe was performed. However, biopsy and histopathological report of the specimen and culture of the pus confirmed presence of Mycobacterium tuberculosis.

Radiological findings

The MRI (Magnetic Resonance Imaging) scan of the head on T1WI showed isointensity. There was no restricted diffusion in DWI (Figures 4 and 5). After gadolinium contrast, a smooth and homogeneous ring enhancement was seen with no enhancement in other brain parenchyma (Figure 6). The ventricular system was symmetrical and no midline shift. Proton single voxel MRS showed marked lipid and lactate peaks at the center of the lesion. The Cho/NAA ratio was 0.167, NAA/Cr was showed isointensity. There was no restricted diffusion in DWI (Figures 4 and 5). After gadolinium contrast, a smooth and homogeneous ring enhancement was seen with no enhancement in other brain parenchyma (Figure 6). The ventricular system was symmetrical and no midline shift. Proton single voxel MRS showed marked lipid and lactate peaks at the center of the lesion. The Cho/NAA ratio was 0.167, NAA/Cr was

Figure 1: T1-weighted axial MRI showing an oval, well encapsulated hypo intense mass in the left frontal lobe.

Figure 2: T2-weighted axial MRI showing the hyperintense mass lesion with hypo intense rim and surrounding oedema in the left frontal lobe.
Background

Tuberculosis is among the top 10 causes of death worldwide. According to the recent WHO data, in 2015, 10.4 million people fell ill...
with TB and 1.8 million died from the disease (including 0.4 million people with HIV). Six countries were included in the list, with India leading and followed by Indonesia, China, Nigeria, Pakistan and South Africa. Almost one-third of the people with HIV were infected with TB bacteria in 2015 globally [1,2]. CNS TB present with high rate of morbidity and mortality and in nearly 1% of individuals with TB, CNS is involved which includes meningitis, tuberculomas, abscess or other manifestations. TB abscess occur more frequently (20%) in HIV infected persons compared to 4% to 7.5% of HIV negative patients with CNS TB [2,3]. Infection of the CNS with Mycobacterium tuberculosis is almost always secondary to a primary focus, the most common being pulmonary. The common manifestations of CNS TB are meningitis and tuberculoma. Tubercular abscess is a rare form of CNS TB occurring in only 4.8% of patients with CNS TB. These lesions occur mostly supratentorially although there are few cases reported to be found in the cerebellum [3-5]. They are associated mainly with immunocompromised individuals but occur in immunocompetent individuals as well. Here, we describe a case of central nervous system tuberculosis manifesting as brain abscess in a 60-year-old male without HIV infection and pulmonary TB.

Discussion

According to the recent WHO data, in 2015, 1.8 million died from TB. It is a leading killer of HIV-positive people (35%). An estimated 49 million lives were saved through TB diagnosis and treatment between 2000 and 2015 [1]. Despite tuberculosis (TB) being a very common infectious disease, with largest number of new TB cases (61%) occurring in Asia in 2015, tubercular cerebral abscess remains a rare entity and occasionally described in the literature [1,2].

The criteria proposed by Whitener [6] based on a review of 57 cases in world literature, has been used for identifying the tuberculous brain abscess cases which includes: 1) macroscopic evidence of abscess with central pus, 2) abscess wall composed predominantly of vascular granulation tissue containing acute and chronic inflammatory cells and 3) evidence of presence of tubercle bacilli demonstrated on culture or by positive acid-fast stain. Our patient fulfilled all the three enlisted criteria.

The source of tuberculous brain abscess is hematogenous dissemination from a primary source, frequently from the lungs. It can also occur via spread of tuberculous foci from meninges to the brain parenchyma or from tuberculous granuloma. The most frequent clinical manifestations include headache, seizures, altered consciousness, fever, paresis, focal neurological deficits [7]. It is commonly seen in immunocompromised patients, mainly AIDS and patients with history of pulmonary TB. Our patient was neither HIV serology positive nor had history of pulmonary TB or other forms of TB.

Magnetic resonance imaging with gadolinium enhancement is the preferred method of initial investigation as it is the most sensitive test for detecting the leptomeningeal disease and parenchymal abnormalities. It is a multiplanar modality, displays the extent and location of the lesion and provides high contrast resolution. The typical feature of TBA in T1WI is a solitary or multiple, well-capsulated hypo intense lesion whereas in T2WI and FLAIR it appears to be a hyperintense lesion with significant peripheral edema. Our case displays these imaging features. According to the published literature, TBA usually shows restricted diffusion on DWI, but only one case was reported without restricted diffusion [8]. The case presented here has no restricted diffusion. The exact underlying mechanism for this in our case is unknown. However, the possible reason may be that, in our case there is no hyper viscosity in the abscess. In our case, TBA shows significant lipids and lactate peaks on MRS which is in accordance with the reviewed literature of Gupta and Dusak [9-13]. Hence, Magnetic Resonance Spectroscopy (MRS) can provide useful information to diagnose TBA [10,11]. Although multiple parameter MRI is a useful imaging tool, TBA can be confused with various other lesions and neuroimaging study is usually nonspecific for diagnosis.

The differential diagnosis of tubercular abscess is wide and includes pyogenic and cryptococcal abscess, metastatic disease and cystic tumors.

Pyogenic abscess

The imaging findings of tuberculous abscess on T1WI, T2WI and enhanced images are similar to pyogenic abscess. But on MR spectroscopy pyogenic abscess always shows presence of amino acids whereas in case of TBA, only lipids and lactate peaks are observed with no evidence of amino acids [10,13]. Pathologically, the pyogenic brain abscess contains large number of neutrophils and proteins. The breakdown of neutrophils causes release of large number of hydrolytic enzymes that hydrolyzes proteins into amino acids [10,13]. Whereas, TBA mostly contains mycobacteria and lymphocytes with less number of neutrophils and necrotic brain tissue. The reason behind high peak of lipid in the spectrum is the lipid rich structure of mycobacteria [10,13]. Similarly, bacterial fermentation leads to occurrence of lactate and necrosis of cerebral tissue results in lactate and lipids [8]. Hence, lack of proteolytic enzymes or amino acids in tuberculous exudates compared to pyogenic inflammation is regarded significant for diagnosis of TBA by MRS. Differentiation of TBA from pyogenic abscess is important for the management.

Fungal abscess

Fungal infections of the CNS are rare in the general population, mainly occurring in immunocompromised patients. They are most commonly located in the middle fossa, basal ganglia and mesencephalon. Neuroimaging in patients with fungal abscess reveals multiloculated thick wall with a necrotic core. On non-contrast MRI, the ring of the fungal abscess is irregular and of low signal on T2-weighted MRI images. The abscess cavity shows intracavitary projections which are considered characteristic of fungal abscesses. These intracavitary projections are confirmed to be fungal hyphae on histopathologic examination. These features vary from TBA. One study of MRS showed increased lipid peaks [13,14].

Metastasis/tumors

Tubercular abscess can simulate metastasis in the CNS. Metastatic lesions are typically subcortical, occurring in or near the gray-white matter junction. MRI is the initial investigation of choice. But conventional MRI cannot provide an accurate diagnosis. Hence, DWI is a useful sequence to differentiate abscess from primary brain tumors or metastasis. Gupta et al. in his literature describes that in DWI, the tubercular abscess cavity is hyperintense while the tumor cavity appears hypo intense [10,13]. However, in our case there was no restricted diffusion in DWI, creating a diagnostic dilemma of metastatic tumor. Another case reported by Karki et al. explains corticosteroid regime and another case by Gupta and Dusak [9-13] as the cause of no restricted diffusion in DWI which was in agreement with our case. In such circumstances, MRS can provide differential diagnostic information. TBA shows marked lipid and lactate peaks with no significant decrease of NAA and slightly increase of Cho whereas metastatic lesion shows markedly increased choline peak and no NAA peak in MRS. Perfusion weighted MRI can...
demonstrate vascularity of the lesion’s wall, differentiating it from the hyper vascular tumor capsule and abscess capsule [8,13]. Primary brain tumors, such as glioblastoma multiforme or anaplastic astrocytoma can have ring-enhancement with surrounded vasogenic edema similar to TBA, but they are large in size, located deep in the white matter and frequently cross the midline, and the enhanced wall is always irregular showing restricted diffusion on DWI. In addition, the MRS findings is different with markedly increased choline peak and decrease NAA peak and the ratio of Cho/NAA is often above 2.5, whereas in TBA it is not.

Neurocysticercosis

Neurocysticercosis is an infectious parasitic disease. The imaging characteristics of neurocysticercosis depend on the stage of the infection. MRI is the imaging modality of choice. During the colloidal stage, the wall of the cyst appears thick and hypo intense with marked perilesional edema on T2-weighted images. After contrasting medium administration, it shows a ring like peripheral enhancement. Usually, the lesions are <20 mm in diameter and multiple in nature compared to TBA which is often solitary [15]. MRS shows decreased NAA and creatine levels and elevated lactate and metabolites such as alanine and succinate [16,17]. In addition, the various laboratory examinations available such as CSF analysis, stool test and ELISA are the mode to confirm neurocysticercosis.

Conclusion

TBA is a rare entity which is often misdiagnosed. The conventional MRI cannot provide sufficient information for the diagnosis. The advanced imaging modality such as DWI and MRS can provide useful information for diagnosis.

References

1. WHO=http://www.who.int/mediacentre/factsheets/fs104/en/.
2. Nelson CA, Zunt JR (2011) Tuberculosis of the central nervous system in immunocompromised patients: HIV infection and solid organ transplant recipients. Clin Infect Dis 53: 9.
3. Roopesh Kumar VR, Gundamaneni SK, Biswas R, Madhugiri VS (2012) Tuberculous cerebellar abscess in immunocompetent individuals. BMJ Case Rep.
4. Saini AG, Dogra S, Kumar R, Nada R, Singh M (2011) Primary tuberculous cerebellar abscess: Case report. Ann Trop Paediatr 31: 4.
5. Oshinowo AG, Blount BW, Golusinski LL (1998) Tuberculous cerebellar abscess. J Am Board Fam Pract 11: 6.
6. Whitener DR (1978) Tuberculous brain abscess. Report of a case and review of the literature. Arch Neurol 35: 148-155.
7. Vidal JE, Cimerman S, Da Silva PR, Szteinbok J, Coelho JF, et al. (2003) Tuberculous brain abscess in a patient with AIDS: Case report and literature review. Rev Inst Med Trop Sao Paulo 45: 111-114.
8. Karki DB, Gurung G, Sharma MR, Shrestha RK, Sayami G, et al. (2015) Tumor like presentation of tubercular brain abscess: Case Report. JMRI 19: 231-236
9. Indrajit JK, Ganesan S (2001) Magnetic resonance imaging in intracranial tuberculosis. Med J Armed Forces India 57: 292-297.
10. Gupta RK, Vatsal DK, Husain N, Chawla S, Prasad KN, et al. (2001) Differentiation of tuberculous from pyogenic brain abscesses with in vivo proton MR spectroscopy and magnetization transfer MR imaging. AJNR Am J Neuroradiol 22: 1503-1509.
11. Jain RS, Handa R, Nagpal K, Prakash S (2014) Clinicoradiological improvement of intracranial tuberculoma with medical management alone. BMJ Case Rep.
12. Araújo-Filho Sda C, Maia L, Silva HB, Almeida JP, Albuquerque LA (2008) Mesencephalic tuberculous abscess in a patient with AIDS. Arq Neuropsiquiatr 66: 259-260.
13. Dusak A, Haykemitz B, Kocaell H, Bekar A (2012) Magnetic resonance spectroscopy findings of pyogenic, tuberculous, and Cryptococcus intracranial abscesses. Neurocom Res 37: 2.
14. Garg RK, Sinha MK (2010) Multiple ring-enhancing lesions of the brain. J Postgrad Med 56: 307-316.
15. Shingadke RG, Prakashchandra SP (2015) Role of advanced diagnostic imaging in intracranial tuberculosis: MR Spectroscopy. J Clin Diagn Res 9: 8.
16. Hur JH, Kim J-H, Park SW, Cho KG (2015) Cryptococcal brainstorm abscess mimicking brain tumors in an immunocompetent patient. J Korean Neurosurg Soc 57: 50-53.
17. Parekh R, Halfka A, Porter A (2014) A rare case of central nervous system tuberculosis. Case Rep Infect Dis.