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Case report

A case of cerebral toxoplasmosis: "Eccentric and concentric sign" in MRI

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ABSTRACT

Central nervous system (CNS) toxoplasmosis is an opportunistic infection caused by the intracellular protozoan parasite *Toxoplasma gondii*. This organism typically causes disease in immunocompromised patients with human immunodeficiency virus (HIV). We reported a case of a 52-year-old woman with neurology symptoms and Magnetic resonance imaging (MRI) brain shows both eccentric and concentric target signs, which are typical signs in a patient with cerebral toxoplasmosis but rarely displayed in the same lesion. The MRI played a crucial role in diagnosing the patient and distinguishing CNS diseases commonly found in HIV patients. Our objective is to discuss the imaging findings that aided in the patient's diagnosis.

Introduction

There have been limited reports on the seroprevalence of toxoplasmosis among immunocompromised individuals, particularly those with HIV. The prevalence rate of toxoplasmosis in this population was found to be 41.2% [1]. Toxoplasmosis is a zoonotic disease caused by the intracellular protozoan parasite Toxoplasma gondii, which is widely distributed in nature and affects many warm-blooded animal species, including humans. The reactivation of latent toxoplasma infection in immunocompromised individuals puts them at an increased risk of opportunistic infections, with toxoplasma encephalitis being the most common manifestation. The infection typically occurs when the CD4+ count drops below 100 (cells/mm3) [1,2].

Magnetic resonance imaging (MRI) is more effective than computed tomography (CT) scanning in identifying cerebral toxoplasmosis. The use of contrast media with CT or MRI can enhance the accuracy of diagnosis.

Case presentation

A 52-year-old women, teacher with no known medical illness presented to our center with reduced speech and less talking about 2 months; however still able to comprehend. Her condition started to become worsening 1 month prior. She started to become slow in normal daily activities. Associated with loss of appetite and loss of weight approximately 10 kg in 1 month.

Otherwise, no history of fever, headache, vomiting, seizure, or blurring of vision. No history of trauma.

On examination, the patient was alert and conscious. GCS 15/15. Cranial nerve examination noted left eye mild ptosis, right upper motor neuron (UMN) palsy, loss of nasolabial fold, and facial asymmetry. Motor examinations were intact. Sensation reduced over the right side of the face, otherwise, the rest are intact. The cerebellar sign shows slight dysdiadokokinesia of left upper limb. She went to a private center and has been admitted there. Subsequently, patient was referred to our center for worsening symptoms.

Computed tomography (CT) brain (Fig. 1) was done show ill-defined hypodensity in the white matter at the right posterior parietal and left fronto-parietal regions. However, no focal enhancing lesion seen within these regions.

Magnetic Resonance Imaging (MRI) of brain (Fig. 2) was also done and showed multiple well-defined intra-axial cerebral lesions of varying sizes seen at left high frontal parasagittal region, bilateral parietal regions, bilateral parasagittal parietal region, and right basal ganglia region (involving the posterior limb of right internal capsule and right thalamus). These lesions demonstrate hypointense signal on T1WI, heterogeneous (alternating hyperintense and hypointense) signal on T2WI, not suppressed on FLAIR, with peripheral rim enhancement on

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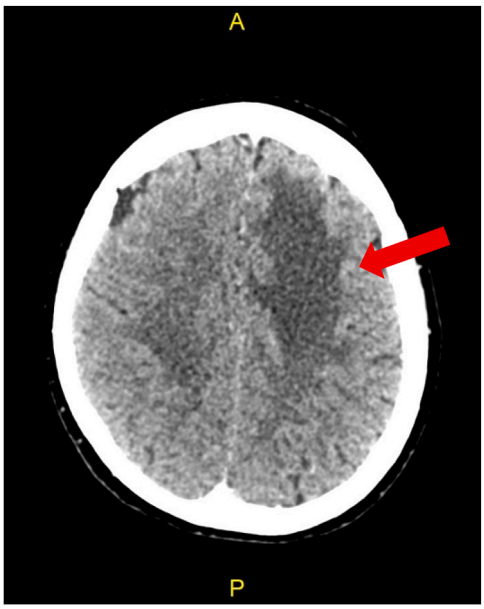

Fig. 1. Axial contrast CT Brain demonstrates ill-defined hypodensity(red arrow) in the white matter at the right parietal and left fronto-parietal regions in keeping with edema.

contrast study. The peripheral rim enhancing component of the lesions show restricted diffusion on DWI/ADC. Mural nodules are seen within some of these lesions, which demonstrate hypointense signal on T1WI, hyperintense signal on T2WI, not suppressed on FLAIR, with enhancement post-contrast. Without the history immunocompromised, the initially impression multiple cerebral metastases were given. Differential diagnosis includes multicentric glioblastoma and infection.

In ward, she then developed high grade fever with thrombocytopenia; thus, dengue serology and viral screening was sent. HIV antibody came back reactive. CD4+ count was 16 cells/mm.

Blood sample for CNS viral pathogens were sent and the toxoplasmosis IgG was reactive with titer 16,380. Thus; patient was treated for cerebral toxoplasmosis and started with anti-toxoplasma drugs (intravenous clindamycin and T. pyrimethamine). Several course of antibiotics and anti-fungal were also started. Patient was discharge with tablet anti-toxoplasma drugs for 6 weeks completion and Pneumocystis Carinii pneumonia (PCP) prophylaxis. However, unable to initiate antiretroviral therapy in view of patient complicated with bed bound, contracture of all four limbs and on nasogastric tube for feeding. Unable to crush the medication to give via this tube. Despite that, patient also defaulted treatment few times. However, she was on regular rehabilitation therapy. Upon further inquiry, it was discovered that the patient had HIV from her husband. She explicitly stated that she had no pets and no prior history of exposure to infected soils.

Discussion

Cerebral toxoplasmosis is a common opportunistic infection in patients with HIV/AIDS and it is fatal if left untreated. Thus, making early diagnosis crucial for a better prognosis through prompt initiation of therapy. The main clinical manifestation of acquired toxoplasmosis in immunocompromised patients is related to the central nervous system, with the most common symptom being headache accompanied by focal neurological deficits, with or without fever [3]. Other clinical presentations may include lymphadenopathy and muscle aches. In AIDS patients, they may have multiple cerebral lesions, resulting in disorientation, drowsiness, hemiparesis, reflex changes, convulsions, coma, and death.

On imaging, cerebral toxoplasmosis usually manifests as multiple lesions involving the basal ganglia, thalamus, and corticomedullary junction [3,4]. On plain computed tomography (CT) scans, the lesions appear as multiple hypodense lesions. After contrast administration, most lesions show nodular or ring enhancement, typically thin and smooth, often with a "target sign." The high-density nodular appearance is seen in lesions with a hemorrhagic component [3].

Magnetic resonance imaging (MRI) of the brain and spine is a crucial investigation tool for immunocompromised patients presenting with neurological symptoms. It is also essential to rule out other CNS sequelae of HIV/AIDS, such as cerebral tuberculosis, cerebral cryptococcus, and progressive multifocal leukoencephalopathy (PML) [4]. MRI can also help differentiate cerebral toxoplasmosis from other CNS diseases that commonly occur in HIV patients, such as primary CNS lymphoma [4].

The typical MRI findings in cerebral toxoplasmosis include the "eccentric target sign" and "concentric target sign." The "concentric target sign" appears as a lesion with a series of concentric rings showing hyperintense and hypointense/isointense signal alternately on T2W imaging. This sign corresponds to hemorrhage and necrosis with foamy histiocytes in CNS toxoplasma infection [3,4]. Strong perifocal edema is usually visible on T2/FLAIR images.

The "eccentric target sign" is seen on T1W post-contrast imaging as a ring-enhancing lesion with an eccentrically located enhancing mural nodule. It comprises three regions: the central eccentric enhancement region, the middle low signal region, and the outer ring/peripheral enhancement region [3,5]. Histologically, the central eccentric enhancement region represents inflamed small blood vessels, while the middle low signal region represents necrosis, and the outer ring enhancement area represents dense histiocytic response [3–5]. These two characteristic signs, the "eccentric target sign" and "concentric target sign," are highly suggestive of cerebral toxoplasmosis and are rarely displayed in the same lesion due to different pathological states [3,4]. In our case, although without history immunocompromised, with MRI shows both the “concentric target sign” and “eccentric target sign”, we need to think possibility of cerebral toxoplasmosis. Therefore, further work-up needed.

In clinical practice, the diagnosis of cerebral toxoplasmosis is usually presumed based on the association of serology, clinical and radiological information [1]. Confirmation of the diagnosis is achieved when the patient responds to empirical anti-Toxoplasma therapy [4]. However, if a patient does not show typical radiological findings of cerebral toxoplasmosis, clinicians should consider several differential diagnoses such as cerebral tuberculosis, primary CNS lymphoma, or other CNS infections such as cryptococcosis, aspergillosis, and Chagas disease. Invasive procedures such as stereotactic biopsy should be considered in all HIV-infected patients with multifocal brain lesions, especially for patients who do not respond to antiparasitic treatment within 10–14 days [2].

Conclusion

In conclusion, this case demonstrates the importance of recognition of the radiological features of cerebral toxoplasmosis in case without known immunocompromised status to prevent delay of treatment and give better prognosis value.

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Ethical approval

Research and ethics committee approval for case reports is not a requirement according to Medical Research and Ethics Committee and Institute for Clinical Research Malaysia.

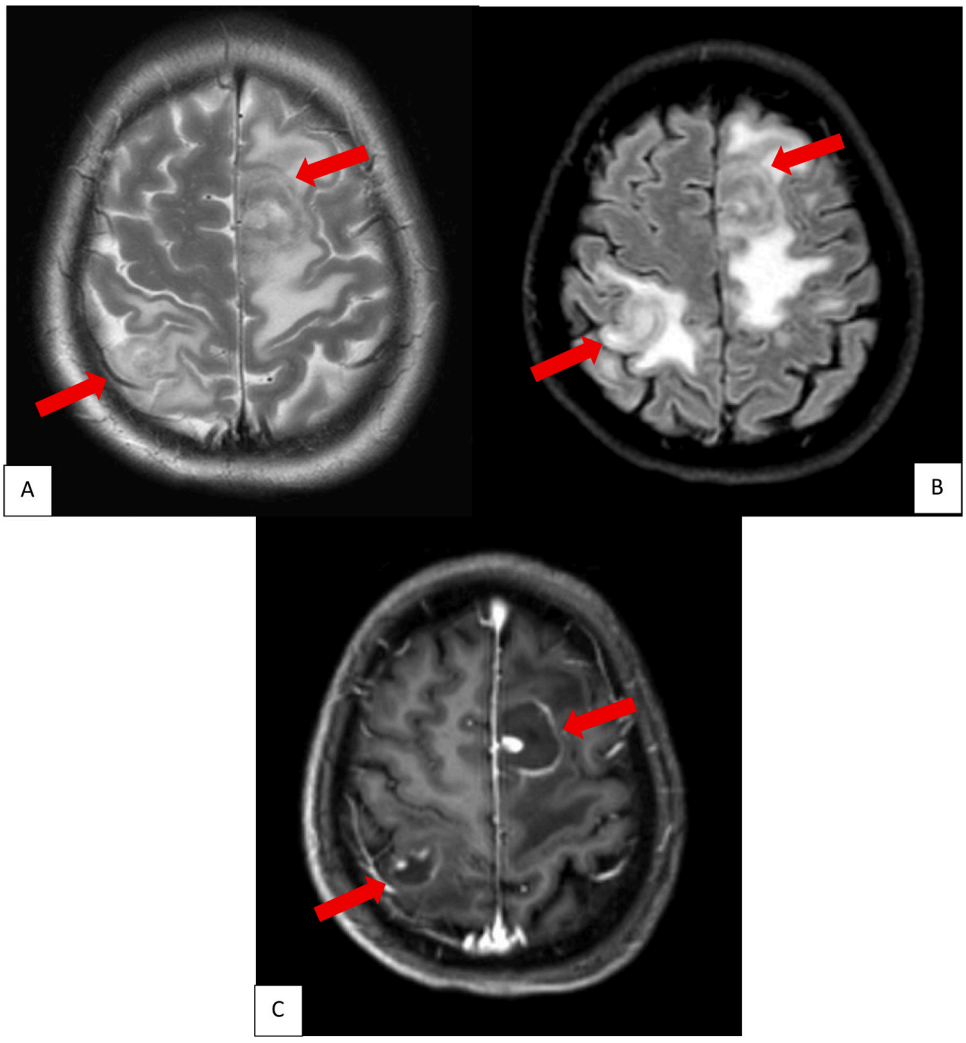

Fig. 2. A) Axial T2 and B) Axial FLAIR showing "concentric" target sign with concentric alternating hypointense and hyperintense rims at right high parietal and left frontal lobe. T2WI and FLAIR showing marked perilesional edema. c) Axial T1W contrast-enhanced MRI showing a ring enhancing lesion at right high parietal and left frontal lobe with eccentric nodule suggestive of eccentric target sign.

Consent

Written consent was obtained from the patient's next of kin for inclusion in this report. Research and ethics committee approval for case reports is not a requirement according to Medical Research and Ethics Committee and Institute for Clinical Research Malaysia.

CRediT authorship contribution statement

All the authors contribute in this case report. All authors have read and approved the manuscript.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

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