Case History

A 19-year-old Chinese man presented with progressive ascending weakness of his left lower limb for 1 week. There was no loss of sensation. His other limbs were unaffected. He also complained of progressive, painless blurring of vision in his left eye for the past 1 month. He has an affinity for wild boar meat from local Chinese restaurants, which he has been consuming on a daily basis for the last 2 years. He denied any fever, headache, high-risk behaviour for acquisition of human immunodeficiency virus (HIV) infection or recent travels. He had bronchial asthma in childhood, but the symptoms are minimal now and there was no recent acute exacerbations.

Physical examination was unremarkable except for the left lower limb power of 3/5 and bilateral papilloedema on direct ophthalmoscopy. A Contrast-enhanced computed tomography (CECT) scan of the brain (Image 1) and Magnetic resonance imaging (MRI) of the brain (Images 2 and 3) were performed. The total leucocyte count was 9.2x10⁹/L, C-reactive protein was 1.2 and erythrocyte sedimentation rate was 6 mm/h. Human immunodeficiency virus screening was negative, anti-toxoplasma antibodies were not detected and serological testing for anti-cysticercal antibodies via enzyme-linked immunosorbent assay (ELISA) did not produce a positive yield. He was treated with oral albendazole for 28 days and corticosteroids, which led to rapid and total resolution of his neurological deficits and CT findings within 6 weeks.

Question

1. Describe the CT and MRI findings.

2. What are differential diagnoses based on the radiological findings?

3. Based on the facts given in this case, what is the most likely diagnosis?

4. What are the diagnostic criteria for the above diagnosis?
Answers

1. Multiple round lesions with rim enhancement and perilesional oedema are seen at the grey-white matter junction of both parietal lobes on the CT scan in Figure 1 and in contrast-enhanced T1-sequenced MRI image in Figure 2. Perilesional oedema is best demonstrated in the Fluid Attenuating Inversion Recovery (FLAIR) MRI (Figure 3).

2. Multiple ring-enhancing lesions are one of the most commonly encountered abnormalities in neuroimaging. These may be attributed to tuberculomas, primary and secondary brain malignancy (e.g., glioblastoma multiforme), pyogenic brain abscess, demyelinating disorders and parasitic infections (e.g., toxoplasmosis and neurocysticercosis).

3. The most likely diagnosis is neurocysticercosis, supported by the patient’s presentation, radiological findings and complete resolution of intracranial lesions with albendazole therapy. The history of chronic ingestion of wild boar meat also supports this diagnosis; however, it is not one of the diagnostic criteria.

4. A set of criteria (Table 1) based on clinical, radiological, serological and epidemiological data has been proposed by Del Brutto to guide physicians in diagnosing neurocysticercosis with varying degrees of diagnostic certainties.

Discussion

General

Neurocysticercosis is the most common parasitic infection of the nervous system. It is endemic in most developing countries and results from ingestion of Taenia solium eggs from contaminated food or via faecal-oral route. Ingested eggs cross the intestinal wall into the bloodstream, where they are carried to brain and subcutaneous tissues, muscles and eyes to form cysticerci. Pigs, dogs, wild boar and sheep are known to play the role of an intermediate host (bearing cysticerci) in the lifecycle of Taenia solium, whereas human are the only definitive host (bearing the tapeworm). Seizures are the most common presentation of neurocysticercosis. However, the presentations may vary and can be related to the location of the cysts and the severity of disease activity.

Neuroimaging

The diagnosis of neurocysticercosis is greatly enhanced by CT and MRI. The latter is superior due to its ability of multplanar imaging and high image definition although the detection of calcified lesions is poor. The number of intracranial lesions and their intracranial locations, different forms of larva during the involuion process and the severity of host’s inflammatory response are demonstrated in CT and MRI images. Imaging features of parenchymal neurocysticercosis vary with the different stages of larval involution.

The CT and MRI images of this patient demonstrate parenchymal neurocysticercosis in which parasitic lesions are found at the grey-white matter junction. The perilesional oedema represents host immune response towards the degenerating cysticercosis larva, also known as the colloidal stage.

Diagnosis

There are many complexities in confirming the diagnosis of neurocysticercosis. Clinical presentation is diverse, depending on the number, size, location of cysts and patients’ immune response. Serological tests used for detection of antibodies against specific antigens of Taenia solium have low sensitivity and specificity. False positive results may be seen in up to 50% of patients with single cerebral lesions or calcified lesions. Furthermore, antibodies persist for years despite successful therapy. Stool examination for proglottids and eggs may only yield a positive result in the presence of severe infection. Neuroimaging studies, being most useful, are not pathognomonic for neurocysticercosis.

The revised diagnostic criteria proposed by Del Brutto include four categories—absolute, major, minor, and epidemiologic, stratified according to their individual diagnostic strengths based on clinical, radiological, serological and epidemiological data. Absolute criteria allow unequivocal diagnosis of neurocysticercosis while major criteria strongly suggest the diagnosis but cannot be used alone to confirm the disease. Minor criteria are frequent but nonspecific manifestations of the disease, and epidemiologic criteria refer to circumstantial evidence favouring the diagnosis of cisticercosis.
### Table 1. Diagnostic criteria and degrees of diagnostic certainty for neurocysticercosis

#### Diagnostic criteria

**Absolute**

(i) Histologic demonstration of the parasite from biopsy of a brain or spinal cord lesion

(ii) Evidence of cystic lesions showing the scolex in neuroimaging studies

(iii) Direct visualisation of subretinal parasites by fundoscopic examination

(iv) Spontaneous resolution of small single enhancing lesions

**Major**

(i) Evidence of lesions highly suggestive of neurocysticercosis in neuroimaging studies

(ii) Positive serum immunoblot for the detection of anticysticercal antibodies

(iii) Resolution of intracranial cystic lesions after therapy with albendazole or praziquantel

**Minor**

(i) Evidence of lesions suggestive of neurocysticercosis in neuroimaging studies

(ii) Presence of clinical manifestations suggestive of neurocysticercosis

(iii) Positive CSF ELISA for detection of anticysticercal antibodies or cysticercal antigens

(iv) Evidence of cysticercosis outside the central nervous system

**Epidemiologic**

(i) Individuals coming from or living in an area where cysticercosis is endemic

(ii) History of frequent travel to disease-endemic areas

(iii) Evidence of household in contact with T. solium infection

#### Degrees of diagnostic certainty

**Definitive**

(i) Presence of one absolute criterion

(ii) Presence of two major and one minor or one epidemiologic criteria

**Probable**

(i) Presence of one major and two minor criteria

(ii) Presence of one major and one minor and one epidemiologic criteria

(iii) Presence of three minor plus one epidemiologic criteria

This patient met two major criteria, namely the highly suggestive lesions on MRI and resolution of symptoms with treatment. However, his serologic tests were negative and he did not meet any of the epidemiologic criteria. The total resolution of his lesions on imaging and symptoms upon treatment, however, clinches the diagnosis.

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### References


