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Asian Pacific Journal of Tropical Medicine

journal homepage: <http://ees.elsevier.com/apjtm>Original research <http://dx.doi.org/10.1016/j.apjtm.2015.12.020>

Neurocysticercosis: A case report and brief review

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ARTICLE INFO

Article history:

Received 15 Oct 2015

Received in revised form 20 Nov 2015

Accepted 3 Dec 2015

Available online 19 Dec 2015

Keywords:

Neurocysticercosis

Taenia solium

Epilepsy

Magnetic resonance imaging

Computed tomography

ABSTRACT

Neurocysticercosis (NCC) is one of the seven neglected endemic zoonoses targeted by the World Health Organization. It is considered a common infection of the nervous system caused by the *Taenia solium* and is known to be the primary cause of preventable epilepsy in many developing countries. NCC is commonly resulted by the ingestion of *Taenia solium* eggs after consuming undercooked pork, or contaminated water. The parasite can grow in the brain and spinal cord within the nervous system, causing severe headache and seizures beside other pathological manifestations. Immigration and international travel to endemic countries has made this disease common in the United States. NCC can be diagnosed with computed tomography and magnetic resonance imaging of the brain. The treatment of the NCC including cysticidal drugs (e.g., albendazole and praziquantel), and neurosurgical procedure, depending upon the situation. A patient of Asian origin came to our clinic with complaints of dizziness, headaches and episodes seizures for the past twelve years without proper diagnosis. The computed tomography and magnetic resonance imaging scans indicated multilobulated cystic mass in the brain with the suspicion of neurocysticercosis.

1. Introduction

Neurocysticercosis (NCC) is one of the seven neglected endemic zoonoses targeted by the World Health Organization [1]. It is considered a common infection of the nervous system and is known to be the primary cause of preventable epilepsy in many developing countries [2–4]. Immigration and international travel to endemic countries has made this disease

common in the United States [5,6]. Surprisingly in individual with no history of pork consumption or travel to endemic areas also have the potential to develop NCC. There have been four reported cases in an Orthodox Jewish community (with strict dietary law that prohibit consumption of pork), the infection was transmitted by workers who has recently emigrated from endemic regions in Latin American countries [7,8]. Epidemiologic studies have demonstrated tight clustering household or household contact with NCC patients have three times higher risk to have positive serology for cysticercosis compared with controls [9].

NCC is a common cause of neurological disease transmitted through parasites called *Taenia solium* (*T. solium*) [10]. It is endemic in Africa, Asia and Latin America, making it the major cause of epilepsy and convulsion in these regions (Figure 1) [11]. It can be transmitted from human-to-human through a fecal-oral route. Contaminated food and water are

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Peer review under responsibility of Hainan Medical College.

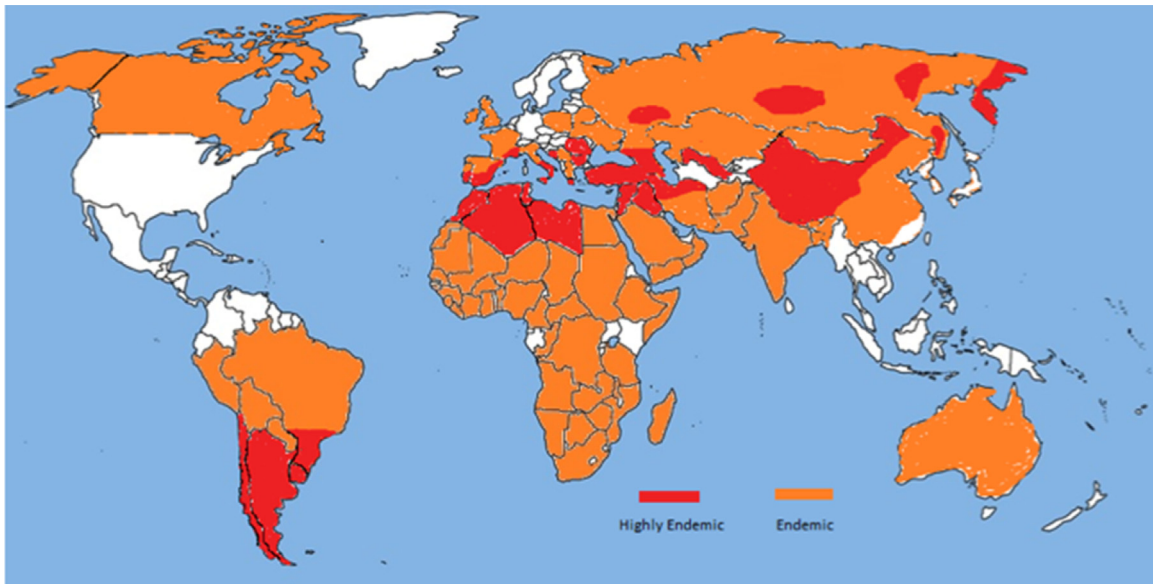


Figure 1. World map showing approximate distribution of NCC [12].

the major sources of this infection [12]. The age-adjusted prevalence of epileptic disease associated with NCC ranges from 10 to 15 per 1 000 inhabitants of tropical countries. Other manifestations of the disease include stroke, dementia, hydrocephalus and vision loss. It is estimated to cause 50 000 deaths every year [11].

NCC is rare in the USA; however with the increase in travel and immigration into the United States, this disease has become common in certain parts of the country. A two-year prospective study of 1 800 patients who presented with seizure in 11 Emergency Departments in the United States showed that 2% of the cases were due to NCC. Emergency departments in Los Angeles, Phoenix, and Albuquerque have also observed an increase in frequency of NCC cases. This part of the country has a higher proportion of Hispanic immigrants as patients [13].

2. Case report

A 34-year-old female, who immigrated to US few years ago, presented to our clinic, complaining of dizziness and mild seizures that have been going on for the past 12 years. Her family noticed an increase in the frequency of her intermittent atypical near-syncope attacks within the past two months and decided to seek medical attention. She also suffers from dyspepsia, nausea with scanty non bilious vomiting. During the initial conversation with the patient for obtaining her medical history, the patient started complaining of dizziness, which eventually led to generalized convulsions that lasted for about one minute. The patient was urgently transported to a near by hospital in the emergency department. At the hospital, computed tomography (CT) of the brain showed multilobulated cystic mass in the posteromedial left temporal/occipital region with surrounding edema. Furthermore, the magnetic resonance imaging (MRI) of the head without contrast revealed a nodular focus of enhancement within the multilobulated cystic mass in the brain with the suspicion of NCC (Figure 2 and 3). Given the deep-seated mass, a biopsy or any surgical procedure was deferred. The patient is currently taking levetiracetam 500 mg once a day and albendazole 400 mg twice a day and is seizure free. The patient is

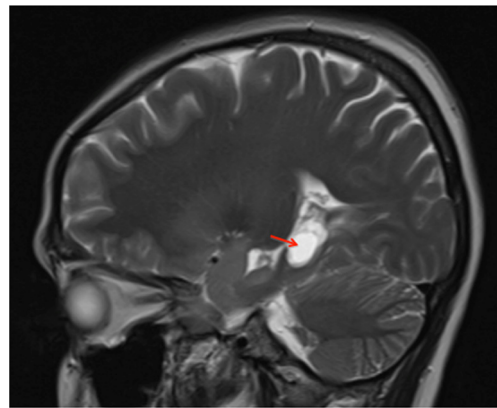


Figure 2. MRI scan of the patient brain showing multilobulated cystic mass (red arrow).

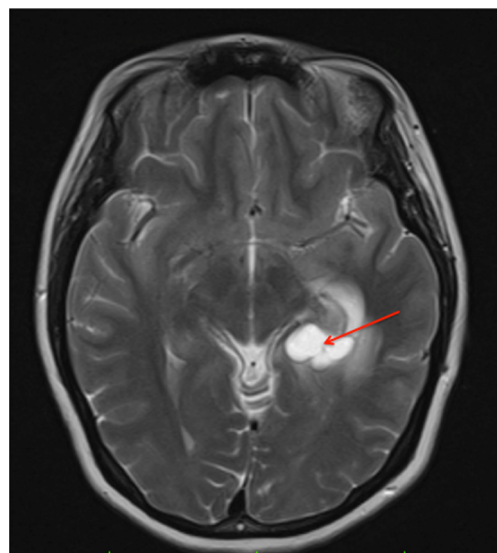


Figure 3. MRI scan of the patients brain with arrow pointing to cystic lesion compression atrium of lateral ventricles (horizontal section).

currently under consideration for CyberKnife radiosurgery on empirical basis without tissue diagnosis.

T. solium, commonly known as adult tape worm, is the parasite involved in pathogenesis of NCC. Humans infected with adult tape worms can reside in the small intestine for years. They may develop up to 7 m in length with each proglottid segment containing 50 000 to 100 000 eggs eventually shed the eggs in feces, which can contaminate water bodies or be ingested by an intermediate host, mostly pigs. The eggs hatch and release the larvae (cysticerci) into the intermediate host. The larvae penetrate the intestinal wall and spread through the blood stream to different organs in the body such as brain, striated muscles, liver and other tissues. The cycle is complete when humans, the definitive host, ingest undercooked pork or untreated water containing the larvae. Once it gets into the human body, it attaches to the intestinal mucosa and grows to full length. The adult tape worm releases cysticerci which can disseminate to different parts of the body. Cysticerci infection of tissues of the central nervous system causes NCC [14,15].

Cysticidal therapy with albendazole or praziquantel has shown to be effective in reducing the number of cystic lesion in NCC. There has been documentation of neurological exacerbation during the second to fifth day of therapy. For this reason, it is recommended to co-administer praziquantel or albendazole with a steroid to decrease inflammation [16]. The present guidelines suggested by the American Academy of Neurology are treatment with albendazole and either dexamethasone or prednisone [13]. Reoccurrence of seizure symptoms is related to the persistence of active brain lesion. Once the NCC lesion clears, the risk of reoccurrence is low [17].

There are currently no medications recommended for the prevention of NCC traveler who wishes to travel to areas where the NCC prevalence is high. The most effective way to reduce transmission includes, community education on routes of transmission, good personal hygiene such as hand washing to food preparation. Reducing the potential reservoir such as preventing the transmission of cysticercal infections to pigs [18,19].

NCC is a common disease in developing countries. It is estimated that 50 million people worldwide have cysticercosis infection, there are many endemic regions includes Central and South America, sub-Saharan Africa, India, and Asia. The prevalence of cysticercosis varies in different regions. It is often found higher in rural areas, especially where pigs are raised in a suboptimal sanitary conditions. Through immigration and international travel, there have been reports of cases this country. It is therefore important for physicians to be aware of the various presentations of the disease and how to diagnose and treat the symptoms promptly. Early detection is very important for a better prognosis. The most effective way to eradicate cysticercal infection will require implementation of strategies to reduce transmission at several stages, such as preventing human tape worm infection due to pork consumption, improving sanitary conditions to prevent transmission of cysticercal infections from humans to pigs and measures to interrupt transmission of eggs between humans.

Conflict of interest statement

We declare that we have no conflict of interest.

References

- [1] WHO. Seven neglected endemic zoonoses – some basic facts [Online]. Available at: http://www.who.int/zoonoses/neglected_zoonotic_diseases/en/. [Accessed on 1st April, 2015].
- [2] WHO. Taeniasis/Cysticercosis [Online]. Available at: <http://www.who.int/mediacentre/factsheets/fs376/en/>. [Accessed on 1st April, 2015].
- [3] Del Brutto OH. Neurocysticercosis. *Neurohospitalist* 2014; **4**(4): 205-212; <http://dx.doi.org/10.1177/1941874414533351>.
- [4] Fogang YF, Savadogo AA, Camara M, Toffa DH, Basse A, Sow AD, et al. Managing neurocysticercosis: challenges and solutions. *Int J Gen Med* 2015; **8**: 333-344; <http://dx.doi.org/10.2147/IJGM.S73249>.
- [5] Cantey PT, Coyle CM, Sorvillo FJ, Wilkins PP, Starr MC, Nash TE. Neglected parasitic infections in the United States: cysticercosis. *Am J Trop Med Hyg* 2014; **90**(5): 805-809; <http://dx.doi.org/10.4269/ajtmh.13-0724>.
- [6] O'Neal SE, Flecker RH. Hospitalization frequency and charges for neurocysticercosis, United States, 2003–2012. *Emerg Infect Dis* 2015; **21**(6): 969-976; <http://dx.doi.org/10.3201/eid2106.141324>.
- [7] Schantz PM, Moore AC, Muñoz JL, Hartman BJ, Schaefer JA, Aron AM, et al. Neurocysticercosis in an Orthodox Jewish community in New York City. *N Engl J Med* 1992; **327**: 692-695.
- [8] Mwape Kabemba E, Blocher Joachim, Wiefek Jasmin, Schmidt Kathie, Dorny Pierre, Praet Nicolas, et al. Prevalence of neurocysticercosis in people with epilepsy in the Eastern Province of Zambia. *PLoS Negl Trop Dis* 2015; **9**(8): e0003972; <http://dx.doi.org/10.1371/journal.pntd.0003972>.
- [9] Goodman KA, Ballagh SA, Carpio A. Case-control study of seropositivity for cysticercosis in Cuenca, Ecuador. *Am J Trop Med Hyg* 1999; **60**(1): 70-74.
- [10] Fleury A, Trejo A, Cisneros H, García-Navarrete R, Villalobos N, Hernández M, et al. *Taenia solium*: development of an experimental model of porcine neurocysticercosis. *PLoS Negl Trop Dis* 2015; **9**(8): e0003980; <http://dx.doi.org/10.1371/journal.pntd.0003980>.
- [11] Roman G, Sotelo J, Brutto OD, Flisser A, Dumas M, Wadia N, et al. A proposal to declare neurocysticercosis an international reportable disease. *Bull World Health Organ* 2000; **78**(3): 399-406.
- [12] CDC. Parasites – cysticercosis [Online]. Available at: http://www.cdc.gov/parasites/cysticercosis/health_professionals/index.html. [Accessed on 1st April, 2015].
- [13] UpToDate. Epidemiology, transmission and prevention of cysticercosis [Online]. Available at: <http://www.uptodate.com/contents/epidemiology-transmission-and-prevention-of-cysticercosis>. [Accessed on 1st April 2015].
- [14] Sorvillo FJ, Christopher DeGiorgio C, Waterman SH. Deaths from cysticercosis, United States. *Emerg Infect Dis* 2007; **13**(2): 230-235.
- [15] Mahanty S, Orrego MA, Mayta H, Marzal M, Cangalaya C, Paredes A, et al. Post-treatment vascular leakage and inflammatory responses around brain cysts in porcine neurocysticercosis. *PLoS Negl Trop Dis* 2015; **9**(3): e0003577; <http://dx.doi.org/10.1371/journal.pntd.0003577>.
- [16] Singhi P. Neurocysticercosis. *Ther Adv Neurol Disord* 2011; **4**(2): 67-81.
- [17] Carpio A, Hauser WA. Prognosis for seizure recurrence in patients with newly diagnosed neurocysticercosis. *Neurology* 2002; **59**(11): 1730-1734.
- [18] García HH, González AE, Del Brutto OH, Tsang VCW, Lianos-Zavalaga F, Gonzalez Guillermo, et al. Strategies for the elimination of taeniasis/cysticercosis. *J Neurol Sci* 2007; **262**(1–2): 153-157.
- [19] Wandura T, Swastika K, Dharmawan NS, Purba IE, Sudarmaja IM, Yoshida T, et al. The present situation and towards the prevention and control of neurocysticercosis on the tropical island, Bali, Indonesia. *Parasit Vectors* 2015; **8**: 148; <http://dx.doi.org/10.1186/s13071-015-0755-z>.