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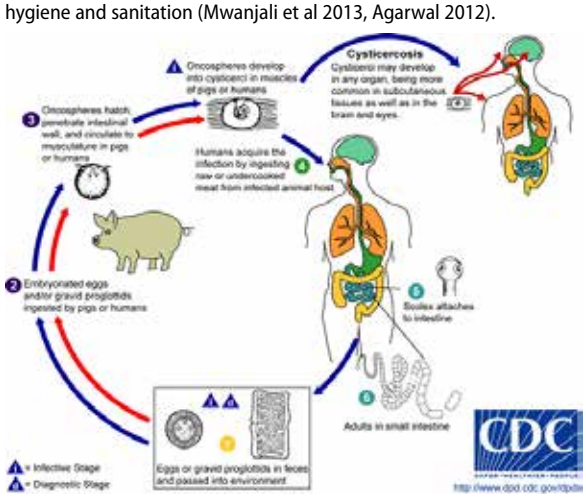
Research Paper MEDICAL SCIENCE

Neurocysticercosis - An Update

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KEYWORDS :

Introduction: Cysticercosis is a major public health problem, especially in the developing world and Neurocysticercosis (NCC) is one of the most common infections of the nervous system in humans. It is caused by larval stage of *Taenia solium* **(**Garcia et al 2003). The disease spreads via the faeco-oral route through contaminated food and water. It is endemic mainly in rural areas of developing countries where people consume pork (Molyneux et al 2011, Patil and Paithankar 2012). The disease more commonly affects young males (Croker et al 2012, Patil and Paithankar 2012). Cysticercosis is generally a disease of lower socioeconomic conditions associated with poor hygiene and sanitation (Mwanjali et al 2013, Agarwal 2012).



Life cycle of Taenia solium (Source: Parasite Image Library: Cysticercosis. DPDx.Centers for Disease Control and Prevention (CDC), www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/AF/Cysticercosis/body_Cysticercosis_il2.htm)

Risk factors:

- Eating undercooked pork
- Poor hygiene
- Drinking contaminated water
- Eating contaminated food
- Eating raw/uncooked vegetables

Clinical manifestations: It presents with seizures and less commonly with headaches (Carpio 2013, Del Brutto 2012). NCC is a leading cause of epilepsy in the developing world. Single cyst infection is more common in India with involvement of parietal lobe in 45% of patients (Patil and Paithankar 2012).

Diagnosis: The diagnosis of NCC is on clinical presentation, abnormal findings on neuroimaging and serology. Del Brutto defined the diagnostic categories of neurocysticercosis, based on different criteria. These criteria were modified in 2001 (Del Brutto et al 2001).

Radiological: CT and MRI provide evidence on the number and topography of lesions and their stage of involution (Garcia et al 2005). Vesicular cysticerci appear on CT and MRI as small and rounded cysts. Many of these lesions have a pathognomonic "hole-with-dot" appearance. Colloidal and granular cysticerci appear as ill-defined lesions surrounded by edema, most of them show a ring or a nodular pattern of enhancement after contrast medium administration. Calcified cysticerci normally appear on CT as small hyperdense nodules without perilesional edema or abnormal enhancement after contrast medium administration.

Microbiological:

I. Antibody-detection assays for cysticercosis: Antibodies against cysticercal antigens can be detected in serum, CSF, urine but a major disadvantage is that false positives can result as antibodies do not necessarily indicate an active infection (Garcia et al 2001). However, antibody detection has the advantage that mixtures of antigens can be used. Antibodies can be detected using complement fixation test, hemagglutination, radioimmunoassay, ELISA, latex agglutination and immunoblot techniques.

ELISA: ELISA has been used widely by for the detection of antibodies in the serum with variable sensitivities. Shukla et al (2008) found a sensitivity of 92% and specificity of 84% of ELISA while studying immunodiagnosis of NCC in definitive cases. Kotokey et al (2006) found 78.43% sensitivity of ELISA test with a specificity of 100%. Dot-ELISA, a modification of ELISA has the advantage that the test is rapid, easy to carry out and the results are read visually. Secondly, the test can be performed easily by just providing minimal basic training to the persons involved in performing the test. Thirdly, nitrocellulose binds more antigens than microtitre plates. Finally the test is inexpensive (Biswas et al 2004).

EITB: Western blot with lentil lectin purified glycoprotein (LLGPs) or the enzyme-linked immunoelectrodifusion transfer blot (EITB) has been the "gold standard" serodiagnostic assay. This assay involves the separation of 7 glycoprotein antigens by SDS-PAGE and its recognition in an immunoblot. EITB assay is more sensitive than the ELISA, especially when serum is being tested & has the highest sensitivity in serum and was originally reported to have sensitivity of 98% and specificity of 100% (Tsang et al 1991). The disadvantage of this test is that it may be false-negative in up to 50% of patients with a single cerebral cyst or in those with calcifications alone (Singh et al 2010). Secondly the test may be positive in patients who had been exposed to the adult parasite without developing cysticercosis (Garcia et al 2005). Also this test has been shown to be less sensitive in children than in adults and the pattern of protein recognition also differed in these age groups. This assay requires more reagents, advanced equipment, and highly trained personnel for antigen purification and assay performance than does the ELISA.

In developing countries, ELISA is preferred because of its better availability, simplicity and lower cost compared with immunoblot.

II. Antigen-detection assays for cysticercosis: Detection of circulating parasite antigen reflects the presence of live parasites, establishes the presence of ongoing viable infection in the absence of definitive radiologic features.

Many antigens have been used for the immunodiagnosis like molecular mass antigens (Atluri et al 2009), excretory/secretory, somatic antigens (Sahu et al 2009), crude soluble extract (Atluri et al 2009), total saline extract (Oliveira et al 2007) , vesicular fluid (Arruda et al 2005), membrane and scolex extracts (Arruda et al 2005). These antigens are commonly derived from Taenia solium but other species like Taenia crassiceps (Arruda et al 2005), Taenia saginata (Oliveira et al 2007), or Taenia taeniformis (Shukla et al 2008) have also been used as antigen sources. Detection of circulating parasitic antigens has a poor sensitivity but may help to monitor the response to treatment (Mahanty and Garcia 2010). The sensitivity of antigen detecting ELISA is reported to be as high as 85% (Garcia and Del Brutto 2000).

Molecular approaches: The PCR can be coupled to restriction fragment length polymorphism. Meri et al (1999) designed *T. solium*-specific primers to amplify part of the known 18S ribosomal RNA gene. PCR tests using the cytochrome *c* oxidase subunit I and cytochrome *b* genes as targets for species-specific confirmation have been developed (Yamasaki et al 2004).

Lastly, nanobodies can be used for its diagnosis in future. Nanobodies have beneficial production and stability properties (Deckers et al 2009) which along with their antigen-recognition characteristics make them a good promising tool for the diagnosis and treatment of NCC. Despite the above mentioned advances in neuroimaging and immunodiagnostic tests, the diagnosis of neurocysticercosis is a challenge in many patients.

Treatment: The immediate therapy is anticonvulsant medications. Antiparasitic treatment should be given in combination with corticosteroids to reduce inflammation and lower the risk of seizures. Albendazole is generally preferable over praziquantel due to its lower cost and fewer drug interactions (Matthaiou et al 2008).

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