Current Status of Diagnostic Techniques for Detecting Neurocysticercosis

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Table 1: Del Brutto diagnostic criteria.

1. Parenchymal neurocysticercosis Includes:
1. Parenchymal cyst with diagnosis (32) related to pathology
2. Single or multiple active parenchymal cysts, with at least one cyst with scolex as identiýed by CT or MRI
3. Multiple parenchymal vesicles without scolex associated with either
a. Seizures: focal or generalized tonic-clonic or
b. Positive serum or CSF ELISA, EITB test
4. Combination of the parenchymal cysticercus in any di erent evolutive stages: vesicular either with or without scolex degenerative (colloidal or nodular) and calciýed
2.Probable parenchymal neurocysticercosis includes
1. Single parenchymal calciýcation or vesicle without scolex or degenerating cyst(s) establishing di erential diagnosis w etiologies which are associated with at least two of the following:
a. Seizures: focal or generalized
b. Subcutaneous or muscle cysts location as conýrmed by biopsy
c. Positive serum or CSF by ELISA or EITB test
d. Plain X-ray showing ñcigar shapedò calciýcations
e. Individuals who live or have lived in or have traveled frequently to endemic countries
2. Multiple parenchymal calciýcations in individuals who live or have lived in or have traveled frequently to endemic co in whom clinical state excludes other etiologies of calciýcations
3. Extra parenchymal neurocysticercosis (intraventricular/basal subarachnoid) Includes:
1. Extra parenchymal cyst with diagnosis related to pathology
2. One or more extra parenchymal cysts with scolex in at least one of them as revealed by MRI
3. One or more extra parenchymal cysts without scolex associated with at least two of the following as revealed by MRI:
a. Hydrocephalus
b. Inþammatory CSF
c. Positive CSF by ELISA, EITB test
d. Presence of single / multiple calciýcations or parenchymal vesicular / degenerative cyst
4. De nitive parenchymal and extra parenchymal neurocysticercosis
Combination of the above deýnitive parenchymal and deýnitive extra parenchymal criteria

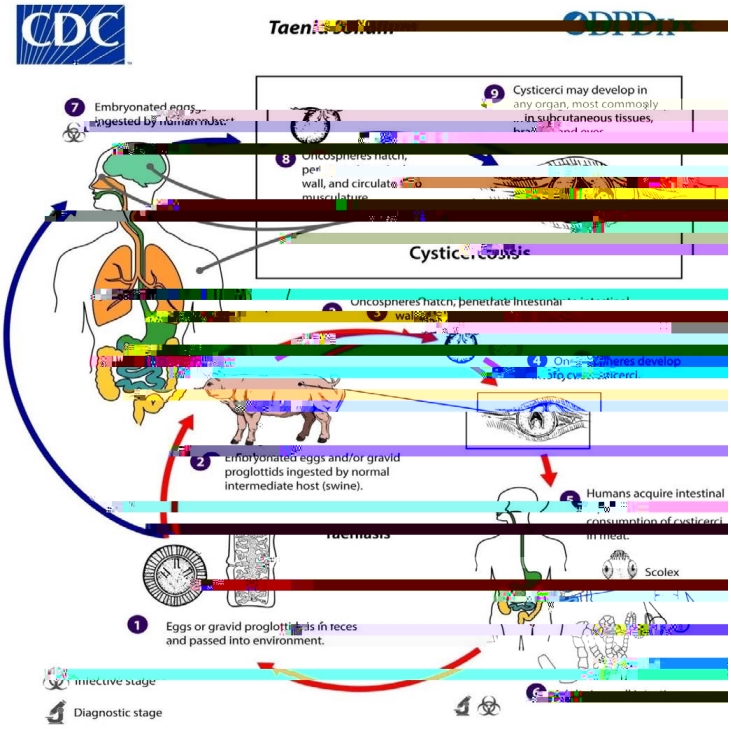

Figure 1: Life Cycle of Taenia solium (CDC, USA).

3D Gradient Echo Sequence (GRE): is technique is considered for intraventricular NCC diagnosis. It only provides T1 contrast information. Enhanced SPGR is preferred for the detection of degeneration of cyst in intraventricular NCC. e limitation is, it is less sensitive for the detection of scolex as compared to the FIESTA but still can be considered in MRI diagnosis of intraventricular NCC.

Fast Imaging Employing Steady-state Acquisition (FIESTA) or Constructive Interference in Steady State (CISS): It is considered as the most sensitive diagnostic technique for subarachnoid spaces (SAB)

E[illegible] I[illegible] A. (E I A): e Ag-ELISA is performed using monoclonal antibody HP10. A study conducted on the CSF samples showed the sensitivity and speci city of 86% and 96% respectively. is assay has also been employed for the detection of T. solium antigen in urine. It shows a sensitivity of 92% while in the case of a single cyst it decreases to as low as 62.5%. e recent guidelines of IDSA/ASTMH suggested the restricted use of ELISA due to high false positive and negative results.

D[illegible] E I A: e dipstick immunoassay is more user- friendly as compared to ELISA and EITB, yet there is very little research done on its development and standardization [7]. Although, the sensitivity detected by the serum was low as compared to the conventional micro plate Ag- ELISA.

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because it can detect the di erence in the signal intensity of CSF and parasite content and can also recognize the structure of the parasite [5]. Hence, this technique should be a part of routine diagnosis in the endemic areas where the cases of SAB are high [18,19]. It is also reviewed as an e cient technique for the diagnosis of intraventricular NCC. By this technique, we can also visualize the ventricular cavities as sometimes the cyst can reach the cavities. is phenomenon can be best visualized by FLAIR MRI. Other recent MRI sequences are susceptibility-weighted imaging (SWI) and Arterial Spin Labeling (ASL).

: It is a very traditional method for assessing the *T.solium* eggs. e method is considered to be highly speci c, provided that the examiner should be an expert.

e sensitivity of the test is low, as to be visible under a microscope certain threshold of eggs is required. Only 10-15% of neurocysticercosis patient have *taeniasis*. Stool microscopy cannot be considered as a species-speci c detection method as the eggs of Taenia species are morphologically similar.

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A[illegible] D[illegible] A.

C[illegible] -A): It is a basic slide agglutination test [6]. A study conducted using the Co-A test in the urine samples reported a sensitivity of 55.5% for NCC cases diagnosed clinically and 62.5% for radio logically diagnosed cases.

performed manually as well as automated, gives quick results as 10 serum samples can be tested within 60 minutes [11].

A -B C E I A (ABC-E IA) A-E I A: ese modi cations of the ELISA technique have proved to be more sensitive technique as compared to the conventional ELISA. One of the signi cant advantages reported in the Lee et al, 1993 study was that in ABC-ELISA, only 1-2 microliter of sample is su cient to detect the antibodies. In a study, the sensitivity of ABC-ELISA and Protein-A ELISA using serum samples was reported as 86.1% and 82.6% respectively. e speci city reported was 93.8% and 93.3% respectively.

2D G E : e method was developed in 1970s and

D

Imaging techniques for the diagnosis of neurocysticercosis is most e cient and accurate. However, high cost and requirement of technical skills become its major lacunae

Vast number of antibody detection test has been implied for the diagnosis till date. e Electro immuno blotting (EITB) is gold standard for the diagnosis whereas there is other serological technique as well which matches the assay sensitivity and speci city. e scope of serological techniques in an accurate diagnosis is low because of its high rate of cross reaction with other antigen and inability to di erentiate active from past infections.

Antigen detection tests as well as other molecular tests to detect DNA had a better future for improving the diagnosis. Molecular techniques such as Polymerase Chain Reaction (PCR) and Loop Mediated Isothermal Ampli cation (LAMP) are very sensitive and can detect even a low parasite load, and hence have potential to strengthen the future of neurocysticercosis diagnosis.

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Neurocysticercosis was under recognized, infrequently diagnosed, and essentially untreatable before 1970. But now it is a commonly recognized disease that is a leading cause of seizures in endemic regions. Yet, there are huge gaps in determining the global severity of disease and infection, in understanding disease pathophysiology and genesis of epilepsy. Neurocysticercosis can be prevented and eradicated with proper strategies. International and national health agencies are helping to control cysticercosis and therefore would prevent millions of cases of epilepsy too. Eradication programs should be e ective for all control purposes, especially for humans carrying adult tapeworms, pigs and infected eggs in the environment. Because of various advances, the diagnosis of Neurocysticercosis has improved signi cantly in specialized hospital setting but the need of improvement is still required in low equipped laboratory areas. Improved diagnosis is necessary to eradicate the disease, as the disease mainly a ect the most vulnerable sector of population.

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