Original Research Article

Comparative study of CT imaging and elisa test using es (excretory-secretory) antigen for case detection and prevalence of neurocysticercosis in paediatric patients at a tertiary health care center

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Abstract

Background: Neurocysticercosis (NCC) is a clinical condition in humans, which infects brain caused by a encysted larvae, cysticercoid of *Taenia solium. Taenia solium* is a cestode which is commonly called as Pork tapeworm. Cysticercosis is one of the most important of the parasitic disease of the nervous system, because of its worldwide distribution, high incidence and variety of symptoms and signs it produces. **Materials and methods:** This is a randomized study conducted for one year as a prospective analysis in 2019 at Vims, Pawapuri, Nalanda medical college. Informed consent has been taken from the patients before doing the diagnostic procedures and other approval taken to do this study. All the suspected cases of Neurocysticercosis as per diagnostic criteria3 from paediatric department were underwent CT neuroimaging at radiology department. Blood samples were collected from all Neurocysticercosis patients by a sterile needle in labeled test tubes under aseptic precautions and then centrifuged to obtain serum, and stored at 4 degree centigrade until reuse. **Results:** A total of 82 blood samples were collected from patients suspected of Neurocysticercosis (NCC). All the samples were subjected to ELISA test. Among 82 patients, males were shown higher preponderance affected with Neurocysticercosis about 62.1% than females. Most commonly affected age group was young ones 6-15years (83.4%) followed by 16-25 years (16.6). **Conclusion:** Maximum positive results on immunological tests were obtained when the number of lesions were high, when the lesions were in contact with CSF and when there were live cysts. High levels of personal hygiene and prevention of faecal contamination with foods also play a major role in preventing the disease. Even though CT / MRI, EITB are important modalities for the diagnosis of NCC cases, they may not be always available in small equipped laboratories and small hospitals in rural areas. In such situations ELISA can be preferred to CT /MRI and EITB for the detection of cysticercal antibody in serum samples. ELISA has become increasingly popular as field test also. Comparative study of CT Radioimaging and ELISA gives better results in terms of diagnostic accuracy.

Key Words: Neurocysticercosis, CT, MRI, ELISA, EITB

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Neurocysticercosis (NCC) is a clinical condition in humans, which infects brain caused by a encysted larvae, cysticercoid of *Taenia solium. Taenia solium* is a cestode which is commonly called as Pork tapeworm. Cysticercosis is one of the most important of the parasitic disease of the nervous system, because of its worldwide distribution, high incidence and variety of symptoms and signs it produces.[1]

- The tapeworm that causes Cysticercosis is endemic to many parts of the world including

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China, Southeast Asia, India, Saharan Africa, and Latin America1. Some studies suggest that the prevalence of cysticercosis in Mexico is between 3.1 and 3.9 percent.[2] Other studies have found the Seroprevalence in areas of Guatemala, Bolivia and Peru as high as 20 percent in humans and 37 percent in pigs in Ethiopia, Kenya and Democratic Republic of Congo around 10 percent of the population is infected, in Madagascar 16 percent. The frequency has decreased in developed countries owing to strict meat inspection, better hygiene and better sanitary facilities3but in India about 4.5/1000 of population.

NCC is common disease but its diagnosis remains problematic. Neuroimaging studies are usually abnormal but in most cases, not pathognomonic, immunological tests have been developed to support the diagnosis.[4] During recent meeting on NCC held in august 2000 in Lima, Peru, a panel of experts agreed upon more accurate and stringent revised criteria for the diagnosis of NCC.[5] Its prevalence is still underestimated because of lack of diagnostic facilities in rural area where the reported cases represent only the tip of iceberg. Hence this study has been undertaken to know the prevalence of Neurocysticercosis and also to compare the radioimaging and ELISA diagnostic modalities which are routinely using to detect Neurocysticercosis.[6]

MATERIALS AND METHODS

This is a randomized study conducted for one year as a prospective analysis in 2019 at Vims, Pawapuri, Nalanda, medical college. Informed consent has been taken from the patients before doing the diagnostic procedures together with other approval to do this study. All the suspected cases of Neurocysticercosis as per diagnostic criteria3 from paediatric department were underwent CT Neuroimaging at radiology department. Blood samples were collected from all Neurocysticercosis patients by a sterile needle in labeled test tubes under aseptic precautions and then centrifuged to obtain serum, and stored at 4 degree centigrade until reuse. All samples were collected before administering the therapy. All samples were considered as potential bio hazards and were handled with care using universal precautions. By using excretory-secretory (ES) antigen, ELISA was done on serum samples of all patients and IgG antibodies were estimated (Cysti cheX test). Patients complaints were noted and were carefully examined for subcutaneous nodules, muscle hypertrophy, levels of sensation and focal neurological deficits. In all patients complete hemogram with absolute eosinophils count, CSF analysis, chest X-ray, mantoux tests were done. The results of all diagnostic works were evaluated and tabulated.

RESULTS

A total of 82 blood samples were collected from patients suspected of Neurocysticercosis (NCC). All the samples were subjected to ELISA test. Among 82 patients, males were shown higher preponderance affected with Neurocysticercosis about 62.1% than females. Most commonly affected age group was young ones (6-15years) about 83.4 followed by 16-25 years (16.6%). Symptomatology assessment was done among NCC patients (Table No:1). Based on these proposed criteria (Del Brutto *et al.*.)3, diagnosis of NCC in our study group was definitive in 48 patients (58.5%) and probable in the remaining 34 patients (41.4%). Out of 82 patients, 9patients (10.9%) had subcutaneous nodules (multiple in seven and single in two). 16patients (19.5%) had one or other focal neurological defects, 7(8.5%) had bilateral papilloedema, 5(6%) had reduced visual acuity, 3(3.6%) had hemiplegic and one had unilateral third nerve paralysis. Hemogram study shown that 40 patients (48.7%) had hemoglobin level less than 12 g/dl, of these in 11(13.4%) patients hemoglobin level was less than 10 g/dl. 23 patients (28%) showed leukocytosis (>11,000). Absolute eosinophilic count was > 500/c.mm in 42 patients (51.2%). In 49 patients (59.7%) ESR was > 20 mm / 1st hour and in 13 patients (15.8%) ESR was more than 40mm/1st hour. CSF study shown that most of the patients with absent or mild pleocytosis presented with seizures and those who had significant pleocytosis had chronic meningitis like presentation. In 38 patients (46.3%), there was CSF pleocytosis (>5 cells/c.mm). CSF protein was 41-60 mg% in 27 (32.9%) patients and more than 60 mg % in 8 (9.7%) patients. Maximum CSF protein observed was 190 mg%. CSF sugar was low, < 40 mg% in 3 (3.6%) patients. In 43 (52.4%) patients CSF sugar was between 40-60 mg%. In 26 (42.6%) patients CSF sugar was > 60 mg%. The lowest CSF sugar observed was 10 mg%. ELISA has performed to detect IgG antibodies using Excretory-Secretory antigen on serum samples. Positivity for IgG antibodies seen in 59 patients about 71.9% (Table No.2). Cysts in brain after diagnosed by CT imaging in total of 82 patients, categorized as degenerating cysts, live cysts and calcified cysts. Their positivity has depicted in Fig.No.1 Parenchymal changes were noted in Suspected cases of Neurocysticercosis. Edematous changes in brain noted as a significant factor on CT scan (FigNo:2). On repeat imaging of Neurocysticercosis cases among 45 patients about 54.8%, most of the cysts in brain were disappeared, few were in same size or calcified (Fig.No.3). Out of 82 patients, 20 patients (24.3%) cysts were in frontal region, in 46 patients (56%) in parietal region and in 22 patients (26.8%) lesions were widespread. Out of 82 patients, 28 patients (34.1%) cysts were located closer to CSF (10 near cortical surface, 5 near ventricular surface

and 7 near both cortical and ventricular surface), 55 (67%) patients cysts were located away from CSF flow.

Table 1: Showing Percentage of Various Symptoms among NCC Patients

Symptoms	No of patients	Percentage
Seizures	65	79.2%
Headache	39	47.5%
Vomiting	33	40.2%
Visual disturbance	23	28%
Fever	22	26.8%
Hemiplegic	3	3.6%
Behavioral Abnormalities	3	3.6%

Table 2: Distribution of Serum Positive Cases in Both Single and Multiple Cysts

		Serum	Percentage
Single	Positive	38	66.6%
	Negative	19	33.3%
	Total	57	69.5%
Multiple	Positive	22	88%
	Negative	3	12%
	Total	25	30.4%

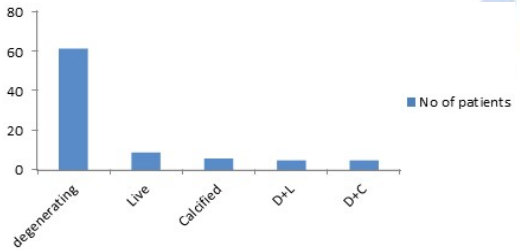

Figure 1: Distribution of Data According to Stage of Larva

DISCUSSION

In this study, majority of the patients (79.2%) presented with seizures. Focal motor with secondary generalization was the commonest seizure type. Seizures were also the most common symptoms in the series reported by Del Brutto *et al.*. Rajasekhar V and Chowdary.[7] G.V.S being seen in 70%-90% of the patients. Headache and associated vomiting was the second commonest symptoms seen in 45% of the patients in our study. Gracia HH *et al.*. found that in 52% of this patients with NCC had headache.[8] In general disseminated cysticercosis was more common in Asian patients with NCC compared to others. In the present study serum was selected for ELISA testing using ES antigen to detect IgG antibodies against NCC. Because measuring IgG antibodies in Serum was more sensitive and specific than using CSF as per different studies.[9] As per this study, among 57 patients who had single CT lesions, ELISA was positive for serum in 38 patients (66.6%) with excretory secretary antigen. Subbarao V Atluri, P.Singhi, Kandelwal N, Malla N *et al.*. found positive anticysticercal antibody in serum against ES Antigen among single cysts diagnosed patients. Similar low immunological positivity in patients with single cysticercal cyst is seen in other studies as well. Sotelo *et al.*[1] found that immunological positivity depends on site and number of the cysticercal lesions, Khandelwal N found that antibody titre correlated with number of CT lesions. Positivity was maximum when there were live cysts and minimum when there were only calcified cysts. Espindola NM *et al.* found that 94% of patients harbouring live cysticercal cysts had IgG antibody in contrast to 44% of patients harboring calcified cysticerci.[10]

CONCLUSION

Maximum positive results on immunological tests were obtained when the number of lesions were high, when the lesions were in contact with CSF and when there were live cysts. High levels of personal hygiene and prevention of faecal contamination with foods also play a major role in preventing the disease. Even though CT / MRI, EITB are important modalities for the diagnosis of NCC cases, they may not be always available in small equipped laboratories and small hospitals in rural areas. In such situations ELISA can be preferred to CT /MRI and EITB for the detection of cysticercal antibody in serum samples. ELISA has become increasingly popular as field test also. Comparative study of Radioimaging and ELISA gives better results.

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