Original article:

Clinico-radiological profile and treatment outcomes in neurocysticercosis between 1-12years of age: Study of in and around Rohilkhand Medical College, Bareilly, North India

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Abstract:

Introduction: This study was aimed to study the clinical and radiological profile of neurocysticercosis and outcomes of treatment in neurocysticercosis.

Methods and Material: A total of 62 patients coming under definitive or probable diagnosis of neurocysticercosis as per the revised diagnostic criteria for neurocysticercosis were included in this study. Clinical history, physical examination, and neuroimaging (CT or MRI) studies were done at the beginning. Patients were treated with albendazole, corticosteroids, and antiepileptic drugs. They were followed up clinically for 3 months and neuroimaging study was repeated 3 months after albendazole therapy.

Results: Definitive cases were 44 (70%) and probable cases were 18 (29%). Male: female ratio was 2.07. Most common age of presentation is between 5-12 years. The commonest presentation was seizures in 38 (95%). 51(82.5%) patients had a single lesion and 11 (27.5%) had multiple lesions in initial imaging study. Commonest site of lesion was parietal lobe (45%). Most common stage of presentation was colloidal (55%). 57 (92.5%) patients were free of seizures at the end of three months.

Conclusions: Neurocysticercosis usually affects young persons, youngest age of presentation 14 months, being equally common among vegetarians. Most common clinical manifestation is seizures. Single lesion is more common than multiple lesions, commonly presenting in colloidal. Clinical and radiological response to 4-week therapy with albendazole is quite satisfactory. All cases of epilepsy in tropical countries should be investigated for neurocysticercosis.

Keywords: Albendazole, colloidal stage, neurocysticercosis, seizures

Introduction

Neurocysticercosis is the commonest parasitic disease of nervous system.[1] The age-adjusted prevalence of active epilepsy in tropical countries ranges from 10 to 15 per 1000 inhabitants, almost twice the level in western countries.[2]Neurocysticercosis has been estimated to cause at least 50 000 deaths worldwide annually.[2] In India, neurocysticercosis has been identified as a cause of 2.2 to 6% unselected cases of seizures.[3]

Neurocysticercosis is caused by the larval stage (cysticerci) of the pork tapeworm *Taeniasolium*. Clinical manifestations of neurocysticercosis are varied due to individual differences in the number, size, and topography of lesions and in the severity of the host's immune response to the parasites. This study aimed to study the clinical and radiological profile of neurocysticercosis and outcomes of treatment in neurocysticercosis.

Materials and Methods

This was a prospective observational study conducted over a period of one year from November 2013 to October 2014, and included 62 patients.

Inclusion criteria

Patients coming under definitive or probable diagnosis of neurocysticercosis as per the revised diagnostic criteria for neurocysticercosis[4][Table 1] were included in this study. However, histologic demonstration of the parasite from biopsy of a brain lesion was not done, as this is an invasive procedure. Also, serum EITB and CSF ELISA tests were not done due to nonavailability of these tests in the institute and non-affordability of the patients. Thus, the diagnosis was based on clinical and radiological features.

Exclusion criteria

Patients of tuberculosis were excluded.

A detailed medical history with emphasis on the description of the seizure, general examination, and neurological examination was performed. Diagnostic evaluation included hemoglobin, peripheral blood smear, total and differential leukocyte counts, microscopic examination of stool done thrice for taeniasis, work-up for tuberculosis (erythrocyte sedimentation rate, Mantoux test, chest radiograph), contrast-enhanced CT scan of brain, or MRI brain. Number, site, stage, size of the lesions, presence of scolex, and perilesional edema were noted.

Table 1: Revised diagnostic criteria for neurocysticercosis [4]

Categories of criteria	**criterias**
Absolute	• Histological demonstration of the parasite from biopsy of brain or spinal cord lesion • Cystic lesions with scolex on CT or MRI • Direct visualization of subretinal parasite by fundoscopy
Major	• Lesions highly suggestive of NCC onneuroimaging • Positive serum EITB for detection of anticysticercalantibodies • Resolution of cysts after antiparasitictherapy • Spontaneous resolution of small single enhancinglesions
Minor	• Lesions compatible with NCC onneuroimaging • Clinical manifestations suggestive ofNCC • Positive CSF-ELISA for detection of anticysticereal antibodies orcysticercalantigens • Cysticercosis outside theCNS
Epidemiologic	• Evidence of household contact with *Taneasolium*infection. • Individual coming from living in an endemicarea. • History of travel to an endemicarea

Definitive: Presence of one absolute criterion or two major plus one minor and oneepidemiologic criteria.

Probable: Presence of one major plus two minor criteria or one major plus one minor and one epidemiologic criteria or three minor plus one epidemiologic criteria

All patients received albendazole in a dose of 15 mg/kg body weight/day in three divided doses for 28 days and oral prednisolone 2 mg/kg/day for initial 5 days of therapy. Antiepileptic drugs were given. Patients were followed up regularly for 3 months after completion of Albendazole therapy. Imaging study was repeated afterthree months after initiation of Albendazole therapy. Following were considered indicators of therapeutic outcome:

Radiological outcome:

Complete resolution - Disappearance of lesion.

Partial resolution - Reduction in size or number of lesions by at least 50% or more of the original.

No resolution - No or less than 50% decrease in the size or number of original lesions.

Calcification of the lesion - appearance of small calcified speck without edema.

Clinical outcome was measured in terms of recurrence of seizures, based on objective reports from patients.

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Results

There were 40 patients included in the study, of which definitive cases were 28 (70%) and probable cases were 12 (30%).Distribution of cases as per criteria for diagnosis of neurocysticercosis is shown in [Table 2].

Group	Criteria	No. of patient	Percentage
Definitive case	(A) One absolute criteria: lesions with scolex in CT/MRI brain (B) Two major criteria: (1) Lesions highly suggestive of NCC on CT brain (2) Resolution of intracranial cystic lesions after therapy with albendazole One minor criteria : clinical manisfestation suggestive of NCC One epidemiological criteria: individual living in an endemic area.	25 19	40.3 30.6
Probable case	One major criteria : lesions highly suggestive of NCC on CT brain One minor criteria : clinical manisfestation suggestive of NCC One epidemiological criteria: individual living in an endemic criteria	18	29
Total		62	100

Patient characteristics

Total 62 patients were included in this study, of which 42 (67.5%) patients were males and 20 (32.5%) were females. The male: female ratio was 2.07. The subject age varied from 1 to12 years with a mean age of 9.8 years. Maximum patients were in the age group of 5 to 12 years (80%). Majority (50%) of cases were of lower socioeconomic strata. Thirty patients (47.5%) were pure vegetarians and 32 (52.5%) patients took a mixed diet. None of the patients were pork-eaters. None of the patients had domestic or occupational exposure to pigs. Of 62, 40(65%) patients were rural and 22 (35%) patients were urban.

The presenting clinical features are shown in [Table 3]. There were 30 (48.2%) patients who had simple partial seizures, 4 (6.5%) patients had complex partial seizures, 7 (11.5%) had partial seizures with secondary generalization, and 21 (33.8%) patients had primarily generalized seizures. In 9 (14.5%)

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patients, Jacksonian progression of seizure activity was seen. Only 7 (11.2%) patients had postictal weakness (Todd's paresis) lasting for few minutes to 8 hours. Status epilepticus was present in 4 (6.5%) patients. Papilledema was observed in 6 (10%) patients. Ocular cysticercosis was not seen in any patient.

Table 3: Symptoms of the patients at presentation

Clinical symptoms	**No. of patients (n=62)**
Seizures	58(95)
Headache	25(40)
Vomiting	27(45)
Loss of consciousness	27(42.2)
Behavioral changes	4(7.5)
Fever	14(22)

Figures in parentheses are given in percentage.

Investigations

Mean hemoglobin level was 10.66 ± 2.54 g/dl. Eosinophilic percentage was raised (>5%) in 4 (10%) patients. Stool microscopy for taeniasis was negative in all patients.

Characteristics of first CT scan/MRI

Fifty three (87.5%) patients underwent contrast-enhanced CT scan and 9 (12.5%) patients underwent MRI scan at the beginning of the study. Of 62 patients, 52 (83.8%) patients had a single lesion and 10 (16.2%) had multiple lesions in initial imaging study. Commonest site of lesion was parietal lobe (45%). Ten patients (27.5%) had lesions involving multiple lobes and 9 (14.5%) patients had frontal lobe lesions.Of 40 patients, 44 (72%) patients were found to have lesions ≤10 mm, whereas 18 (29%) patients had lesions >10 mm. Scolex was seen in initial imaging study in 30 (48.5%) patients. Forty-six (75%) patients had perilesional edema at the time of presentation, whereas 16 (5%) patients had no perilesional edema. None of the patient had mass effect due to lesion.

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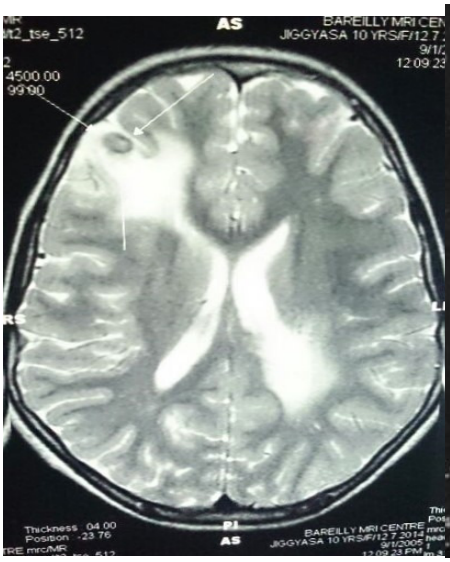
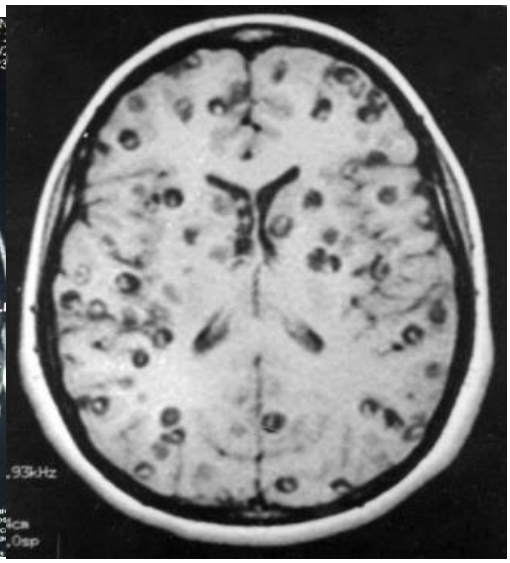


Fig. showing single lesion with Peri-lesional edema



Fig, showing multiple lesions

Clinical outcome

Clinical outcome was assessed on the basis of recurrence of seizures, based on objective reports from patients. Fifty-seven (92.5%) patients were free of seizures, whereas five patients (7.5%) had recurrence of seizures, at the end of three months. All 52 patients who had a single lesion in the initial imaging study were seizure free and five of 10 patients with multiple lesions in initial imaging study were free of seizures at the end of 3 months. Of the 52 patients with a single lesion who were seizure free, 28 (54.42%) had complete resolution of the lesion on follow-up imaging study at the end of 3 months; 08 (15.18%) had partial resolution; 06 (11.13%) lesions underwent calcification; and lesions remained unaltered in 10 (19.13%) patients.However, of five patients with multiple lesions who were seizure free, 4 (40%) had partial resolution and 1(10%) patient had calcification of lesion.

Five (8%) patients had recurrence of seizures during the three-month follow-up period. All of these patients had multiple lesions in the initial imaging study and the lesions were unaltered in the follow-up study at the end of 3 months.

No patient developed signs of elevated intracranial pressure during or soon after therapy. Nine patients (15%) developed headache on day 3 to 4 of treatment with cysticidal drugs not associated with any other feature of raised intracranial pressure. Interruption of the therapy was not required in any of these cases.

Radiological outcome

Radiological follow-up at 3 months in patients with single lesion (n = 52) and in patients with multiple lesions (n = 10) is shown in [Table 4]. At the end of 3 months, only six patient (9.6%) had perilesional edema. None of the patients had shown appearance of new lesions on follow-up imaging study.

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Table 4: Radiological follow-up at 3 months in patients with single lesion (n = 52) and multiple lesion (n=10)

Radiological outcome	**No. of patients**	**No. of patients**
	Single lesion (n=52)	**Multiplelesion (n=10)**
Complete resolution	28 (54.42%)	00 (0%)
Decrease in size	08 (15.18%)	4 (40%)
Calcification	06 (11.13%)	1 (10%)
Unaltered	10 (19.13%)	5 (50%)
Increase in size	00 (0%)	00 (0%)
Total	52 (100%)	10 (100%)

Discussion

The subject age varied from 1 to 12 years with a mean age of 9.8 years, the peak age was at 12 years with slight male predominance. Mean age of patients in other studies from Nepal,age varied 2.6 years to 14 years with the mean age of 10.6 years and the peak age was at 12 years with slight male predominance, ratio being male:female 1.2.[6] These data show that neurocysticercosis is common in children and young adults worldwide. Thus, the age distribution of the patients in the present study was similar to other Indian as well global studies.

Cysticercosis is generally a disease of lower socioeconomic conditions associated with poor hygiene and sanitation. In a study from Kerala, Kuruvillaet al.[7]found that 73% patients belonged to lower socioeconomic category. In other studies from Chandigarh, 69% and 82.7% of the patients of lower socioeconomic strata were involved.[8, 9] Majority (77.5%) of the cases in the present study were of lower socioeconomic class. Thus, results were similar to other Indian studies.

Although cysticercosis had been reported to be higher in non-vegetarian people, especially pork eaters, many (46%) of our patients were pure vegetarians, and none of the patients consumed pork, thereby supporting the fact that feco-oral contamination seems to be the major route of the disease. In a previous study from Chandigarh, 53.2% patients were documented as pure vegetarians.[9]The present study,also has a high percentage of rural patients, probably related to poor hygienic conditions and higher amount of fecal contamination of drinking water in rural areas, which wassimilar to other Indian studies.

Seizures are reported as the most common symptom in neurocysticercosis, occurring in 70 to 90% of patients. Similarly, 38 (95%) patients in the current study presented with seizure as the chief complaint.

In literature, partial seizures are the most commonly reported seizures in patients with single lesion neurocysticercosis.[9, 14, 15] Majority (86.20%) of the patients with single lesion in this study also had partial seizures.

Papilledema was observed in 4 (8%) patients. Das et al. reported papilledema in 16.5% patients.[3]

Most of the studies in India deal with single lesion neurocysticercosis (solitary cysticercal granuloma). A study by Kuruvillaet al.[7]found single lesion in 40% and multiple lesions in 60% patients. Single lesion was present in 76% and multiple lesions in 24% patients in a study by Singhiet al.[15] Similarly, Kotokey et al.[13] reported single lesion in 66.66% and multiple lesions in 33.33% patients; and Rajshekhar

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et al.[13] reported single lesion in 60.88% and multiple lesions in 39.13% patients.

Thus, although most of the Latin American studies show that multiple lesion neurocysticercosis is common in that part of the world, most of Indian studies show that single lesion neurocysticercosis is more common form of disease in India.

The present study found single lesion in 72.5% patients and multiple lesions in 27.5% patients, showing that single lesion neurocysticercosis is more common than multiple lesions, which is in agreement with most other Indian studies.Parietal lobe has been found to be the most common site of single lesion neurocysticercosis.[8, 9, 14]In this study, 45% of the lesions were situated in the parietal lobe. Baranwal et al. and Singhi et al. reported parietal lobe involvement in 41% and 57.3% patients, respectively. [8, 9]Since most of the patients present with motor or sensorimotor seizures, distribution of lesions about the sensorimotor cortex is well expected. Less commonly reported sites are temporal lobe, basal ganglion, and cerebellum, which was also observed in our study.[8, 9] Thus, the distribution of the lesion in this study was similar to other studies.

Fifty-seven (92%) patients were free of seizures, whereas five patients (8%) had recurrence of seizures, at the end of three months. The seizure recurrence in patients treated with Albendazole in other studies was 13% (Gogia et al.),[14] 56% (Garcia et al.),[5]and 18% (Kuruvilla et al.).[7] Thus, the seizure recurrence of 7.5% in the current study is less than that observed by other authors.

In this study, of 62patients, 47 (76%) patients had radiological resolution (complete resolution + partial resolution + calcification) at the end of three months. The radiological resolution in various other studies at the end of three months was64.5% (Baranwal et al.),[8] and 62.5% (Singhi et al.).[15] The radiological resolution in 76% in the current study is comparable with last three studies.

Conclusions

This study concludes that neurocysticercosis usually affects young persons. It is equally common among vegetarians. Most common clinical manifestation is seizures, partial seizures being most common in patients with single lesion and primarily generalized seizures in patients with multiple lesions. Single lesion is more common than multiple lesions, commonly presenting in colloidal stage (ring-enhancing lesion). Clinical and radiological response to 4-week therapy with albendazole is quite satisfactory, with control of seizures in 92% patients and radiological resolution in 76% patients at the end of 3 months. We recommend that all cases of epilepsy in tropical countries should be investigated for neurocysticercosis.

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