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Original Research Article

Study of clinical and radiological profile of children with neurocysticercosis

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ABSTRACT

Background: To study the clinical and radiological profile of children with Neurocysticercosis Hospital based, Observational study conducted in SPMCHI, Jaipur from June 2015 to June 2016.
Methods: 50 children diagnosed of neurocysticercosis based on clinical features and findings on magnetic resonance imaging with contrast were enrolled while excluding the other common causes of granuloma.
Results: A total of 50 children completed this study. Mean age of the presentation was 8.68±2.133 (5 to 16) years, with an M: F of 0.92:1. Overall patients presented with generalized seizure in 76%, focal in 16%, headache±vomiting in 6%, focal neurodeficit in 2% and combination of symptoms in 60.5% cases. MRI brain showed a solitary lesion in 45 (90%) and multiple in 5 (10 %). At presentation lesions were vesicular in 46 %, nodular calcified in 16 %, granular nodular in 10 %, colloidal vesicular in 6% and mixed in 6%. One child presented with a starry sky appearance.
Conclusions: Neurocysticercosis usually affects young persons, youngest age of presentation 5 years, was found more common among vegetarians. Most common clinical manifestation is seizures. Single lesion is more common than multiple lesions, commonly presenting in vesicular stage. NCC should be considered first in the differential diagnosis of new-onset seizure among the children of developing countries, where taeniasis is endemic.

Keywords: NCC, MRI, CSF, MT

INTRODUCTION

Human cysticercosis, an infection by the larval stage (cysticercus) of the pork tapeworm Taenia solium, is the most common parasitic central nervous infection world-wide.[1] It is highly endemic in the Asian developing countries like India. Humans acquire tapeworm infection via the feco-oral route, usually by the ingestion of food or water contaminated with the eggs of T. solium.[2] The disease may, therefore develop even in individuals who do not eat pork. NCC relatively more common in certain rural communities' due to poor sanitation, use of human feces for fertilizing plants in gardens or farms, and lack of controlled pens for pigs.[3] 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.[4]

Our present study attempts to assess the clinical features, diagnostic modalities available with special emphasis on imaging modalities of pediatric neurocysticercosis cases over duration of one year from June 2015 to June 2016.

METHODS

The study was carried out in the Department of Pediatrics, SMS medical college, Jaipur, India. Symptomatic patients with magnetic resonance imaging

(MRI) scan brain showing lesions of NCC in various stages (eg. Vesicular, colloidal vesicular, nodular calcified and mixed) were included. Other common causes of a ring enhancing lesions such as tuberculoma were excluded.

The children (where possible), their parents and witnesses were interviewed separately with the help of a predesigned questionnaire. Every patient's parents and legal guardians confirmed participation in the study freely and voluntarily.

Case suspect: Any child aged between 1 month to 18 years presenting with unprovoked seizures, headache, vomiting or unexplained neurological symptoms or signs.

Inclusion criteria

A case suspect meeting the Del Brutto's criteria (Definitive+probable cases) for diagnosis of Neurocysticercosis were included in the study.

No separate diagnostic criteria have been laid down for pediatric neurocysticercosis so the adult criteria of Del Brutto et al., was used in our study.[5] According to those criteria, either one absolute criteria or a combination of 2 major, 2 minors and 1 epidemiologic criterion are necessary for the definitive diagnosis (Table 1). Probable diagnosis is made by 1 major plus 2 minors or 1 major plus 1 minor plus 1 epidemiologic criterions or 3 minors plus 1 epidemiologic criterion.

Table 1: Del Brutto's criteria.

Absolute criteria
Histological demonstration of the parasite from biopsy of a brain or spinal cord lesion evidence of cystic lesions showing the scolex on neuroimaging studies direct visualization of subretinal parasites by fundoscopic examination
Major criteria
Evidence of lesions highly suggestive of neurocysticercosis on neuroimaging studies positive serum immunoblot for the detection of anticysticercal antibodies resolution of intracranial cystic lesions after therapy with albendazole or praziquantel spontaneous resolution of small single enhancing lesions
Minor criteria
Evidence of lesions compatible with neurocysticercosis on neuroimaging studies presence of clinical manifestations suggestive of neurocysticercosis positive cerebrospinal fluid elisa for detection of anticysticercal antibodies or cysticercal antigens evidence of cysticercosis outside the central nervous system
Epidemiological criteria
Individuals coming from or living in an area where cysticercosis is endemic. History of travel to disease-endemic areas Evidence of a household contact with taenia solium infection
Definitive: presence of one absolute criterion presence of two major plus one minor and one epidemiological criteria
Probable: presence of one major plus two minor criteria presences of one major plus one minor and one epidemiological criteria presence of three minor plus one epidemiological criteria

Table 2: Escobar classification correlating on MRI.

Stage of NCC	Cyst	T1	Edema	Post-GD
Vesicular	Dot sign	Hyperintense scolex	+	No enhancement
Colloidal vesicular	Cyst and wall becomes thickened	Hyper intense to CSF / scolex seen as eccentric foci	++	Brightly enhances
Granular nodular	Retracts	Scolex not visible	↓	Less marked enhancement
Nodular calcified	Calcified	Signal drop out	Absent	No enhancement

All the children who met the inclusion criteria were enrolled in the study after taking informed parental consent. Total of 50 such eligible children were included in the study. Among 50 children who were eligible, 27 cases qualified under definitive cases and 23 cases qualified as probable case. Detailed clinical history was taken including diet history, sanitation, socioeconomic status and family history. Physical examination and neurological examination was performed. Diagnostic evaluation included hemoglobin, peripheral blood smear, total and differential leukocyte counts, microscopic examination of stool microscopy for taeniasis, work-up for tuberculosis (erythrocyte sedimentation rate, Mantoux test, chest radiograph), and MRI brain. Number, site, stage, size of the lesions, presence of scolex, and perilesional edema were noted. 50 children with NCC who underwent an MRI brain with contrast were classified (Table 2) into various stages of NCC.[6-8]

P value < 0.05 was considered as the cut-off value for significance. All analyses were performed using IBM SPSS statistics, version 2.0, for Windows.

RESULTS

Age incidence

Among those 50 patients who completed the study the mean age of onset of symptoms was 8.68±2.133 (5 to 16) years 7 to 9 years age group was the commonest age group to be involved (36%) followed by 5-7-year age group (34%). Sex incidence: Female patients constituted nearly 52% (n=26) of the total cases, M: F ratio of 0.92:1.

Clinical presentation

The most frequent manifestation was seizure in 46 (92%) patients, followed by headache and or vomiting in 3 (6%) patients and neurological deficits like monoparesis in 2% patients. Generalized seizures were present in 76% of cases and focal seizure 16%.

Out of 50 children, 32 children consumed a vegetarian diet and 18 consumed a non-vegetarian diet. Among 18 children who consumed non-vegetarian diet only two consume pork as a part of their diet.

On physical and neurological examination, none of the children were in coma, 10% children had signs of meningeal irritation. A lumbar puncture was done on 5 children who had signs of meningeal irritation whose results were within normal limits.

Laboratory studies

Eosinophilia was present in 16 % of cases respectively. High ESR >30 mm/hr were found only in 10% of cases. Mantoux tests of all patients with neuro-imaging findings consistent with NCC were negative.

Neuro-imaging (MRI with contrast)

Single parenchymal ring (REL) was found in 45 (90%) patients. Multiple RELs were seen in only 5 (10%) cases, Maximum numbers of lesions i.e. 48% of lesions were seen in parietal lobe followed by 18% of lesions seen in occipital lobe and 16% lesions seen in frontal lobe.

Stage of NCC were categorized respectively (Table 3), 23 children had a lesion in vesicular stage, followed by 16 children with the lesion in nodular calcified stage while 5 children had lesions in granular nodular stage and only three children had a lesion in colloidal vesicular stage.

17 out of 24 children who had lesions in the parietal lobe presented with GTCS seizures while 6 children presented with focal seizures and one child only had headache and vomiting. One child who presented with focal neurological deficit had a lesion in frontal lobe and the child who had lesions >100 on MRI presented with GTCS seizures.

Table 3: Distribution of stages of NCC

Stage of lesion		Number	%
Vesicular	Active	23	46
Colloidal Vesicular	Active	3	6
Granular Nodular	Active	5	10
Nodular Calcified	In-Active	16	32

DISCUSSION

Neurocysticercosis is one of the most common causes of unprovoked seizures in pediatric population. Not only the affected children suffer from the condition, the siblings who share the same dietary and sanitary practices are at a great risk.

In present study out of 50 children, 26 patients were female while 24 were male children with Male: female ratio was 0.92:1 and the mean age of onset of symptoms was 8.68±2.133 (5 to 16) years 7 to 9 years age group was the commonest age group to be involved (36%) followed by 5-7-year age group (34%). Among 50 children 11 belonged to the Muslim community and 39 children were Hindus.

A study conducted by Shrestha BM et al included 68 children out of which 43 were female and 25 were male and Age of the patients ranged from 2 to 14 years (mean-5.8 years), with peak incidence among 8 to 10 years children.

Preschool-age children (<6 years) constituted only seven (10.3%) children. Forty-seven (69.1%) of the patients were older than 7 years.[9] Thirty-two children consumed a vegetarian diet and 18 consumed a non-vegetarian diet. Among 18 children who consumed non-vegetarian diet only two consume pork as a part of their diet.

According to Bhattacharjee S et al seven out of 38 were pure vegetarians and the rest were non-vegetarians, but most of them never took pork as this habit is not a socially prevalent custom in India.[10] In a Previous study from Chandigarh by Singhi P et al, 53.2% patients were documented as pure vegetarians.[11]

Most common symptom was seizures, 76 % of children presented with generalized tonic-clonic seizures, 16 % with focal seizures, and 10 % developed bilateral focal seizures, while 6 % of children presented with nausea and vomiting and 2 % of children had focal neurological deficit. In a study conducted by Ravi Singh Chauhan et al 95% of children had seizures as their chief complaint.[12] 10% had signs of meningeal irritation and 8% of children had blurred disc margins.

In a study conducted by Bhattacharjee S et al symptoms of raised intracranial tension like headache with or

without vomiting were there in 63.2% cases at initial presentation.[10] A lumbar puncture was done on children showing signs of meningeal irritation which yielded results within normal limits. Tuberculosis is a common cause of granuloma producing a symptomatology and causing a diagnostic dilemma. Out of 50 children, 86 % had a normal chest X-ray while 7 had hilar lymphadenopathy.

Mantoux test was negative in all the 50 children. Gastric aspirate/sputum for acid fast bacilli and CBNAAT (Gene Xpert) were negative in all the cases.

On studying MRI of 50 children, 45 had a single lesion, 4 children had two lesions and one child had lesions >100 in number. A Study by Kuruvilla et al found single lesion in 40% and multiple lesions in 60% patients.[13] Single lesion was present in 76% and multiple lesions in 24% patients in a study by Singhi et al.[11]

Similarly, Rajshekhar et al reported single lesion in 60.88% and multiple lesions in 39.13% patients.[14] On MRI maximum numbers of lesions i.e. 48 % of lesions were seen in parietal lobe, 18 % of lesions seen in occipital lobe, 16 % lesions seen in frontal lobe followed by 10 % of lesions were in temporal lobe, mixed lesions were seen in rest of the 8 % of children. Singhi et al reported parietal lobe involvement in 41% and 57.3% patients, respectively.[11]

In a study conducted by Bhattacharjee S et al parietal lobe was the most common site of involvement (74.1%) followed by frontal lobe involvement around 15% cases.[10]

In present study, out of 50 children who presented with neurocysticercosis, 23 had a lesion in vesicular stage, followed by 16 children with the lesion in nodular calcified stage while 5 children had lesions in granular nodular stage and only three children had a lesion in colloidal vesicular stage.

In a case series studied by Chandra B et al, the granular nodular lesions with inflammation were predominant with percentage of 38.6%.[15] In a recent study from Odisha, a state neighboring to Andhra Pradesh, by Sahu et al calcified cysts were predominant, accounting for 47.06% of the total patients diagnosed to be NCC.[16]

One child who presented with focal neurological deficit had a lesion in frontal lobe and the child who had lesions >100 on MRI presented with GTCS seizures. Singhi et al and Talukdar et al et al in their studies reported similar findings.[11,17]

Following Tables show the comparison with different studies on NCC.

Table 4: Comparing demography and dietary practices of children with NCC.

Study	Present study	Gauchan e et al[18]	Shrestha BM et al[9]	Ruiz-garcia m et al[19]	Rosenfeld a et al[20]	Zammarchi l et al[21]
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Study size	50	109	68	122	47	21
Male	24 (48 %)	66 (60.5%)	24 (26%)	51 (41%)	18 (38.2%)	10 (47.6%)
Female	26 (52 %)	43 (39.5%)	44 (64%)	71 (59%)	29 (61.7%)	11 (43.4%)
Non-vegetarian	18 (32 %)	-	-	-	-	-
Vegetarian	32 (64 %)	-	-	-	-	-
Mean age	8.68 yrs	9.77 yrs	5.8 yrs	8 yrs	8.4 yrs	5.8 yrs

Table 5: Comparing the presenting symptoms of children with NCC.

Study	Present study	Gauchane et al[18]	Shrestha bm et al[9]	Ruiz-garcia m et al[19]	Rosenfeld a et al[20]	Zammarchi l et al[21]
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Generalized seizures	38 (76 %)	45 (41%)	10 (15%)	68 (55.7%)	9 (19%)	12 (57%)
Partial seizures	8 (16 %)	40 (36%)	51 (85%)	54 (44.3%)	32 (68%)	9 (42%)
Headache	33 (66%)	5 (4%)	26 (38%)	71 (58 %)	15 (31.2%)	8 (38%)
Vomiting	26 (52%)	8 (6%)	26 (38%)		15 (31.2%)	9 (42%)
Focal deficit	1 (2%)	0	10 (15%)	15 (12%)	4 (8%)	9 (42%)

Table 6: Comparing imaging (MRI) findings of children with NCC.

Study	Present study	Gauchan E et al[18]	Shrestha BM[8]	Ruiz-Garcia M et al[19]	Rosenfeld A et al[20]	Zammarchi L et al[21]
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Number of lesions						
Single lesion	45 (90 %)	89 (81.6%)	57 (83%)	102 (83.6%)	42 (89%)	17 (81%)
Multiple lesions	4 (8 %)	20 (18.4%)	7 (10%)	20 (16.3%)	5 (11%)	4 (19%)
Location						
Parietal lobe	24 (42 %)	65 (59%)	-	-	-	-
Frontal lobe	8 (16 %)	17 (15%)	-	-	-	-
Occipital lobe	9 (18 %)	15 (13%)	-	-	-	-
Temporal lobe	5(10%)	-	-	-	-	-
Stage of lesions						
Vesicular	23 (46%)	80 (73%)	-	-	9 (19.1%)	11 (52%)
Colloidal vesicular	3 (6%)	-	-	-	-	-
Granular nodular	5 (10%)	-	-	-	-	-
Nodular calcified	16 (32%)	10 (10.9%)	4 (5%)	-	25 (53%)	6 (28%)

CONCLUSION

The study gives a database about the spectrum of NCC in a tertiary care hospital of our region, NCC didn't have any sex prediction. Occurrence of NCC was unaffected with the consumption of pork or a non-vegetarian diet. In our country other causes of granuloma, most commonly of tubercular origin must be ruled out before arriving to a diagnosis of NCC.

We recommend all the children presenting with unprovoked seizures, headache, vomiting and unexplained neurological signs and symptoms in tropical countries to undergo an imaging study (MRI) to diagnose NCC.

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