

## Research Article

# Neurocysticercosis: clinical presentations, serology and radiological findings: experience in a teaching institution

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**Received:** 13 December 2015

**Accepted:** 06 January 2016

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## ABSTRACT

**Background:** The objective of the study was to study the clinical presentations, serological evidence and radiological findings in cases of neurocysticercosis in a teaching institution with attached tertiary care hospital settings.

**Methods:** A total of 60 paediatric age group patients were enrolled in the study and their clinical presentations, serological profile and radiological findings were recorded. Study data was evaluated in a retrospective analysis of the descriptive hospital based observational study conducted at Safdarjang hospital (SJ) hospital, New Delhi.

**Results:** Generalised seizures were the most predominant clinical presentation in 28/60 cases (47%). Majority of the patients had single lesions in parietal lobe in CT head. 90% of the patients showed perilesional oedema on CT scan. Differences in IgG positivity rate in the various age groups were not significant either for serum or CSF - the p values were 0.67 & 0.052 respectively. Seropositivity was also not significantly associated with presence of active NCC lesions on CT ( $p=0.254$ ). In further analysis, diet was not found to have any significant influence on either seropositivity ( $p$  value=0.673) or on the pattern of presentation on CT ( $p=0.260$ ). NBM-It is disappointing to know that only 20% urban 45% rural is aware of 8 hours NBM before surgery.

**Conclusions:** Observations suggest there is variability in the clinical, serological and radiological presentation of neurocysticercosis when compared with standard criteria.

**Keywords:** Neurocysticercosis, Seizures, Serology, Albendazole

## INTRODUCTION

Neurocysticercosis, especially in childhood is an important cause of neurological morbidities.<sup>1</sup> As per WHO estimates, nearly 50 million people from developing countries are infested with taeniasis and 50,000 die from this parasitic infection each year.<sup>2,3</sup> The infection is endemic in parts of South America and Eastern Europe, the Indian subcontinent, south East Asia, and sub Saharan Africa.<sup>3</sup> It is also estimated that 20 -50 % epilepsy cases may be due to neurocysticercosis in the region involving India, China, Indonesia, South and Central America.<sup>4</sup> Known for its enmity with the human races since decades, the diagnosis of NCC still remains intriguing despite a vast array of serological and imaging

techniques in our diagnostic armamentarium. Most importantly, clinical manifestations are nonspecific, neuroimaging findings are not pathognomic and the conflicting reports about diagnostic accuracy of serological tests adds to the dilemma.<sup>5</sup> In India and other less developed countries, the diagnosis of neurocysticercosis is frequently difficult because several other prevalent neurological disorders can present with a similar clinical and neuroimaging picture with the major differential diagnostic aspect being tuberculosis.<sup>5</sup> The two most commonly considered diagnosis for ring enhancing lesions are neurocysticercosis and tuberculoma.<sup>4-5</sup>

A set of objective diagnostic criteria has been set up based on clinical, imaging, immunological and

epidemiological data.<sup>5,12</sup> Since these parameters ought to change with the geographical areas, therefore the same set of criteria may not be applicable to each and every geographical region.<sup>5</sup> The purpose of the observational study was an attempt to know the differences, if any, existed in different aspects of NCC cases in the institution with attached teaching medical college as it may be helpful to clinicians & epidemiologists to review, at least on periodic basis, the diagnostic criteria applicable to the currently prevalent clinical scenario of the disease.

**METHODS**

A total of 60 children in the age group one year to fourteen years were studied over one year period from Oct to September 2011. Study subjects included children with seizures having ring lesions in CT cranium – single or multiple (age 1-14 years). A careful exclusion of other causes of similar neurological illness, especially known epileptics already on antiepileptic drug therapy or prophylaxis, and patients with known chronic neurological illnesses like congenital malformations of CNS, pre-existing hydrocephalus, cerebral palsy, neuro-degenerative diseases were excluded. A detailed history with special emphasis on symptoms, family history and dietary habits were recorded. Physical examination, including relevant investigations, was undertaken in each case to exclude other causes.

The patients were then subjected to CT scan examinations. Serum & CSF IgG ELISA technique was performed using ELISA kits supplied by IVD Research Inc, Carlsbad, CA-Cat code: TS - 96 intended for qualitative screening of serum IgG antibodies to Taenia solium.

**RESULTS**

**Types of seizures**

Generalized seizures were a common finding as seen in 28/60 cases (47%) with Generalised tonic clonic seizures accounting for 24/60 cases (40%). Complex partial seizures constituted 30% (18/30). Duration of seizures revealed that majority of children experienced seizures for <5 min (71.6%) (Table 1).

**Lesions in the CNS**

Patients predominantly had single lesions in CT head. Parietal lobe was the favoured site of predilection for the parasite i.e. 25/60 (41%). Conglomerate lesions were none. Majority of the patients had perilesional oedema on CT scan i.e. 54/60 (90%) (Table 2).

**Table 1: Clinical presentation of patients with neurocysticercosis.**

Type of seizures					Duration of seizures			Headache	Vomiting	Other presentations		
SP (R)	SP (L)	CP (R)	CP (L)	CP- with secondary generalisation	GT	GTC	<5 min	5-15 min	>15 min			
5 (8)	6 (10)	10 (17)	8 (13)	3 (5)	4 (7)	24 (40)	43 (71.6)	11 (18.3)	6 (10)	44 (73)	27 (45)	13 (22)

**Table 2: CT scan findings in epileptic patients.**

No. of lesions N (%)			Location of lesions N (%)						Eccentric nodule N (%)	Perilesional edema N (%)	Midline shift N (%)	Effacement N (%)	
Single	Multiple	Conglomerate	Frontal	Parietal	Occipital	Temporal	Parieto-occipital	Frontoparietal	Others				
55 (94)	5 (6)	0 (0)	6 (10)	25 (41)	6 (10)	5 (8)	10 (17)	8 (14)	0 (0)	2 (3.3)	54 (90)	2 (3.3)	2 (3.3)

**Serological tests**

Serological results were analysed and are expressed with reference to age groups as: ‘less than 5 years, 5-10 years and more than 10 years’. The highest serum IgG

positivity was observed in patients greater than 10 years of age (41.67%). The serum IgG positivity was least in age 5-10 years (11.11%). The difference in rates of seroprevalence in the three age groups was not significant either (p value = 0.064). None of the patients was positive

for IgG in CSF. Neither for serum, nor for CSF, was the difference in IgG antibody positivity rate in the three age groups significant. (p value= 0.67 & 0.052 respectively). Presence of IgG antibodies in the serum alone or in both the CSF and serum, was not significantly associated with presence of active NCC lesions on CT (p=0.254 & 0.477 respectively). None of the patients with calcifications as seen in CT was found to be seropositive either (Table 3).

**Table 3: Serological results according to age group.**

Age group	Serum IGg Elisa				CSF IGg Elisa					
	Positive		Negative		Positive		Negative			
	N	%	N	%	Total	N	%	N	%	Total
≤5 yrs	3	25	9	75	12	0	0	12	100	12
5-10 yrs	4	11.11	32	88.89	36	0	0	36	100	36
>10 yrs	5	41.67	7	58.33	12	0	0	12	100	12
total	12	20	48	80	60	0	0	60	100	60

**Diet**

A greater percentage of patients were non-vegetarians (70%). Interestingly, none of the sixty patients studied was found to be a pork eater. There was no significant difference in the seropositivity rates of vegetarians and non-vegetarians (p value=0.673). Majority of the patients presented with single lesions on CT, irrespective of the diet pattern. The diet, therefore, in the analysis was found to have no significant impact on the pattern of presentation on CT examination. (P value =0.260) (Table 4).

**Table 4: Comparison of presence of CT lesion - single or multiple - irrespective of site, serology and diet.**

		Diet Pattern					
		Vegetarian		Non vegetarian (Non-pork)		Non vegetarian (pork)	
		n	%	n	%	n	%
Sero-logy	Positive	3	16.67	9	21.42	0	
	Negative	15	83.33	33	78.58	0	
CT lesions	Single	17	94.44	38	90.48	0	
	Multiple	1	5.56	4	9.52	0	

**DISCUSSION**

A number of studies, in India, show a predominance of partial seizures caused by NCC while others witnessed generalised seizures as the most common type.<sup>9-14</sup> In the present critically analysed, study, generalised seizures were the predominant type (47%). A similar study at another institution in the capital region of Delhi has revealed complex partial seizures as the most frequent type (55.55%).<sup>11</sup> The criteria as proposed by Del Brutto et

al included clinical manifestations as minor criteria. Given the differences in presentation, it seems imperative to presume that a single set of diagnostic criteria of NCC cannot be uniformly applied.<sup>8,15,16</sup>

A major presentation of NCC is seizures while other clinical features such as focal deficits, raised intracranial pressure, intellectual deterioration are not so common in India.<sup>15</sup> The present study corroborates to this observation because ‘other clinical features as mentioned above’ were found in 22% of patients only. In a study by Gogia et al, it was also seen only in 12.5%.<sup>11</sup> The clinical features in several American NCC series comprise epilepsy, raised ICT and meningeal racemosecysticercosis and these occur roughly in equal proportions.<sup>16-17</sup> In the Indian settings, albeit, there are a host of other disease entities that have their clinical features similar to NCC and differential diagnosis and the final diagnosis need be done cautiously.

The CT spectrum of NCC varies from ‘single lesions with or without enhancement’ to ‘disseminated ring lesions with or without features due to hydrocephalus, meningitis, infarction and mass effect’.<sup>17,18</sup> In India, the major CT finding in patients has been documented as a single contrast ring enhancing lesion with parietal lobe as the favourite site while perilesional oedema also presents in majority of other patients.<sup>17-19</sup> In the present study, 94% of the lesions were single and perilesional oedema was seen in 90% cases and parietal lobe was the most common site of parasite lodgement (41%).

It is important to note that in a similar study by Gogia et al, the single lesion was seen in 70.83% cases and perilesional oedema was found in 100% of patients.<sup>11</sup> The observation reflects that by no radiological means the differentiation between NCC and tuberculoma is very distinct. In Indian set up, tuberculoma is common and differential diagnosis gets complicated.<sup>15</sup> The differentiation becomes more difficult in cases of multiple ring enhancing lesions.<sup>16,17</sup> In addition, there is a wide range of disease entities with the same radiological picture.<sup>20,21</sup> International criteria as proposed by Del Brutto et al needs review in relation to Indian settings.<sup>8,16</sup> As included in these criteria, the visualisation of scolex is very important but it requires a more sensitive imaging technique than a CT scan and not every patient can be subjected to a MRI scan, therefore the inclusion of this criterion too needs revision.

In the present study, 21.6% of patients were positive for IgG ELISA and none for CSF. No significant correlation between the age groups and sero-positivity of IgG ELISA either in serum or CSF existed (p values observed as 0.064 & 0.67). In endemic regions in Latin America, the sensitivity and specificity of these tests have been reported to be >90%.<sup>22</sup> However, other authors have reported the dismal performance of serology in identification of NCC associated primarily with parenchymal granulomas, solitary cysts, and

calcifications and in patients presenting with uncomplicated seizures which are the usual clinico-radiological profile of Indian children with NCC.<sup>23,24</sup> To quote one more example IgG ELISA was positive in sera of 26.38% of patients & in CSF of 6.94% of patients in a study by Gogia and Arora from Delhi.<sup>11</sup> Hence, again, the inclusion of EIAs in serum and in CSF needs validation in Indian settings and even the access to these serological studies is limited in our country.<sup>28</sup> Either ELISA positivity in CSF and serum or serum alone didn't correlate significantly with the presence of active lesions on CT ( $p=0.477$  &  $0.254$  respectively). Active lesions were found in 7.5% of patients with positive CSF & serum IgG & 19.4% of patients with positive serology. None of the patients with calcifications on CT had positive serology. A revisit to the importance of serology in Indian settings requires revision, however according to some Indian studies it serves to support the clinical diagnosis stating that ELISA test may be done to have additional supportive evidence to judiciously support the line of treatment initiated.<sup>23</sup>

Do dietary habits influence serology and CT findings? In our study none of the patient was pork eater. More importantly, there was also no correlation of diet with CT findings of number of lesions ( $p=0.260$ ). Though a high incidence of NCC is reported in western literature<sup>25</sup> in patients consuming or handling pork in unhygienic conditions, our findings reaffirm the observation that vegetarians are equally susceptible to NCC &, as customarily believed, pork consumption is not a requisite for this infection.<sup>26</sup> No correlation of diet pattern with serology ( $p$  value =  $0.673$ ) emerged. Some studies have clearly revealed that albendazole treatment is not significantly known to alter either the recurrence of seizures or the follow up CT scan pictures for example in a study by Siddharth and Talukdar, 2003, no repeat evidence of seizures was observed in 87.5% of patients on albendazole treatment & 77.5% of patients on placebo and lesions disappeared in 60.71% of patients in albendazole group and 62.5% of patients in placebo group as observed in a study by .<sup>11</sup> Various other Indian studies too have found no difference in seizure recurrence with albendazole treatment.<sup>24,26,27</sup> It appears that the major criterion of Del brutto et al criteria also needs revision. Given the global difference in epidemiology, clinical features and radiological presentations about neurocysticercosis, there are needed to modify the criteria for the diagnosis of this disease entity in Indian geographical and epidemiological settings. As also is suggested in one review study about the need for modifications of diagnostic criteria in India, the analysis is an attempt to put forth the present clinical scenario and emphasize the need for revision of literature related to NCC.<sup>26</sup> However, more studies on the importance of serology and radiological findings are needed. It is acknowledged that the sample size is small for any generalised conclusions to be drawn yet this will go a long way in strengthening the need for revision of Indian

diagnostic criteria to diagnose it timely and confidently manage the NCC patients.

## CONCLUSIONS

Observations suggest there is variability in the clinical, serological and radiological presentation of neurocysticercosis when compared with standard criteria.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Arora BS, Dhamija K. Neurocysticercosis: clinical presentations, serology and radiological findings: experience in a teaching institution. *Int J Res Med Sci* 2016;4:519-23.