International Journal of Contemporary Pediatrics
Sangale D et al. Int J Contemp Pediatr. 2023 Mar;10(3):300-304
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291
DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20230423

Original Research Article

Clinico-demographic profile of children with neurocysticercosis and risk factors for persistent seizures

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Received: 28 July 2022
Revised: 26 August 2022
Accepted: 14 February 2023

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ABSTRACT

Background: Neurocysticercosis is one of the common cause of acquired epilepsy in childhood. The objective of this study was to study the clinic-demographic profile of children having Neurocysticercosis and to evaluate the potential risk factors for persistent seizures.
Methods: A prospective observational study was conducted after recruiting 30 children with neurocysticercosis. After detailed history and clinical examination, the neuroimaging findings were studied. Patients were started on standard anti-helmenthic and antiepileptic therapy. A regular follow up was taken with regard seizure recurrence. A neuroimaging was repeated at 6 moths follow up.
Results: Among 30 children with neurocysticercosis who presented with first seizure due to neurocysticercosis, focal seizure was the commonest (63.3%) presentation and 23.3% of these presented with status epilepticus. Out of 30 cases, 7 (23.3%) patients had seizure recurrence on follow up. Patients presenting with status epilepticus, neuroimaging showing larger lesions (size more than 10 mm), multiple number of lesions and persistent presence of lesion on the CT scan at a follow up of 6 months were the factors found to have significant positive association with recurrence of seizures on follow up.
Conclusions: There are potential clinical and radiological risk factors which are associated with the recurrence or persistence of seizures in patients with neurocysticercosis.

Keywords: Neurocysticercosis, Epilepsy, Persistent seizures

INTRODUCTION

Neurocysticercosis (NCC), one of the most common helminthic infestations of the central nervous system caused by larval stage of *Taenia solium*. It is highly prevalent in low and middle income countries. It is one of the most common causes of acquired epilepsy and neurological morbidity in children.[1] It is the commonest cause of focal seizures in North Indian children.[2,3]

Most cysts are located in the brain parenchyma and therefore cause seizures. The cysts pass through four stages of developement: vesicular, colloidal, granular nodular, and nodular calcified stage.[4] It is observed that calcified cysticerci are not totally dead cysts but may intermittently release parasite antigens that causes inflammatory edema and may cause recurrent seizures.[5,6]

Seizure recurrence is low in children (10%-20% of cases).[7,8] As per studies done in the past, seizure recurrence correlates significantly with an abnormal CT (persistence or calcification of lesion or multiple lesions prior to starting cysticidal therapy) and an abnormal electroencephalograph at the time of AED withdrawal.[7,9] These patients require longer durations of antiepileptic drug therapy. Seizures secondary to NCC usually respond well to first-line single antiepileptic drug and may require multidrug therapy in few cases.[10]

The primary objective of this study was to study the clinic-demographic profile of children having neurocysticercosis and to evaluate the potential risk factors for persistent seizures.

METHODS

This was a prospective observational study conducted at Tertiary care Hospital and Medical College (Lokmanya Tilak Municipal Medical College and Hospital) over the duration of 18 months (July 2018 to January 2020). Total of 30 children upto 12 years of age were recruited after an informed written consent from legal parents or guardians and ethical clearance from Institute Ethical Committee.

Inclusion criteria

Children up to 12 years presenting with first episode of unprovoked seizure or acute neurological deficit was screened. Diagnosis was made on basis of clinical findings, computed tomography with contrast suggesting neurocysticercosis and magnetic resonance imaging was done for confirmation of diagnosis in doubtful cases.

Exclusion criteria

Children were excluded if they had- known chronic neurological illness; epilepsy with known etiology; critically sick; and those who already received prolonged anti-helminthic or steroid.

Data collection and analysis

All data were entered in a predesigned case record proforma and managed in Microsoft excel sheet. Children were treated with standard anthelminthic and antiepileptic therapy for seizure control. The follow up was taken at 1 week, 2-week, 1 month, 3 months, 6 months and 1-year period after starting treatment. At every follow up, frequency of seizure recurrence, symptomatic improvement or worsening of symptoms.

A CT scan was repeated at 6 months after starting treatment. All responses were tabulated by the investigator using Microsoft-Excel 2016 Software.

Data was analysed by using SPSS software version 20.0 and Microsoft excel. Statistical tools used were- mean, standard deviation, proportions and percentages and Chi square test. P value<0.05 was considered significant. Any seizure occurring more than one week after index seizure was considered as recurrent or persistent seizures.

Currently, the most commonly accepted operational definition for convulsive status epilepticus is either 5 minutes or more of continuous seizure activity or two or more discrete seizures between which there is incomplete recovery of consciousness. In this study operational definition of status epilepticus was used.

RESULTS

This study comprised total 30 patients with neurocysticercosis. In this study group, 11 (36.7%) patients presented with generalized seizures, out of 19 focal seizures, 12 (40%) patients presented with right focal seizures, 5 (16.7%) patients presented with left focal seizures and 2 (6.6%) patients presented with focal seizure with secondary generalization.

Also, 2 (6.7%) patients had seizures lasting for less than 2 min, 21 (70%) patients had seizures lasting for 2 to 5 min, 2 (6.7%) patients had seizure lasting for 5 to 10 min. 4 patients (13.3%) had seizures lasting for 10 to 15 minutes.

1 patient had seizure lasting for 15 to 20 minutes and 7 (23.3%) patients presented with status epilepticus. 28 (93.3%) patients had seizure control with one antiepileptic medication, 2 (6.7%) patients required two drugs for the seizure control. Also it was found that; 2 (6.7%) patients presented with headache along with seizures. 2 (6.7%) patients had ocular cysticeri in extra-ocular muscles as on B-scan ultrasonography.

As per data on neuroimaging characteristics it was found that 18 (60%) patients had single lesion while 12 (40%) patients had multiple lesions of neurocysticercosis on neuroimaging. Also 17 (56.8%) patients had lesion in frontal region, 7 (23.3%) patients had lesion in parietal region, 4 (13.3%) patients had lesion in temporal lesion, and 1 (3.3%) patient had lesion in parietal and occipital region while 1 (3.3%) patient had lesion in frontal and parietal area. Total of 23 (76.7%) patients had lesions less than 10 mm size while 7 (23.3%) patients had lesions more than 10 mm size.

The scolex was seen on neuroimaging of 6 (20%) patients and perilesional edema was visible in 26 (86.7%) patients. Total of 11 (36.7%) patients had lesions in colloid stage, 9 (30%) patients had lesions in granular stage, 6 (20%) patients had lesions in vesicular stage and 4 (13.3%) patients had lesion in calcified stage of neurocysticercosis on neuroimaging. When follow up CT scan was repeated at 6 moths it was found that 15 (50%) patients showed resolution, 5 (17%) patients showed persistence and 10 (33%) patients showed calcification of initial lesion of neurocysticercosis.

All patients were followed up at at regular interval. Out of 30 cases, 7 (23.3%) patients had seizure recurrence on follow up. 0ut of these 7 cases, 3 patients had focal seizures and 4 patients had generalized seizures. The association of seizure recurrence with the semiology of seizure was not significant (p= 0.19). It was observed that the percentage of seizure recurrence is highest (66.7%) in patients presenting with status epilepticus than patients without status epilepticus (12.5%) and this difference was statistically significant. out of 7 patients who had multiple lesions on neuroimaging, 5 patients had seizure recurrence.

Highest number of seizure recurrence was found to be in patients with multiple lesions and this difference was found to be statistically significant (p value=0.053).

The association between site of lesion (frontal, parietal, temporal or multiple sites) and seizure recurrence was not statistically significant (p=0.525).

It was found that patients showing neurocysticerci lesions more than 10 mm has highest seizure recurrence (71.4%) than those showing lesions less than 10 mm (8.7%) and this difference was found to be statistically significant (p value=0.01).

Out of 7 patients with seizure recurrence, 6 patients had perilesional edema. And association of perilesional edema with seizure recurrence was not statistically significant p=0.933).

No patient with seizure recurrence had scolex on neuroimaging and association of recurrent seizures with presence of scolex was not statistically significant (p=0.131).

Of 7 cases of patients with recurrent seizures, 4 patients had granular stage, 1 patient had colloid stage, and 2 patients had calcified stage of neurocysticercosis on neuroimaging. However, there was no statistically significant association found with the seizure recurrence (p=0.075).

A follow up CT scan -brain done after 6 months of initial presentation, it was seen that all 7 patients with seizure recurrence had persistence of lesion on follow up scan and this association of seizure recurrence with persistent lesion was statistically significant (p value=0.03).

Table 1: Baseline clinical and demographic characteristics of neurocysticercosis patients.

S. no.	Variables	Value
1.	Age in years (mean±SD)	Mean age=8
2.	Sex distribution	Males- 17 (56.6%)
		Females- 13 (43.3%)
3.	Urban	30 (100%)
4.	Diet	Vegeterian- 4 (13.3%)
		Non-vegeterian- 26 (87.7%)
5.	Animal exposure	0
6.	Semiology of seizure	Generalized- 36.7%
		Focal- 63.3%
7.	Duration of seizure	Less than 2 min, 2 to 5 min, 5 to 10 min, 10 to 15 min, 15 to 20 min
8.	Status epilepticus	7 (23.3%)
9.	Headache	2 (6.7%)
10.	Ocular cysticerci	2 (6.7%)

Table 2: Baseline neuroimaging characteristics of neurocysticercosis patients.

Characteristics	Values N (%)
No. of lesions	Single= 18 (60.0) Multiple= 12 (40)
Location of lesions	Frontal=17 (56.8), parietal=7 (23.3), temporal= 4 (13.3), parietal+occipital=1 (3.3%), frontal+parietal= 1 (3.3%)
Size of lesions (mm)	<10= 23 (76.7), >10 = 7 (23.3)
Presence of scolex	Scolex present=6 (20)
Presence of perilesional edema	Perilesional edema present=26 (86.7)
Stage of lesions	Colloid stage=11 (36.7), granular stage=9 (30), vesicular stage=6 (20), calcified stage=4 (13.3)
Status of lesions on follow up CT scan	Resolution=15 (50), persistent= 5 (17), calcification= 10 (33)

Table 3: Distribution of clinical and neuroimaging parameters in patients with and without seizure recurrence.

Variables	Seizure recurrence (n=7)	No seizure recurrence (n=23)	P value
Status epilepticus	4	2	0.05
Multiple lesions NCC	5	7	0.053
Large size NCC(>10 mm)	5	2	0.01
Presence of perilesional edema	6	20	0.933
Presence of scolex	0	6	0.0131
Presence of persistent or calcified lesion on 6 months follow up scan	7	8	0.03

DISCUSSION

In this study of 30 patients of newly diagnosed neurocysticercosis, 17 (56.6%) were females and 13 (43.3%) patients were males. Highest proportions of patients were between age group 6 to 9 years with mean age of 8 years. Kumar et al reported 56% males and most of the patients between age group 10-14 years.[11] In a study by Gupta et al proportion of girls with NCC was significantly higher as compared to boys and older

children were significantly greater compared to younger ones and mean age of children was 9.8±3.9 years.[12]

In this study 4 (13.3%) patients were vegetarian and 26 (86.7%) were non- vegetarian. In a study by Singh et al, out of 54 solitary calcified NCC patients 34 patients (63%) were non- vegetarian.[13] In the present study highest number of patients were presented with focal seizures (63.3%) as compared to generalized seizures (36.7%). A. Kumar et al found that generalized seizures were more common (76.7%) than focal seizures. Gupta et al reported that generalized seizures occurred in around three fourth (75%) of NCC cases, while remaining one fourth (25%) had focal seizures.[11,12] In a study by Rao et al simple partial seizures accounted for 140 cases (68.96%) followed by generalized seizures in 33 cases (16.20%) and complex partial seizures 30 cases (14.78%).[14] 7 (23.3 %) patients presented with status epilepticus. 2 (6.7%) patients also presented with headache along with seizures. Gupta et al reported headache in 14% of children.[12] Seizure control was achieved with monotherapy in 28 (93.3%) patients and 2 (6.7%) patients required two drugs. Neuroimaging findings in our study revealed that 18 (60.0%) cases had single lesion while 12 (40%) had multiple lesions. Study by Rao et al revealed single NCC lesion in 75.98% and multiple in 24.01% cases.[14] Kumar et al reported 67.5% children with single lesion and 32.5% multiple lesions on neuroimaging.[11] In the present study 17 (56.8%) cases had frontal lesion which was found to be the most common site. 23 (76.7%) patients had smaller lesions (<10 mm) and 7 (23.3%) patients had larger lesions (>10 mm). A Kumar et al reported 79% with parietal lobe lesions, 15% frontal lobe lesions and 6% occipital lobe lesions.[11]

On staging the lesion on neuroimaging, 11 (36.7%) patients had lesion in colloid stage, 9 (30%) in granular stage, 6 (20%) in vesicular stage and 4 (13.3%) in calcified stage of neurocysticerci. 26 (86.7%) had perilesional edema and 6 (20%) patients had scolex visualized on neuroimaging. Gupta et al reported 76% lesions in vesicular, 6% in colloidal and 18% lesions in calcified stage of development.[12]

Possible risk factors for seizure recurrence in neurocysticercosis

In this study the association of different factors with the recurrence of the seizures was studied and possible risk factors were established. Out of all 30 cases, 7 (23.3%) had seizure recurrence on follow up. Singh et al studied 54 patients over the period of 1 year and 13(24.07%) patients developed seizure recurrence.[13] In a study by Carpio et al thirty one (40.3%) patients experienced seizure recurrence.[15] Gupta et al reported 8 cases of seizure recurrence out of 72 cases of NCC.[12] The risk factors for seizure recurrence in the present study were-status epilepticus at presentation, size of the lesion more than 10 mm, number of lesions and persistence of lesions on follow up CT scan at 6 months. The association with type of seizure (generalized verses focal), stage and location of lesion, presence of perilesional edema, presence of scolex was not found to statistically significant. Hence the risk factors for seizure recurrence in our study were-status epilepticus at presentation, size of the lesion more than 10 mm, number of lesions and persistence of lesions on follow up CT scan at 6 months.

In the study by Singh et al status epilepticus at presentation, size of lesion more than 10 mm, presence of perilesional edema and scolex were significantly associated with seizure recurrence on univariate analysis.[13] On multivariate analysis, only presence of perilesional edema was an independent predictor of seizure recurrence.[16] Singhi et al have studied the difference in rate of seizure recurrence after 1 verses 2 years of antiepileptic therapy and factors predictive of seizure recurrence. Significant association was found with abnormal CT (persistence or calcification of lesions) and abnormal EEG prior to anticonvulsant drugs withdrawal. In the study by Kumar et al the risk factors like mean age of onset, male gender, partial seizure at presentation, lesions >5 on neuroimaging and EEG abnormalities at presentation were not found to be statistically significant.[11]

Limitation

In our study small sample size was a limitation. Patients referred in our study were from urban area; hence we could not find any association with animal exposure.

CONCLUSION

In this study we found that focal seizure was the commonest (63.3%) presentation and most of these (93.3%) presented with seizure more than 2 min, indicating that seizure due to neurocysticercosis is not a self- limiting seizure. Neuroimaging findings showed maximum patients (60%) had single lesions and most of them were in frontal area (56.8%). Maximum lesions were found to be in colloid stage (36.7%) and in few lesions scolex was identified (20%). All presented with seizures and were started on anti-epilepic medications. Most of the patients (n=28) achieved seizure control with only one antiepileptic drug. Out of 30 cases, 7(23.3%) patients had seizure recurrence on follow up. Patients presenting with status epilepticus, neuroimaging showing larger lesion (size more than 10 mm), multiple number of lesions and persistence of lesion on follow up CT scan were the factors found to have statistically significant association with recurrence of seizures.

Recommendation

We recommend further studies on larger scale to understand the risk factors for seizure recurrence in a child with neurocysticercosis.

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: Sangale D, Adhikari A, Gajre M. Clinico-demographic profile of children with neurocysticercosis and risk factors for persistent seizures. Int J Contemp Pediatr 2023;10:300-4.