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Research Article

Active Epilepsy as Indicator of Neurocysticercosis in Rural Northwest India

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Objective. To determine the contribution of neurocysticercosis as a cause for active epilepsy and to establish Neurocysticercosis as major definable risk of epilepsy in our setup. *Methods*. We conducted a door-to-door survey of 2,209 individuals of Bhore Pind and Bhore Kullian villages in Chattah zone of district Jammu (Jumma and Kashmir, Northwest India) to identify patients with symptomatic epilepsy. Patients with active epilepsy were investigated with neuroimaging techniques to establish diagnosis of NCC (neurocysticercosis). *Results*. Among 25 patients with epilepsy 10(40%) had CT/MR evidence of past or recent NCC infection. This gave us the point prevalence of 4.5/1000 for Neurocysticercosis in our study population. *Interpretation*. The study shows a high prevalence of NCC accounting for symptomatic epilepsy in our part of India.

1. Introduction

Neurocysticercosis (NCC) is a frequent cause of neurological disorders in many developing countries and is a predominant cause of epilepsy in India [1–4]. NCC is the cause of seizures in about 37% of otherwise healthy children >3 years of age. The prevalence of human cysticercosis has been estimated between 3% (based on autopsy studies) [5] and 9% (based on immunological data) [6]. However its true prevalence and association with neurological disorders at community level is largely unknown. The association of NCC with high prevalence of epilepsy in developing countries is mostly based on hospital studies [7–9].

NCC was found to cause nearly one-third of all cases of active epilepsy in both the urban and rural regions as per a study conducted in Vellore district of Tamil Nadu [10].

2. Material and Methods

The study was conducted in 2,209 individuals of 6 villages of Chattah zone of Jammu district, the winter capital city of Jammu and Kashmir state of India. The villages were randomly selected by simple random technique from a total of 36 villages of Chattah zone with a total population of 30,975. Chattah was chosen because of the presence of known cases of NCC as recorded by our Neurology Department. This choice was helped further by the willingness of community members to participate in operational research project.

Majority (60%) of population of Chattah is directly or indirectly involved with transport business. Villagers in Chattah take mixed diet (both vegetarian and non-vegetarian).

A door-to-door survey, covering a sample population of 2,209, was performed by a team of interns with the help of clinical epidemiologist from the Department of Community Medicine. A register was set up with one record for each family, containing data on age, gender, occupation, education, and number of family members. During a follow-up visit WHO protocol for assessing presence of neurological disorders was initiated [11]. This tool was used to quantify headaches, epilepsy, cerebrovascular disorders, extra pyramidal syndromes, and peripheral neuropathies and consisted of

Table 1: Prevalence and prevalence ratios (/1000) by age and sex of epilepsy, Chattah, Jammu.

Age (yrs)	Males		Females		Total	
	No.	Pre/1000	No.	Pre/1000	No.	Pre/1000
0–9	3	10.86	0	—	3	5.82
10–19	7	26.51	1	4.36	8	16.12
20–29	3	15.62	0	—	3	7.69
30–39	4	25.64	2	14.81	6	20.61
40–49	1	9.25	1	11.36	2	10.20
50–59	0	—	2	32.25	2	14.9
60 and above	0	—	1	12.04	1	5.32
Total	18	15.35	7	6.75	25	11.31

Prevalence ratio for sex = 1.35.

a structured interview and a task-based selective neurological examination [12, 13].

The interview was conducted by a second group of internship students with the help of clinical epidemiologist and medical officer in Chattah. A Hindi questionnaire translated from WHO protocol, containing 12 questions and 10 tasks for individuals >7 years, was used. The version for children <7 yrs contained 16 question and no tasks. For those who did not understand spoken Hindi, an intern (bilingual member) from the survey team was trained for translation. The protocol thus developed was first tested in another village (Bhore Camp) of Chattah zone on a sample population of 40 families selected randomly.

The study was completed in three stages. In stage 1, each individual eligible for inclusion in the survey was visited by a team of clinical epidemiologists and medical officers in Chattah. Individuals absent from their homes were asked to visit the medical officer on the subsequent day. Written informed consent for participation in all stages of study was obtained from each individual.

In stage 2, all individuals who responded to WHO protocol positively were invited to undergo examination by a neurologist and a physician, under standard conditions. In stage 3 all individuals suspected to be cases of active epilepsy on the basis of history by neurologist were listed for further study.

A prevalent case of active epilepsy was defined as a person who has had at least one epilepsy seizure in the previous 5 years, regardless of antiepileptic drug (AED) treatment, as has been established in previous community-based studies [14] & conforming to the recommendations of the International League against Epilepsy [15].

Children with febrile seizures were excluded for further evaluation. The complimentary examination systematically included a CT and or MRI. 16 of the 25 individuals in the study had already undergone a complimentary examination in the form of neuroimaging. The remaining individuals were investigated with a contrast-enhanced CT after obtaining a written informed consent.

The diagnosis on CT\MRI was ready by a radiologist independent of the survey team. A diagnosis of NCC was made on the basis of criteria described by del Brutto et al. [16].

Calcification was seen on CT\MRI as small, round or elongated, high-density lesions in the parenchyma; single or multiple cysts were described as rounded low-density lesion & the encephalitic phase was referred to as a low density irregular area on plain CT which, after contrast infusion, displayed a nodularity/ring enhancement [17].

Single calcification was ascribed to possible neurocysticercosis after other types of granulomatous disease, mainly tuberculosis, were ruled out clinically.

50 individuals, chosen randomly from amongst those screened negative in stage 1, were examined by the neurologists. No epilepsy was found in any of them.

3. Results

The distribution by age & sex of the studied population was typical of developing communities with young population under 20 yrs of age comprising about 46% of the total. Information was obtained from individuals living in two villages of Chattah block. At the end of stage 1, 402 individual had tested positive for neurological disorder with headache being the most common. All these people were evaluated by the neurologist & physician trained in neurology at the Chattah Health Facility. There was no loss of participants between stage 1 & stage 2. At the end of stage 2, 25 individuals were confirmed as suffering from active epilepsy, as already defined [15, 16].

The point prevalence, thus calculated, was 11.31/1000. The prevalence ratio for men was more than double in comparison to women. Prevalence ratio dropped at the extremes of age. The number of cases & prevalence ratio by age & sex of 25 patients are shown in Table 1.

Table 2 shows the classification of these cases according to seizure type. Seizures in 6 patients were classified as generalized & in 19 as partial. 16 out of 25 patients had undergone CT\MRI. Remaining number of individuals were invited for further examination by radiologist.

Among 25 patients with epilepsy 10 (40%) had CT evidence of past or recent NCC infection, using criteria described by del Brutto et al. (Absolute criteria or two major, one minor, and an epidemiological criteria) [18] (Table 3).

Table 2: Percentage of cases according to seizure type Chattah, Jammu.

Type of seizure	No. of cases	%
Generalized seizures	6	24
Partial seizures	0	0
Simple Partial	3	12
Complex partial	3	12
Partial with sec. generalization	13	52
Total	25	100

Table 3: Summary of CT findings in 25 patients with epilepsy.

CT/MRI findings	No. of patients	%
Single intracranial calcification	4	16
Multiple intracranial calcification	2	8
Single cyst/ring enhanced lesion	3	12
Multiply cyst/calcification	1	4
Tuberculoma	2	8
Atrophic lesions	2	8
AVM	1	4
Normal	10	40
Total	25	

This gave us the point prevalence of 4.5/1000 for Neurocysticercosis in our study population.

In a large percentage (40) radiological findings were normal.

Two patients listed as suffering from active epilepsy were on antitubercular medication and had systemic evidence of pulmonary tuberculosis.

4. Discussion

The present study is the only study using neuroepidemiological and neuroimaging procedures to assess the prevalence of NCC on community-based approach from our part of India. It might have methodological inadequacies for establishing diagnosis, but this is the closest we could reach to establish etiological basis for epilepsy, in our setup. The study shows a high prevalence of NCC accounting for epilepsy. This is in confirmation with few studies on NCC in our part of world. In a study in Uttaranchal region of India 3.94% of 15,000 patients reporting to hospitals, screened showed neurocysticercosis [18].

Prevalence rate for epilepsy in a study conducted in Kashmir valley (Jumma and kashmir) is lower (2.47/1000) than our study [19]. Pork consumption is not allowed for religious reasons in Kashmir valley, making area free of human taeniasis, which is a cause for development of NCC. This comparison explains the high prevalence of epilepsy in our part of Jumma and kashmir and contribution of NCC in it.

In a major community-based study conducted in Vellore district of Tamil Nadu, covering a large population base, NCC was a major cause of active epilepsy in both urban and rural regions. 34% of patients with active epilepsy had a definitive or probable NCC as the cause of their seizures [10].

In comparison our study shows a higher prevalence of NCC accounting for epilepsy probably because of the factors favoring development of human cysticercosis.

Human cysticercosis is human-to-human infection acquired faeco-orally, usually in areas with deficient sanitation & improper stool disposal, factors prevalent in Chattah block. The risk is enhanced by an easy availability of pig meat in poor sanitary conditions.

Although the number of epilepsy cases is not large, it seems that men become ill in higher proportions probably due to outdoor eating habits prevalent in Chattah. Patients with NCC typically present with partial seizures with secondary generalization in our study. Only a few reported studies [20–22] have used neuroimaging to estimate the prevalence of NCC in a community. In a study of 2,273 residents of an Ecuadorian rural community, the prevalence rate of active epilepsy was 11.4 per 1,000 (20) which is almost similar to our study. Of the 31 people with AE, 26 had a plain CT scan examination, and a diagnosis of NCC was made in 14(53.8%) which is slightly higher than our study. Because only a plain CT was done, enhancing cysticercal lesions such as granulomas would not have been detected.

In a random sample of 118 people without seizures from same community, CT showed evidence of NCC in 17(14%).

In a community-based CT study [21] involving 2,415 residents of Atahualpa, Ecuador, 24 patients were found to have AE, giving a prevalence rate of 9.9 per 1,000. CT scan showed NCC lesions in five (26.3%) of the 19 patients who accepted the examination. The Salama study [22] conducted in a rural Honduras reported the results of a survey among 6,473 residents. The prevalence rate of AE was reported to be 15.4 per 1,000. A CT scan performed in 90 (90%) of the 100 patients with AE showed evidence of NCC in 36.6% of patients. The above studies suggest that NCC is the cause of 26.3% to 53.8% of all cases of AE. NCC was the cause of AE in 40% of our patients, suggesting that NCC is as much of a problem in India as in Latin America. It is interesting to note that the prevalence of AE in the Kashmir division of Jumma and kashmir state of India, a region that is thought to be free of cysticercosis because of its Muslim majority population, was only 2.47 per 1000 [11].

So with the same state we have a highly comparable data as far as the prevalence of NCC is concerned. The study underlies a need to identify areas of focus as far as public health initiatives to tackle NCC are concerned. The radiological data presented confirmed that NCC is the major definable risk of epilepsy in our setup. It is preventable & treatable. Concerted multidisciplinary efforts focusing on the risk factors can help to decrease substantially the burden attributable to epilepsy.

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