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A prospective incidence study of epilepsy in a rural community of West-Bengal, India

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Abstract

Epilepsy is a major health problem in India, but community based incidence study is rare. This study was undertaken to determine the incidence rate in a rural community of the state of West Bengal, India. The study was done through house to house survey by a dedicated team of neurologists, who carried out the survey cum case detection over 5 years. A total of 38 cases were detected during the survey period in a population of 20,966. The age adjusted (to World Standard Population) average annual incidence rate was 42.08 per 100,000 persons per year (95% confidence interval, 29.75-57.86). This rate was higher than many developed countries, but lower than the developing countries. Cerebral infection was the most common putative factor observed. An increasing trend of incidence of epilepsy has been observed over the years during the period of the study.

INTRODUCTION

Epilepsy is a major health problem in developing countries including India. India has the second largest population in the world with almost one billion plus inhabitants, and 70% of the people live in rural communities. Though there are many prevalence studies, only one incidence study has been performed in the rural population of India.[1-7] The single incidence study from the Southern India has documented a rate of 49.3 per 100,000[7], and the global incidence varies from 11 to 190 (Table 1). India, being a multiethnic and multi linguistic country needs more community based incidence study to observe the trend of epilepsy in different communities. Epidemiological studies are usually carried by trained non-professional workers in the developing countries due to dearth of trained professionals. This is a study to determine the incidence rate and pattern of epileptic disorders in a rural population of Eastern India, utilizing the neurology service from a tertiary care neurological institute in Kolkata, the capital of the state of West-Bengal in the survey cum case detection program.

METHODS

Study design

This is a prospective longitudinal study in a rural population of the state of West Bengal to determine the average annual incidence of epilepsy.

Survey Area

The survey was carried out in a total of 12 well –demarcated villages of Baruipur block, a rural area of South 24-Parganas district in West Bengal. The above block is about 40 kilometers away from the centre of the city of Kolkata and is easily reachable by car or train. It has a typical tropical climate.

Sample population

The population chosen was based on purposive cluster sampling. A total population of the villages according to census report (Census India, 1991) was 20,966 inhabitants. The population was very stable. Out of the total population, 51.4% were Hindus and the rest were Muslim. All inhabitants understood and spoke Bengali. Total number of families was 3,529, and average family had 5.8 members. Average income per month was Rs

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Table 1: Incidence of epilepsy in different countries

Author with year of study in parenthesis	Place of study	Incidence rate per 100,000 populations	Remarks
Pond (1960)[19]	UK	70	All seizures
Krohn (1961)[20]	Norway	11	All seizures
Zielinski (1974)[21]	Poland	26	Seizures excluding SS, FS
Juul-Jensen (1983)[22]	Denmark	39 (men), 28 (women)	Seizures excluding FS
Granieri (1983)[23]	Italy	31	Seizures excluding SS, FS, PS
Placencia (1992)[11]	Ecuador	190	Excluding FS
Hauser (1993)[13]	USA	44	Excluding SS, FS, PS
Mani (1997)[24]	India	49.3	Excluding HWE
Olafsson (2005)[25]	Iceland	57	All seizures

SS: single seizure; FS: Febrile seizure ; PS: Provoked seizure; HWE: Hot water epilepsy

1,500 per family (USD 35). The employments were daily wage labor (40%), agriculture (40%), fisherman (10%), and service sector (10%). Source of drinking water was tube-well (80%) and pond (20%). Predominant addiction was tobacco smoking as well as chewing and country liquor. These were commoner among men. All inhabitants in the selected villages were eligible for participation in the study.

Survey methods

At the beginning of the survey, all members of the survey team constituted of neurologists made a planning about the case ascertainment method, screening instrument to be used and the population to be selected. The survey team was assisted by local guides and *panchayat* (local government) persons who helped the team in introducing to the people of the community. Several meetings were arranged to explain the idea of conducting the survey. The survey was conducted in two stages. In the first stage, a door-to-door survey was carried out using a validated screening instrument. The WHO proforma (1981), translated in the local vernacular language (Bengali), had already been used for the screening of the population elsewhere in the state. This questionnaire was already tested in a previous study and a high accuracy could be achieved for identifying neurology cases, achieving a sensitivity of 98.73% and specificity of 99.92%. This was for identifying neurological cases, and the neurologists acted as the gold standard.[1] The survey team visited the houses and enlisted the name of potential cases with seizure disorders. Locked houses or the houses where residents were absent were revisited on holidays with prior notifications. In the event of absence or non-availability of villagers, three attempts were made to trace them in the screening process. If these attempts failed or in cases of refusal, these villagers and families were excluded from the study. The possible cases identified in stage 1, were examined clinically by the same team using the same operational definitions in the second stage. The clinical examinations were conducted at the temporary clinics set up either in the near-by schools, clinics or in the premises of the office of the *gram-panchayat*. The survey was combined with service, and we provided medicine and also counseling to the needy patients.

The basis of diagnosis was primarily clinical. It was determined mainly on the description of the eye-witness on seizure manifestations. EEG recordings were not done as a routine procedure for all persons suspected of having epilepsy. However, previous EEGs, medical prescriptions and available laboratory and radiological investigations were taken into consideration as supportive evidence of diagnosis. Seizures were

defined and classified according to the clinical descriptions outlined in the ILAE commission report on seizure classification (1981).[8] The same surveillance was continued over the next 5 years to record new cases and follow up of old cases for one year. Data on the incidence of epilepsy was obtained by enquiring the head of the household, or the mother in case of children, or the most reliable family informant. This was to provide the age of onset and year of onset for any member of the family affected with epilepsy.

Operational definitions

Operational definitions were based on the definitions by the Commission on Classification and Terminology of the International League against Epilepsy.[8] *Epilepsy* was defined as a condition characterized by 2 or more unprovoked seizures or seizure episodes. An unprovoked seizure is one without an acute underlying cause. Multiple seizures occurring in a 24 hour period are considered a single seizure episode. *Active epilepsy* is defined as a person with epileptic seizure in the previous 5 years regardless of antiepileptic drug treatment or on antiepileptic treatment. Attacks were classified as *febrile seizures* if they occurred between the ages of 6 months and 5 years, associated with a febrile illness not caused by an infection of the CNS, without previous neonatal seizures or unprovoked seizures. For the seizures types reported here, we used the definitions proposed by the commission on classification and terminology of the International League against epilepsy.[8]

Definition of putative causes

"Meningitis" was considered a possibility if there was a previous history of febrile illness with severe headache, signs of meningeal irritation, frequent vomiting with or without cerebrospinal examination having been performed, and when such illness had lasted for more than 7 days.

"Encephalitis" was considered probable if a febrile illness was associated with loss of consciousness necessitating hospital admission with or without convulsion during the acute illness, with or without cerebrospinal fluid examination, and with duration of such illness for more than 7 days.

Significant *"Head injury"* was considered probable only if there had been loss of consciousness lasting more than 30 minutes with amnesia of the accident, with or without hospital admission.

Significant *"Birth trauma"* was considered probable if one or more of the following had occurred: Unduly prolonged labor, breathing difficulty, deep cyanosis, convulsions, feeding difficulties, prolonged or deep jaundice or delayed milestones.

"Granuloma": CT brain scan evidence of single small disc or ring hypodense lesion with or without calcification and contrast enhancement. It could be single or multiple. If the granulomas are small, single, possess scolex and do not show any space occupying effect, they are considered as due to possible neurocysticercosis.

Statistical analysis

Incidence rate is defined as number of new cases of epilepsy occurring during a given time interval usually one year, in the specified population. Ninety five percent confidence interval of the rate was calculated based on Poisson ratio. Age adjustment is also done based on standard Indian rural population (1991), Standard World population (WSP)[9] and USA (1990) population.

RESULTS

Table 2 showed the distribution of sample population and also that of standard rural population of India based on 1991 census. Our sample population had less younger population (62.4% versus 74.5% below 40 years) and higher elderly subjects (25.3 versus 13.4% above 50 years) than standard rural Indian population. Out of the sample population, a total of 239 inhabitants (1.12%) did not either participate or could not be contacted and hence was excluded from denominator for purposes of calculating the incidence rates. Thus the denominator of this study was 20,727 subjects. During the study period, a total of 38 new cases were identified. Five years cumulative incidence rate stood at 183.33 per 100,000 and average annual incidence rate of epilepsy was 36.66/100,000 (95% CI, 25-47.8). Age adjusted rates were calculated to 53.97 /100,000 (95% CI, 37.78- 73.86) based on Indian population, 33.72 /100,000 (95% C I, 23.6- 46.2) based on USA 1990 population and 42.08 (95% CI, 29.75-57.86) based on Standard World population.

Table 3 showed the age specific incidence rates which were higher in younger population than elderly except a surge in fifth decade. Sex

Table 2: The age and sex specific distribution of the population

Age group in years	Men		Women		Total		Indian rural population (1991)
	n	%	n	%	n	%	
0-4	855	7.8	690	7.1	1,545	7.5	12.7
5--9	822	7.5	670	6.9	1,492	7.2	13.7
10--14	779	7.1	631	6.5	1,410	6.8	11.9
15--19	811	7.4	661	6.8	1,472	7.1	9.2
20--29	1832	16.7	1,547	15.9	3,379	16.3	16.5
30--39	1969	17.9	1,603	16.5	3,572	17.2	12.7
40--49	1390	12.7	1,224	12.5	2,614	12.6	9.3
50--59	948	8.6	870	8.9	1,818	8.8	6.4
60--69	796	7.2	808	8.3	1,604	7.7	4.4
>70	778	7.1	1,043	10.7	1,821	8.8	2.6
Total	10,980		9,747		20727		

Table 3: Age specific incidence rates of epilepsy

Age group in years	Population	No. of cases population	CIR per 100,000 population	AAIR per 100,000
0--4	1,545	10	647.2	129
5--9	1,492	9	603.2	120
10--14	1,410	6	425	85
15--19	1,472	3	203.8	40
20--29	3,379	2	59	11.8
30--39	3,572	2	56.05	11.2
40--49	2,614	4	153	30
50--59	1,818	1	55	11
60--69	1,604	1	62	12
> 70	1,821	0	0	0
Total	20,727	38	183.33	36.66

CIR: Cumulative incidence rate over 5 years, AAIR: Average annual incidence rate

specific incidence rate revealed slightly higher rate among men (n = 21, 38.25/100,000, 95% CI, 23.37-59.09) than women (n=17, 34.88/100,000; 95% CI, 20.3-55.84).

Among the type of epilepsy (Table 4), generalized tonic and clonic pattern was the commonest variety. Among the recognizable putative factors, granuloma was the commonest. Only 2 patients died during our period of surveillance. One of them was a case of inadequately treated post stroke seizure. Another patient was a case of subacute sclerosing panencephalitis. All the new patients were taking medications as per our advice till the end of our survey. Detailed history taking and physical examination were done in all cases. The investigations performed were: EEG

Table 4: Classification of epilepsy (n=38)

	No	percent
Seizure classification		
Simple partial	4	10.5
Complex partial	8	21.1
Generalized from onset		
Tonic clonic	12	31.5
Myoclonic	4	10.5
Absence	5	13.1
Secondarily generalized	4	10.5
Unclassifiable	1	2.6
Family history of seizures		
1st degree relatives	2	5.2
Probable etiological factors		
Delivery related trauma	2	5.2
Cerebrovascular accident	2	5.2
Neurocysticercosis	4	10.5
Other CNS infection (meningitis, encephalitis)	2	5.2
Head injury	0	0
Unknown	26	68.4

(24 cases, 63.2%), CT Brain (20 cases, 50%) in the private medical service facilities. Enhancing lesion from granuloma was seen in 4 out of 20 (20%) cases.

An increasing trend in age adjusted incidence of epilepsy was also observed in this study between 1992 and 1998, based on annual incidence rates of epilepsy (Table 5 and Figure 1).

DISCUSSION

Epilepsy is the second commonest neurological disorder after headache in India.[1-3,5] However community based prospective incidence study on epilepsy is rare. This community based study had been designed primarily to determine the incidence of epilepsy in rural India over 5 years period based on strict criteria as per the guidelines for epidemiological studies for epilepsy.[8]

Though the initial base population selected was small, this helped us to develop rapport with the community through regular survey cum service visits and to continue this longitudinal study over the years. To the best of our knowledge, no prospective community based study over 5 years had been carried out previously in India. Regular visits and community interactions helped to get cooperation from study population. Physicians' participation also ensured high degree of compliance among our new patients.

As for the protocol, the diagnosis of seizure was made based on clinical grounds. However some of the patients had undergone investigations, such as EEG and CT brain scan in their private capacity. This helped to confirm clinical diagnosis and determine the probable etiologies in some of the cases.

The study excluded those subjects who were either absent or refused to participate. The rest of the inhabitants responded to the questionnaires. Thus there was no obvious response bias affecting the study result. Another strength of this study was that it was carried out repeatedly to pick up new cases prospectively over 5 years. This helped to avoid recall bias when the incidence rate was measured on a one time cross sectional survey.

This study carried over 5 years, showed an age adjusted to WSP average annual incidence rate of 42.08 per 100,000 populations per year

Table 5: Incidence rate of epilepsy per year between 1992 through 1998

Year	population	New cases	AIR per 100,000
92-93	20,966	6	28.61
94-95	20,960	8	38.16
95-96	20,952	7	33.40
96-97	20,945	8	38.10
97-98	20,937	9	42.98

AIR: age adjusted incidence rate

(95% CI, 29.75- 57.86), which is higher than many developed countries (Table 1). However the incidence rate of the present study is lower than countries from Latin America and Africa (Table 1). Rwiza *et al* found an annual rate of 73 per 100000 populations per year in Ulanga, a rural Tanzanian district in Africa.[10] Placencia *et al* documented an incidence of122 to 190 per 100,000 populations per year in the Andean region of Ecuador, single and symptomatic seizures included.[11] On the other hand, the incidence rate of the present study is similar to the only other study from India[7] and some of the developed countries (Table 1).[12]

The reason for this low figure in the present study may be due to adoption of strict inclusion criteria and also exclusion of cases of febrile seizures, single seizures and acute symptomatic seizures. India is a country of multilingual and multiethnicity having different genetic, environmental and cultural variation, which may affect the incidence of epilepsy.[5,24] Together with socio-economic factors, these lead to high incidence rate in Latin America and Africa.

Sex specific incidence rates did not show any significant differences (Table 3). The lack of gender effect on the incidence rates is consistent with findings from other studies.[10-11,13-14]

Age specific incidence rates showed progressive decline over the years except a slight surge in 40-49 years age group (Table 3). Interestingly, typical late life increase in incidence rate is absent in our study probably due to relatively younger age of our population as compared to developed countries (Table 3). The age specific incidence rate was highest in the first decade of life. Higher incidence rate in younger age group is consistent with similar findings in other studies.[13,17,22]

Generalized seizures accounted for the majority of our cases (55.1%). Our results differ

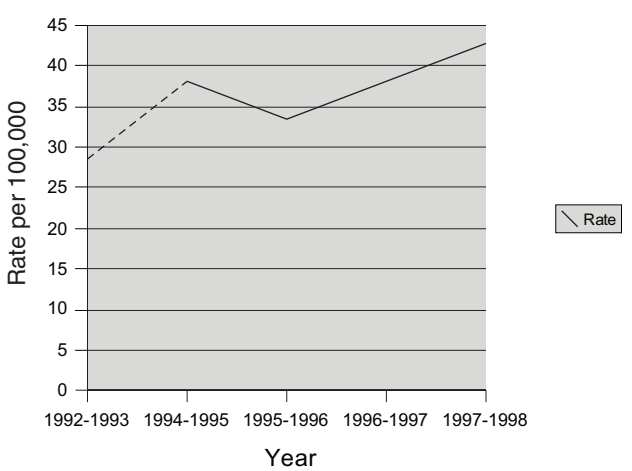

Figure 1: Graph showing increased incidence of epilepsy between 1992-1998

from the findings in Nigeria[16] where partial seizures accounted for most of the cases, but are in agreement with most previous studies in Africa[15], and other community based studies in India, which showed a preponderance of tonic clonic seizures of 60-90%.[5] Because no routine EEG was used for classification, partial seizures becoming rapidly secondarily generalized may have been misclassified as primary tonic clonic seizures. However, strict clinical criteria were used in our study. Whenever there was doubt, the seizures were categorized as unclassifiable. Most studies showing a preponderance of partial over generalized seizure involve urban, semi urban, or hospital populations.[12, 27] Wide variation in seizure subtypes in different studies may indicate unsatisfactory methods, bias in case ascertainment, varying definitions, improper reporting by observers, and lack of use of investigative facilities in community studies.

In this study no possible etiology could be determined in 68.5% of the cases. This finding was comparable to those reported from developing countries elsewhere.[16,24,26-27] Head trauma was not a major factor since motor traffic was minimal in this rural belt. Birth trauma was found to be an important risk factor, amenable to preventive measures. In a Nigerian study[16], a substantial difference in the prevalence ratio of epilepsy between a rural village (37 in 1,000) and a town (5.3 in 1,000) was seen. Among the explanations were the presence of an effective primary health care programme and improved antenatal care in the town as opposed to the village. One of the reasons for low incidence rate in the present study may be due to poor recall of putative events due to ignorance and illiteracy.

CNS infections (meningitis/ encephalitis) including granuloma were responsible for 15.7% of seizure disorders and have been noted as important risk factor in other developing countries.[28,29] One of the commonest causes of granuloma is neurocysticercosis, the most common parasitic disease of the CNS. The precise incidence and prevalence of single enhancing CT documented lesions in India are not known. All data available in India are from hospital studies.[30-34] A study from North India by Garg *et al* on 1,023 patients with simple partial seizures documented a single enhancing CT lesions in about 50% of patients.[31] A study from Western India on 150 patients with simple partial seizures and CT scanning has revealed single enhancing lesions in approximately 26%.[32] The incidence of these lesions was higher among children; 40% of the patients were younger than 15 years of age. Similarly a study from Southern India by Murthy *et al* has reported CT lesions in 23.4% of patients with all types of epilepsies.[33] A report from Central India by Garg and Nag had documented a higher incidence (72%) of single enhancing lesions among children and adolescents when CT scanning was performed after the first seizure.[34] In our study, we could document granuloma in 4 out of 20 (20%) subjects who had CT brain scan performed. It is possible that if all the persons underwent CT brain scan, the rate of enhancing lesion could be different.

An increasing trend has been noticed over the years during the study in incidence of epilepsy (Table 5 and Figure-1). It may possibly due to better detection of cases because of increasing awareness from sustained campaign in the study area.

Some of the limitations of this study were that we could not perform case-control study which would help to determine the risk factors. We were also not able to determine the syndrome specific incidence rates, since many patients did not have the required investigations.

In conclusion, the incidence rate of epilepsy in a rural community in West Bengal, Eastern India was similar to the developed countries, and lower than some of the developing countries. There was no rise of incidence in the elderly age group, possibly due to young age of the sample population. An increasing trend of incidence of epilepsy was noticed over the 5-years study period. This may be due to increased detection from greater awareness. Granuloma was the most common etiology in patients who underwent CT brain scan.

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