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Epidemiology of epilepsy in Singapore children

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Abstract

This is a study on the cumulative incidence of epilepsy in 96,047 children born in all government hospitals in Singapore between 1/1/1980 and 31/12/1982 known to be still living in Singapore at the age of 9 years. Epilepsy was defined as a chronic condition with recurrent unprovoked afebrile seizures. Case ascertainment was based on retrospective review of medical records.

The cumulative incidence of epilepsy by age 9 years was 3.50 per 1000 over-all; 3.51 in males; 3.49 in females. The age and sex specific cumulative incidences per 1000 were as follows: Chinese males: 3.67, Chinese females: 3.86, Malay males: 2.20, Malay females: 2.28, Indian males: 5.37, Indian females: 2.73. There were no significant differences in rates between the males and females. However, rates were significantly lower in Malays compared to Chinese and Indians. The rates were not significantly different between Chinese and Indians.

In 54% of patients, the cause of epilepsy could not be determined. Acquired causes accounted for only 10% of cases.

Keywords: Cumulative incidence, Epilepsy, Race, Sex, Singapore

INTRODUCTION

Epilepsy is a common neurological disorder especially in paediatrics. Prevalence rates vary widely from study to study. It is not clear whether these differences are real and due to genetic and/or environmental factors, or spurious and due to differences in definition and methodology between different studies.

Singapore is a small, multiracial country with a relatively uniform environment. The racial composition is Chinese 77.7%, Malays 14.1%, Indians 7.1%, other races 1.1%. It is thus a suitable setting to investigate the influence of race on the prevalence of epilepsy.

MATERIALS AND METHODS

Definition

An unprovoked afebrile seizure (AFS) is one which occurs in the absence of fever, and is not symptomatic of recognised acute neurological illness. Epilepsy is a chronic condition in which the patient has recurrent AFS. A single AFS or a cluster of AFS occurring within 24 hours but which does not recur is not considered as epilepsy. This definition is in accordance with the guidelines for epidemiologic studies on epilepsy published by the International League Against Epilepsy.[1]

Subjects and method

The population base of the study was children born between 1/1/1980 and 31/12/1982 in all government hospitals, who were known to be still living in Singapore at the age of 9 years. The total number of life-births over the 3 years for the whole of Singapore was 126,121, of which 101,257 were born in government hospitals. Of the 101,257 live-births, 96,047 (95%) were known to be still living in Singapore at the age of 9 years. The outcome of the other 5% is unknown. Many of these were born to foreigners and may have emigrated.

Hospital discharge diagnoses of all government hospitals between 1/1/1980 and 31/12/1991 were searched for diagnoses of seizures, epilepsy and any disease which may be associated with seizures such as meningitis, encephalitis, encephalopathy, Reye's syndrome, cerebral palsy and mental retardation. The records of all patient born between 1/1/1980 and 31/12/1982 with any of the above diagnoses were traced, patients with AFS were identified and their records abstracted by the first author.

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Children born in government hospitals with a history of AFS were asked to come to the School Health Services. At the time of this visit, a complete history including birth, developmental, family, general medical and seizure history was obtained and physical examination was carried out by one of the authors.

Of the 336 children who were identified to have epilepsy, 42 did not come for the medical evaluation. Follow-up information was available on all 42 patients through medical records and/or telephone interviews. Another 58 children had a single AFS or a cluster of AFS within 24 hours, all were followed up to the age of 9 years without recurrence of seizures. All 58 were excluded from this study as they did not meet the definition of epilepsy.

Population statistics and statistics of hospital discharges were obtained from the Ministry of Health, Singapore.

Chi-square test was used to compare the rates of epilepsy between the different race and sex subgroups.

RESULTS

By the age of 9 years, 336 children developed epilepsy giving a cumulative incidence of epilepsy of 3.50/1000 over-all; 3.51/1000 in males; 3.49/1000 in females; 3.76/1000 in Chinese; 2.25/1000 in Malay; 4.09/1000 in Indians. The race and sex specific rates are shown in table 1. The rates were not significantly different between male and female (P=0.99) for all race groups combined as well as in each race group. The cumulative incidence was significantly lower in the Malays compared to Chinese ($p<0.002$) and in Malays compared to Indians ($p<0.014$), but not significantly different between Chinese and Indians ($p=0.7$).

The extent to which patients were investigated for an underlying cause of epilepsy varied with the clinical features of the patient as well as the idiosyncrasies of the phycisian in charge. Most patients (89%) had electrocencephalograms (EEG), but this did not always include both waking and sleep studies; 41% of the patients had computerised tomographic scans and/or magnetic resonance imaging of the brain. Other studies such as chromosome cultures, studies for inborn errors of metabolism, work up for intra-uterine infections were carried out only when clinical features indicated a need for such investigations.

The cause of the epilepsy was unknown in 183 patients (54%). Benign epilepsy of childhood with centrotemporal spikes (BECT) was the most common cause (15%). Acquired causes accounted for only 10% of the cases. Table 2 shows the distribution of cases by etiologic categories.

The highest incidence of epilepsy was in the first month of life (0.3/1000 per month) followed by the second to sixth months (0.1/1000 per month). The incidence declined further between 7 to 18 months of age after which it remained relatively constant up to age 9 years. (Table 3)

DISCUSSION

Reported prevalence rates of epilepsy in children range from 2.5 to 121 per 1,000, with most clutering around 4-6 per 1,000.[2] Variability may be due to differences in the age ranges included, definition of epilepsy, methods of case ascertainment, or population differences in the underlying frequency of childhood epilepsy.

The over-all cumulative incidence of 3.50 per 1000 in this study is similar to studies in other countries for the same age range (table 4). It also is in accordance with cumulative incidence of 5 per 1000 by age 18 years found in a study of Singapore males.[3] In that study of 18 year old men, case detection was by history taken by doctors who were examining potential army recruits. The cumulative incidence per 1000 population by age 18 years was 5.7 in Chinese, 2.9 in Malays and 4.8 in Indians. In a third epidemiological study of epilepsy in Singapore, the racial composition of hospital discharges for epilepsy was 73.4% Chinese, 13.4% Indians and 9.1% Malays.[4] Compared to the population racial composition of 77.7% Chinese, 7.1% Indians and 14.1% Malays, there was obviously less Malay epileptics hospitalised then would be expected. Hence all 3 studies on the epidemiology of epilepsy in Singapore have found a lower rate in Malays compared to Chinese and Indians.

In our cohort of children born in government

TABLE 1: Race and sex specific cumulative incidences of epilepsy (rates per 1000) by 9 age years.

	Both sexes	Males	Females
All Races	3.50	3.51	3.49
Chinese	3.76	3.67	3.86
Malay	2.25	2.20	2.28
Indian	4.09	5.37	2.73

TABLE 2: Etiology of epilepsy in 336 patients

		N	%
1.	Unknown	183	54.4
2.	Benign epilepsy with central-mid temporal spikes	49	14.9
3.	Miscellaneous familial epilepsies	20	6.0
4.	Childhood & juvenile absence epilepsies	12	3.6
5.	Benign familial infantile epilepsy	7	2.1
6.	Benign epilepsy with occipital spikes	5	1.5
7.	Malformations of the brain	19	5.7
8.	Intrauterine infection (toxoplasmosis)	1	0.3
9.	Tuberose sclerosis	2	0.6
10.	Birth asphyxia	5	1.5
11.	Post-natal acquired		
	(hypoglycaemia,	3	0.9
	head injury,	6	1.8
	post meningitis or encephalitis,	6	1.8
	post encephalopathy	6	1.8
	infarct	2	0.6
	tumor	2	0.6
	haemorrhagic disease of new born)	3	0.9

hospitals, the composition was 72.9% Chinese, 18.7% Malays, 7.5% Indians. The larger proportion of Malays compared to the the racial composition of the entire Singapore population is due to their higher birth rates and their preference for delivery in government hospital. Discharge statistics from government hospitals showed that for children born between 1/1/1980 and 31/12/1982, Chinese, Malays and Indians accounted for 72.7%, 15.6% and 8.1% respectively. This suggest that Malays are less likely to be admitted to a government hospital when they are ill compared to Chinese and Indians, and may partially account for the lower rates of epilepsy found in this study. However, this can not account for the degree of discrepancy in rates of epilepsy between Malays and the other two races, nor the lower rate that was present even in the study of 18 year old men in which case detection was by personal interview by a doctor.[3] In that study, there was great incentive for the individual to report any occurrence of seizure because this may excuse him from strenuous military service.

The proportion of patients who are Malays in each etiologic category of epilepsy is shown in table 5. It can be seen that Malays are under-represented in all categories except for malformation of the brain. Hence, in both inherited as well as acquired causes of epilepsy, Malays appear to have a lower incidence than Chinese and Indians. The authors have no satisfactory explanation for this observation.

The proportion of patients in whom no etiology could be determined for their epilespy was 54%. This is similar to the 69% found in the U.S.A. study by Cowen at al.[5] The second most common cause was BECT. This accounted for 14.9% of cases. Since not all patients had both waking and sleep EEGs, the actual proportion of patients with BECT may be even higher. There is general consencus that BECT is one of the most frequently seen epileptic syndromes in children. In Heijbel et al.'s study[6], it represented 15.7% of all nonfebrile seizures seen in patients 0-15 years old; in that study, patients with absence seizures comprised only 4.3%, similar to the 3.6% in our study. Acquired causes accounted for only 10% of cases of epilepsy in our study, and 17% in the Oklahoma study[5],

TABLE 3: Distribution of age at onset of epilepsy

Age at onset	Oklahoma5		Singapore	
	No.	%	No.	%
<1 yr	366	32	124	37
<1 mo	126	11	29	9
1-5 mo	112	10	61	18
6-11 mo	128	11	34	10
1-4 y	297	26	116	35
5-9 y	220	19	96	29

TABLE 4: Comparision of reported prevalence of epilepsy (rates per 1000) between the ages of 0 to 9 years

Location	Author	Rate
Present study		3.5
Oklahoma, U.S.A.	Cowen et al., 1989[5]	5.2
Rochester, MN, U.S.A.	Hauser and Kurland, 1975[7]	4.4
Carlisle, England	Brewis et al., 1966[8]	3.3
Copparo, Italy	Granieri et al., 1983[9]	4.7
Guam, Mariana Islands	Stanhope et al., 1972[10]	3.0
Six cities in China	Li et al., 1985[11]	3.5

making if unlikely that even major improvements in health care will significantly reduced the incidence of epilepsy.

Of the 336 patients with epilepsy, all had been admitted to a government hospital at some time in their life. It was common practise for paediatric patients seen at any of the government hospitals for the first time with seizures to be admitted. During the study years, 82% of all hospital admissions in Singapore were to government hospitals. Parents who choose to delivery in government hospitals are more likely to consult government hospitals when their children are ill. Considering the above factors, the cumulative incidence of 3.50 per 1000 by age 9 years is an under-estimate, but probably not too different from the actual rate.

The distribution of age at onset of seizure found in our study is very similar to that in Oklahoma[5] (Table 3) and Rochester Minnesota.[7] This suggests that in all populations, the incidence of epilepsy is highest in the first year of life.

In conclusion, epilepsy occurs in at least 3.50 per 1000 Singapore children by the age of 9 years. The cumulative incidence is lower in Malays than Chinese and Indians. Most of the cases (54%) have no known etiology for their epilepsy. Of the known causes, BECT is the most common. Acquired causes account for only 10% of cases of epilepsy.

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TABLE 5: Percentage of patients who are Malays in each etiologic category

Etiology of epilepsy	%
1. Unknown	14
2. Benign epilepsy with central-mid temporal spikes	12
3. Childhood and juvenile absence epilepsies	0
4. Benign familial infantile epilepsy	14
5. Miscellaneous familial epilepsies	10
6. Benign epilepsy with occipital spikes	0
7. Acquired causes (intra-uterine infection, birth asphyxia, hypoglycaemia, head injury, meningitis, encephalitis, encephalopathy).	12
8. Brain malformation	21
Percentage of Malay in the study population	19

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