

Epidemiology of febrile seizures in Singapore children

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Abstract

This is a population based study of febrile seizure occurrence in 30,754 children born in two government hospitals in Singapore between 1/1/80 and 31/12/82 followed up to the age of 6 years. The case ascertainment was based on combined questionnaire survey with medical records review. Febrile seizure was defined as a seizure that occurred after age one month, in association with fever but without evidence of intracranial infection or defined cause. Seizures with fever in children who have suffered a previous unprovoked afebrile seizure were excluded. The cumulative incidence of febrile seizures by age 6 years was 4.47% over-all; 5.14% in males; 3.75% in females. The age and sex specific cumulative incidences were as follows: Chinese males: 5.2%, Chinese females: 4.0%, Malay males: 5.0%, Malay females: 3.0%, Indian males: 5.2%, Indian females: 3.3%. There were no significant differences in rates between the three races, however, the rates were significantly higher in males compared to females in all three races.

Keywords: Epidemiology, cumulative incidence, febrile seizures, race, sex, Singapore.

INTRODUCTION

Febrile seizure (FS) is the most common seizure disorder in all races. In USA¹, South America², and Western Europe³, between 2% and 5% of all children experience febrile seizures (FS) before age 5 years. Estimates of the frequency of FS are much higher in Japan⁴ (8%) and the Mariana Islands⁵ (15%). 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 78%, Malays 14%, Indians 7%, other races 1%. It is thus a suitable setting to investigate racial influence on the prevalence of FS.

MATERIALS AND METHODS

FS was defined as a seizure that occurs in childhood after age one month, associated with a febrile illness not caused by an infection of the central nervous system, without previous neonatal seiures or previous unprovoked seizure, and not meeting criteria for other acute symptomatic seizures. This is the definition recommended in the guidelines for epidemiologic studies on epilepsy issued by the International League Against Epilepsy.⁶

The population base of the study were 30,754 children born in two government hospitals (Toa Payoh Hospital and Alexandra Hospital) between 1/1/80 and 31/12/82 whose neurological status was known at age 6 years.

Hospital discharge diagnoses of all government and university hospitals between 1/1/1980 and 31/12/1993 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, mental retardation etc. The records of all patient born between 1/1/1980 and 31/12/1982 with any of the above diagnoses were traced, patients with seizures of any type were identified and their records abstracted.

The electroencephalography (EEG) laboratories at Tan Tock Seng Hospital, Singapore General Hospital and National University Hospital serve all the government and university hospitals in Singapore as well as many of the private practitioners. The name and birth certificate number of all patients who were born between 1/1/1980 and 31/12/1982 who had EEG studies in any of the three laboratories were obtained. Their medical records were traced, those with seizures identified and their records abstracted.

Parents of all children born between 1/1/1980 to 31/12/1982 were sent questionnaires

at the time of school entry (age 6 or older) asking if their child ever had seizures.

Children born in Toa Payoh Hospital or Alexandra Hospital with a history of seizures of any type were asked to come to the School Health Services. At the time of this visit, a complete history (birth, developmental, family, general medical and seizure history) was obtained and physical examination was carried out by one of the authors.

RESULTS

Of the 1375 children who were identified as having FS, 19 (1%) did not come for the medical evaluation. However, follow-up information on 10 children was available either from hospital records or through telephone calls to the family. Only 9 had no follow-up information available. Of the 1375 children, 1064 (77%) were admitted to hospital for their FS, 232 were only seen as out-patients by private practitioners, 79 never consulted any doctor. Hence 311 patients (23%) were never admitted for FS and only identified by the questionnaires returned by their parents when they were aged 6 years. Of the 1064 patients with FS identified by hospital records, parents of 238 patients (22%) denied any seizures in the questionnaire which they were asked to complete at age 6 years.

The cumulative incidence of FS by age 6 years was 4.47%; 5.15% in males; 3.76% in females. The race and sex specific rates are shown in table 1. The rates were not significantly different between the races ($P < 0.1$). The higher rates in males was found for all three races and was statistically significant in each race.

Of the 1064 cases who had been admitted for FS, 876 were admitted for their first FS so that the exact age of onset of FS known. Nine patients had their first FS before the age of 3 months, 5 between the 5 and 6 years of age. The mean age of first FS was 20.1 months (20.2 months in males and 19.8 months in females); the median age at time of first FS was 18

months; 80% of patients had their first FS between the ages of 8.7 months and 34.9 months.

From the hospital records, 17 patients were admitted for first FS after the age of 6 years, the oldest had his first FS at the age of 11.6 years. If it is assumed that all patients with first FS occurring after the age of 6 years are admitted to hospital, the cumulative incidence of FS up to the age of 12 years would be 4.53%. Comparing this rate with 4.48% by age 6 years, it can be seen that very few patients have their first FS between age 6 and 12 years.

DISCUSSION

Whilst it has long been acknowledged that FS is a very common paediatric condition, studies in different populations had suggested extremely wide variations in incidence in different countries. Figures vary from 0.2% in Sweden⁷ to 15% in the Mariana Islands.⁵ Differences in the rates of FS may be due to different definitions of FS, the methods of ascertainment, and true differences between the populations investigated.

As for differences due to ascertainment methods, the mean incidence rate was 2.7% (range 1.5 to 4.8%) by questionnaire surveys, 4.3% (0.1 to 14%) by reports of general practitioners or medical records reviews.⁸ The importance of ascertainment method is shown in this study. Of the 1064 patients with FS identified by hospital records, 22% of the parents denied any seizures in the questionnaire which they were asked to complete at 6 years. On the other hand, 23% patients were never admitted for FS and only identified by the questionnaires. Our study combined questionnaire survey with medical records review and obtained rates similar to the average found by other studies using similar ascertainment methods. Case ascertainment by clinical examinations by physicians or pediatricians of all subjects in the study would probably be able to identify further a significant number of patients with FS who were not admitted to hospital and denied the

TABLE 1: Race and sex specific cumulative incidences of FS by 6 years, and *P* value for differences between sexes.

	Both sexes	Males	Females	<i>P</i> value
All Races	4.47%	5.14%	3.75%	.000001
Chinese	4.65%	5.20%	4.05%	<.0001
Malay	4.03%	4.98%	3.01%	<.00004
Indian	4.30%	5.19%	3.33%	<.03

occurrence of seizures in the questionnaire. Tsuboi⁸, using this method, was able to identify 16% more FS subjects than by medical records alone. But this method is difficult and expensive. Thus, the actual prevalence of FS in Singapore is probably higher than the figures indicated above.

The National Institute of Neurological and Communicative Disorders and Stroke Collaborative Perinatal Project (NCP)⁹ is the largest and most comprehensive study on FS. In the NCP study, of 1,821 children with FS, 1,706 or 94% were followed up to age 7 years, 3.48% of white children and 4.24% of black children had FS. The higher rate in black compared to white children was significant ($P < .001$). The cumulative incidence of FS in Japan was higher than than USA and Europe⁸ again suggesting the importance of racial factor. In our study consisting of a multi-racial population, there is no significant difference in cumulative incidence of FS for the three ethnic groups; Chinese, Malays and Indians. One other explanation given for the high rates of FS found in Japan compared to western countries is that Japanese mothers usually sleep with young children and seizures do not go unnoticed. In Singapore, Chinese, Malay and Indian parents all usually sleep with their young children, yet the rates is closer to that in America,^{1,2} Europe³ rather than Japan.⁴

A higher rate of FS in males have been found in many studies.^{9,10,11} In the report from NCP,⁹ more boys had FS than girls (3.66% vs. 3.28% for whites and 4.64% vs. 3.85% for blacks), but the differences between sexes within race was significant only among black children ($P < .009$). Our findings of a significantly higher rates in males compared to females in Chinese, Malay and Indians are thus in accordance with previous studies.

The average age of onset of FS in the NCP study which included patients up to the age of 7 years was 23.3 months in girls and 23.2 months in boys. This is slightly older than 19.8 months in girls and 20.2 months in boys found in our studies which included patients only up to the age of 6 years. The vast majority of patients with FS have their first seizure between the ages of 8 months and 3 years, but FS can occur in children below the age of 3 months and above the age of 6 years.

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