Investigating the prevalence of febrile convulsion in Kayseri, Turkey: An assessment of the risk factors for recurrence of febrile convulsion and for development of epilepsy

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ABSTRACT

Purpose: The purpose of this study was to investigate the prevalence and recurrence of febrile convulsion (FC) and risk factors for development of epilepsy in school children throughout in the Kayseri provincial center.

Method: Ten thousand individuals selected using "stratified cluster sampling" from a student population of 259,428 inside the Kayseri Urban Municipality represented the study sample. Fifteen thousand questionnaires were distributed, of which 10,742 (71.6%) were returned. Telephone interviews were performed with the families of the students reported as having undergone FC, and the medical records of patients with a history of hospitalization were evaluated. Data were analyzed on IBM SPSS Statistics 22.0 package program. Significance was set at $p < 0.05$.

Results: Prevalence of FC was 4.2% in girls and 4.3% in boys, with a total prevalence of 4.3%. Recurrence of FC was observed in 25.4% of cases. Risk of recurrence increased 7.1 times in subjects with a history of FC in first and second degree relatives, 17.8 times in those with fever interval <1 h before convulsion and 17.6 times in those with pre-convulsion body temperature $<39\,^\circ$C. Epilepsy developed in 33 (7.2%) cases. Neurodevelopmental abnormality was the most important risk factor for epilepsy (21.1-fold risk increase).

Conclusions: Analysis revealed that FC with a good prognosis had a high rate of recurrence and a higher risk of epilepsy than in the general population. The prevalence of FC in the province of Kayseri was closer to that in developed rather than developing countries.

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1. Introduction

Febrile convulsion (FC) is described by the International League Against Epilepsy (ILAE) as convulsion occurring during febrile disease in children aged over one month with no previous afebrile convulsion, with no infection involving the central nervous system (CNS), and with no identified cause such as electrolyte imbalance, metabolic disorder, intoxication or trauma [1–3]. Onset after the age of 7 years is rare [1].

FC is the most common childhood seizure disorder [3]. Incidence and prevalence of FC is thought to vary depending on geographic, socioeconomic variations, and genetic disposition.

Previous studies have reported prevalence of FC up to the age of 7 between 2% and 8% [3–8]. The prevalence in the USA and Europe is reported at 2–5%, at 6–9% in Japan and 14% in Guam [9–12]. The prevalence in Turkey is uncertain, although prevalence of FC have been reported in primary school children at Diyarbakır and final year students at Istanbul University 8,9%, 5,5% respectively. Aydın et al. [15] reported a lifetime prevalence of FC of 9,7% in a study from the province of Izmir

FC recurs in approximately 25–50% of children with FC [1–3]. Recurrence in cases with onset below the age of 1 year is approximately 50%, and approximately 10% in cases with onset after the age of 3 [3]. The main factors increasing the risk of recurrence of FC are seizure onset below the age of 1 year, family

history, low fever during FC and short-lived fever before seizure [3,16,17].

Progression to epilepsy in FC is a controversial subject. The risk of progression to epilepsy in single FC is regarded as no different to that in the general population (approximately 0,5%), although a reported rise to 2–10% as risk factors increase [3]. Risk factors for epilepsy in the literature include a family history of epilepsy, neurodevelopmental abnormality, complex FC and short fever interval before seizure [1,3,18,19].

This study was planned as the second stage of our work assessing the prevalence of epilepsy in school children aged 7–17 in the Kayseri provincial center in the 2010–2011 academic year [20], and it was performed in districts in the Kayseri provincial center in order to determine the prevalence of FC in 7–17 years old children who had experienced FC when they were 1 month-old to 6 year-old. The results were analyzed for assessing the risk factors for recurrence of FC, and development of epilepsy in patients diagnosed with FC, and monitoring of FC.

2. Materials and methods

This study was approval by the Local Ethics Committee of Erciyes University (2015/404).

2.1. Determination of sample size

The population of this cross-sectional study consisted of 259,428 students attending a total of 725 primary and high school or equivalent institutions inside the borders of the Kayseri Metropolitan Municipality, 184,281 (71.03%) receiving primary education and 75,147 (28.96%) secondary education (high schools) [21]. The stratified cluster sampling method was used.

2.2. Selection of individuals

In the light of the approximately 75–80% return rates in previous prevalence studies, 15,000 questionnaires were distributed. Primary (71.03% of the population, sample size 10,655 students) and high (28.96% of the population, sample size 4345 students) schools were grouped separately to determine their weights within the population, the proportions of which were represented within the population. Schools were stratified according to socioeconomic level, 20% high, 60% medium and 20% low, from Kayseri Provincial Education Directorate Statistical Office data proportional to national socioeconomic group classifications and socioeconomic groups in the population. Each school within these strata was regarded as a cluster. Seven schools (clusters) of the 145 schools with a low socioeconomic level, 21 of the 435 schools with a moderate socioeconomic level and 7 of the 145 schools with a high socioeconomic level were determined using simple random sampling. Schools in each set were numbered on the basis of alphabetical order, and schools were selected on a random basis with the help of a computer program. A study population of 15,000 students was established using random sampling in such a way as to include 3000 high socioeconomic level students, 9000 medium socioeconomic level students and 3000 low socioeconomic level students, equally divided between males and females, from classes in the 35 identified schools.

2.3. Study protocol

Following receipt of approval from the Provincial Education Directorate, a questionnaire consisting of 40 items prepared in line with prevalence study criteria for developing countries recommended by the World Health Organization (WHO) and the Guidelines for Epidemiologic Studies recommended by International League Against Epilepsy (ILAE) – Commission of Epidemiology and Prognosis (CEP)-1993 was distributed to schools for the purpose of determining the prevalence of febrile convulsion. "Having experienced FC" represented the dependent variable of the research. Age, sex, social security, consanguineous marriage, residence, parental education level, history of FC in the family and family history of epilepsy were independent variables of the research into FC. The first 22 questions concerned the subjects' sociodemographic characteristics. The remaining 18 questions were drawn up in line with the Epidemiological Studies Guidelines recommended by ILAE–CEP–1993. Cases were reassessed at the 2nd and 3rd states of the study using a separate patient assessment form consisting of 35 questions in order to elicit detailed information in patients who had undergone FC. Students described as having undergone FC according to the results of the 2nd stage questionnaire were reassessed on the basis of school counseling service records or telephone interviews with families. In order to confirm diagnosis of FC in the telephone questionnaire, we inquired whether the case had been diagnosed with FC by a health institution. Students monitored at any health institution with a diagnosis of FC and agreeing to interview were invited for check-up at our clinic in the 3rd stage. Seizure semiology, physical examination, drugs used for treatment, recurrence of FC and risk factors for epilepsy were evaluated. Available imaging records and/ or reports for first electroencephalography (EEG) performed after FC attack and EEGs performed after 6, 12 or 24 months were reassessed, and the results were recorded as normal or pathological. Findings for patients who had undergone cranial imaging [computed tomography (CT) and/or magnetic resonance imaging (MRI)] and whose imaging records were available were reassessed. Results were recorded as normal or pathological, and no additional cranial imaging and EEG were performed.

2.4. Statistical analysis

Data were analyzed on the IBM SPSS Statistics 22.0 package program (IBM Corp., Armonk, New York, USA). Descriptive statistics were expressed as number (n), percentage (%) and mean ± standard deviation ($\bar{x} \pm sd$). Normal distribution of numerical variables were investigated using the Shapiro-Wilk test and Q–Q plots. The two group independent samples t test was used in two-group comparisons. Categoric variables were analyzed using the chi square test. Binary logistic regression analysis with Wald backward elimination was used to determine risk factors. Significance was set at $p < 0.05$. Levels of significance were derived as for two-tailed tests.

3. Results

The study group consisted of 10,742 children, with a return rate of 71.6%.

3.1. General demographic findings

A total of 10,742 individuals, with a mean age of 12.01±3.16 years, 5312 (49.5%) male and 5430 (50.5%) female responded to the questions in the questionnaire ($p = 0.112$). Completed questionnaires were received for analysis from 7790 (72.5%) primary school students and 2952 (27.5%) from high school students. Examination of the economic status of the cases comprising the sample revealed that 20.8% had a good level of income, 58.3% a moderate level and 20.9% a low level.