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Original Article

Prevalance of Epilepsy in School-age Children in Erzurum

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ABSTRACT

Objective: *This study aimed to investigate the prevalence of epilepsy in school children in Erzurum and compare it with prevalence studies in Turkey and worldwide.*
Methods: *This is a cross-sectional study conducted in the center of Erzurum. From the universe formed by 74,732 students, 5,571 people were selected through the "proportionate stratified sampling method" and 4,560 (80%) of the 5,700 questionnaires distributed were collected. Based on the data obtained, 563 students were accepted as possible epilepsy cases and examined for epilepsy.*
Results: *TOf the students participating in the study, 51.3% were female and 48.6% male. Six girls (3/1000) and 10 boys (5/1000), a total of 16 cases (4/1000) were detected to be followed-up for epilepsy. Prevalence rates were found to be 4.5/1000, 2.6/1000 and 3.6/1000 for males, females and the total population, respectively. The prevalence of active epilepsy was determined to be 4/1000, 2/1000, and 3/1000 for males, females and the sum of both, respectively.*
Conclusion: *Epilepsy is an important health problem for our region. The prevalence of epilepsy among school-age children in Erzurum was close to the prevalence rate seen in developed countries. Febrile convulsion, low educational level and low socioeconomic level are the risk factors for epilepsy.*

INTRODUCTION

Epilepsy is a condition characterized by sudden, recurrent epileptic seizures that are not triggered by an identifiable event due to abnormal and excessive electrical discharges in cortical neurons.[1] Epilepsy adds to society's burden by adversely impacting children's physical and social lives. Preventive and curative health services can help to change this situation. Epidemiological studies are needed to reveal the frequency and causes of epilepsy, to prevent its development, and to determine appropriate treatment approaches.[2]

In studies conducted to date, the mean prevalence of epilepsy has been found to be 18.5/1000 (between 2.8 and 44/1000).[3,4] The prevalence of epilepsy was reported to be 8-17/1000 in a limited number of studies performed in Turkey.[4,5] Many studies have shown differences in prevalence rates. To determine the prevalence values, many studies should be carried out in the different regions of Turkey.

The aim of this study is to determine the prevalence of epilepsy in school-age children aged 7-16 in Erzurum city center, to evaluate the risk factors in patients diagnosed with epilepsy, and as a result of the data obtained, to contribute to the prospective approaches for the follow-up and treatment of epilepsy for our country.

MATERIALS and METHODS

Study area and Population

Erzurum is the largest city in the Eastern Anatolia Region. Its total population is approximately 784,941.

This study was planned in order to determine the prevalence of epilepsy in children in primary education and high school age in Erzurum. According to the data of Erzurum Provincial Directorate of National Education and Statistics Department, 54,580 students study in 184 primary schools and 20,152 students in 29 high schools,ie. a total of 74,732 students in 213 schools within the boundaries of the metropolitan city.

Sample Selection

The study's sample included 5571 students selected from the population of elementary and high schools within the boundaries of Erzurum Metropolitan using the "proportional stratified sampling method". The elementary and high schools were grouped separately, and their weight in the population was determined, and they were represented in the sample in proportion to their weight. Considering that each elementary school consists of 8 classes with an average of 25 students and the high schools consist of 4 classes with 20 students, each school was considered a cluster, and 13 clusters were included in the sample. While determining the sample size, epilepsy prevalence (p) was taken as 0.56% d 0.02 and the formula n=Nt2p.q / d2 (N-1) + t2pq was used at 95% confidence interval. The sample size was calculated to be 5064, but it was aimed to use 5571 questionnaires, assuming that 10% of the questionnaires would be excluded from the study.

Questionnaire Form

Approval was obtained from Atatürk University Faculty of Medicine Ethics Committee. The study was conducted in two stages. In the first stage, 11 questions were about the socio-demographic characteristics of the cases. 15 questions were prepared according to the "Guidelines for Epidemiologic Studies" proposed by the "ILAE-CEP-1993" in the prevalence study conducted by Karaağaç et al. in Silivri, and these questions were asked during realization of the study.[6] We added ten questions to increase the sensitivity of the survey. The sensitivity and specificity of these survey questions were detected as 99% and 76%, respectively. In accordance with the Principles of Helsinki Declaration, an "informed consent" form was obtained from the parents who participated in the study. Scoring was made by evaluating the data obtained in the first stage.

Statistical Analysis

The data were evaluated using the SPSS 15.0 package program. Data were expressed as number, percentage, mean and standard deviation. Prevalence of epilepsy, age, gender, socio-economic status, social security, consanguineous marriage, residence, parents' educational level, family history of epilepsy, and febrile convulsion, risk factors related to epilepsy and febrile convulsion history in the child were analyzed with Fisher-Freeman-Halton Test and chi-square test. Level of statistical significance was taken as $p<0.05$. The reason of using chi-square test was to find the significant differences between the expected frequencies and observed results to understand whether the distribution of categorical variables differ from each other. The independent variables of the study were age, gender, social security, consanguineous marriage, homeownership, and monthly income, and parental educational level, family history of epilepsy, and febrile convulsions, risk factors associated with epilepsy and history of febrile seizures in children. The dependent variables of the study were related to the prevalence of epilepsy.

RESULTS

Stage One; **Socio-Demographic Characteristics:**

A total of 5,571 questionnaires were distributed and 4,560 responses were received, with an 81.8% return rate. Of the questionnaire forms, 2,784 (61.0%) were taken from primary education schools and 1,773 (38.9%) forms from high schools. The mean age of the questionnaire was 12.7±3.4, and 51.33% of the students were female and 48.6% were male. In terms of educational level, 57.4% of fathers and 67.9% of mothers were primary school graduates. When examined in terms of consanguinity; 11.7% of the parents were 1st degree relatives. Monthly income of 34.1% of the cases was low. There was a history of epilepsy in 6.5% and febrile seizure in 25.4% of the families. The results are shown in Table 1.

Second Stage Findings; Prevalence Findings

The data obtained in the first stage were evaluated. Study participants who scored 3 over 9 questions (n=563) were accepted as possible epilepsy cases.

Table 1. Family history of epilepsy and febrile seizures

	n	%
Epilepsy in the family		
Yes	295	6.47
No	4262	93.53
Family members, and relatives with a history of epilepsy		
Mother	32	11.31
Father	35	12.37
Siblings	76	26.86
Aunt, uncle,	81	28.62
Cousin or nephew	59	20.85
Family history of a febrile seizure		
Yes	1156	25.37
No	3401	74.63
Family members, and relatives with a history of febrile seizures		
Mother	75	6.78
Father	115	10.39
Siblings	604	54.56
Aunt, uncle,	106	9.58
Cousin or nephew	207	18.70

Table 2. The questionnaire for the possible epilepsy cases

1. Does your child have epilepsy?
2. How does your child have seizures?
3. If you answered yes to the first question, how many seizures had your child had in the last five years?
4. How often do the seizures occur in your child?
6. How many years has your child had a seizure?
7. Have you ever had an EEG done on your child?
8. If yes, what were the results of the EEG?
9. Is your child taking medication for epilepsy?
10. How many years has your child been taking medication?
11. If your child is on treatment, what medication is he/she taking?
12. Has the medication resulted in a decrease in seizures?
13. What is the blood level of the medication your child is taking?
14. Has your child ever had meningitis or encephalitis?
15. Did your child not receive oxygen at birth?
16. Has your child ever had a sudden stroke?
17. Has your child ever had a concussion?
18. Does anyone in your family have epilepsy?
19. If so, who has it?
20. Does anyone in your family have a febrile seizure?
21. If so, who or what has it?
22. Has your child ever had a febrile seizure?
23. At what age did your child have his or her first febrile seizure?
24. Has your child had more than one febrile seizure? If yes, how often?
25. Has your child taken medication for a febrile seizure?
26. If yes, what medication did he/she take?

Potential epilepsy cases were summoned to Atatürk University Medical Faculty Paediatrics Department Polyclinic to be examined for definite epilepsy. The questionnaire shown in Table 2 was applied to the respondents. While 250 out of 563 participants were examined in the hospital. 150 persons who did not wish to come to the hospital were examined by telephone and screened for epilepsy. The families of participants who might have epilepsy were persuaded and called to the hospital. Fifty-seven individuals were evaluated in terms of epilepsy in their schools, whereas 106 individuals could not be reached because school counseling services were unavailable, and telephone communication was not possible.

Cases participating in the study were evaluated for drug use due to epilepsy (active or inactive epilepsy) or febrile seizures. Active epilepsy patients were defined as patients who had at least one seizure in the past five years, whether treated or not. Inactive epilepsy was used for patients who were untreated or seizure-free in the last five years. Epilepsy was defined as the presence of two or more unprovoked seizures. Febrile seizures were defined as the most common seizures in childhood, usually between the ages of 3 months and five years, associated with fever and without evidence of intracranial infection. As a result of the study, 13 (2.3%) possible epilepsy cases were classified as active epilepsy, 3 (0.5%) as inactive epilepsy, and 80 (14.2%) as febrile convulsions (Table 3). In the second stage of the study, 334 (59.3%) of 563 possible epilepsy cases were not evaluated as epilepsy. When the family history of epilepsy in epileptic cases was evaluated, epilepsy was found in the family in 7 (43.7%) of 16 patients, 3 of 6 female patients and 4 of 10 male patients. When evaluated in terms of febrile seizures in the family, positive history was found in 4 of 6 female patients

Table 3. Distribution of cases with possible epilepsy

	n	%
No epilepsy	334	59.3
Inactive epilepsy	3	0.5
Active epilepsy	13	2.3
Febrile convulsion	80	14.2
Conversion	3	0.5
Panic attack	1	0.2
Syncope	22	3.9
Syringomyelia	1	0.2
Could not be reached	106	18.8
Total	563	100.0

Table 4. Distribution of risk factors in epileptic individuals

	n	%
Having meningitis		
Yes	1	6.2
No	15	93.8
Oxygen deprivation at birth		
Yes	3	18.7
No	13	81.3
Sudden paralysis		
Yes	0	0.00
No	16	100
Having a concussion		
Yes	2	12.5
No	14	87.5

Table 5. Comparison of socio-demographic findings in epileptic and non-epileptic subjects

		Epilepsy group					
		With epilepsy		Without epilepsy			
		n	%	n	%	Chi-square, Fisher-Freeman-Halton Test*	p
Gender	Female	6	46.2	234	53.9		
	Male	7	53.8	200	46.1	0.306	0.580
Health insurance	Health card for uninsured people in Turkey	4	30.8	161	37.1		
	SSI (Social İnsurance İnstitution)	7	53.8	177	40.8		
	Bagkur (Social security organization for artisans and the self-employed)	1	7.7	52	12.0		
	Paid Retirement Fund	0	0.0	13	3.0		
		1	7.7	31	7.1	0.89*	0.873
Consanguineous marriage	1st Degree Kinship	3	23.1	78	18.0		
	2nd Degree Kinship	1	7.7	86	19.8		
	No Kinship	9	69.2	270	62.2	1.142*	0.564
Home ownership	Own	8	61.5	258	59.4		
	Rent	5	38.5	160	36.9		
	Dwelling-House	0	0.0	16	3.7	0.033*	1.000
Monthly income	<500 TL	7	53.8	171	39.8		
	500-999 TL	3	23.1	162	37.7		
	1000-1999 TL	3	23.1	80	18.6		
	≥ 2000 TL	0	0.0	17	4.0	1.56*	0.619
Father's educational level	Illiterate	1	7.7	39	9.0		
	Primary School Graduate	10	76.9	273	62.9		
	High School	1	7.7	102	23.5		
	University	1	7.7	20	4.6	2.372*	0.407
Mother's educational level	Illiterate	3	23.1	143	32.9		
	Primary School Graduate	9	69.2	262	60.4		
	High School	0	0.0	24	5.5		
	University	1	7.7	5	1.2	4.118*	0.237

Table 6. EEG findings of possible epilepsy cases

EEG Findings	n	%
Normal	47	38.5
Focal epileptic form	3	2.5
Generalized epileptic form	3	2.5
Suspected epileptic form	1	0.8

Table 7. Distribution of epilepsy prevalence by gender

	With epilepsy		Without epilepsy			
Gender	Number	%	Number	%	Total	p
Female	6	0.26	2333	99.74	2339	0.30
Male	10	0.45	2211	99.55	2221	
Total	16	0.35	4544	99.65	4560	

Table 8. Age-adjusted prevalence of epilepsy in females and males

	MALE		FEMALE		TOTAL	
GRADE	Total population	Expected case	Total population	Expected case	Total population	Expected case
7-10	14,160	130	13,324	38	27,484	167
11-14	14,039	41	13,057	53	27,096	94
15-18	11,518	26	8,634	10	20,152	36
TOTAL		39,717	179	35,015	74,732	269
Age-adjusted prevalence (prevalence/1000)		**4.5**		**2.6**		**3.6**

and 4 of 10 male patients, a total of 8 patients (50%), and no statistically significant difference was found (p>0.05).

In the epileptic cases, a positive history of epilepsy was found with a frequency of 2.8% in the father, 6.6% in the siblings, and 1.7% in the cousins and nephews. The 1st degree consanguinity was 25%, and 2nd degree consanguinity was 6.2%. This finding was not found to be statistically significant (p>0.05). The fathers, and mothers of epileptic cases were found to be primary school graduates, in 75% and 68.7% of the cases, respectively. When the history of febrile convulsion in epileptic cases was questioned equal number of participants gave affirmative (n=8: 50%), and negative (n=8.50%) answers 8 and the difference was not found to be statistically significant (p=0.000). In our study, 10 subjects (62.5%) answered "yes" and 6 (37.5%) answered "no" to the question about bringing child to hodja to pray for him/her for any reason. The data were considered statistically significant (p=0.000). The risk factors of epilepsy cases are shown in the Table 4.

In our study, no statistically significant difference was found when socio-demographic findings of epileptics and non-epileptics are compared as shown in Table 5 (p>0.05).

When the cases participating in the study were examined in terms of drug use due to possible epilepsy (active or inactive epilepsy) or febrile convulsion, it was determined that the patients used valproic acid (VPA) (n=12:2.1%), carbamazepine (CBZ) (n= 5: 0.9%), VPA + levetiracetam (n=2: 0.4%), oxcarbazepine (n=1: 0.2%), phenobarbital (n= 1: 0.2%), levetiracetam ((n= 1: 0.2%) (0.2%) rectal diazepam (n=1: 0.2%), and CBZ + topiramate (n=1: 0.2%). The distribution of drugs used by patients with epilepsy was valproic acid in 6, carbamazepine in 4, phenobarbital in 1, levetiracetam in 1, oxcarbamezepine in 1, VPA + levotiracetam in 2, and CBZ + topiramate in 1 student. EEG was performed in 55 of 563 students included in the study. The results are shown in the Table 6.

Thirteen (81.2%) students with possible epilepsy had undergone Computed Brain Tomography and/or Magnetic Resonance Imaging which demonstrated normal anatomy (n=10: 76.9%), cystic lesions in the right temporal (n=1: 7.69%), astrocytoma (n=1: 7.69%) and encephalomalastic area (n=1: 7.69%).

According to the questionnaire results, the distribution of epilepsy prevalence by gender was 2.6/1000 in females, 4.5/1000 in males and 3.5/1000 in total as it is shown in Table 7.

In cases where the study population is insufficient to reflect the general population, the age-adjusted prevalence of epilepsy can be used to evaluate the study results more reliably. In this study, the age-adjusted prevalence rate was determined using the age- and gender-specific cumulative prevalence rate based on the population in the age group of 7-17 years (Table 8). This situation ensured that the calculated prevalence better reflected the prevalence of the entire target population rather than the sample. The cases were separated into three age groups to calculate the age-adjusted prevalence of epilepsy (Table 8).

DISCUSSION

Epidemiological studies relevant to epilepsy provide information about the risk factors that cause epilepsy, the natural course of the disease, and its economic and cultural aspects. Many studies have been conducted to determine the prevalence of epilepsy in the world. However, studies conducted in our country are far from revealing its prevalence. Prevalence studies conducted in developed countries are satisfactory. Prevalence provides important information about the etiology of the disease, reveals the natural history of the event and helps to guide allocation of health resources. The prevalence of epilepsy in developed countries is generally reported to be 6-8/1000. (USA, 6.8/1000; Italy, 6.2/1000; Iceland, 7.7/1000; Estonia, 3.6/1000; Japan, 9/1000; India 22.2/1000,and Turkey 8/1000.[7-12] In our study, the prevalence of clustered epilepsy was found as 3/1000 in females, 5/1000 in males, and 4/1000 for the sum of both groups. Epidemiological studies on the prevalence of epilepsy in certain age groups are scarce in our country.

In our study, a similar prevalence rate (5.6/1000) was found in a study conducted by Aydın et al in the same age group in İzmir.[13] This prevalence rate was lower than the prevalence rate (10.2/1000) in the study conducted by Karaağaç et al., which was performed in different age groups using similar methods.[6] Again in the same age group and using similar methods, the prevalence rate was 8/1000 in the study by Canpolat et al. conducted in Kayseri.[14] The prevalence rate was found as 8.6/1000 in a study conducted by Çan G et al. in 4288 cases aged 0-17 years in Trabzon.[15] Hüseyinolu et al. screened 17,345 patients in Kars between the ages of 6 and 14 and calculated the prevalence rate to be 8.6/1000[16]. In a 1980 study conducted in rural Ankara by Y. Bilgin, the prevalence rate was determined to be 7.39/1000. Seizure classifications, however, were not clear in this research.[17]

Although the different results of the studies depend on genetic, age, and geographical reasons, hiding diseases also emerges as an important problem in studies based on questionnaires.

The prevalence of epilepsy in developing countries varies between 3/1000-42/1000, and the mean prevalence range rate has been found to be 18.5/1000 in population-based studies using the WHO protocol.[18] Prevalence rates have been determined as follows: Guatemala, 5.8/1000; Tanzania, 10.2/1000; Kashmir, 2.4/1000; native population in Panama, 57/1000, and Nigeria, 37/1000.[19-23] In our study, the prevalence rate was found to be lower. The prevalence rate determined in our study is close to the prevalence rates of developed countries.

The prevalence rates of epilepsy in developed and developing countries vary widely between 3-22.2/1000 worldwide. Prevalence rates differ in studies performed due to many important factors as the use of different methodologies, materials, terminology, and diverse patient groups. In a pilot study in which prevalence was investigated with the ICBERG protocol, the prevalence has been indicated as 8/1000, while the prevalence has been reported as 18.5/1000 in the evaluation made with the WHO protocol for the same region.[24,25] Reporting high prevalence rates in the studies conducted in central and south America where the WHO protocol was used, makes us think the prevalence rates differ according to the methods applied. Therefore, the ICBERG protocol has been developed recently and the results of the studies based on the ICBERG protocol are more selective and specific, reflecting the prevalence rates with a more unbiased and accurate probability. The study population is limited to a specific region in all studies conducted in Turkey and in most studies conducted worldwide. Serdarolu et al. in Ankara conducted the most common study on this topic in Turkey.[30] Only one age group was

examined in our research, and this age group is critical in reflecting the general prevalence in Turkey. Since we determined the age-adjusted prevalence rate of epilepsy in our study, the determined prevalence demonstrates the prevalence of the entire target population rather than the sample.

Comparison of socio-demographic findings of epileptics and non-epileptics in our study, have demonstrated that they did not differ significantly between both groups similar to the studies of Karaağaç et al[6] which was considered statistically significant. In their study conducted in Honduras, Medina et al. have found that 67% of epilepsy cases had a family history.[26] This rate has been found to be 22% in the study by Tekle-Haimanot et al.[27] In the study conducted by Al Rajeh et al. in Arabia, it has been found that there was at least one epileptic relative in the family in 24% of epilepsy cases.[28] Studies have shown that the incidence of epilepsy in families of epileptic people is 2.5 times higher than in normal healthy population. Studies have shown that children with epileptic mothers carry a higher risk than children of epileptic fathers. However, in our study, 2.8% of fathers were found to have a positive history of epilepsy, which was not considered significant. In a study conducted by Yaman et al., in familial epilepsies, first, and second degree consanguinities have been found with prevalence rates of 10.3%, and 5.9%, respectively This indicates the importance of environmental factors as well as genetics in the emergence of epilepsy.[29]

Comparison of the prevalence rates of active epilepsy found in our study with the study of Karaağaç et al. performed in Silivri (10/1000, 10.3/1000, 10.2/1000) showed lower prevalence rates[6]. When compared with the study conducted by Aydın et al (4.5 / 1000, 7/1000, 5.6 / 1000), similar prevalence rates were found.[13] Compared to the study conducted by Canpolat et al. (7/1000, 4/1000, 6/1000), lower prevalence rates were obtained.[14] Our study data were found to be similar to the study conducted by Aydın et al. In our study, the prevalence rate of active epilepsy was found to be higher in males compared to females (4/1000 and 2/1000). We thought that this may be due to the fact that exposure to risk factors later in life such as head trauma are more common in males and that males participate more actively in social life.

When comparing the age-adjusted prevalence rates of epilepsy in our study, the study of Aydın et al. found 9.2/1000 for the age group 7-10 years, 12.1/1000 for the age group 11-14 years, and 13.4/1000 for the age group 15-17 years for males, females, and the total population, respectively. It was found to be 15.2/1000, 10.0/1000, 12.6/1000, respectively[13]. On the other hand, Serdaroğlu et al. reported a prevalence rate of 7/1000 at age 7-10 years, 8/1000 at age 11-14 years, and 7/1000 at age 15-17 years.[30] In the study by Canpolat et al. reported 8/1000 at age 7-10 years, 9/1000 at age 11-14 years and 6/1000 at 15-17 years.[14]

When comparing the prevalence of gender-specific epilepsy with the study of Aydın et al. and Canpolat et al., they obtained similar results as in this study.[13,14] In many studies, the prevalence rates of epilepsy in males have been found to be 1.1-1.4 times higher than females. According to the results of the study conducted in our country, the prevalence rates of the male gender are generally higher than the female gender. Except for the study performed by Serdaroğlu et al., there is no statistically significant difference between genders ($p>0.05$). In a study by Tellez-Zenteno et al in Canada, the researchers have found that the prevalence rate of epilepsy was significantly higher in families with low monthly income, low education, and unemployment problems compared to others.[31] In the study of Hesdorffer et al, it has been shown that low socioeconomic level in the adult age group increased the prevalence rate of epilepsy.[32] The fact that there was no statistically significant difference as for the economic level of participants in our study is attributed to the low number of active epilepsy cases and the families may have avoided answering questions about their economic levels.

In a Swedish research on the prevalence of epilepsy, Forsgren et al. reported that an etiologic cause could only be found in 17-57 % of the cases.[33] In the study conducted by Aydın et al., a history of Central Nervous System (CNS) infection has been found in 6 persons (18%).[13] Similar rates were also found in our study, and the risk of developing epilepsy after CNS infection was found to be similar to that reported in the literature.

Many studies have been conducted on the increased risk of developing epilepsy after febrile convulsion. In our study, a history of febrile convulsion was found in 50% of epilepsy patients. History of febrile convulsion was found to be statistically significant in epileptic cases (p=0.000). Different prevalence rates of febrile convulsion which increased the risk of epilepsy have been reported in various studies: (Aydın et al., 25.5%; Cansu et al. 19%; Çalışır et al., 30%; Hüseyinoğlu et al., 7%, and Canpolat et al. 40%).[13,14,16,34] Higher rates were found in our study. It is thought that this is due to the geographical differences of the regions where the studies were conducted. In a study conducted in Rochester Minnesota, USA between 1935-1979, the incidence of clustered epilepsy after febrile convulsion has been found to be 6%.[18] This incidence has been found to be 2.5% after simple febrile convulsion and between 6% and 50% after complicated febrile convulsion.[18] However, in our study, febrile convulsion was not differentiated as simple and complicated febrile convulsion.

Most of the epidemiological studies conducted in Turkey are based on prevalence studies. Moreover, most of these prevalence studies are local surveys. Incidence studies are challenging to perform due to the lack of accurate and regular records. As a result of this study, we concluded that a more comprehensive organization is needed to obtain optimal prevalence rates.

CONCLUSION

When all these study data are evaluated together, epilepsy continues to be an important health problem in our region. As a conclusion, preventable risk factors, especially febrile convulsion, are important as the risk factors for epilepsy, and that the factors causing epilepsy and their prevalence rates should be determined in different socio-economic layers of our country and the actual prevalence should be determined. However, incidence and long-term cohort studies are needed to better determine the etiology of epilepsy.

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