ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/pediatr.2024-105193

Evaluation of Demographic, Clinical, Laboratory Findings and Treatments of Our Cases with Febrile Convulsions: A Descriptive Research

Febril Konvülsiyonlu Olgularımızın Demografik, Klinik, Laboratuvar Bulguları ve Tedavilerinin Değerlendirilmesi: Tanımlayıcı Araştırma

İlkiz Özge ÖZDİL YILMAZ[a], Yasemin KARAL[b]

[a]İstanbul Health and Technology University Faculty of Medicine Hospital, Department of Child Health and Diseases, İstanbul, Türkiye
[b]Trakya University Medical Faculty Hospital, Department of Child Health and Diseases, Department of Child Neurology, Edirne, Türkiye

Our article was published as a report in the 10th İnternational Trakya Family Medicine Congress Proceedings Book.

ABSTRACT Objective: In this study, we aimed to determine the sociodemographic, clinical and laboratory characteristics, responses to treatment options, and risk factors for the development of epilepsy in cases who presented to our clinic with febrile convulsions (FC) and were diagnosed with FC. **Material and Methods:** 200 patients who applied to Trakya University Faculty of Medicine, Department of Pediatrics Outpatient Clinic and Child Neurology Polyclinic between January 2014-December 2018 and were diagnosed with febrile convulsion were evaluated retrospectively. In recurrent simple febrile convulsions and in all complicated febrile convulsions, electroencephalography (EEG) was performed. In case of abnormal EEG findings, appropriate treatment was started. **Results:** The male/female ratio was 1.22/1, 78% were term births. The average age at diagnosis was 21.82±12.69 months. 52.5% were complicated. The common source of fever was upper respiratory tract infection (83%). 10% had a family history of epilepsy and 25% had a history of febrile convulsions. The recurrence rate was 22.5%. Abnormal EEG was detected in 8% of the patients. Patients with recurrence had higher platelet counts and patients with epilepsy had higher C-reactive protein levels. **Conclusion:** Epilepsy was observed in %13 of febrile convulsions. The rate of epilepsy diagnosis was high in those with abnormal EEG (81%). As a result; monitoring of febrile convulsions is important due to the increased risk of epilepsy and frequent recurrence compared to the general population. Although we found no significant difference between treatment options in preventing recurrence, rectal diazepamand antipyretics may be preferred since it is easy to apply and has few side effects.

Keywords: Seizures febrile; epilepsy; therapy; risk factors; biomarkers

ÖZET Amaç: Bu çalışmamızda, ateşli havaleyle kliniğimize başvurup febril konvülsiyon tanısı alan vakaların sosyodemografik, klinik, laboratuvar özelliklerini, tedavi seçeneklerine yanıtlarını, epilepsi gelişimi açısından risk faktörlerini belirlemeyi amaçladık. **Gereç ve Yöntemler:** Ocak 2014-Aralık 2018 arasında Trakya Üniversitesi Tıp Fakültesi Çocuk Sağlığı ve Hastalıkları Genel Pediatri ve Çocuk Nörolojisi Polikliniği'ne başvurup febril konvülsiyon tanısı alan 200 hasta retrospektif olarak değerlendirildi. Tekrarlayan basit febril konvülsiyonlarda ve tüm komplike febril konvulsiyonlarda poliklinik takiplerinde en geç bir haftada elektroensefalografi (EEG) çekildi ve anormal bulgusu olanlarda uygun tedavi başlandı. **Bulgular:** Olguların erkek/kız oranı 1,22/1, %78i term doğumdu. Tanı yaşı ortalama 21,82±12,69 aylıktı. %52,5'u komplike febril konvulziyondu. En sık ateş odağı üst solunum yolu enfeksiyonuydu. (%83). Vakaların %10'unda ailede epilepsi öyküsü, %25'inde febril konvülsiyon öyküsü vardı. Rekürrens oranı %22,5'ti. Hastaların %8'inde anormal EEG saptandı. Rekürrensi olan hastaların trombosit değerleri, epilepsi gelişen hastaların C-reaktif protein seviyeleri daha yüksekti. **Sonuç:** Febril konvülsiyonların %13'ünde epilepsi geliştiği görüldü. Anormal EEG'si olanların (%81) epilepsi tanısı alma oranı yüksek tespit edildi. Sonuç olarak; febril konvülsiyonların genel popülasyona göre artmış epilepsi riski ve rekürrensin sık görülmesi nedeniyle izlemi önemlidir. Rekürrensi önlemede tedavinin belirgin farkı olmasa da rektal diazepam ve antipiretik tercihleri uygulaması kolay, yan etkisi az gruptadır.

Anahtar Kelimeler: Febril konvülsiyon; epilepsi; tedavi; risk faktörleri; biyobelirteçler

TO CITE THIS ARTICLE:
Özdil Yılmaz İÖ, Karal Y. Evaluation of demographic, clinical, laboratory findings and treatments of our cases with febrile convulsions: A descriptive research. Turkiye Klinikleri J Pediatr. 2025;34(1):10-8.

Correspondence: İlkiz Özge ÖZDİL YILMAZ
İstanbul Health and Technology University Faculty of Medicine Hospital, Department of Child Health and Diseases, İstanbul, Türkiye
E-mail: yilmazilkiz@gmail.com

Peer review under responsibility of Turkiye Klinikleri Journal of Pediatrics.

Received: 03 Sep 2024 ***Received in revised form:*** 08 Apr 2025 ***Accepted:*** 14 Apr 2025 ***Available online:*** 15 Apr 2025

The most common type of convulsion seen in children is febrile convulsions (FC).[1] According to the American Academy of Pediatrics, FC is defined as a convulsion occurring between 6-60 months of age, caused by a fever due to an infection without affecting the central nervous system (CNS) or without another identified cause (such as electrolyte imbalance, intoxication, metabolic disorder, or trauma), in children who didn't have afebrile convulsion before.[2] The frequency of FC can vary in different studies, ranging between 4-5%.[3] It is estimated to be 5-10% in some regions of the world.[4] The variation in the frequency of FC among different countries and regions is thought to be multi-factorial, including local environmental factors and genetic reasons.[5] Boys are more effected than girls. The male to female ratio is approximately 1.4:1. It has been found that children with a family history of FC have a fourfold increased risk compared to the general population. It is most commonly seen between 18-22 months of age.[6] They are triggered when the axillary body temperature reaches 38.5 °C and usually develop within 1-2 hours after the onset of fever. Upper respiratory tract viral infections (URTI) are seen to cause FC more frequently than other infections.[7]

In this study, we aimed to determine the sociodemographic, clinical, and laboratory characteristics of patients diagnosed with FC who presented to our clinic, to evaluate their responses to applied treatment options, and to identify risk factors for epilepsy development and recurrence rate, taking into account the importance of close monitoring and careful diagnosis of these patients.

MATERIAL AND METHODS

Our study was conducted at the Pediatric Neurology Department of Trakya University Medical Faculty, Child Health and Diseases Outpatient Clinic, with patients diagnosed with FC who were followed up between January 2014-April 2018. FC was defined as convulsions occurring between the ages of 6 months to 5 years, associated with fever of at least 38°C without CNS infection, metabolic imbalance, or a history of afebrile seizures. The study was approved by the local pediatric ethics committee of Trakya University Faculty of Medicine Scientific research Ethics Committee, date: February 3, 2020, TUTF BAEK 2020/69) and was conducted in accordance with Good Clinical Practice guideline and ethical standards as laid down in the 1964 Declaration of Helsinki. The study is performed after signed parental informed consent.

The convulsions lasting less than 15 minutes, not recurring within 24 hours, and without focal characteristics were classified as Simple FC (SFC). Convulsions lasting longer than 15 minutes, recurring within 24 hours, or showing focal characteristics were classified as Complex FCs (CFC). Recurrence was defined as the reappearance of a convulsion at a different time period not associated with the same illness course. Epilepsy was diagnosed in patients who had at least 2 unprovoked seizures within 24 hours apart. Patients' files were retrospectively reviewed, including data from the hospital's information system, laboratory tests, and radiological imaging results.The included cases were analyzed for gender, age at onset of FC, birth history, parental consanguinity, family history of FC and epilepsy, type of seizure, and clinical and laboratory findings. Electroencephalography (EEG) was performed in cases with recurrent simple FC and in all complicated FC and was performed in patients with both groups while they were being followed up in the outpatient clinic. Those in which epileptiform discharge was detected as a result of EEG were considered abnormal EEG. Appropriate antiepileptic treatment was started for those with abnormal EEG findings.

The data regarding the form, duration, fever focus, body temperature during the seizure, frequency of FC seizures, and the effectiveness of the antiepileptics used by the patients, laboratory results, lumbar puncture (LP), EEG and magnetic resonance imaging (MRI) results were evaluated. Laboratory results including C-reactive protein and LP results were evaluated alongside reference values from Trakya University Faculty of Medicine's laboratory, hemogram results were evaluated together with pediatric age group norm reference values. Patients' data were transferred to the "Patient Follow-up Form".

STATISTICAL ANALYSIS

For the evaluation of the research data, SPSS version 19.0 (IBM, United States) was used. Categorical variables in the study were shown as number (n) and percentage (%), while numerical data were presented as mean and standard deviation. The prevalence of patients' diagnoses was calculated. In the comparison of categorical data, the Pearson chi-square test was used, and in cases where the variables did not show normal distribution, the Mann-Whitney U test was used for comparisons between variables. Statistical significance was considered at $p<0.05$.

RESULTS

Of our patients, 110 were male, 90 were female (1.22/1). The patients' ages ranged from 6 months to 60 months, with a mean age of 21.82±12.69 months. Most commonly, 138 patients (69%) were under 2 years old. The average age for each gender was around 18 months.

At birth, 156 patients (78%) were full-term, 120 patients (60.1%) were born with normal spontaneous vaginal delivery, and 38 (19%) had a history of difficult delivery. Family history of FC was present in 50 patients (25%), and a history of epilepsy was present in 20 patients (10%). Table 1 shows the distribution of the patients' demographic characteristics.

When the foci were examined, the most frequently observed focus was URTI in 166 (83.0%) patients. No focus was detected in 2 (1.0%) patients. LP was performed on these 2 patients, but there is no sign of CNS enfection.

When the follow-up process of patients was examined, it was found that 45 (22.5%) patients experienced recurring seizures, and 26 (13.0%) patients received a diagnosis of epilepsy. Patients who were under continuous antiepileptic treatment had a higher rate of seizure recurrence, while those with tonic-clonic and focal seizure clinics had lower rates compared to other clinics. It was observed that patients with abnormal EEG results had a higher rate of seizure recurrence compared to other clinical features (Table 2).

In patients receiving continuous antiepileptic therapy, a higher rate of epilepsy development was observed. Patients with abnormal EEG results were found to have a higher rate of receiving an epilepsy diagnosis. When comparing the body temperature during seizures, it was found that patients who experienced seizures below 38.3°C had a higher rate of receiving an epilepsy diagnosis. Patients who had multiple seizures also had a higher rate of receiving an epilepsy diagnosis (Table 3).

It was observed that EEG were conducted for 145 out of 200 patients (72.5%). Among them, 129 (64.5%) showed normal EEG results, while 16 (8%) showed abnormal EEG results. Among the 49 patients (24.5%) with SFC, abnormal EEG results were found in 5 (2.5%), and among the 96 patients (48%) with CFC, abnormal EEG results were found in 11 (5.5%). There was no significant relationship found between the type of FC and EEG findings (p=0.605) (Table 4).

Platelet counts were found to be higher in patients with recurrence compared to those who don't have recurrence. C-reactive protein levels were higher in patients with epilepsy compared to those who didn't develop epilepsy. No relationship was found between other laboratory values and the development of epilepsy (Table 5, Table 6).

A statistically significant relationship was found between the development of epilepsy during follow-up and the body temperature at which seizures occurred and also between the number of seizures.

TABLE 1: Distribution of patients according to demographic characteristics

		n (number of people)	% (percentage)
Gender	Male	110	55.0
	Female	90	45.0
Birth week	Borderline preterm (37-38 week)	24	12.0
	Term (38-42 week)	156	78.0
	Postterm (>42 week)	20	10.0
Type of birth	Cesarean section (C/S)	80	39.9
	NSVD	120	60.1
Difficult birth history		38	19.0
Parental consanguinity		4	2.00
Family history of epilepsy		20	10.00
Family history of FC		50	25.00

n: Number of people. NSVD: Normal spontaneous vaginal delivery

TABLE 2: Comparison of patients' seizure recurrence with other variables

		Seizure recurrence		
		No n (%)	**Yes n (%)**	**p value***
Gender	Male	84 (76.4)	26 (23.6)	0.670
	Female	71 (78.9)	19 (21.1)	
Age	Below 1 year old	39 (70.9)	16 (29.1)	0.136
	1-2 years old	70 (84.3)	13 (15.7)	
	Above 2 years old	46 (74.2)	16 (25.8)	
Type of birth	C/S	62 (77.5)	18 (22.5)	0.105
	NSVD	107 (89.2)	13 (10.8)	
Birth week	Borderline preterm (37-38 week)	14 (58.4)	10 (41.6)	0.134
	Term (38-42 week)	144 (92.3)	12 (7.7)	
	Postterm (>42 week)	18 (90.0)	2 (10.0)	
Difficult birth history	No	143 (89.4)	19 (10.6)	0.574
	Yes	35 (92.2)	3 (7.8)	
Family history of epilepsy	No	138 (76.7)	42 (23.3)	0.572
	Yes	17 (85)	3 (15)	
Parental consanguinity	No	152 (77.6)	44 (22.4)	0.904
	Yes	3 (75)	1 (25)	
Family history of FC	No	114 (76)	36(24)	0.379
	Yes	41 (82)	9 (18)	
Body temperature at which the seizure occurred	Below 38.3 degrees	90 (75.0)	30 (25.0)	0.300
	Above 38.3 degrees	65 (81.3)	15 (18.8)	
Number of seizures	1	57 (65.0)	3 (5.0)	**<0.001**
	>1	98 (70.0)	42 (60.0)	
EEG	Normal	97 (75.2)	5(9.1)	**0.033**
	Abnormal	8 (50.0)	32 (24.8)	
Radiological imaging (MRI)	Normal	50 (80.3)	18 (26.5)	0.513
	Abnormal	3 (60.0)	2 (40.0)	
Treatment	No.antipyretic if necessary	65 (86.7)	10 (13.3)	**0.035**
	Intermittent rectal diazepam	12 (80.0)	3 (20.0)	
	Continuous antiepileptic	84 (71.2)	34 (28.8)	
Febrile seizure type	Simple	67 (81.7)	15 (18.3)	0.689
	Complex	88 (74.6)	30 (25.4)	
Seizure clinic	Tonic	7 (100)	0 (0)	**0.010**
	Klonic	3 (100)	0 (0)	
	Atonic	7 (46.7)	8 (53.3)	
	Tonic klonic	128 (78)	36 (22)	
	Focal	84 (76.4)	26 (23.6)	

*chi-square test; n: Number of patients. C/S: Cesarean section; NSVD: normal spontaneous vaginal delivery; FC: Febrile convulsions; EEG: Electroencephalography; MRI: Magnetic resonance imaging

(p=0.048, p<0.001). It has been determined that in patients who develop epilepsy, the body temperature value at which seizures occur is lower and also the number of seizures is 3 or more. No statistically significant relationship was found between the development of epilepsy during follow-up and the duration of seizures, the age of the patient, and the age at which the first seizure occurred. When we compare the patients whom were diagnosed with epilepsy during follow-up and the EEG results, a statistically significant difference was found (p<0.001). Development of epilepsy is seen in 13% of febrile seizures. Those who have abnormal EEG (81%) has high tendency to develop epilepsy.

TABLE 3: Comparison of patients' epilepsy development with other variables

		Development of epilepsy		
		No n (%)	Yes n (%)	p value*
Gender	Male	98 (89.1)	12 (10.9)	0.331
	Female	76 (84.4)	14 (15.6)	
Age	Below 1 year old	39 (70.9)	16 (29.1)	0.678
	1-2 years old	70 (84.3)	13 (15.7)	
	Above 2 years old	46 (74.2)	16 (25.8)	
Type of birth	C/S	64 (80.0)	16 (20.0)	0.072
	NSVD	108 (90.0)	12 (10.0)	
Birth week	Borderline preterm (37-38 week)	16 (66.7)	8 (33.3)	0.184
	Term (38-42 week)	145 (92.9)	11(7.1)	
	Postterm (>42 week)	19 (95.0)	1 (5.0)	
Difficult birth history	No	143 (89.4)	19 (11.7)	0.524
	Yes	35 (87.5)	3 (7.8)	
Family history of epilepsy	No	156 (86.7)	24 (13.3)	0.674
	Yes	18 (90)	2 (10)	
Parental consanguinity	No	170 (86.7)	26 (13.3)	0.435
	Yes	4 (100)	0 (0)	
Family history of FC	No	127 (84.7)	23 (15.3)	0.089
	Yes	47 (94)	3 (6)	
Body temperature at which the seizure occurred	Below 38.3 degrees	98 (81.7)	22 (18.3)	**0.004**
	above 38.3 degrees	76 (95.0)	4 (5.0)	
Number of seizures	1	57 (95.0)	3 (5.0)	**0.028**
	>1	117 (83.6)	23 (16.4)	
EEG	Normal	117 (90.7)	12 (9.3)	**<0.001**
	Abnormal	3 (18.8)	13 (81.3)	
Radiological imaging(MRI)	Normal	55 (80.9)	13 (19.1)	0.265
	Abnormal	3 (60.0)	2 (40.0)	
Treatment	No.antipyretic if necessary	73 (97.3)	2 (2.7)	**0.001**
	Intermittent rectal diazepam	14 (93.3)	1 (6.7)	
	Continuous antiepileptic	94 (79.7)	24 (20.3)	
Febrile seizure type	Simple	71 (86.6)	11 (13.4)	0.786
	Complex	103 (87.3)	15 (12.7)	
Seizure clinic	Tonic	6 (85.7)	1 (14.3)	0.689
	Klonic	3 (100)	0 (0)	
	Atonic	13 (86.7)	2 (13.3)	
	Tonic klonic	141 (86)	23 (14)	
	Focal	11 (100)	0 (0)	

*chi-square test; n: Number of patients. C/S: Cesarean section; NSVD: normal spontaneous vaginal delivery; FC: Febrile convulsions; EEG: Electroencephalography; MRI: Magnetic resonance imaging

DISCUSSION

FC are the most common neurological problem in childhood and the most frequently encountered type of convulsion. In general, although they have a favorable prognosis, they can recur and evolve into afebrile seizures. Therefore, understanding predisposing factors is of great importance.

FC is more commonly observed in boys compared to girls. In studies conducted abroad and in our country, the male-to-female ratio has been reported as 1.3/1-1.36/1 respectively.[8,9] In our study with 200 patients, a similar male-to-female ratio of 1.22/1 was found.

Genetic factors are known to play a significant role in FC. However, the complete genetic transmis-

TABLE 4: Evaluation of EEG findings according to the type of FC

	Normal EEG n (%)	Anormal EEG n (%)	Total n (%)	p value*
SFC	44 (22)	5 (2.5)	49 (24.5)	
CFC	85 (42.5)	11 (5.5)	96 (48)	0.605
Total	129 (64.5)	16 (8)	145 (72.5)	

*chi-square test; n: number of patients. EEG: Electroencephalography; SFC: Simple febrile convulsions; CFC: Complex febrile convulsions

TABLE 5: Comparison of laboratory variables with patients' seizure recurrence

		Recurrence rate No n (%)	Yes n (%)	p value*
C-reactive protein	Normal	98 (77.2)	29 (22.8)	0.881
	High	57 (78.1)	16 (21.9)	
White blood cells	Low	16 (72.7)	6 (27.3)	
	Normal	125 (77.6)	36 (22.4)	0.772
	High	14 (82.4)	3 (17.6)	
Neutrophil count	Low	7 (77.8)	2 (22.2)	
	Normal	118 (76.1)	37 (23.9)	0.286
	High	30 (83.3)	6 (16.7)	
Hemoglobin	Low	57 (76)	18 (24)	0.694
	Normal	98 (78.4)	27 (21.6)	
MCV	Normal	63 (77.8)	18 (22.2)	0.177
	High	92 (78)	26 (22)	
Platelet count	High	2 (28.5)	5 (71.5)	**0.009**
	Low/normal	122 (78.2)	34 (21.8)	

*chi-square test; n: Number of patients; MCV: Mean corpuscular volume

sion remains unclear. In studies conducted abroad and in our country, a history of FC among first-degree relatives has been found to be 26.6-20.8% respectively.[10,11] An estimated 10-33% of patients have a first-degree relative with a positive seizure history, along with a concordance rate of approximately 35-69% in monozygotic twins and 14-20% in dizygotic twins, which suggests that the cause of febrile seizures may have a genetic component.[12] In our study, the frequency of FC among first-degree relatives was found to be 25%, similar to the literature.

The accepted fever threshold in FC has been reported as axillary 38°C in one group of studies, and 38.5°C and above in another group.[8] In our study, the body temperature ranged from 37.5°C to 40°C, with an average of 38.3°C. It was found that 120 patients (60%) had seizures at temperatures below 38.3°C, and in this group, the risk of developing epilepsy was significantly higher.

The source of fever in FCs is often viral infections such as URTI, pharyngitis, urinary tract infections, acute otitis media, pneumonia, roseola infantum, and non-infectious diseases. In the study of Carman et al. the most frequently detected virus was adenovirus, followed by influenza A and influenza B.[13] In the study by Abuekteish et al. involving 203 patients, URTI was reported as the fever focus in 53% of cases, while in the study by Öztürk et al. this rate was 75.8%. Similarly, in our study, URTI was most frequently detected at a rate of 83%, consistent with the literature.[14,15]

In the study by Verrotti et al. CFC were found in 27.2% of cases, and in the study by Duffner, they were found in 22.5% of cases.[16,17] Ling reported that 90% of seizures in his study and Knudsen reported 96% of seizures lasted less than 15 minutes.[10,18] In our study, the number of cases with CFC was found to be 105 (52.5%). This result may be due to our institution being a tertiary care center, where complicated and recurring cases are referred or transferred from lower-level healthcare facilities. Among the CFC cases in our study, 85 (80.9%) had recurrence within 24 hours, 22 (20.9%) lasted longer than 15 minutes, 9 (8.6%) had focal seizures, and 2 (1.9%) were diag-

TABLE 6: Comparison of laboratory variables with patients' development of epilepsy

		Development of epilepsy No n (%)	Yes n (%)	p value*
C-reactive protein	Normal	106 (83.5)	21 (16.5)	**0.049**
	High	68 (93.2)	5 (6.8)	
White blood cells	Low	18 (81.8)	4 (18.2)	
	Normal	140 (87)	21 (13)	0.526
	High	16 (94.1)	1 (5.9)	
Neutrophil count	Low	9 (100)	0 (0)	
	Normal	132 (85.2)	23 (14.8)	0.881
	High	33 (91.7)	3 (8.3)	
Hemoglobin	Low	65 (86.7)	10 (13.3)	0.914
	Normal	109 (87.2)	16 (12.8)	
MCV	Normal	75 (92.6)	6 (7.4)	0.647
	High	98 (83.1)	20 (16.9)	
Platelet count	High	7 (100)	0 (0)	0.355
	Low/normal	134 (85.9)	22 (14.1)	

*chi-square test; n: Number of patients; MCV: Mean corpuscular volume

nosed as complex due to both focal seizures and lasting longer than 15 minutes.

In previous studies, imaging tools such as EEG, MRI, and brain tomography have been found to be largely typical in children with FC, and it was shown that they are not associated with recurrence or development of epilepsy.[19] Children with a history of complex febrile seizure, febrile seizure at an earlier age, prolonged febrile seizure, abnormal neurodevelopment, abnormal EEG, and a family history of epilepsy have an estimated 2% to 10% risk of developing epilepsy, depending now how many risk factors are present.[20]

In our study, imaging was performed on 73 patients, of whom 15 patients received a diagnosis of epilepsy. Pathology was detected in the imaging of 2 patients who also developed epilepsy during follow-up. Patients with abnormal EEG results were found to have a higher rate of having an epilepsy diagnosis.

In a previous study, simple febrile seizures increased the risk of epilepsy development 4.04 times.[21] In our study development of epilepsy is seen in 13% of febrile seizures. Those who have abnormal EEG (81%) has high tendency to develop epilepsy.

Previous studies have suggested a relationship between convulsions triggered by different mechanisms of the immune system and elevated acute-phase reactants such as C-reactive protein, which are indicators of inflammation, with epilepsy. Another study found that thrombocytosis, seen as an acute-phase reactant, was also associated with febrile seizures, and Interleukin-6 levels and platelet levels were found to be higher in febrile seizure patients compared to the control group.[22] Platelet counts were found to be higher in patients with recurrence compared to those who don't have recurrence. C-reactive protein levels were higher in patients with epilepsy compared to those who didn't develop epilepsy.

Both simple and complex FC have shown a higher recurrence rate in patients receiving treatment compared to those who did not receive treatment. One treatment option is continuous use of antiepileptic drugs. Li et al. reported in their study that phenobarbital, diazepam, phenytoin, and antipyretics did not show significant superiority in preventing FC recurrence attacks over each other.[23] In our study, a recurrence rate of 28.8% was observed in patients using long-term antiepileptic drugs. There was no statistically significant relationship found between seizure recurrence and development of epilepsy based on the type of treatment received.

Our study had some limitations. A majority of our patients had complex FCs, which differs from the data in the literature. Based on the data we analyzed, we believe that some patients' seizures were terminated in the emergency department after admission, hence their duration was recorded as <5 minutes. However, according to the literature, seizure recurrence and epilepsy are directly proportional to seizure duration. We attribute this to providing information to families for seizure management and termination of seizures in the emergency department for some cases, resulting in shorter durations. Additionally, no relationship was found between family history of FC, recurrence and epilepsy in our region. We believe this may be due to healthcare providers and families in our region providing more appropriate follow-up and treatment during febrile illness periods, potentially raising the threshold for experiencing FC.

In the literature, the role of sodium channels in the pathogenesis of epilepsy and FC is mostly mentioned, and in addition, some studies have pointed out the relationship between Familial Febrile Seizures gene loci and related syndromes. On the other hand, the condition known as Dravet Syndrome may be mistakenly perceived as FC. Dravet Syndrome should be considered if afebrile focal seizures and myoclonies are added to febrile seizures and negatively affect the child's mental functions over time.

Sodium voltage-gated channel alpha subunit 1 gene analysis should be used, especially in the presence of prolonged and lateralized febrile seizures. If a mutation is detected, the diagnoses of Genetic Epilepsy Febrile Seizures Plus, typical or borderline Dravet Syndrome should be reviewed, taking into account the patient's clinic.We believe that with the data obtained from the result of comprehensive epidemiological and genetic studies, the available current data in the literature will solidify and illuminate

the role of genetic predisposition in the etiopathogenesis of FC in the future.

CONCLUSION

FC are the most common type of convulsion in childhood. Although they generally have a benign course, they can recur and transform into afebrile seizures. Therefore, understanding predisposing factors is crucial, and careful monitoring is needed. Despite being considered a benign condition, we found that there is high frequency of recurrence and increased risk of epilepsy compared to the general population. In our study development of epilepsy is seen in 13% of febrile seizures. Those who have abnormal EEG (81%) has high tendency to develop epilepsy. Also there is no significant difference between treatment options in preventing recurrence, but antipyretic and rectal diazepam may be preferred in patients treated because it is easy to apply, and it has fewer side effects.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

***Idea/Concept:** İlkiz Özge Özdil Yılmaz, Yasemin Karal; **Design:** İlkiz Özge Özdil Yılmaz, Yasemin Karal; **Control/Supervision:** İlkiz Özge Özdil Yılmaz, Yasemin Karal; **Data Collection and/or Processing:** İlkiz Özge Özdil Yılmaz, Yasemin Karal; **Analysis and/or Interpretation:** İlkiz Özge Özdil Yılmaz, Yasemin Karal; **Literature Review:** İlkiz Özge Özdil Yılmaz; **Writing the Article:** İlkiz Özge Özdil Yılmaz, Yasemin Karal; **Critical Review:** İlkiz Özge Özdil Yılmaz, Yasemin Karal, Burak Barış Yılmaz; **References and Fundings:** İlkiz Özge Özdil Yılmaz, Burak Barış Yılmaz; **Materials:** Yasemin Karal, İlkiz Özge Özdil Yılmaz; **Other:** Burak Barış Yılmaz, İlkiz Özge Özdil Yılmaz.*

REFERENCES

1. Sawires R, Buttery J, Fahey M. A review of febrile seizures: recent advances in understanding of febrile seizure pathophysiology and commonly implicated viral triggers. Front Pediatr. 2022;9:801321. [Crossref] [PubMed] [PMC]
2. Subcommittee on Febrile Seizures; American Academy of Pediatrics. Neurodiagnostic evaluation of the child with a simple febrile seizure. Pediatrics. 2011;127(2):389-94. [Crossref] [PubMed]
3. Yayla V, Çakmak G, Apak İ, Ateş U, Erdoğan F. İlkokul çocuklarında geçirilmiş febril konvülsiyon prevelansı. Yeni Sempozyum. 1997;35:11-3. [Link]
4. Yakut A. Febril Konvülziyon. Türkiye Klinikleri J Pediatr-Special Topics. 2003;1(2):119-27. [Link]
5. Canpolat M, Per H, Gümüş H, Elmalı F, Kumandaş S. Kayseri ili febril konvülsiyon prevalansının araştırılması; febril konvülsiyon rekürrensi ve epilepsi gelişimi için risk faktörlerinin belirlenmesi. XV. Ulusal Çocuk Nörolojisi Kongresi Özet Kitabı; 22-25 Mayıs 2013; Türkiye: 2013. p.93-4.
6. Erdil A, Tan H, Turan Mİ, Küçükaslan İ, Acemoğlu H. Erzurum il merkezinde çocuklarda febril konvülziyon prevalansı [Febrile seizure prevalence in children in the Erzurum provincial center. Türkiye Klinikleri J Pediatr. 2016;25(2):67-73. [Crossref] [Link]
7. Pavone P, Corsello G, Ruggieri M, Marino S, Marino S, Falsaperla R. Benign and severe early-life seizures: a round in the first year of life. Ital J Pediatr. 2018;44(1):54. [Crossref] [PubMed] [PMC]
8. Okumura A, Uemura N, Suzuki M, Itomi K, Watanabe K. Unconsciousness and delirious behavior in children with febrile seizures. Pediatr Neurol. 2004;30(5):316-9. [Crossref] [PubMed]
9. Özmen M, Çalışkan M. Febril konvülziyonlar. İst Çocuk Klin Derg. 1995;30(3):116-21. [Link]
10. Ling SG. Febrile convulsions: acute seizure characteristics and anti-convulsant therapy. Ann Trop Paediatr. 2000;20(3):227-30. [Crossref] [PubMed]
11. Yılmaz Ü, Özdemir R, Çelik T, Ataş Berksoy E. Febril konvülziyonlu çocuklarda klinik ve paraklinik özellikler [Clinical and paraclinical features in children with febrile seizures]. Dicle Tıp Derg. 2014;41:156-62. [Crossref] [Link]
12. Leung AK, Robson WL. Febrile seizures. J Pediatr Health Care. 2007;21(4):250-5. [Crossref] [PubMed]
13. Carman KB, Calik M, Karal Y, Isikay S, Kocak O, Ozcelik A, et al. Viral etiological causes of febrile seizures for respiratory pathogens (EFES Study). Hum Vaccin Immunother. 2019;15(2):496-502. [Crossref] [PubMed] [PMC]
14. Abuekteish F, Daoud AS, al-Sheyyab M, Nou'man M. Demographic characteristics and risk factors of first febrile seizures: a Jordanian experience. Trop Doct. 2000;30(1):25-7. [Crossref] [PubMed]
15. Öztürk MK, Önal AE, Tümerdem Y, Gürses RC, Baykal B, Gökyiğit AZ, et al. Prevelance of febrile convulsions in a group of children aged 0 to 9 years in a slum in İstanbul. Med Bull İstanbul. 2002;35(2):79-84. [Link]

16. Verrotti A, Latini G, di Corcia G, Giannuzzi R, Salladini C, Trotta D, et al. Intermittent oral diazepam prophylaxis in febrile convulsions: its effectiveness for febrile seizure recurrence. Eur J Paediatr Neurol. 2004;8(3):131-4. [Crossref] [PubMed]

17. Subcommittee on Febrile Seizures; American Academy of Pediatrics. Neurodiagnostic evaluation of the child with a simple febrile seizure. Pediatrics. 2011;127(2):389-94. [Crossref] [PubMed]

18. Knudsen FU. Febrile seizures: treatment and prognosis. Epilepsia. 2000;41(1):2-9. [Crossref] [PubMed]

19. Wo SB, Lee JH, Lee YJ, Sung TJ, Lee KH, Kim SK. Risk for developing epilepsy and epileptiform discharges on EEG in patients with febrile seizures. Brain Dev. 2013;35(4):307-11. [Crossref] [PubMed]

20. Lee SH, Byeon JH, Kim GH, Eun BL, Eun SH. Epilepsy in children with a history of febrile seizures. Korean J Pediatr. 2016;59(2):74-9. [Crossref] [PubMed] [PMC]

21. Cansu A, Serdaroğlu A, Yüksel D, Doğan V, Ozkan S, Hirfanoğlu T, et al. Prevalence of some risk factors in children with epilepsy compared to their controls. Seizure. 2007;16(4):338-44. [Crossref] [PubMed]

22. Biçer S, Arslan G, Yılmaz Ç, Öztürk S, Aktay N, Arıda Ö, et al. Febril konvülziyonlar: Klinik ve risk faktörleri [Febrile seizures: clinical and risc factors]. Göztepe Tıp Derg. 2003;18:88-91. [Link]

23. Li G, Bauer S, Nowak M, Norwood B, Tackenberg B, Rosenow F, et al. Cytokines and epilepsy. Seizure. 2011;20(3):249-56. [Crossref] [PubMed]