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The Risk Factors in Children with Simple and Complex Febrile Seizures: An Epidemiological Study

*Alireza Eskandarifar[1], Asadolah Fatolahpor[1], Gamileh Asadi[2], Ibrahim Gaderi[3]

[1]Assistant Professor, Department of Pediatric, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran. [2]Medical Student, Student Research Committee, Kurdistan University of Medical Sciences, Sanandaj, Iran. [3]Assistant Professor, Social Determinants of Health Research Center, Kurdistan University of Medical Sciences, Sanandaj, Iran.

Abstract

Background

Febrile seizure is the most common seizure disorders. Febrile seizure is divided into two groups of simple and complex seizures. The aim of this epidemiological study was to assess the risk factors involved in the incidence of febrile seizures between the children referred to Besat hospital in the city of Sanandaj (Iran).

Materials and Methods

The present paper is a cross-sectional study performed on 334 children with 6-60 months of age hospitalized in Besat hospital in Sanandaj due to febrile seizures in 2014 and 2015. The data collection tool was a checklist including some information such as age, gender, final diagnosis and type of seizure, residential location, serum level of electrolytes and CBC. After collecting the data, description and analytical analysis were performed through SPSS version 20 software to assess the data**.**

Results

Among the 334 children (average age 22.4± 12.8 months) hospitalized because of febrile seizures, 57.5 present were boys and the majority of them were living in the urban areas (72.2‰). Also, 81 percent of the children were hospitalized due to simple febrile seizures and upper respiratory tract infection (URTI) was the most common cause of febrile seizures with 42.8 percent. There was not seen any significant statistical association between the type of seizure and the variables of sex, residential location, age group and serum level of electrolytes ($P>0.05$). However, the association between residential location and age group with the cause of febrile seizures was statistically significant ($P<0.05$).

Conclusion

Given that the results of this study indicated that URTI is the most common cause of febrile seizures among the children.

Key Words: Children, Febrile Seizures, Iran, Risk Factors.

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Corresponding Author:

Alireza Eskandarifar, MD, Department of Pediatric, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran.

E-mail: are1372@gmail.com.

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1- INTRODUCTION

Seizure accompanied by fever or febrile seizures (FS) is one of the common problems in children. Its prevalence in some parts of the world has been reported as high as 10 percent. However, in most of the studies the reported figures have been 2-4 percent (1-2). Febrile seizures typically happen between 6-60 months of age with the temperature 38 degree Celsius and more. They do not happen due to infection of central nervous system or electrolyte and metabolic disorders.

Also, there is no record of seizure without prior fever in the patients. Febrile seizures are divided into two categories of simple and complex seizures. Simple febrile seizures, from the very beginning, are generalized; they are tonic – colonic seizures often accompanied by fever. They usually last 15 minutes and would not happen again in the course of 24 hours. However, a complex seizure includes one or more of the following characteristics:

- Lasts more than 15 minutes,
- Has focal pattern,
- Happens again in the course of 24 hours.

Generally, 2 to 5 percent of neurologically healthy infants and children have experienced, at least one (usually sample) seizure. Two to seven percent of children with febrile seizures will get epilepsy in the future (3-5). Studies conducted in different countries regarding febrile seizure differ in terms of racial, genetic, and geographic factors. For example some of the investigations have mentioned that the positive family history, type of the seizure, temperature, and age of the incidence are the risk factors of the seizure incidence. Some others have mentioned growth problems, abnormal neurological examination, and recurrent attacks as factors involved in increasing the incidence of epilepsy. These factors, if coincide, sometimes cause a 50 percent possibility of increasing epilepsy and recurrent febrile seizure (3, 4, 6). Due to the anxiety as the consequence of the febrile seizure attacks and their effects including dysarthria, mental retardation, cerebral palsy, epilepsy, and side effects of the drugs taken for prevalence and treatment of the disease, huge social and economic burdens are imposed on the families and the society (1-6).

Therefore considering the importance of prevalence, early diagnosis and treatment of febrile seizures in children, reducing the costs of hospitalization and treatment, as well as, rarity of the-studies conducted in the region, the present study was conducted with the aim of epidemiological investigations of the risk factors involved in simple and complex febrile seizures among the children referred to Beast hospital in Sanandaj city (Iran).

With identification of these risk factors and proper approach to them, could be taken towards the improvement of the health of the children, as the basis for the health of the society.

2- MATERIALS AND METHODS

The present study was a cross-sectional study and approved by Research Ethics Committee of Kurdistan University of Medical Sciences, Iran. The study population consisted of 334 children with 6-60 months of age hospitalized due to febrile seizures in the pediatric ward of Besat hospital in Sanandaj city, North West of Iran in 2014-2015.

The data collection tool was a checklist including information such as age, gender, and final diagnosis, type of seizure, residential location, the amount of sodium, potassium and calcium as well as hemoglobin, white blood cell and platelet count. This checklist was provided by researcher and completed by medical student.

The researchers referred to the all records of the 6-60 months age children who were hospitalized due to febrile seizures, retrospectively. The information regarding each case was entered in the related checklists. Those patients with the background of chronic neurological conditions or metabolic disorders were excluded from the study.

The patient were divided into two groups of patients with simple febrile seizures and those with complex febrile seizures. The collected data were entered into SPSS version 20.0 software, then descriptive (mean frequency and relative frequency) and analytical (Chi square test, exact fisher test, and independent t-test) analysis were performed. Significance level was confided as less than 0.05.

3- RESULTS

In this study, **Table.1** shows the demographic characteristics of children with 6-60 months of age referred to the pediatric ward of Besat hospital in Sanandj city (Iran) due to febrile seizure during 2013 and 2014. As it is indicated, 192 (57.5 %) persons of these children hospitalized due to febrile seizures were boys and 241 (72.2 %) persons of them were city residents. Also, 271 persons (81 %) of these children were hospitalized due to simple febrile seizures.

Moreover, upper respiratory tract infection (URTI) had been the most common cause of fever and seizure with 42.8 percent. In order to examine the association between the type of febrile seizure (simple and complex), and the variables of gender, residential location and age groups of children with 6-60 months for age, Chi square test was performed (**Table.2**).

As it is shown, although simple febrile seizures and complex febrile seizures were common in boys and girls, respectively, this difference was not significant (P=0.241). Also, the examination of the association between the type of seizures and the residential location indicated that simple febrile seizures and complex febrile seizures were common in city residents and resident of rural areas, respectively. However, this difference was not significant, as well (P=0.464). Also, although complex febrile seizures were more common in children with lower than one year of age, this difference was not significant; that is, there was no significant relationship between the type of febrile seizure (simple, complex), with the age of the children (P=0.245) (**Table.2**).

Table.3 shows the results of the independent t-test performed to determine the association between the type of febrile seizure (simple and complex), and variables of platelet, hemoglobin, white blood cell, potassium, sodium, calcium levels, fever and age among the children hospitalized due to febrile seizures. As it is indicated, the results of this test showed that the foregoing variables in the two groups of children do not indicate a significant difference (P>0.05).

Table.4, also, shows the results of Chi square test, indicating the association of the cause of the seizure and the type of the seizure, gender, residential location, and age groups among children hospitalized due to febrile seizures. These results suggest that only the association between residential location [the frequency of URTI; as the most common cause of febrile seizures, in children residing in the cities and gastroenteritis (GE) among the children residing in the rural areas were higher] and age groups (the frequency of URTI in children with more than one year-old of age was significantly higher than less than one year-old) with the cause of febrile seizure was statistically significant (P<0.05).

Table-1: Demographic features among children participating with 6-60 months of age

Variables	Number	Percent
Gender		
Boy	192	57.5
Girl	142	42.5
Residential location		
Urban areas	241	72.2
Rural areas	93	27.8
Type of the seizure		
Simple	271	81
Complex	63	19
Cause of the febrile seizure		
(URTI)	143	42.8
(GE)	67	20
Pneumonia	11	3/3
Vaccine	11	3/3
UTI	6	1/8
Un-known	96	28/7

GE: Gastroenteritis; URTI: Upper respiratory tract infection; UTI: Urinary tract infection.

Table-2: The relationship between the type of febrile seizure (simple and complex), and the demographic variables

Variables	Simple febrile seizure		Complex febrile seizure		P- value
Gender	Number	Percent	Number	Percent	
Boy	160	83.3	32	16.7	0.0241
Girl	111	78.2	31	21.8	
Total	271		63		
Variables	Simple febrile seizure		Complex febrile seizure		P- value
Residential location	Number	Percent	Number	Percent	
Urban area	200	83	41	17	0.0164
Rural area	71	76.3	22	23.7	
Total	271		63		
Variables	Simple febrile seizure		Complex febrile seizure		P- value
Age groups (year)	Number	Percent	Number	Percent	
≤ 1	55	76.4	17	23.6	0.0245
>1	216	82.4	46	17.6	
Total	271		63		

Table-3: The relationship between the type of febrile seizure (simple and complex), and variables of fever, and age Hb, WBC, Plt , K, Na, and Ca levels

Variables	Type of febrile seizure	Number	Mean	SD	P- value
PLT (cell/mm3)	Simple	271	239.9	96	0.132
	Complex	63	273.6	96.7	
Hb (gr/dl)	Simple	271	11.2	1.08	
	Complex	63	11.1	1.09	0.801
WBC (cell/mm3)	Simple	271	11.75	4.9	
	Complex	63	10.73	4.8	0.143
K(meq/L)	Simple	271	4.12	0.48	0.489
	Complex	63	4.17	0.41	
Na (meq/L)	Simple	271	135.8	3.90	0.845
	Complex	63	135.7	3.37	
Ca (meq/L)	Simple	271	9.27	0.68	0.239
	Complex	63	9.15	0.62	
Age (Month)	Simple	271	22.1	12.3	0.465
	Complex	63	23.4	15	
Fever (Celsius)	Simple	271	38.45	0.74	0537
	Complex	63	38.38	0.72	

Hb: hemoglobin; WBC: white blood cell, PLT: platelet; K: potassium; Na: sodium; Ca: calcium.

Table-4: The relationship between the cause of the seizure and the type of the seizure

Type febrile seizure	Simple febrile seizure		Complex febrile seizure		P- value
Cause of febrile seizure	Number	Percent	Number	Percent	
GE	54	19.9	13	20.6	
UTI	5	1.80	1	1.5	
URTI	122	45	21	33.3	0.899
Vaccine	8	3	3	4.8	
Pneumonia	8	3	3	4.8	
Unknown	74	27.3	22	34.9	
Total	271	100	63	100	
Gender	Boy		Girl		P-value
Cause of febrile seizure	Number	Percent	Number	Percent	
GE	33	17.2	34	23.9	
UTI	4	2.1	2	1.4	
URTI	76	39.6	67	47.2	0.127
Vaccine	7	3.7	4	2.8	
Pneumonia	6	3.1	5	3.5	
Unknown	66	34.3	30	21.2	
Total	192	100	142	100	
Residential location	Urban areas		Rural areas		P-value
Cause of febrile seizure	number	percent	number	percent	
GE	46	19	21	22.6	
UTI	3	1.2	3	3.2	
URTI	117	47.7	26	28	0.001
Vaccine	8	3.3	3	3.2	
Pneumonia	7	3.3	4	4.3	
Unknown	60	24.9	36	39.06	
Total	241	100	93	100	
Age group	≤ 1 year		>1 year		P-value
Cause of febrile seizure	Number	Percent	Number	Percent	
GE	22	30.5	45	17.1	
UTI	0	0	6	2.3	
URTI	26	36.1	117	44.6	0.012
Vaccine	3	4.2	8	3.1	
Pneumonia	4	5.6	7	2.7	
Unknown	17	23.6	79	30.2	
Total	72	100	262	100	

4- DISCUSSION

The present study was conducted with the aim of epidemiological investigations of the risk factors involved in simple and complex febrile seizures among the children referred to Besat hospital in Sanandaj city (Iran) due to simple and complex febrile seizures. The results indicated the most of the children, hospitalized because of febrile seizure, were boys and city residents. Also, most of the children had simple febrile seizure and upper respiratory tract infections (URTI), was the most common cause of febrile seizure. A significant statistic association was not seen between type of febrile seizure (simple and complex) with variables of gender, residential location, and age groups among the 6-60 months old children hospitalized because of febrile seizures. Also, the association of the type of febrile seizure (simple and complex) with the level of electrolytes in serum, Platelet, hemoglobin, white blood cell, potassium, sodium and calcium among the children was not statistically significant. However, the association of residential location (the frequency of URTI, the most common cause of febrile seizure, was higher among children residing in cities and the frequency of GE was higher in children residing in rural areas), and the age groups (the frequency of URTI among the children with more than one year of age was significantly higher than that of those with less than one year of age) with the cause of febrile seizures was statistically significant.

Febrile seizure is the most common form of seizure during childhood. It is mostly observed during the age of 6 months to 5 years and its peak of age is between 14 to 18 months (2, 3, 4). The prevalence of febrile seizures, in some parts of the world have even been reported to be 10 percent. However, most of the reserves have reported of 2-4 percent for it (1-3). The findings of the present study showed that the ratio of children hospitalized due to seizure was higher in the boys (57.5%) then than the girls. This is similar with the studies conducted in this field (1, 7, 8). For instance, in the studies conducted by Hassanpoure et al. (1), and Ehsanipour et al. (7) the ratios of the boys hospitalized due to seizure were 64.5% and 54.5%, respectively. The main reason behind this, is not clear. However, the conducted studies, especially those carried out in developing countries suggest that cultural beliefs and paying more care and attention to infant boys, comparing to infant girls, are involved in this regarded (9-11).

The results of this study showed that most of the children hospitalized because of febrile seizures were city residence (72.2%); also, around 81 percent of these hospitalized children had been diagnosed with simple seizures. These findings are similar with the other conducted studies in this field (12, 13). For example a study conducted by Abbaskhanian et al. (12), in Mazandaran (Iran) indicated that 79 percent of the cases diagnosed with febrile seizures belonged to the category of simple febrile seizures, and only 21 percent of these cases were put into the category of complex febrile seizures. In the present study the most common causes of fever in children were URTI and GE, which were in line with other studies (13-15).

It is essential to note that in the present study, 28.7 percent of causes of fever were unknown; this should be brought into consideration when monitoring the causes of febrile seizures. Although simple febrile seizures were more common in the boys and complex febrile seizures were more common among the girls in the present study, this difference was not statistically significant; that is, there was no association observed between gender and the type of seizure. These findings are similar with those of studies carried out by Ehsanipour et al. (7), and Abbaskhanian et al. (12).

Moreover, although the complex seizure was more common in children with under one- year of age than the children with more one- year of age, this difference was not statistically significant. This is inconsistent with the study conducted by Barzegar et al. (13); for in that study, the mean age of the children with complex febrile seizure was lesser than that of the children with simple febrile seizure. Perhaps one of the reasons for the non-significant association and inconsistency with other studies is the less in number (sample size) for the children with complex febrile seizure comparing to the children with simple febrile seizure.

In our study, there was not found any association between the level of electrolytes, platelet, hemoglobin, white blood cell, potassium, sodium, calcium, and fever, with the type of seizure. This is in line with studies conducted by Fallah et al. (14), Valencia et al. (16), and Daoud et al. (17). The studies carried out by Kiviranta et al. (18), and Nowruzi et al. (19), indicated that the patient with lower level of sodium are more prone to recurrence of febrile seizures. However, this association was not found in our study. Anemia leads to reduction in oxygen carriage and delivery to different tissues including brain.

Fever increases metabolism and whereby worsens the negative effects of anemia on the brain and consequently causes febrile seizures. Therefore, it might be possible to reduce the risk of febrile seizures through prevention and treatment of anemia. In this study, there was not any significant association between the level of hemoglobin and the type of febrile seizure. However, in the studies conducted by Abbaskhanian et al. (12), and Daoud et al. (17) statistically, the level of hemoglobin in blood serum among the children with febrile seizures was significantly lower. In this study the association between the residential location and the cause of febrile seizure was significant , the frequency of URTI, the most common cause of seizure, was higher among the children living in the cities, and GE was more common among the children living in rural areas. Regarding the reason behind this, it could be mentioned that since population density in urban areas is more than the population density in rural areas, social interactions are higher in cities and therefore, the chance of infection transmission is probably increased in the society. Also, the association between the cause of febrile seizure and the age groups indicated that the most frequency among all age groups, belonged to URTI; whereas, UTI had the lowest frequency among all the age groups, probably due to the earlier diagnoses and treatments of UTI.

4-1. Limitations of the study

Some of the limitations this study confronted were lack of proper categorizations in the archive and lack of accurate registration of descriptions and the results of clinical examinations in the records.

5- CONCLUSION

Given that the results of this study showed that most of the children hospitalized due to febrile seizure were boys and city residents, an also given that upper respiratory tract infection (URTI), is the most common cause of febrile seizures, closed attention is required for control and prevention programs of febrile seizures. Training parents in order to prevent children from having contracts with in individuals diagnosed with gastroenteritis and respiratory infections, proper hand washing, and consideration of public health principals could lead to a reduction of this infections among the children and consequently reduce the risk of developing febrile seizures.

6- CONFLICT OF INTEREST: None.

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