

Investigating Blood Pressure Levels in Children with Febrile Seizures

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Abstract

Introduction: The aim of the present study was to investigate the level of blood pressure in children with febrile convulsion (seizures) (FC). **Materials and Methods:** The present case-control study was carried out on 100 children aged 6 to 60 months referred to the emergency department. Children in the control group included children with symptoms other than FC and the case group had FC symptoms. Blood pressure was measured in these children and data analysis was conducted using SPSS ver. 19. **Results:** There is a significant difference between the two groups in terms of the declared percentiles ($p=0.001$). That is, a total of 60%, 20% and 10% of the subjects in the FC group were in the 50-90, 90-95 and 95-99 percentiles, respectively. There was a significant difference between the two groups in terms of systolic blood pressure (SBP) and diastolic blood pressure (DBP) ($p=0.001$). The mean SBP and DBP values were higher in the FC group. **Conclusion:** SBP and DBP values increase in children with FC.

Keywords: Fever; Convulsion; Blood pressure; Febrile seizures

Introduction

Febrile convulsion (FC) can be due to meningitis, brain abscess, and encephalitis, undiagnosed convulsion associated with fever or FC.^[1] Febrile convulsions, with a prevalence of 2-5%, are the most common disorder of the child's nervous system.^[2] American Academy of Pediatrics defined febrile convulsions as "seizures that occur in febrile children (higher than 38°C) who do not have an intracranial infection, metabolic disturbance, or history of afebrile seizures."^[3,4] This disorder usually occurs in children aged 6-60 months (average age of 22 months).^[1] The FC mechanism is still unknown; however, many etiologic factors certainly play a role in its development, and fever is not the only risk factor; in other words, fever is a condition necessary for seizure in these children, but not the sufficient one.^[5] The value of SBP and DBP normally increases in the 1-18 age range. Pediatric hypertension is defined as average SBP and/or diastolic BP (DBP) that is ≥ 95 th percentile for gender, age.^[6] Pediatric HTN consists of primary (intrinsic) or secondary types. Intrinsic HTN is currently the most common cause of HTN in children. Kidney disease is the most common cause of secondary HTN in children. Pediatric HTN has many causes.^[7] Obese children are more likely to develop primary HTN than other children. As the age increases, blood pressure also increases. Extremely high blood pressure during childhood can be a risk factor for HTN in adulthood. Previous researches showed that HTN may start from childhood or puberty. Therefore, it is recommended to regularly monitor blood pressure of children aged 3 years and above during medical visits. Patients with HTN are often asymptomatic. Therefore, one of the most important responsibilities of the health care team is identifying high-risk individuals and training on how to change their lifestyle.^[7,8] Concerning the relationship between hypertension and FC in children, although there are studies on the relationship between different types of chronic blood pressure and maternal pregnancy with FC in children.^[9,10] but considering the importance of identifying the factors associated with FC in children, and adopting subsequent necessary steps to improve the prognosis of this group of children on one hand, and since there has been no study on the blood pressure in children with FC, on the other hand, the aim of the present study was to measure the blood pressure in children with FC referring to the Emergency Department or Pediatric Wards of Amir Kabir Hospital in Arak.

Methods

The present case-control study was carried out on 100 individuals. Each group consisted of 50 individuals. The patients were selected using simple random sampling and based on inclusion and exclusion criteria. The inclusion criteria included obtaining informed consent from children's parents or guardians, children of both genders and with the age range of 6 to 60 months, children with simple FC, no history of complex FC, suffering from only fever-induced convulsion, lack of the presence or history of complex FC according to patients' history and medical records throughout the study period, and failure to diagnosis seizures induced by causes other than FC in the child during the study. Exclusion criterion also included lack of consent to participate in the study. One group was considered as control. The control group consisted of children aged 6-60 months admitted to the emergency department with symptoms other than FC and the case group included children aged 6-60 months with simple FC, which was confirmed by a pediatrician. Children in both groups were homogenous in terms of age and gender. Simple FC was diagnosed based on the following definition for FC and simple FC criteria: Fever-induced convulsion refers to the convulsion associated with fever higher than 38 degrees without intracranial infections, metabolic disorders, or history of afebrile seizures.^[3,4] Simple FC is characterized as follows: 1) Each time the fever rises, only one seizure occurs each time 2) It takes less than 15 minutes. 3) The seizure is generalized and lacks focal neurological symptoms.^[1,2] Finally, the information is compared in both groups. The mean age, gender, number of hospitalization days, frequency of fever and seizure, and DBP and SBP were measured and compared in both groups. A demographic and clinical checklist was completed for all children enrolled in the study. This checklist contains

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the following variables: Age, gender, weight, height, age of first simple FC, frequency of simple FC, FC history in other children of the family, history of other seizures other than FC in the family, place of residence (Arak city / village), birth weight (ELBW: below 1000 grams, VLBW: 1000-1500 grams, LBW: 1500-2500, NBW: 2500-4000 grams, LGA: above 4000 grams), gestational age (GA): full term, under 37 weeks (preterm), over 40 weeks (post-term).

Measuring and reporting blood pressure in children

Systolic and diastolic blood pressure was measured by headphone and using digital pressure gauge (CITIZEN REF CH-452) as well as cuffs suitable for the child's age. The blood pressure was measured by the intern. Initially, the device cuff was wrapped around the right arm and the hand was placed at heart level. Age, gender, and height should be considered while assessing hypertension and diagnosing hypertension. A sphygmomanometer with a cuff of appropriate size was used while measuring blood pressure (BP) in children in such way that the cuff width covered about two thirds (80%) of the arm's length. A small BP cuff will give falsely high readings. BP measurement was carried out three times for each child in such way that the blood pressure was measured after five minutes rest and after entering the ward or any invasive measures. And if, based on available curves, the patient's BP level is more than 95 percentile considering his/her age, gender, and BMI, the patient suspected of developing hypertension will be visited to measure blood pressure again in the next two turns visits with a two weeks of interval (a total of three visits). And if the patient has blood pressure more than 95 percentile based on the above curve during three separate BP measurements, (s) he will be considered as a hypersive person; otherwise (s) he will be considered as people with normal blood pressure. Finally, the basic and clinical data recorded in the checklist were entered into SPSS ver. 20 software and then analyzed.

Results

The present case-control was carried out on a sample size of 100 individuals with 50 subjects in each group. There was no significant difference between the case and control groups regarding age, height age of the first febrile convulsion and family history and place of residence ($p>0.05$) [Tables 1- 6].

Table 1: Comparison of frequency of birth weight in FC and control groups.

Group Birth weight	FC Number (Percent)	Control Number (Percent)	p-value
10 (20)	0 (0)	10 (20)	0001/0
5 (10)	0 (0)	5 (10)	
25 (50)	20 (40)	25 (50)	
10 (20)	30 (60)	10 (20)	
0 (0)	0 (0)	0 (0)	

Chi-square test

There was a significant difference between control and case groups in terms of birth weight in ($p=0.0001$). In the control group, birth weight was less than 1000 grams in 20% of cases, and the weight range of 1000-1500 grams is seen in 10% of cases.

Table 2: Comparison of gestational age distribution in FC and control groups.

Group Gestational age	FC Number (Percent)	Control Number (Percent)	p-value
Under 37 weeks	30 (60)	35 (70)	0.2
37-40 weeks	20 (40)	15 (30)	
Over 40 weeks	0 (0)	0 (0)	

Chi-square test

There was no statistically significant difference between case and control groups in terms of gestational age ($p=0.2$).

Table 3: Comparison of the distribution of number of offspring produced by the same pregnancy in each pregnancy in the FC in and control groups.

Group Number of offspring produced by the same pregnancy	FC Number (Percent)	Control Number (Percent)	p-value
Singleton	40 (90)	50 (100)	0.001
Twin and more	10 (10)	0 (0)	

There was a significant difference between the two groups in terms of number of offspring produced by the same pregnancy ($p=0.001$). A total of 10% of the children were twin and more in the FC group.

Table 4: Comparison of distribution of delivery type in the FC and control groups.

Group Delivery	FC Number (Percent)	Control Number (Percent)	p-value
Normal	35 (70)	40 (90)	>0.05
C-section	15 (30)	10 (10)	

There was no significant difference between the two groups in terms of type of delivery ($p>0.05$).

Table 5: Comparison of percentiles of blood pressure in children in FC and control groups.

Group Percentile	FC Number (Percent)	Control Number (Percent)	p-value
Under 50	5 (10)	15 (30)	0.0001
50-90	30 (60)	35 (70)	
90-95	10 (20)	0 (0)	
95-99	5 (10)	0 (0)	
Above 99	0 (0)	0 (0)	

There is a significant difference between the two groups regarding the declared percentiles ($p=0.0001$) in such way that a total of 60%, 20% and 10% of the subjects in the FC group were in the 50-90, 90-95 and 95-99 percentiles, respectively.

Table 6: Comparison of mean and standard deviation of systolic and diastolic blood pressure in children assigned to FC and control groups.

Group Blood pressure	FC Mean \pm SD	Control Mean \pm SD	p-value
Systolic	76 \pm 14/99	64 \pm 6/30	0001/0
Diastolic	63 \pm 13/59	47 \pm 6/46	0001/0

There was a significant difference between the two groups in terms of level of systolic and diastolic blood pressure ($p=0.001$). The mean systolic and diastolic blood pressures were higher in the FC group.

Discussion

Febrile seizures (FS) are frequent convulsive disorders, occurring in infants and young children. The causes of febrile convulsions are usually benign. Such convulsions are common in children and their long-term consequences are rare.^[11,12] So far, according to a search of existing and available resources, no close study aimed at assessing the level of blood pressure in children with febrile convulsion, no have been done on this subject.

Mohammadi et al. conducted a study to investigate the biochemical disorders in children with febrile seizure. This cross-sectional study was performed on 172 adolescent children with febrile convulsion. In this study, their measured sodium, potassium, calcium and glucose. In the study, 35 patients had Hyponatremia and 2 cases of Hypernatremia and 135 normal sodium, 8 cases of Hyperkalemia and 8 cases of Hypokalemia and 156 normal cases of potassium, 27 cases of Hypocalcaemia and 11 cases of Hypercalcemia and 132 normal blood calcium. In one case, blood glucose was low. According to the

statistics, there is no significant relationship between the presence of electrolyte disturbances in the form of a decrease or increase in sodium, potassium, or blood sugar and seizure. Accordingly, in the clinical situation of each child, a specific underlying problem and only if patients develop symptoms of these disorders can be measured by measuring serum electrolytes.^[13]

In 2006, Barzegar and colleagues conducted a study to investigate epidemiologic and clinical features of the first febrile seizure attack in children. Within a year, all children over one month and under 12 years of age with the first febrile seizure were enrolled to this study and the peak in febrile seizure was the second year of life and were more common in males. 75.2% of the type of simple febrile convulsion and 24.8% of the type of convulsion were complex. There was a significant relationship between the age and type of febrile seizure. Clinical Characteristics The first febrile seizure attack in this study is similar to other studies.^[14]

The present case-control study was carried out on 100 children 50 individuals in each group. In this study, there was no significant difference between the case and control groups regarding age, height, age of the first febrile seizure and family history and place of residence ($p > 0.05$). There was a significant difference between case and control groups in terms of birth weight ($P = 0.0001$). In the control group, birth weight was less than 1000 grams in 20% of cases and weight range of 1000-1500 grams was seen in 10% of cases. There was no statistically significant difference between the case and control groups in terms of gestational age ($p = 0.2$). There was a significant difference between the two groups regarding the number of offspring produced in the same pregnancy ($P = 0.001$), with 10% of the children being born as twin and more in the FC group. There was no significant difference between the two groups in terms of type of delivery ($p > 0.05$). There was a significant difference between the two groups regarding the declared percentiles ($p = 0.001$) in such way a total of 60%, 20% and 10% of the subjects in the FC group were in the 50-90, 90-95 and 95-99 percentiles, respectively. There was a significant difference between the two groups in terms of systolic and diastolic blood pressure ($p = 0.001$). Systolic and diastolic blood pressures were higher in the FC group. So far, no study has been conducted with the same title or similar conditions, and this study is the first study carried out in this field.

Conclusion

The result of this study shows that there was a significant difference between the two groups in terms of systolic and diastolic blood pressure. The mean systolic and diastolic blood pressures were higher in the FC group.

Acknowledgment

The present study is the result of a PhD dissertation. The ethics code for this study is REC.1395.454. Hereby, the authors would like to appreciate all the individuals who participated in this study and

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Conflict of Interest

The authors disclose that they have no conflicts of interest.

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