

Trace Elements in Febrile Seizure Compared to Febrile Children Admitted to an Academic Hospital in Iran, 2011

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ABSTRACT

Background and Aim: Pathogenesis of Febrile Convulsion (FC) is unknown but some elements and genetic predispositions have been considered in the top list. This case-control study was designed to compare some trace elements in paediatrics who were admitted with FC and those in febrile ones without seizure attacks at an academic hospital in northeast of Iran.

Material and Methods: This case-control study was done from June 2010 to July 2011 on 160 paediatrics (6-months to 5-years old) who were diagnosed with FC and on 160 age-matched febrile children as control group. Data on the age, gender, past history of fever and convulsion, age at the first episode of seizure and family history of FC were gathered by using a designed checklist. Complete Blood Count (CBC), serum iron, Total Iron Binding

Capacity (TIBC), zinc, magnesium and calcium were tested after taking informed consents from the parents. Serum levels of trace elements were measured by a photometric method. Independent t-test or non-parametric Mann-Whitney test were used to compare means between two groups.

Results: There were no significant differences between the cases and controls with regards to the gender or age. TIBC and magnesium were lower in FC, but calcium, iron and zinc were higher in FC as compared to those in the other group (not significant).

Conclusions: So, it could be said that deficiency of trace elements was not significantly related to febrile convulsion in our study and it seemed that these tests were not necessary in FC cases. But further investigations on other trace elements are needed.

Key words: Febrile convulsion, Zinc, Magnesium, Calcium

INTRODUCTION

The International League Against Epilepsy (ILAE) defined a febrile seizure as "a seizure which was associated with a febrile illness in the absence of a CNS infection or an acute electrolyte imbalance in children who were older than 1 month of age, who did not have prior afebrile seizures". Febrile seizures or convulsions (FC) are most common between 6 months and 5 years of age, with a peak incidence at about 18 months of age. An onset above age of 7 years is rare, although it does occur [1]. FC occurs during fever due to a viral or bacterial infection such as a respiratory infection or otitis media, when the temperature rises rapidly, because immature brain system cannot sufficiently cope with the stress of a high temperature [2].

It occurs in 2-5% of infants and children. The pathogenesis of FC is unknown in most of the cases, but various factors have been considered in the aetiology, which are as follows: alteration in some elements and a genetic predisposition [3-5], having a first- or second-degree relative with a history of FC, maternal smoking in pregnancy, low birth weight, a neonatal stay of >30 days, attendance at day care, an increased number of febrile illnesses, fever which is greater than 39.4°C, and particular infectious illnesses [4,6]. Disturbance in serum electrolytes is among the most pathogenesis' theories for FC, but it has not been confirmed as yet [2]. Different trace elements, especially iron, have been measured in various sets of studies [4, 6-7].

This case-control study was designed to compare some trace elements in paediatrics who were admitted with FC and in those febrile ones without seizure attacks at an academic hospital in northeast of Iran.

MATERIAL AND METHODS

In this case-control study which was done from June 2010 to July 2011 on patients who were admitted to an academic paediatrics

hospital in northeast of Iran, 320 individuals were included: 160 cases which included 6-months to 5-years old paediatrics who were diagnosed with febrile convulsion (FC) and 160 age-matched children with fever and without seizure as control group which was from the same setting.

Data with regards to the age, gender, a past history of fever and convulsion, age at the first episode of seizure and family history of FC were gathered by using a designed checklist.

Blood samples (4 cc) were taken on the first day of admission (at the first 6 hours) for CBC, serum iron, Total Iron Binding Capacity (TIBC), zinc, magnesium and calcium. The exact goal of the project was mentioned to parents of children and their informed consents were taken. Local ethical committee confirmed the process. Serum levels of trace elements were measured by a photometric method by using an auto analyzer device. Coded data were entered into SPSS-15 software and normal distribution was assessed at first. Then, independent t-test or non-parametric Mann-Whitney test were used to compare means between two groups.

RESULTS

As has been shown in [Table/Fig-1], there were no significant differences between the cases and controls with regards to the gender (p-value = 0.64).

The mean age of febrile seizure cases was 25.9 ± 15.43 months and that of the control group without febrile seizures was 28.60 ± 22.52 months, which were not statistically significant (p-Value = 0.20).

Results showed that the ages of FC children were about 2.7 months lower than ages of those without seizures, although this was statistically non-significant [Table/Fig-2].

TIBC and magnesium were lower in FC, but calcium, iron and zinc were higher as compared to those of the other group. These differences were not significant [Table/Fig-2].

Due to the definition of calcium deficiency, iron deficiency and so on; the results were evaluated by using agreement tables. No significant relationship has been seen as yet [Table/Fig-3].

		Groups		Total
		FC	Febrile without seizure	
Gender	Male	84 (52.5%)	80 (50%)	164 (51.3%)
	Female	76 (47.5%)	80 (50%)	156 (48.8%)
Total		160 (100%)	160 (100%)	320 (100%)
P-value		0.64		

[Table/Fig-1]: Comparing the distribution of gender between cases and groups

Variables (Mean±SD)	Groups	
	Febrile convulsion (n=160)	Febrile without seizure (n=160)
Age	25.90±15.43	28.63± 22.51
Calcium	9.45±0.57	9.39±0.50
Ferrous	37.65±34.45	35.12±35.24
TIBC	402.47±54.79	408.89±52.87
Magnesium	2.38±0.57	2.40±0.58
Zn	13.69±2.60	13.33±2.66

[Table/Fig-2]: Comparing mean (±SD) of age and serum level of some trace elements between cases and controls

		Groups		Total
		FC	Febrile without seizure	
Calcium (µg/dl)	< 8.1	1 (.6%)	1 (.6%)	2 (0.6)
	8.1-10.5	159 (99.4%)	159(99.4%)	318(99.4%)
P-value		0.99		
Iron	Deficient	117 (74.1%)	123 (77.8%)	240 (75.9%)
	Normal	41 (25.9%)	35 (22.2%)	76 (24.1%)
p-value		0.43		
Magnesium (µg/dl)	Hypomagnesaemia	9 (5.8%)	9 (5.8%)	18 (5.8%)
	Normal	145 (94.2%)	146 (94.2%)	291 (94.2%)
p-value		0.99		
Zinc (µg/dl)	Deficiency	22 (14.1%)	27 (16.9%)	49 (15.5%)
	Normal	134 (85.9%)	133 (83.1%)	267(84.5%)
p-value		0.49		
TIBC	≤ 420	76 (48.4%)	72 (45.6%)	148 (47%)
	>420	81 (51.6%)	86 (54.4%)	167 (53%)
p-value		0.61		

[Table/Fig-3]: Comparing the deficiency of the trace elements between cases and controls

DISCUSSION

Results of the present investigation revealed no significant relationship between electrolyte disturbances and febrile convulsion in paediatrics in our settings. Ages of FC children were about 2.7 months lower than ages of those without seizures, although this was statistically non-significant, but it could be important from the medical view.

TIBC and magnesium were lower in FC, but calcium, iron and zinc were higher as compared to those of the other group (not significant). Also, no significant differences were found between two groups with regards to the definitions of deficiencies of the mentioned trace elements. Relatively small numbers of cases and case-control design of this study may have caused some limitations which needed discussion. More follow up and longitudinal studies may be helpful.

Amiri et al., reported significantly lower levels of zinc and selenium in febrile convulsion but copper level was not different. The reported mean level (±SD) of zinc was 66.13 (±18.97)µg/dl in FC as compared to level of 107.87 (±28.79) µg/dl which was seen in healthy group [2]. The serum level of zinc which was seen in Korea (Lee et al.,) was 60.5±12.7 µg/dL in the febrile seizure group and it was 68.9±14.5 µg/dL in the afebrile seizure group [8]. This level of zinc was much higher than that which was seen in our study. In our study, the mean (±SD) level of zinc was 13.69±2.60 µg/dl and it was 13.33±2.66 µg/dl in FC and control groups, respectively (this was not statistically significant). Our results showed very low serum levels of zinc in the paediatric population regardless of the convulsion status and this needs further attention, as it has also other important roles in growth and development of children.

Donaldson et al., showed that hypomagnesaemia was present in about 3% of FC cases and they recommended that in the first simple febrile seizure attacks in children, these routine haematological and biochemical tests were not necessary [9]. In the present report, we found a magnesium deficiency in 5.8% of the cases and controls, which may be considered as an overall problem which is not especially related to FC.

Iron deficiency anaemia is one of the most important aetiologies which have to be considered as having a key role in febrile seizures and some studies have revealed significant differences between cases of FC and healthy controls with regards to their iron status. The frequency of low serum iron was reported to be as high as 56.2% in Shiraz (Iran) and it was 30.5% in Kenya [7, 10]. Also, it has been hypothesized that iron deficiency could be important in brain development and that so, it should be noticed and treated more urgently [11]. Low serum iron levels were seen in 74.1% of FC cases and in 77.8% of controls, which were much more than those which were seen in the mentioned reports and they should be considered as a general health problem in our paediatric population.

Chou et al., evaluated the factors which were associated with abnormal laboratory findings in 240 children who had visited the Emergency Department (ED) after having their first seizures. Abnormalities were found in 11 (6.2%) of 177 children for calcium (not significant) [12]. But in the present study, only one (0.6%) child in each group showed calcium deficiency.

CONCLUSION

We found no significant differences between cases with FC and controls without convulsion with regards to the electrolyte disturbances in our setting. So, it could be said that deficiency of trace elements was not significantly related to febrile convulsion in our study and these tests did not seem to be necessary for FC cases. But, further investigations on other trace elements are needed.

An interesting or a terrifying problem which was confronted in the present study was the general deficiencies of zinc, iron and magnesium in our children (cases and controls), which should attract more interest in digging for the aetiologies.

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