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

SEPIDEH AMOUIAN¹, SAKINEH MOHAMMADIAN², NASER BEHNAMPOUR³, MOHSEN TIZROU⁴

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 younger 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].

<table>
<thead>
<tr>
<th>Variables (Mean±SD)</th>
<th>Groups</th>
<th>Febrile convulsion (n=150)</th>
<th>Febrile without seizure (n=150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>25.90±15.43</td>
<td>28.63±22.51</td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td>9.45±0.57</td>
<td>9.39±0.50</td>
</tr>
<tr>
<td>Ferrous</td>
<td></td>
<td>37.65±34.45</td>
<td>35.12±35.24</td>
</tr>
<tr>
<td>TIBC</td>
<td></td>
<td>40.47±54.79</td>
<td>408.69±52.87</td>
</tr>
<tr>
<td>Magnesium</td>
<td></td>
<td>2.38±0.57</td>
<td>2.40±0.58</td>
</tr>
<tr>
<td>Zn</td>
<td></td>
<td>13.69±2.60</td>
<td>13.33±2.66</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Variables (Mean±SD)</th>
<th>Groups</th>
<th>Febrile convulsion (n=150)</th>
<th>Febrile without seizure (n=150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (µg/dl)</td>
<td></td>
<td>8.1-10.5</td>
<td>9.1-10.5</td>
</tr>
<tr>
<td>Iron</td>
<td></td>
<td>117 (71.4%)</td>
<td>123 (77.8%)</td>
</tr>
<tr>
<td>Magnesium (µg/dl)</td>
<td></td>
<td>9 (5.8%)</td>
<td>9 (5.8%)</td>
</tr>
<tr>
<td>Zinc (µg/dl)</td>
<td></td>
<td>22 (14.1%)</td>
<td>27 (16.9%)</td>
</tr>
<tr>
<td>TIBC</td>
<td></td>
<td>&lt;= 420</td>
<td>&gt; 420</td>
</tr>
</tbody>
</table>

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

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.

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.

REFERENCES


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