

Role of serum zinc levels in simple febrile convulsions in children

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Abstract

Background: Febrile convulsions in children can be induced by several factors. In febrile convulsions there is an enhanced neuronal excitability during the normal brain maturation. Gamma amino butyric acid is an important inhibitory neurotransmitter. Zinc has a regulatory effect on glutamic acid decarboxylase and the synthesis of GABA. **Aim:** To determine whether children with simple febrile convulsion had low serum zinc levels compared to children with fever alone. **Material and Methods:** In this prospective observational study a total of 100 children were divided in case and control groups, i.e., children with simple febrile convulsions (case group=50 children) and febrile children without convulsions (control group=50 children). Serum zinc was done by calorimetric method. **Results:** The mean serum zinc levels in the present study in simple febrile convulsions and in fever alone without convulsions were 50.44 μ g/dl and 59.5 μ g/dl respectively. Mean Zinc levels were significantly less in children with simple febrile convulsions. **Conclusion:** The serum zinc levels were decreased in children with simple febrile convulsions when compared to children with fever alone without convulsions, thus indicating that zinc deprivation plays significant role in the pathogenesis of febrile convulsions. **Key Word:** Children, simple febrile convulsions, simple fever without convulsions, serum zinc

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maturation. Gamma amino butyric acid is an important inhibitory neurotransmitter. Zinc has a regulatory effect on glutamic acid decarboxylase and the synthesis of GABA. Attempts have been made to identify predisposing risk factor like family history, metabolic disturbance (especially serum zinc, magnesium, glucose, calcium).³⁻⁵ This knowledge has a practical value and advising parents regarding recurrent convulsions. This study was conducted to determine whether children with simple febrile convulsion had low serum zinc levels compared to children with fever alone.

INTRODUCTION

Febrile seizure is a common neurologic problem occurring in children aged between 6 months to 5 years. The etiology of febrile seizure is unknown but genetic factors or electrolyte disturbances may have a role in its occurrence or recurrence.¹ To date it is revealed that febrile seizures can be induced by several factors. It is generally believed that febrile seizure is an age-dependent response of the immature brain to fever. This postulation is supported by the fact that most (80 -85%) febrile seizures occur between 6 months and 3 years of age, with the peak incidence at 18 months.² Although the mechanism of this increased susceptibility is unclear, animal models suggest that there is enhanced neuronal excitability during the normal brain

MATERIAL AND METHODS

A prospective observational study done on 100 children in the age group of 6 months to 5 years over a period of two years. A total of 100 children were equally divided into case and control group i.e. children with simple febrile convulsions (case group=50 children) and febrile children without convulsions (control group=50 children).

Inclusion criteria

- Case group - children with simple febrile convulsions and
- Control group - children with fever without convulsions.

Exclusion criteria

- Children on zinc supplementation,
- Children on any medications (antiepileptic drugs)
- Children with malnutrition (grade III and grade IV) according to I.A.P classification
- Children with seizure disorders
- With diarrheal disease
- Children already known to have zinc deficiency

The study was approved by institutional ethical committee. Informed consent was obtained from the subject’s parents or guardians. 50 cases were compared with 50 age matched controls. A detailed history was obtained including age, sex, socioeconomic status, duration of fever before onset of seizures, duration of seizures, consanguinity, family

history of epilepsy, febrile seizures and consanguinity. Complete physical examination of the child was performed with weight, height, head circumference and mid arm circumference to emphasis that there is no evidence of malnutrition. Laboratory investigations such as Hemoglobin and total leukocyte count, C-reactive protein (CRP) and serum zinc were done. Serum zinc was done by calorimetric method. Normal range of serum zinc levels were taken as 70 to 150 micrograms/dl.

Statistical analysis

The co-relation between serum zinc levels in relation to age, sex and duration of seizures were analyzed by Chi-square test and independent t-test. The data analysis was computed using the SPSS v15 software and p value <0.05 was considered statistically significant.

RESULTS

In the simple febrile convulsions group, majority i.e., 48% of children were below 2 years of age followed by 36% between 2 to 3 years, whereas in the fever group, majority 52% of children were below 2 years of age followed by 26% between 2 to 3 years. In simple febrile convulsions 60% were males respectively and in fever alone males were 32%.

Table 1: Age distribution of children studied

Age in years	Children with Simple Febrile Convulsions		Children with Fever without Seizures	
	No	%	No	%
<2 years	24	48%	26	52%
2-3 years	18	36%	13	26%
3-4 years	6	12%	7	14%
4-5 years	2	4%	4	8%
Total	50	100%	50	100

Upper respiratory tract infection was found to be triggering illness for simple and complex febrile convulsions in 72% and 52% of the cases respectively.

Table 2: Focus of infection

Cause	Children with simple febrile convulsions (n=50)		Children with fever without seizures (n=50)		P value
	No	%	No	%	
Acute gastritis	3	6.0	4	8.0	0.909
ASOM	3	6.0	2	4.0	1.000
Dengue	4	8.0	9	18.0	0.359
URTI	36	72.0	26	52.0	0.006**
UTI	3	6.0	6	12.0	0.159
Viral Fever	1	2.0	3	6.0	0.371

(ASOM=Acute suppurative otitis media; URTI= Upper respiratory tract infection; UTI= Urinary tract infection)

The mean serum zinc levels in the present study in simple febrile convulsions and in fever alone without convulsions were 50.44 µg/dl and 59.5 µg/dl respectively. Mean Zinc levels were significantly less in children with simple febrile convulsions followed by children with complex febrile convulsions with P=<0.001. Serum zinc levels were found to be low in 84% of children in simple febrile convulsions. Serum zinc levels were found to be low in 74% of children in fever alone group.

Table 3: Serum Zinc levels in children studied

Sr. Zinc level	Children with simple febrile convulsions		Children with fever without seizures	
	No	%	No	%
Low	42	84%	37	74%
Normal	7	14%	11	22%
High	1	2%	2	4%
Total	50	100%	50	100%

DISCUSSION

The mean serum zinc levels in the present study in simple febrile convulsions and in fever alone without convulsions were 50.44 µg/dl and 59.5 µg/dl respectively. Children with febrile convulsions both simple and complex have statistically significant low serum zinc levels when compared to children with fever alone without convulsions. Children with fever alone did not show decrease in serum zinc level compared to other groups which is similar to findings of other studies. Mollah MA *et al*⁷ published a study comparing serum and CSF Zinc levels of febrile seizure children to their matched non-seizure febrile peers. Mean Zn concentration in both serum and CSF was less in febrile seizure children than in their matched non- seizure febrile peers ($p < 0.001$). Kumari *et al*⁸ observed in a case control study found that mean serum zinc level was significantly lower in cases as compared to control ($p < 0.05$) in children having febrile seizure. Ganesh R *et al*⁹ compared serum zinc levels in 38 cases of simple febrile seizure with 38 age matched controls with statistically significant results ($p < 0.001$). Amiri M *et al*,¹⁰ Modarresi MR *et al*,¹¹ Hydarian F *et al*,¹² and Lee J and Kim JH,¹³ also gave similar results which are comparable with our study. However, Garty BZ *et al*¹⁴ had their findings which did not support the hypothesis that febrile convulsions are related to the reduced zinc concentration. The serum zinc levels did not show any significant correlation with age of onset, sex, axillary temperature or fever seizure interval in our study. All previous studies have shown similar findings in this aspect. As serum zinc concentration in any population is influenced by factors such as dietary pattern, vitamin A, vitamin D deficiency, zinc levels in the soil and water, further studies are needed in this aspect to identify the probable cause for this finding.

CONCLUSION

The serum zinc levels were decreased in children with simple febrile convulsions when compared to children with fever alone without convulsions, thus indicating that zinc deprivation plays significant role in the pathogenesis of febrile convulsions. The role of zinc in febrile

convulsions should be investigated by further studies and if the results are reproducible, zinc supplementation can be given in febrile convulsions.

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