

Original Research Article

Association between serum selenium levels and febrile seizures in Indian children: a case control study

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ABSTRACT

Background: Febrile seizures are the most common form of childhood seizures. Children are at particular risk for selenium deficiency. There was various hypothesis about the co-relation between selenium levels and febrile seizures. The aim of the present study was to determine whether there were any changes in serum selenium levels in children with febrile seizures when compared to children with febrile illness without seizures.

Methods: This was a hospital based prospective case control study, consisting of 40 children (20 cases and 20 controls) aged between 6 months to 60 months. The serum selenium level was measured in each of them by atomic absorption spectrophotometer. Data was analysed by using frequency percentage and pearson's chi square test.

Results: Out of the 40 children included in the study, serum selenium level was lower in febrile seizure group (80%) when compared to controls (20%) which was statistically significant (P value: 0.003). Also, there was no statistically significant difference between males and females.

Conclusions: In the present study, we found significantly low serum selenium levels in children with febrile seizures as compared to the children with febrile illness with no seizures. Decreased levels of selenium in children with febrile seizures may be the result of oxidative damage, occurring in the neuronal cells. In our study, a significant co-relation between low levels of selenium and febrile seizures have been observed in children. However, since the numbers are small, further studies with larger sample size are recommended.

Keywords: Febrile, Seizures, Selenium deficiency, Selenium

INTRODUCTION

Febrile convulsions are the commonest provoked seizures affecting children. These are defined as seizures occurring during fever between 6 months to 5 years of age without infection of central nervous system in a neurologically normal child.¹ Brain contains a high quantity of selenium, especially gray matter and the predominant function of selenium is to serve as an antioxidant via the selenium dependent enzymes like glutathione peroxidase (GPX) and phospholipid hydroperoxide glutathione peroxidase (PHGPX).² Brain produces high amount of reactive oxygen species, owing

to high aerobic metabolism and being very sensitive to oxidative injury, damage can occur in neuronal cells if reactive oxygen species are not detoxified by enzymatic antioxidants.³ Many studies have shown an association between low serum selenium levels and febrile seizures equally.³⁻⁵ Some studies have shown no association.⁶ Hence our study is an attempt to evaluate the association between the serum selenium level and febrile seizures. The objective of this study was to determine the serum selenium levels in children with febrile seizures and to compare the serum selenium in children with febrile seizures and children without seizures. And to compare the serum selenium level in different age groups and sex.

METHODS

All children in the age group of 6 months to 5 years admitted to paediatric ward or Paediatric Intensive Care Unit with febrile seizures or febrile illness were enrolled in the study.

This study included 20 children (children who had fever with generalized convulsion persisting less than 15 minutes without features of intracranial infection) and another 20 children as controls (children who had only fever without convulsion). All these children had normal neurological examination.

Informed and written consent of the parents of the cases and controls was obtained prior to enrolment in the study. The study was approved by the ethics committee of the hospital. A detailed history including age, sex, seizure details (duration, type and recurrence), nature of febrile illness and family history of epilepsy or febrile seizures was taken. Physical examination findings including temperature at admission, anthropometry, nutritional status according to IAP classification was recorded. Sample of blood which was drawn from the patient while collecting blood for other clinically indicated investigations at the time of admission was used to determine the serum selenium levels. All relevant details were recorded in the predesigned Proforma. Estimation of serum selenium was done using atomic absorption spectrophotometer with the help of chemical engineering department at National Institute of Technology (NITK), Surathkal, Karnataka, after obtaining appropriate permission and approvals.

Normal range for the study¹⁰

- Selenium levels in different age groups
- 6 to 12 months: 0.17-1.47 micromole/L
- 1 to 5 years: 0.43-1.63 micromole/L.

A febrile seizure is a primary generalized, usually tonic-clonic, associated with fever, lasting for a maximum of 15 min.⁷

Inclusion criteria

Case group

- Aged between 6 months to 5 years
- Children with first episode of febrile seizure or recurrent febrile seizure
- Developmentally normal child
- Children admitted to paediatric intensive care unit (PICU)/ Paediatric ward.

Control group

Children aged 6 months to 5 years who were admitted with febrile illness without febrile seizures and fulfilling exclusion criteria.

Exclusion criteria

- Complex febrile seizures
- History of complex febrile seizures
- Children younger than 6 months or older than 5 years of age
- Developmental delay and children with neurologic impairment
- Proven neurological infections
- Child on multivitamins
- Suspected meningitis or being treated as presumed / possible meningitis
- Patient unwilling to give consent.

RESULTS

There was a total of 40 children (20 cases and 20 controls) in our study in the age group between 6 months to 5 years of age. Seventeen children (85%) in the case group had low selenium levels in association with febrile seizures compared to only 4 children (20%) in the matching control group, which was statistically significant (P value: 0.003) (Table 1). Furthermore, both groups were matched as regards age, gender, seizure type, duration and anthropometric measurements. Serum selenium levels in the current study found no statistically significant difference with the above said parameters between cases and controls.

Table 1: Serum selenium levels in cases and controls.

Selenium level	Cases (n = 20)	Controls (n = 20)	Total	P Value
6-12 months	6	3	1	2
>1 - 5 years	11	-	3	14

Table 2: Age distribution.

Selenium level	Cases (n = 20)	Controls (n = 20)	Total	P Value
6-12 months	9	3	12	0.376
1-5 years	11	17	28	

In the case group, children between 6-12 months were 9 (45%) whereas between 1-5 years was 11 (55%) as compared with the control group where 3 (15%) children were between 6-12 months of age and 17 (85%) children were between 1-5 years of age (Table 2) and there was no statistically significant difference between the groups (P value: 0.376).

Table 3: Gender distribution.

	Cases (n = 20)	Control (n = 20)	Total	P value
Male	13	12	25	0.744
Female	7	8	15	
Total	20	20	40	

DISCUSSION

Febrile convulsion is one of the more frequent problems encountered in clinical paediatric practice. About 2-5% of all children suffer from at least one febrile convulsion in childhood.⁸ Patho-physiology of febrile seizures is not clearly known and studies have indicated multiple aetiologies involved in the pathogenesis of febrile seizures like genetic factors, electrolyte disturbances like low sodium and magnesium, reduction in iron, copper, zinc and selenium.³ This study was done to establish the levels of serum selenium in children with febrile seizures.

In the current study, serum selenium levels in cases was significantly lower as compared with the controls (p value: 0.003), which is similar to studies done by Salah ON et al, Amiri et al and Mahyar et al.³⁻⁵ In a meta-analysis by Saghezade A et al, it was found that in children with febrile seizures there was no significant difference in serum selenium levels when compared to children with febrile illness without seizures.⁶

In this study, serum selenium levels with respect to age, gender, weight and height, there was no statistically significant difference which is similar to the study conducted by Khoshdel A et al.⁸

Serum selenium levels in our study showed no statistically significant difference with regards degree of fever or duration of febrile seizure. This is similar to a study done by Balci O and Yilmaz D, which also showed no significant co-relation.⁹

Production of reactive oxygen species and neuronal damage is one of the hypotheses postulated for causation of febrile seizures in selenium deficient children. Results of the present study indicate a significant correlation between selenium deficiency and febrile seizures.

CONCLUSION

The children with febrile seizures in our study group had low serum selenium levels which were statistically

In the case group, 13 children were males (65%) and 7 were females (35%) whereas in the control group, 12 children were males (60%) and 8 were females (40%) (Table 3) and no statistically significant difference between the groups noted (P value: 0.744).

significant when compared to the control group. Measuring the selenium levels may have a role in management of febrile seizures. Since our numbers were small, further studies are recommended to further establish the relation between febrile seizures and serum selenium levels.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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