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Research Article

Serum zinc levels in children with simple febrile seizures

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ABSTRACT

Background: Febrile convulsions are the most common type of seizures in children. Febrile seizure is an event in infancy and early childhood usually occurring between 6 months and 5 years of age, associated with fever but without the evidence of intracranial infection or defined cause. Febrile convulsions have good prognosis. Zinc acts as a cofactor of glutamic acid decarboxylase, an enzyme which maintains the production of GABA in central nervous system. The aim of the present prospective observational study was to estimate the levels of serum zinc in children with febrile convulsions and to compare serum zinc levels between children with febrile seizures and febrile children without seizures.
Methods: A prospective observational study was done on 100 children for one year period from August 2012 to July 2013, admitted in a tertiary care centre. Of these 50 children were diagnosed to have febrile convulsions. The other 50 were febrile children without seizures. Serum zinc levels were measured in all 100 subjects using calorimetric methods. Data was analyzed using SPSS version 15.
Results: Mean serum zinc levels in children with febrile seizures were 68.4 micrograms/decilitre and mean serum zinc levels in control group was 94.1 micrograms/dl (p=0.0001). There were no significant differences in relation to age and gender. Serum zinc levels were significantly low in children who had febrile seizures of prolonged duration (p=0.0001).
Conclusions: These findings revealed that there is correlation between serum zinc and simple febrile seizures. Serum zinc level was significantly lower in children with simple febrile seizures in comparison with febrile children without seizure.

Keywords: Simple febrile seizures, Serum zinc

INTRODUCTION

Epilepsy is being the one of the most common disease of the brain.[1] Epilepsy affects approximately 50 million people in the world and approximately 80% of it is seen in developing countries. Epilepsy accounts for 1% of global burden of disease, statistics equal to breast carcinoma in women and lung carcinoma in men.[2] A simple febrile seizures is generalized, tonic clonic in nature, lasts for few seconds and rarely up to 15 min, is followed by a brief period of postictal drowsiness and occurs only once in 24 hours.[3] The seizure incidence in offspring of individuals with a history of febrile convulsion was 10%.[4]

A number of trace elements are said to play a role in febrile seizures by their co-enzyme activity or ability to influence ion channels and receptors. Studies have shown that iron, zinc, selenium, copper and magnesium play significant role in febrile seizure. The zinc chelator phytate, found in seeds and cereal bran, can contribute to zinc malabsorption.[5] In the brain, zinc is stored in specific

synaptic vesicles by glutamatergic neurons[6] and can "modulate brain excitability".[7] It plays a key role in synaptic plasticity and so in learning.[8]

Zinc acts as a cofactor of glutamic acid decarboxylase, an enzyme which maintains the production of GABA in central nervous system and decreased level of zinc has been observed in febrile seizures.[9,10] In CNS zinc acts as a neuro secretory product or cofactor.[11] Apart from this zinc also stimulates the activity of pyridoxal phosphate which is involved in the synthesis of pyridoxal phosphate from pyridoxal.[12]

METHODS

A prospective observational study done in a tertiary care centre during the period of August 2012 to July 2013 (1 year), children in the age group of 6 months to 5 years were included. A total of 100 children, 50 each in case and control group i.e. children with febrile seizure (case group) and febrile children without seizures (control group). The inclusion criteria for case group being children with simple febrile seizures and for control group being children with fever without seizures. The exclusion criteria were children on zinc supplementation, or on any medications (antiepileptic drugs) or 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 were also excluded.

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, family history of 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.

All children were subjected to the following investigation: Hemoglobin and total leukocyte count which was done by auto analyzer. C-reactive protein (CRP) done by nephelometry method and serum zinc done by calorimetric method. Zinc status in children with febrile seizures were compared with different variables such as age, sex, socioeconomic status, duration of fever before seizures, duration of seizures, consanguinity, family history of epilepsy, family history of febrile seizures and consanguinity, zinc levels in febrile children without seizures. Normal range of serum zinc levels were taken as 70 to 150 micrograms/dl.

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

The following results were obtained from the study. The study group consisted of 50 cases and 50 controls. Majority of the cases were between 1 to 2 years (44%). Infants were 42%. Very few children were between 2 to 3 years (10%) and between 3 to 4 years (4%) as shown in Table 1. There were 33 (66%) males and 17(34%) females among cases. Among the cases, fever was triggered by respiratory tract infection in 37 (74%) of the children, family history of febrile seizures were present in 11 (22%) children. In our study 31 (62%) of the children in cases group had low serum zinc levels and only 5 (10%) of children in control group had low serum zinc levels. On other hand only 19 (38%) of children in case group and 45 (90%) of children in control group had normal serum zinc levels and the comparison was highly significant with p value of 0.0001 as shown in Table 2. There is no significant difference in Serum zinc levels among cases in relation to age and sex but there is a significant difference in relation to duration of seizures i.e. serum zinc levels were significantly low in children who had seizures of prolonged duration as shown in Table 3.

Table 1: Age distribution of cases.

Age group (months)	Cases	
	No.	**%**
<12	21	42
13-24	22	44
25-36	5	10
37-48	2	4
Total	50	100

Table 2: Serum zinc levels among cases and controls.

Serum zinc	Cases		Controls	
	No.	**%**	**No.**	**%**
Normal	19	38	45	90
Low	31	62	5	10
Total	50	100	50	100

*p=0.0001; degree of freedom (df) = 1

Table 3: Serum zinc levels in relation with duration of seizures among cases and controls.

Duration of seizures (minutes)	Serum zinc levels in cases	
	Normal	**Low**
<5	13	1
5-10	4	18
10-15	2	12

*p=0.0001; degree of freedom (df) = 1

DISCUSSION

In this study, among cases majority were males (66%) with M:F ratio=1.9:1. The results in other Indian studies done by Ganesh et al. study[13] and Leela Kumara et al.[14] did not show significant male preponderance. Hartfield et al.[15] reported that maximum children with febrile seizures were in the age group less than 24 months and mean age was 17.9 months. The mean age of children with febrile seizures in our study is also 17.9 months. In a study done by Leela Kumari et al.[14] 5.8% of cases and 56.5% of controls were in the age group less than 17 months. Alberto Romero Guzman et al.[16] found that 55% of children with febrile seizures were among 6 months to 24 months, which is almost similar to our study. In the present study, 11 (22%) cases had family history of febrile seizure. Offringa et al.[17] in 1994 studied that, of children with febrile seizures 24% had family history of febrile seizures which is similar to our study. In our study we found out in children with lower serum zinc levels prolonged seizures were observed, Sadlier[18] et al. found out that 87% of the children in their study had seizures <10 min, while 9% had seizures lasted for 15 min which is mostly similar to our study where children with seizures <10 min were 72%. Berg et al.[19] in 1996 also found out that 87% of children had febrile seizures for <10 minutes and only 9% of children had seizure for more than 15 minutes.

The results of this study detected that serum zinc levels was significantly low in children who had simple febrile seizures in comparison with children who had fever without febrile seizures. Similar results were seen in other studies which are as follows Papierkowski et al.[20] from Poland in 1999, who observed that serum and CSF zinc levels were significantly low in children with febrile seizures when compared with healthy children in control group. Gunduz et al.[21] from turkey in 1996 observed that serum and CSF zinc levels was decreased in children with infectious diseases and this decrease was more significant in patients with febrile convulsions. Kumar et al.[22] in 2011, Ehsanipour et al.[23] (2003 to 2005), Amiri et al.[24] (2010), Ganesh et al.[13] in 2006 and Mahayar et al.[25] in 2013 found out that mean serum zinc levels were significantly lower in children with febrile seizures as compared to controls. In this study serum zinc levels were significantly low in children who had seizures of prolonged duration which is similar to the study done by Margaretha et al. in 2009.[26]

CONCLUSION

In our study serum zinc levels were low in children with simple febrile seizures in comparison with febrile children without seizures and also in children with lower serum zinc levels prolonged seizures were observed. Hence children with low serum zinc levels are more prone to get febrile seizures than children with normal serum zinc levels. However further prospective observational studies with large number of cases are required to establish the correlation between serum zinc and febrile convulsion.

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