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ASSOCIATION BETWEEN SERUM ZINC LEVEL AND SIMPLE FEBRILE SEIZURES IN CHILDREN

Pediatrics

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ABSTRACT

Introduction: Febrile seizure is one of the most important types of convulsions in children. Zinc are important trace elements that affect some enzymes in central nervous system, and their deficiencies could disturb the inhibitory mechanisms in the brain, thus producing convulsions. Objective of the study was to find out the association between serum zinc levels and febrile seizures in children. **Methods:** This hospital based cross sectional study was done in Sri Krishna Medical College, Muzaffarpur, Bihar, India for one-year period from August 2019 to July 2020**.** A total of 100 children aged between 6 months to 5 years admitted in the hospital presenting with febrile seizures were included in the study. Informed consent was taken from their attendants and classified into 2 groups of 50 each. Group A: Children with febrile seizures (50 cases), Group B: Children without seizures (50 control). Serum zinc was measured by colorimetric method and compared among the groups using statistical methods. **Results:** Mean serum zinc level in cases was 30.96±7.93ugm/dl and in controls it was 35.95±9.25ugm/dl. Serum zinc level was found significantly low in cases of simple febrile seizures as compared to controls (P<0.05). Male to female ratio was 1.63:1. Majority of the children were between 6 to 12 months (36%).**Conclusions:** This study reveals that there is positive correlation between low serum zinc levels and febrile convulsions.

KEYWORDS

Serum zinc, Zinc supplementation, febrile convulsions

INTRODUCTION:

Febrile seizures occur in young children at a time in their development when seizure threshold is low. They typically occur relatively early in an infectious illness usually during the rise of temperature curve [1]. Febrile seizures occur in common childhood infections such as infections of the respiratory system, otitis media, acute gastroenteritis, and children respond to these infections with comparably higher temperatures [2]. 94% occur within the first three years of age and 6% after three years of age. Approximately one half appears during second year of life with peak incidence between 18 to 22 months. Febrile seizures occurring before 6 months should raise the suspicion of serious infections like bacterial meningitis [3]. A number of trace elements are said to play a role in febrile convulsions by their co-enzyme activity or ability to influence ion channels and receptors. Studies have shown that iron, zinc, selenium, copper and magnesium play a significant role in febrile convulsions. Neurons rich in zinc carry the element in their synaptic vesicles. They are a special group of neurons [4]. Zn is a co-factor of glutamate decarboxylase which is an enzyme needed for gamma-aminobutyric acid synthesis in the central nervous system and reduced CSF zinc levels have also been noted in febrile convulsions. Recent evidences indicate that zinc deficiency plays a significant role in febrile seizures. Zinc increases storage capacity of glutamate or slows down the release rate of glutamate [5]. Zinc increases the activity of pyridoxine needed for pyridoxine formation reciprocally pyridoxine increases the activity of glutamate decarboxylase which results in gamma-aminobutyric acid syntheses. Thus, decreased zinc levels lowers GABA synthesis which would precipitate seizures [6]. Zinc plays an important role in tissue or cell growth. With respect to transcription, zinc appears to interact with nuclear proteins that bind to promoter sequences of specific genes, zinc forms a structural component of zinc fingers which recognize DNA base sequences during replication and transcription of DNA [7].This study aims to determine zinc levels in children who have febrile convulsions and thus help to reveal possible associations between zinc deficiency and febrile convulsions.

METHODS:

A total of 100 infants and children aged between 6 months to 5 years fulfilling the inclusion criteria were included. The study comprised of 2 groups - Group A: Children with febrile seizures (50 cases), Group B: Children without seizures (50 control). Inclusion criteria were children with simple febrile seizure and normal development. Febrile seizures were defined as seizures accompanied with fever (≥38°C) without Central Nervous System (CNS) infection. Children with diarrhea, pneumonia, protein energy malnutrition, developmental delay and or neurological deficit and children on zinc therapy were excluded from the study. A written informed consent was obtained from parents/guardians of all the children after fully explaining the study procedure. Socio-demographic data, seizure details, nature of febrile illness, family history of epilepsy/febrile seizures, temperature at admission, nutritional status and vital signs namely heart rate, respiratory rate and blood pressure were measured. The axillary temperature was recorded in all children with thermometer for three minutes, followed by general examination and systemic examination in detail. Taking aseptic precaution, 2 ml of blood was collected in morning, non-fasting state within 24 hours of contact of patient in all the 2 groups. The sample was centrifuged for 3-4 minutes at 3000-4000 rpm; serum thus obtained is collected and preserved at 2-8°C in sterile deionized plain vials. Estimation of serum zinc was done within 6 hours of collection. Method used was based on colorimetric test kit, reagent used was 2-(5-bromo-2-pyridylazo)-5-(N-propyl-N-sulphopropylamino)-phenol. Zinc forms a red chelate with it. Increase in the absorbance of wavelength 560 nm can be measured and is proportional to concentration of the zinc. In the present study serum zinc level less than 65 µgm/dl was taken as cut off for zinc deficiency [11]. The groups included in the study were compared with respect to serum zinc level. All the statistical calculations were done through SPSS 16.0.

RESULTS:

The study group consisted of 50 cases and 50 controls. Majority of the cases were between 6 to 12 months (36%). Very few children were in the upper age group i.e. between 2 to 3 years (16%), 3 to 4 years (8%) and between 4 to 5 years (6%) as shown in Table 1.

Table: 1 Age group distribution of group A and group B

Age group (months)	Group A (cases) = 50		Group B (controls) = 50	
	No	%	No	%
13-24	18	36%	14	28%
13-24	17	34%	19	38%
37-48	8	16%	12	24%
37-48	4	8%	3	6%
49-60	3	6%	2	4%

There were 31 (62%) males and 19 (38%) females among cases with male female ratio of 1.63:1 as shown in Table 2

Table 2: Gender distribution of group A and group B.

Gender	Group A (cases) = 50		Group B (controls) = 50	
	%	No	%	No
Male	31	62%	29	58%
Female	19	38%	21	42%
Total	50	100%	50	100%

Table: 3 Comparison of mean serum zinc level between group A and group B.

Variables	Serum zinc level (ugm/dl)	Mean difference	Mean difference
Group A	30.76±7.93	-5.23	<0.05
Group B	35.95±9.25		

Table: 3 represents the mean serum zinc level in the both groups. Mean serum zinc level was -5.23ugm/dl less in cases of simple febrile seizure as compared to controls (P<0.005)

Table 4: Comparison of mean serum zinc level between group A and group B.

Zinc level	Group A (cases) = 50		Group B (controls) = 50		Total	
	No	%	No	%	No	%
<65µgm/Di	30	60%	17	34%	47	47
>65µgm/Di	20	40%	33	66%	53	53
Total	50	100%	50	100%	100	100

Table: 4 represents the number of patients in both groups with bio-chemical hypozincemia and shows that 30 (60%) of the cases and 17 (34%) of the controls had bio-chemical hypozincemia (P= 0.001).

DISCUSSION:

The results of this study revealed that the mean serum zinc level in children affected with febrile seizure is lower than in normal healthy children and the difference is statistically significant. Children with febrile convulsions have statistically significant low serum zinc levels when compared to normal children. Children with fever alone did not show a decrease in serum zinc level compared to other groups which are similar to findings of other studies [8]. Hauser et al compared 50 cases of simple and complex febrile seizures each with a control which showed significant low zinc values in seizure group (p<0.002) [9]. Engel L et al in his study zinc values was significantly lower in cases compared to controls with a p value<0.05[10] Hitz et al conducted a study comparing both serum and CSF zinc levels in febrile seizures with nonconvulsive fever group[11]. He showed a statistically significant difference of p value <0.001. Ganesh et al from Chennai, Lee et al, and Hitz et al also showed similar results [12] the serum zinc levels did not show any significant correlation with age of onset, gender, family history and nutritional status in this present study. All previous studies have shown similar findings in this aspect Hamed SA et al., study shows that the trace elements such as zinc have crucial role in pathogenesis of seizures [13]. The study of Gündüz Z et al. on 102 children with febrile seizures indicated that the serum zinc level in the group affected with febrile seizures was significantly lower than those in control group [14]. In a very latest study by Mishra OP et al. on 20 children with febrile seizures and 48 children as control group, it was reported that the serum zinc level in children affected with febrile seizure was lower than those in control group, and the difference was significant [15]. In contrast to our study, Kafadar I et al. found no significant difference in serum Zinc concentration in children with febrile convulsion and other two control groups. This may be due to the smaller sample size in their study [16]. Limitations of the study were zinc estimation in the present study was done by colorimetric method. Atomic Absorption Spectrometry (AAS) is a more accurate method to measure serum zinc level. This study showed that serum zinc level decreased during infection and that decrease was more significant in patients with febrile seizures.

CONCLUSIONS:

This study reveals that there is positive correlation between low serum zinc levels and febrile convulsions.

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