



A comparative study of serum magnesium levels in febrile children from 6 months to 5 years of age with and without seizures

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Abstract:

Aim: To compare serum Magnesium level in febrile children from 6 to 60 months of age with and without seizures.

Methods: It is a hospital based comparative observational study, done at Department of Pediatrics, SPINPH, SMS Medical College, Jaipur, from May 2021 to November 2022. There were case and control group, we took 70 febrile children with seizure in the case group and 70 febrile children without seizure in the control group from 6 month to 5 years of age. After taking Informed consent from parents a detailed history was taken and after doing a clinical examination, serum magnesium levels were measured by Beckman Counter AU680.

Results: Mean age of cases and control were 24.89 ± 16.63 and 26.40 ± 17.31 month respectively. there were 41 male and 29 female in case group and 39 male and 31 female in control group. There was no significant difference between case and control group in term of age and gender. Mean level of serum magnesium was 1.19 ± 0.32 in case group and 1.90 ± 0.29 in control group which was significantly different.

Conclusion: We found a positive correlation between deficiency of serum magnesium level and febrile seizure. However, more studies at a larger level required to establish a strong correlation between the two.

Keywords: Serum magnesium levels, Febrile convulsion

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1. Introduction

Febrile Seizure is one of the most prevalent neurological disorders during childhood.¹ Febrile Seizures are defined as seizures that occur between the age of 6-60 months with a temperature of 38°C (100.4°F) or higher, that are not the result of central nervous system infection or any metabolic imbalance, and that occur in the absence of a history of prior afebrile seizure.² Febrile seizures are of 2 types

1. Simple Febrile Seizure.
2. Complex Febrile Seizure.

About 30-40% of children with the first episode of febrile seizure will experience recurrences, hence

it is important to understand and prevent febrile seizures.³ Febrile seizure is a multifactorial disorder, there are many risk factors like age, sex, genetic predisposition, changes in the levels of neurotransmitters, degree and duration of fever which are responsible for febrile seizure. The role of trace elements like sodium, calcium, potassium, and magnesium are identified in causing febrile seizure.^{4,5} Magnesium being the most abundant intracellular divalent cation regulates many intracellular functions and has a profound effect on neural excitability. It is the fourth most common cation in the body. The normal plasma magnesium levels are 1.5 to 2.3 mg/dl.⁴

Magnesium is well known for its diverse action in



the human body. In the nervous system magnesium is important for optimal nerve transmission and neuromuscular conduction as well as protection against nerve excitotoxicity {excessive excitation leads to cell death}^{6,7}. Glutamate is a major excitatory neurotransmitter in the brain acting as an agonist at N-Methyl- D-aspartate (NMDA) receptors. Extracellular Mg²⁺ normally blocks NMDA receptors. Thus, hypomagnesemia leads to glutamate-mediated depolarization of the postsynaptic membrane and enhancement of epileptiform electrical activity.^{8,9} Magnesium is obtained from whole grains, nuts, and green leafy vegetables. However, global diet trends are moving towards high consumption of low-magnesium processed food.^{10,11}

In the view of above discussion, we try to assess magnesium status in children aged 6 months to 5 years with febrile seizure and to find an association between magnesium and febrile seizure.

Material and Methods

- The study was conducted in the department of Pediatrics, SPINPH, SMS Medical College, Jaipur, from May 2021 to November 2022. It is a hospital based comparative observational study. The required sample size was 70 subjects in each group.

Inclusion Criteria

Case: Children from 6 month to 5 years of age who presented to Pediatrics Department of SPINPH Hospital with Febrile Seizure.

Control:The control selected with a similar age group presented with a short duration of Fever but without seizure.

Exclusion criteria

Children presented with:

- Atypical Febrile Seizures.
- Afebrile seizures.
- Any signs of CNS infection.
- Sick children, those with neurodevelopmental delay.
- Liver, renal, or endocrinal disorders.
- Refusal for consent.

All the children who met inclusion criteria were enrolled in the study after taking written informed consent from parents. Detailed history was taken. A general and systemic examination was done in all the cases to find out the cause of fever. At the time of admission, 2 ml of blood was taken from the peripheral veins in a plain glass tube. Sample was sent to laboratory for Magnesium level and was measured by Beckman counter AU 680.

Statistical analysis

Data was recorded on a prechecked proforma, Statistical analysis performed using IBM SPSS statistics. Version 20, Continuous variables were summarized as mean and standard deviation and compared by student t-test, Nominal/categorical variable were summarized as proportion (%) and compared among groups using chi square test. A p value <0.05 was considered as the cut-off value for significance.

Results

In Our Study Maximum cases (50%) and control (31.42%) were in the age-group of 6-18 months followed by the age group of 19-30 months with 21.42% cases and 24.28% control. The mean age was 24.89 ±16.6 in the case and 26.40±17.31 in the control group.

Table1: Mean age of case and control

	Case		Control	
	Mean	SD	Mean	SD
Mean Age	24.89	16.63	26.40	17.31
Median (Range)	20.00(6.00-60.00)		20.00(6.00-60.00)	
P value (Result)	0.598			

P value is 0.598. The result is not significant at p <.05



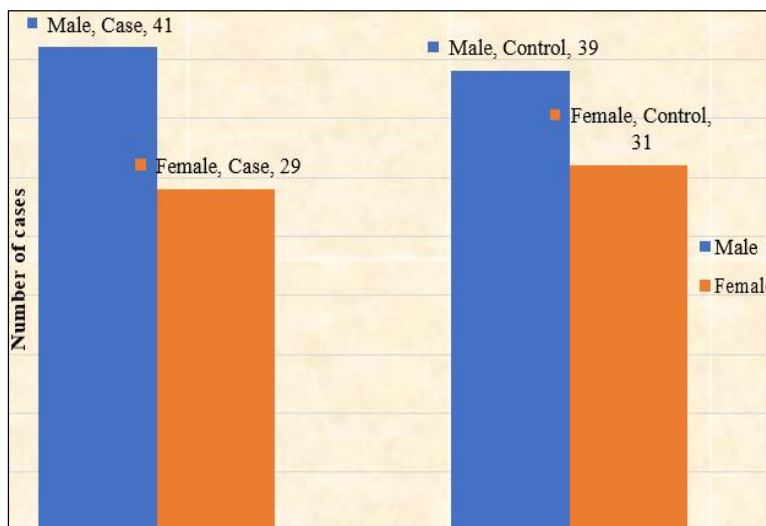


Figure 1: Distribution of Case and Control According to Gender

The maximum number of patients 41 (58.57%) with febrile seizures were male and the rest were

female 29 (41.43%). The mean age and sex were similar in both groups.

Table2: Distribution of cases and controls according to Serum Magnesium Level

	Case		Control	
	No.	%	No.	%
Deficient (≤ 1.5 mg/dl)	59	84.30	09	12.09
Normal (> 1.5 mg/dl)	11	15.70	61	87.91
Total	70	100.00	70	100.00

425

Above table depicts that among the case group 59 (84.3%) patients had deficient serum magnesium level and 11 (15.70%) had normal level. In control

group 9 (12.9%) had deficient serum magnesium level and 61(87.91%) had normal levels.

Table3: Mean value serum magnesium

	Case		Control	
	Mean	SD	Mean	SD
Mean Magnesium Level	1.19	0.32	1.90	0.29
P value (Result)	p<0.001			

The p-value is .001 The result is significant at $p < .05$

The mean magnesium level in the case group was 1.19 ± 0.32 and in the control group was 1.90 ± 0.29 . The difference between each group was found statistically significant (p -value < 0.001). The result is significant at $p < .05$.

Discussion

The study was undertaken to assess the serum magnesium levels in febrile children from 6 months to 5 years of age with and without seizures. 50-60% of body magnesium is in bone where it serves as reservoir . Most intracellular magnesium is bound to protein, of about 25% is exchangeable. Because cells with higher metabolic rate have higher magnesium, most of it is present

in muscle and liver. Magnesium is essential for membrane stabilization and nerve conduction.¹² In Our Study Maximum cases (50%) and control (31.42%) were in the age- group of 6 - 18 months followed by the age group of 19-30 months with 21.42% cases and 24.28% control. The mean age was 24.89 ± 16.6 in the cases and 26.40 ± 17.31 in the control group. A similar study done by Namakin et al.⁵2016 also found the mean age of cases was 24.1 ± 13.4 months and of control was 19.8 ± 11.1 months, Goutham A S et al.¹³also found in his study the mean age of cases was 1.97 ± 1.33 years and in the control, group was 2.01 ± 1.02 year. The result of our study is comparable to the above mention studies, the incidence of febrile



seizure is decrease with increasing age due to myelination and maturity of the brain. In our study, the maximum number of patients 41 (58.57%) with febrile seizures were male and the rest were female 29 (41.43%). Kannachamkandy *et al.*¹⁴, GOUTHAM A S *et al.*¹³ Talebian *et al.*¹⁵ also came to a similar conclusion and found male predominance in febrile seizure, there were 65.7% and 54.3% 61.7% male children in cases respectively.

In our study we found a positive correlation between serum magnesium and febrile seizure. magnesium deficiency was present in 59 (84.3%) cases and 9 (12.9%) control. The difference between each group was found statistically significant (p-value < 0.001). The mean magnesium level in the cases is 1.19 ± 0.32 and in the control is 1.90 ± 0.29 . Namakin, *et al.*⁵ (2016) did a case-control study and found the mean value of serum magnesium level was 1.9 ± 0.32 in cases and 2.27 ± 0.38 in control, the P value is < 0.001 which is statistically significant. Goutham A.S. *et al.* (2017)¹³ a conducted study on serum magnesium level in febrile children. Mean levels of magnesium was 1.97 ± 0.24 and 2.19 ± 0.20 in cases with febrile convulsion and febrile patients without seizures respectively and there were significant differences.

Conclusion

No association was found in term of Age and gender between case and control group. The mean levels of serum Mg were significantly low in FS group when compared with control group. That conclude hypomagnesemia can cause febrile seizure. Further studies with a larger study group are required to conclude that magnesium supplementation can prevent the febrile seizure.

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