

A case control study to assess the role of magnesium and calcium among children with febrile seizures in a tertiary care hospital

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Abstract

Background: Febrile seizures defined as seizures that occurs between the age of six and sixty months, with a temperature of 38 degree C 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 seizures. A seizure is a transient occurrence of signs and/or symptoms resulting from abnormal excessive or synchronous neuronal activity in the brain. **Objective:** To assess the role of Magnesium and Calcium among Children with Febrile Seizures in a tertiary care hospital. **Methodology:** The present Case Control Study was conducted by the Department of pediatrics at Government multispecialty hospital, Sector-16, Chandigarh from November 2015 to October 2016. A total of 50 Children in study age group 6 months to 5 years admitted in the pediatric ward who were satisfying the inclusion criteria were included. **Results:** In the present study the mean Serum Magnesium level was found to be 2.10 ± 0.24 mg/dl among cases and among control the level was found to be 1.95 ± 0.16 mg/dl. The association was found to be statistically significant between two group on comparing Mean Serum Magnesium. In the present study on analyzing the mean serum calcium levels it was found that among cases group nearly 90% of them had normal levels and 10% of them had abnormal serum calcium levels and in the control group all the subjects had normal serum calcium levels and the association between both the groups was found to be statistically significant. **Conclusion:** This study shows that serum magnesium levels are normal in children with febrile seizures. It indicates that serum magnesium may not have a significant role in the pathogenesis of febrile convulsions. Our study sample was not representative of entire population because all children were mostly from surrounding urban area.

Keywords: Magnesium, Calcium, Febrile Seizures, Convulsion.

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Received Date: 14/05/2021 Revised Date: 19/06/2021 Accepted Date: 23/07/2021

DOI: <https://doi.org/10.26611/10141934>

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	Accessed Date: 11 September 2021

INTRODUCTION

Febrile Seizures are defined when the child aged between six to sixty months present with a temperature of 38 degree or more which has resulted not from the infection involving the central nervous system infection or any kind of metabolic imbalance and which as occurred in the absence of prior history of afebrile seizures.¹ The pathogenesis of febrile seizure remains unexplained. Febrile seizure occurs in young children due to their lower level of seizure threshold. It was thought previously that it occurs relatively early in infection usually during the raise phase of the temperature curve. Nearly 30 to 40 % of the children who had experience febrile seizures will have the

recurrences in the future hence presence of febrile seizure will be considered to be an important event to remember. The exact pathogenesis and mechanism involved in the febrile seizures is not yet fully understood and various theories have been proposed by various authors. Few of them opined that the genetic predisposition plays an important role, even changes in the level of neurotransmitters, deficiency or excess of some trace elements.^{2,3} The role of trace elements like sodium, potassium, Calcium and Magnesium in causing the febrile seizure. The normal level of these trace electrolytes is required for normal functioning Central Nervous System and any changes in these values leads to direct and direct impact in the cell membrane ion gradient and leads to improper nervous discharges and results in convulsions among the children.⁴ Magnesium is a chemical gate-keeper, so calcium entry to nervous cell increases due to magnesium deficiency, and finally causes over stimulation, spasm and convulsion.⁵ Magnesium acts as a cofactor in many enzymatic reactions. It is involved in energy metabolism, protein synthesis, RNA and DNA synthesis, also maintains electrical potential of nervous tissues and cell membranes. It has the role in regulating potassium fluxes and in calcium metabolism. Decrease in magnesium level results in depletion of muscle potassium as well as decreased plasma concentration of calcium. As it regulates the enzyme activity it controls calcium and potassium channels and promote membrane stabilization. It is also responsible for the maintenance of the transmembrane gradients of sodium and potassium.^{6,7} Mg also acts as a voltage-dependent calcium channel antagonist, thus hypomagnesaemia will leads to release of calcium ions, which causes nerve excitability. Mg also affects calcium metabolism as the production of cyclic adenosine monophosphate (camp) is Mg dependent, which in turn controls the release of parathyroid hormone.⁸

Objective:

To estimate the role and levels of serum magnesium and calcium levels among children with febrile seizures.

MATERIALS AND METHODS

The present Case Control Study was conducted by the Department of pediatrics at Government multispecialty hospital, Sector-16, Chandigarh from November 2015 to October 2016.

A total of 50 Children in study age group 6 months to 5 years admitted in the pediatric ward at... Government multispecialty hospital, Sector-16, Chandigarh satisfying the inclusion criteria were included

INCLUSION CRITERIA: CASES: Cases are defined as seizures that occurs between the age of 6 and sixty months, with a temperature of 38° C 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 a febrile seizure. **CONTROLS:** Age and sex matched children admitted in pediatric ward with fever but without seizures. Fever in controls was defined as axillary temperature above 99°F or Oral temperature above 100°F.

EXCLUSION CRITERIA: Children admitted with acute CNS infection. Known case of seizure disorder. Developmental delay.

Prior to inclusion of the children in the study, a detailed history of the presenting complaints was recorded which included duration of fever, time of onset of seizures, type of seizures, duration of seizures, past history of seizures and family history of seizures. In addition, history suggestive of any triggering factors for the febrile episode like cough and cold, nasal discharge, ear discharge, burning micturition or crying during micturition were also recorded. Three milliliters of whole blood were collected by venipuncture under strict aseptic precautions in sterile metal free acid propylene washed plastic test tube. The sample was allowed to stand without any disturbance for five hours to enable settling down of erythrocytes. Then the serum was separated by centrifuging at 2500 revolutions per minute under aseptic conditions. Serum blood sugar, serum levels of sodium, potassium, total calcium and ionized calcium were estimated. Data was entered in MS excel and analyzed using SPSS V 21. The data was represented using figures, percentages and tables. Chi Square test was used to check the association between categorical variables and unpaired t test to check for association for contiuous variables. A p value of less than 0.05 was found to be statistically significant

RESULTS

The present study was conducted on 50 study subjects Were evaluated for the level of Magnesium and calcium levels among the children with febrile seizures were analyzed.

Table 1: Social Profile of the study subjects

Social Profile	Group		P Value	
	Cases	Control		
Age Group	<1 yrs.	12 (24%)	13(26%)	Chi Square = 1.57 p= 0.813
	1-2 yrs.	18(36%)	20(40%)	
	2-3 yrs.	10(20%)	9(18%)	
	3-4 yrs.	5(10%)	6(12%)	
	4-5 yrs.	5(10%)	2(4%)	
Gender	Male	34(68%)	38(76%)	Chi Square = 0.794 P=0.373
	Female	16(32%)	12(24%)	

In the present study nearly 36% of the cases were in the age group of 1 to 2 years, 24% were aged less than 1 years, 20 % of them were between 2 to 3 years, 10% were aged between 3 to 4 and 4 to 5 years among cases and on comparing with control group it was found to be

statistically insignificant. On Comparing gender between both the groups it was found to be more male predominant in case and control group and the association was found to be statistically insignificant.

Table 2: Comparison of Serum Magnesium levels among both the groups

		Group		P Value
		Cases	Control	
Serum Magnesium	Normal	36(72%)	46(92%)	Chi Square = 6.78 P=0.009
	Abnormal	14(28%)	4(8%)	

In the present study among cases nearly 72% of them had Normal Serum Magnesium Levels and 28% of them had abnormal levels and among the control group nearly 92 % of them had normal Level and 8% had abnormal levels of Serum magnesium. The association between Serum Magnesium and the Groups was found to be statistically significant.

Table 3: Comparison of Mean Serum Magnesium levels among both the groups.

		Group		P Value
		Cases	Control	
Mean Serum Magnesium		2.10±0.24	1.95±0.16	T value =3.67 P=0.0004

In the present study the mean Serum Magnesium level was found to be 2.10±0.24 mg/dl among cases and among control the level was found to be 1.95±0.16 mg/dl. The association was found to be statistically significant between two group on comparing Mean Serum Magnesium.

Table 4: Comparison of Serum Calcium among Both the groups

		Group		P Value
		Cases	Control	
Serum Calcium	Normal	45(90%)	50(100%)	Chi Square = 5.26 P=0.022
	Abnormal	5(10%)	0(0%)	

In the present study on analyzing the mean serum calcium levels it was found that among cases group nearly 90% of them had normal levels and 10% of them had abnormal serum calcium levels and in the control group all the subjects had normal serum calcium levels and the association between both the groups was found to be statistically significant.

DISCUSSION

This study was conducted to determine the role of serum magnesium and calcium level in children with febrile convulsion which was compared to febrile children without convulsion. These two groups of children were compared with respect to their age, sex, nutritional status and socioeconomic status. In the present study mean age of the children was found to be 24.6 years of age which is

comparable to the study finding of Namakin K *et al.*⁹ where the mean age was 24 months. In the present study majority of them who had febrile seizures were between the age group of 1 to 2 years of age which was similar to the study finding of Ahmad Talebian *et al.*¹⁰ where nearly 48% of them were between 1 to 3 years of age. In the present study the gender distribution among the cases was seen more among males when compared to females in both the groups. The findings of our study was found to be similar and comparable to the study findings of Namalkin K *et al.*⁹ In another study Talebian, *et al.*¹⁰ study also the sex ratio was found to be contrasting to our study but there were no significant differences in the prevalence of Seizure among gender. In our study the mean serum magnesium levels were 2.10 mg/dl and 1.95 mg/dl in children with febrile convulsion, febrile children without convulsion respectively. Similar results are demonstrated in Y. sreekrishna, *et al.*¹¹ Nahid K khosroshahi, *et al.*¹² N.Nutter *et al.*¹³ and Burhanoglu study *et al.*¹⁴ However the mean serum magnesium levels in these studies are high when compared to our study. In contrast to our study Talebian, *et al.*¹⁰ Papierkowski Namakin *et al.*,¹⁵ Sreenivasaiah *et al.*¹⁶, Dr. sherlin banu *et al.*¹⁷ revealed that the serum 78 magnesium levels are significantly lower than compared to normal children but those studies were done in limited cases.

The mean serum magnesium level in N. Rutter *et al.*¹³ and Y. Sreekrishna *et al.*¹¹ studies were 2.3mg/dl and 2.1 mg/dl respectively. The mean serum magnesium level in controls was 1.95 mg/dl which is slightly lower than the children with febrile seizures. In Ahmad Talebian, *et al.*¹⁰ Namakin, N.Rutter *et al.*¹³ studies the mean serum magnesium levels are in upper limit of normal levels. Serum calcium levels in our study is having significant role in children with febrile seizures. But mean serum calcium level in case and controls are similar. These results are similar with that of Namakin *et al.*¹³ study . In contrast Al-Haekim's, *et al.*¹⁸ study Azar nickvar *et al.*¹⁹ study results showed that the serum calcium level had no role in febrile seizures.

CONCLUSION

In our study all the case subjects had serum magnesium levels within the normal range, with a mean of 2.04 mg/dl. This study shows that serum magnesium levels are normal in children with febrile seizures. It indicates that serum magnesium may not have a significant role in the pathogenesis of febrile convulsions. Our study sample was not representative of entire population because all children were mostly from surrounding urban area. This study does not include children with recurrent febrile seizures. So far no studies were done to estimate the serum magnesium levels on recurrent febrile seizure.

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Source of Support: None Declared
Conflict of Interest: None Declared