

## AN OBSERVATIONAL STUDY ON SERUM MAGNESIUM LEVELS IN CHILDREN WITH STATUS EPILEPTICUS ATTENDING A TERTIARY CARE HOSPITAL IN SOUTHERN TAMILNADU

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### Abstract

**Background:** Seizure is the neurological problem most commonly encountered during childhood and is a devastating experience for the parents or the caretaker. The objectives is to estimate the serum magnesium level in children presenting with status epilepticus and to correlate the association of serum magnesium level with severity/stage of status epilepticus. **Materials and Methods:** The Study group consisted of 120 children of age group 1 month to 12 years for a period of one year from August 2020 to July 2021 presenting with status epilepticus of any cause in Institute of Child Health and Research Centre, Government Rajaji hospital, Madurai medical college, Madurai. The study was carried out after getting Approval from the institutional Ethical committee. About 3ml of venous blood sample was taken as a part of routine investigation and serum magnesium level was estimated and the value of serum magnesium level along with other variables was correlated with stage or severity of status epilepticus. **Result:** The incidence of status epilepticus was higher among seizure disorder children on AED. Fever serves as a provoking factor for status epilepticus. The higher age > 5 years had mostly established status epilepticus where in children in 1 to 5 years had more refractory status epilepticus and lesser age had more super refractory status epilepticus. While evaluating the mean serum magnesium level, higher level was seen in children with established status epilepticus whereas lower level was seen in children with refractory and super refractory status epilepticus. **Conclusion:** We conclude that mean serum magnesium level was low and statistically significant in children with refractory and super refractory status epilepticus and also serum magnesium level had negative correlation with severity or stage of status epilepticus. Role of therapeutic magnesium in status epilepticus in children especially refractory and super refractory status epilepticus has to be established by further interventional studies.

## INTRODUCTION

Seizure is the central nervous system dysfunction characterized by abnormal electrical activity in the brain neurons that may be synchronous or excessive leading to motor, sensory & autonomic system

disturbances with altered level of consciousness. Approximately 5% of children experience seizure within first 5 years of life.<sup>[1]</sup>

Status epilepticus is defined as seizures persisting for > 5 minutes in children or two or more consecutive seizures with incomplete recovery of

consciousness.<sup>[2]</sup> Magnesium is an essential cofactor for enzymes such as ATPases, Cyclases and Kinases which are important for nerve conduction and membrane stabilisation.<sup>[3]</sup> Hypomagnesemia results in a state of neuronal hyperexcitability and convulsions. Symptoms usually begin in concentration <1.2 mg/dl. Seizures usually occur in concentration < 1 mg/dl.<sup>[4]</sup>

A case control study done by C.Rama Krishna et al. on serum magnesium levels in seizure disorders showed that Serum magnesium levels were significantly decreased in patients with seizure disorder compared to controls. Serum magnesium levels were also found to be lower when time between previous and last seizure is shorter.<sup>[5]</sup> A prospective observational study done by Bharathiet al, on serum magnesium levels and its correlation with febrile convulsions in children aged 6 months to 5 years showed a significant association between hypomagnesemia and typical febrile convulsion.<sup>[6]</sup>

Hence a study was undertaken to estimate the serum magnesium level in children presenting with status epilepticus and to correlate the association of serum magnesium level with severity/stage of status epilepticus.

## MATERIALS AND METHODS

This Prospective observational study was carried out for a period of 1 year in Institute of Child Health and Research Centre, Government Rajaji Hospital & Madurai Medical College, Madurai. A total of 120 cases presenting with status epilepticus were included in the study. Children with Age group from 1 month to 12 years and children presenting with status epilepticus whether Convulsive / Non-convulsive/Febrile / Afebrile/New onset / known seizure disorder on Anti- Epileptic drugs were taken

as study subjects. Serum magnesium was estimated by calmagite method which is a complexometric indicator used in analytical chemistry to identify the presence of metal ions in solution.

### Statistical Analysis

The data collected regarding all the selected cases were recorded in Microsoft's Excel 2010. Data analysis was done using SPSS version 22 software. The mean (SD) values of more than three groups were compared using one way ANOVA test and the proportions were compared using chi-square test. P value of <0.05 was considered statistically significant. Correlation Analysis methods of spearman rho and kendall's tau was used to evaluate the strength of association between categorical variables.

## RESULTS

This study was conducted to estimate the serum magnesium level in children presenting with status epilepticus and to correlate the association of serum magnesium level with severity/stage of status epilepticus. Majority of children were in the age groups of 1 to 5 years (47.5%) followed by > 5 years of age (28.3%). Majority of children were female (55%) followed by male (45%). Majority of children showed had a clinical history of Anti-Epileptic drugs (42.5%) followed by fever (40%). The stage of status epilepticus among children were 58.3% had established, 32.5% had refractory and 9.2% had super refractory status epilepticus. The type of seizures among children 93.3% had convulsive type and remaining 6.7% had non convulsive type of seizures followed by the duration of seizures among children which showed 74.2% had > 30 mins and remaining 25.8% had lesser than 30 mins of status epilepticus at the time of presentation.

**Table 1: Distribution of study participants.**

S.no	Variable	Frequency (%)
	AGE	
1	< 1 year	29(24.2)
2	1-5 years	57(47.5)
3	> 5 years	34(28.3)
	Total	120(100)
	Sex wise- Distribution	
1	Male	54(45)
2	Female	66(55)
	Total	120(100)
	Clinical history	
1	Fever	48(40)
2	Anti-Epileptic Drugs	51(42.5)
3	Birth Asphyxia	16(13.3)
4	Developmental Delay	34(28.3)
5	Family History	10(8.3)
	Status of status Epilepticus	
1	Established	70(58.3)
2	Refractory	39(32.5)
3	Super-Refractory	11(9.2)
	Total	120(100)
	Types of seizures	
1	Convulsive	112(93.3)
2	Non- convulsive	8(6.7)

Total	120(100)
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A significant difference existed among mean age with stage of status epilepticus by one way ANOVA with  $p = 0.009$ . The higher age  $> 5$  years had mostly established status epilepticus where in children in 1 to 5 years had more refractory status epilepticus and lesser age had more super refractory status epilepticus.

**Table 2: Mean age comparison with stage of status epilepticus.**

Age	N	Mean	SD	F	Sig.
Established	70	4.3459	3.34458	4.952	0.009
Refractory	39	2.8387	2.7687		
Super refractory	11	1.9273	1.6038		
Total	120	3.6343	3.15036		

One Way ANOVA (Significance  $< 0.05$ )

A significant difference also existed among mean serum magnesium level with stage of status epilepticus by one way ANOVA with  $p = 0.0001$ . The higher level was seen in children with established status epilepticus whereas lower level was seen in children with refractory and super refractory status epilepticus

**Table 3: Mean serum magnesium level comparison with stage of status Epilepticus.**

Serum Magnesium Level (mg/dl)	N	Mean	SD	F	Sig.
Established	70	2.191	0.5583	8.496	0.0001
Refractory	39	1.797	0.6807		
Super refractory	11	1.582	0.5135		
Total	120	2.007	0.6339		

One way ANOVA (significance -  $< 0.05$ )

**Table 4: Comparison of selected variables with stages of status epilepticus**

	Established	Refractory	Super refractory	Total	Chi square	p
SEX						
Male	32	18	4	54	0.367	0.832
Female	38	21	7	66		
Total	70	39	11	120		
Duration of seizure						
<30mins	31	0	0	31	29.856	0.0001
>30mins	39	39	11	89		
Total	70	39	11	120		
Type of seizure						
Convulsive	65	36	11	112	0.877	0.645
Nonconvulsive	5	3	0	8		
Total	70	39	11	120		

Chi-square test (Significance -  $< 0.05$ )

No significant association was found between gender and stage of status epilepticus among children. A statistically significant association existed among duration of seizures and stage of status epilepticus children by Chi Square test with  $p = 0.0001$  which tells that lesser than 30 minutes pattern will be only established status epilepticus. Among 70 members in established status epilepticus, 39 had status epilepticus  $> 30$  minutes. No statistically significant association was found among type of seizures and stage of status epilepticus in children. [Table 3]

Correlation Analysis between the study variables by nonparametric methods of Spearman Rho and Kendals Tau with 5% level of significance were done for Age of children which had negatively ( $-0.25$ ) correlated with stage of epilepticus. History of fever had negatively correlated with age ( $-0.29$ ), with history of Anti-epileptic drugs ( $-0.289$ ) and with history of developmental delay ( $-0.249$ ) correlation coefficients. History of developmental delay had positive correlation with history of Anti-Epileptic drugs ( $0.5$ ) and with history of birth asphyxia ( $0.569$ ) correlation coefficients. The duration of seizures had

positive correlation with stage of status epilepticus. The serum magnesium level had negatively correlated with stage of status epilepticus ( $-0.33$ ) at 5% level of significance. [Table 4]

## DISCUSSION

The incidence of status epilepticus was more common among girls ( $n=66, 55\%$ ) than boys ( $n=54, 45\%$ ) and 1 to 5 years was the most vulnerable age group ( $n=57, 47.5\%$ ). This was in accordance with previous studies on study on serum magnesium levels and its correlation with febrile convulsions in children aged 6 months to 5 years by Bharathi et al.<sup>[6]</sup>

While evaluating the clinical history of study participants, it was found that majority of them was a known case of seizure disorder on AED ( $n=51, 42.5\%$ ) followed by H/O fever ( $n=48, 40\%$ ). The incidence of status epilepticus was higher among seizure disorder children on Anti-Epileptic drugs (AED). Fever serves as a provoking factor for status epilepticus. This was in accordance with previous studies by S K Gupta et al,<sup>[7]</sup> where

majority of the children had previous seizure episodes and on AED. Family history of epilepsy (n=10, 8.3%) and H/O developmental delay (n=34, 28.3%) was observed in this study. This is not in concordance with Sung –Jin Baek et al where family history was seen in 14.3% and developmental delay in 3%.<sup>[8]</sup>

Significant difference exists among mean age with stage of status epilepticus by one way anova with p =0.009. The higher age > 5 years had mostly established status epilepticus where in children in 1 to 5 years had more refractory status epilepticus and lesser age had more super refractory status epilepticus. This was in accordance with previous studies by S K Gupta et al where lesser age had more superrefractory and refractory status epilepticus.<sup>[7]</sup> Significant difference exists among mean serum magnesium level with stage of status epilepticus by one way ANOVA with p =0.0001. The higher level was seen in children with established status epilepticus whereas lower level was seen in children with refractory and super refractory status epilepticus. This was in accordance with previous studies by S K Gupta et al where higher the fall in serum magnesium was associated with frequent and refractory convulsions.<sup>[7]</sup>

No significant association between gender, type of seizure and clinical history such as AED, fever, family history of seizure disorder, birth asphyxia and developmental delay with stage or severity of status epilepticus. This was in accordance with previous studies by S K Gupta et al and Sung –Jin Baek et al.<sup>[7,8]</sup> Finally in our study while establishing the relationship between the study variables by nonparametric methods of Spearman Rho and Kendals Tau with 5% level of significance, Age of the children had negative correlation with stage or severity of status epilepticus. Age, H/O AED, H/O developmental delay was negatively correlated with history of fever H/O AED and H/O birth asphyxia was negatively correlated with history of developmental delay.

Finally the important part of our study to assess the serum magnesium levels with severity of stage or severity of status epilepticus was found that serum magnesium levels Has negatively correlation with severity or stage of status epilepticus. This was in

accordance with previous studies by Bharathi et al, S K Gupta et al and Sung –Jin Baek et al.<sup>[6-8]</sup>

## CONCLUSION

The incidence of refractory and super refractory status epilepticus is high among children due to delay in hospital visit by parental negligence, electrolyte abnormalities, delay in initiation of treatment and many other factors leading to mortality and morbidity in the form of neurological sequelae such as development, cognitive and behavioural disturbances. we conclude that mean serum magnesium level was low and statistically significant in children with refractory and super refractory status epilepticus and also serum magnesium level had negative correlation with severity or stage of status epilepticus.

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