



## **Frequency of Hypomagnesaemia in Children with Hypocalcemic Seizures**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aim:** To determine the frequency of hypomagnesaemia in children with hypocalcemic seizures.

**Study Design:** Cross sectional descriptive study.

**Place and Duration:** Department of Pediatrics, Liaquat University Hospital, Jamshoro / Hyderabad. From November 2017 to April 2018.

**Methodology:** Children (06 months to 06 years age and of either gender) having Two or more than two hypocalcemic seizures within 12 hours duration were included in the study. The children with hypocalcemic seizure were assessed for magnesium deficiency (hypomagnesaemia). The evaluation of hypomagnesaemia was done according to the cut off / reference values for hypomagnesaemia (<1.8 mg/dl). The data was collected on pre-structured proforma (attached).

**Results:** Total 147 children with hypocalcemic seizures were taken in this study, among them 49 (33.3%) patients had found low magnesium level and 98 (54.4%) patients had normal magnesium level.

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**Conclusion:** Seizures associated with hypocalcaemia is one of the common type of convulsion in children. In our study, a positive relation was found between low levels of serum magnesium and hypocalcemic seizures.

**Keywords:** Hypomagnesaemia; children; hypocalcaemic seizures.

## 1. INTRODUCTION

Seizures due to hypocalcemia is the common cause of seizure in children and it is the most common biochemical abnormality causing tetany, muscle cramp, and paresthesia [1-2]. Magnesium plays an important role in establishing the electrical potential across cell membranes as a result of its involvement in the  $\text{Na}^+/\text{K}^+$  ATPase system [3-4]. Deficiency of Mg play a significant role in hypocalcemic seizures and the reported prevalence for hypomagnesaemia in seizures was 25% [5] Thus, keeping in view the available prevalence, there is a need to explore the hypocalcemic seizures as far as magnesium deficiency is concerned. The study will be supportive for primary care pediatrician and health care providers. They should consider screening for serum magnesium level in children with hypocalcemic seizures, as early screening can reduce and prevent various life-threatening events. Objective of this study is to determine the frequency of hypomagnesaemia in children with hypocalcemic seizures.

## 2. OPERATIONAL DEFINITION

**Convulsion:** The convulsion was evaluated by physical finding / examination (sign) and labeled as positive when body muscles contract and relax rapidly and repeatedly.

**Hypocalcemic seizures:** Convulsion with serum calcium level below 8.5 mg/dL was considered as hypocalcemic seizures [6].

**Hypomagnesaemia:** The serum magnesium level <1.8 mg /dL was considered as hypomagnesaemia [7].

## 3. MATERIALS AND METHODS

This Cross sectional descriptive study was conducted by Non-probability consecutive sampling technique at Department of Pediatrics, Liaquat University Hospital, Jamshoro / Hyderabad from November 2017 to April 2018. Taking the prevalence of hypomagnesaemia in hypocalcemic seizures 25%<sup>5</sup> with 07% margin of error, total 147 children with hypocalcemic

seizures were taken. Children (06 months to 06 years age and of either gender) having two or more than two hypocalcemic seizures within 12 hours duration were included in the study. Children with history of congenital anomalies of CNS and other metabolic conditions causing seizure or receiving magnesium and calcium supplements were excluded from the study. Children with history of vomiting and nasogastric suction, gastrointestinal fistulas and ostomies (as such results in gastrointestinal magnesium loss) were also excluded. Hypocalcemia was treated with intravenous calcium gluconate and in case of refractory seizures injection magnesium sulphate was also given.

The children with hypocalcemic seizure were assessed for magnesium deficiency (hypomagnesaemia). The specimen was evaluated by senior pathologist having more than 05 years clinical laboratory experience. A written consent was taken from parents at the time of enrollment. The evaluation of hypomagnesaemia was done according to the cut off / reference values for hypomagnesaemia (1.8 mg/dl). The data was collected on pre-structured proforma (attached). Permission was taken from the ethical review committee of Institution.

The data was analyzed in SPSS version 22.0. The frequency and percentage (%) were calculated for hypomagnesemia in hypocalcemic seizure children and also for gender distribution. The mean  $\pm$  standard deviation (SD) was calculated for numerical variables [age, magnesium, body mass index/Z-scoring, number and duration of seizures]. The stratification were done for age, gender and body mass index (BMI)/Z-Scoring, number and duration of hypocalcemic seizure to see the effect on the outcome. The post-stratification chi-square test was applied on categorical variables at 95% confidence interval and the p-value  $\leq 0.05$  were considered as statistically significant.

## 4. RESULTS

In this study 147 patients were included. The average age of patients was  $2.59 \pm 1.9$  years, average body mass index was  $21.3 \pm 4.5 \text{ kg/m}^2$ .

Average duration of seizures in patients was 6.48± 2.47 hours and serum magnesium level was 2.01±0.24. There were 67 (45.6%) male patients and 80(54.4%) female patients in this study. Female proportion was higher than male. (Table 1).

About 49 (33.3%) patients had low magnesium level and 98(54.4%) patients had normal magnesium level in this study. Less than 3 year old children had hypomagnesemia in 27 (42.9%) cases while 22(26.2%) children of more than 3 years of age were hypomagnesemic. Age showed significant difference with p-value 0.03. About 21(31.3%) males and 28(35%) female had hypomagnesaemia. There was non-significant difference between genders, p-value 0.06 (Table 2).

Hypomagnesemia was present in 22(34.9%) children, who had seizures for less than 6 hours while it was present in 27(32.1%) children who had seizures for more than 6 hours. Duration of seizures showed non-significant difference (p-value 0.72). Total 29(28.2%) children were hypomagnesemic whose BMI was <23, while it was present in 20(45.5%) children whose BMI was greater than 23. BMI showed significant difference with p-value 0.04 (Table 3).

About 19(25.3%) children had hypomagnesemia, who had 3 or less than 3 seizures episodes while it was present in 41.7(41.7%) children who had more than 3 episode of seizures. Frequency of seizures showed significant difference with p-value 0.036 (Table 4).

**Table 1. Descriptive statistics**

Variables	mean	SD
Age (years)	2.59	1.9
BMI	21.3	4.5
Duration of seizures (hrs.)	6.48	2.47
Magnesium level	2.01	0.24
<b>Gender</b>	<b>Frequency</b>	<b>Percentages</b>
Male	67	45.6
Female	80	54.4
Total	147	100
<b>Hypomagnesaemia</b>	<b>Frequency</b>	<b>Percentages</b>
Yes	49	33.3
No	98	66.7
Total	147	100

**Table 2. Stratification for hypomagnesaemia with regard to age groups and Gender**

Age	Hypomagnesaemia		Total	
	Yes	No		
Less than or equal to 3	27	36	63	P-value=0.03
	42.9%	57.1%	100.0%	
More than 3	22	62	84	
	26.2%	73.8%	100.0%	
Total	49	98	147	
	33.3%	66.7%	100.0%	
<b>Gender</b>	<b>Hypomagnesaemia</b>		<b>Total</b>	<b>P-value=0.06</b>
Male	Yes	No	67	
	21	46		
Female	31.3%	68.7%	100.0%	
	28	52	80	
Total	35.0%	65.0%	100.0%	
	49	98	147	
	33.3%	66.7%	100.0%	

**Table 3. Stratification for hypomagnesaemia with regard to duration of seizures and BMI**

Duration of seizures	Hypomagnesaemia		Total	
	Yes	No		
Less than or equal to 6 hours	22 34.9%	41 65.1%	63 100.0%	P-value=0.72
More than 6 hours	27 32.1%	57 67.9%	84 100.0%	
Total	49 33.3%	98 66.7%	147 100.0%	
BMI	Hypomagnesaemia		Total	
	Yes	No		
≤23	29 28.2%	74 71.8%	103 100.0%	P-value=0.04
>23	20 45.5%	24 54.5%	44 100.0%	
Total	49 33.3%	98 66.7%	147 100.0%	

**Table 4. Stratification for hypomagnesaemia with regard to number of seizures**

Number of seizures	Hypomagnesaemia		Total	
	Yes	No		
≤3	19 25.3%	56 74.7%	75 100.0%	P-value=0.036
>3	30 41.7%	42 58.3%	72 100.0%	
Total	49 33.3%	98 66.7%	147 100.0%	

## 5. DISCUSSION

The causes of hypomagnesemia are poor oral intake, renal or gastrointestinal disorder. Hypomagnesemia is usually associated with other electrolyte disorders like hypocalcemia. Seizures are the common manifestation of hypocalcemia and hypomagnesemia. Successful treatment of seizures depends upon proper and accurate diagnosis. Serum calcium and magnesium level should be a part of initial diagnostic workup in children with seizures. Antiepileptic drugs are ineffective alone if the seizures are associated with electrolyte disorder.

In our study 147 hypocalcemic children were included. About 49 (33.3%) patients had low magnesium level and 98(54.4%) patients had normal magnesium level. In an international study that was done on 22q11.2 deletion syndrome children, both hypocalcemia and hypomagnesemia was present in significant number of children ( $P = 0.046$ , two-tailed Fisher's exact test). Six (31.6%) children also had concurrent low serum magnesium documented [8].

A study having children between the age of 1-month to 2-years showed that fifteen babies (19.3%) had vitamin-D deficiency as a cause for their hypocalcemia and 3 (3.8%) had hypocalcemia with significant hypomagnesemia (<0.7 mg/dl) [9]. Hypomagnesemia is a common cause of hypocalcemia. Hypomagnesemia could be due to nutritional factors or due to familial hypomagnesemia with secondary hypocalcemia [10]. A study done on children with cerebral palsy. Serum magnesium and calcium was significantly lower in the patients compared to the controls,  $p < 0.0001$  and  $p < 0.05$  respectively [11].

In a study, metabolic abnormalities were present in 89 neonates. The prevalence of hypomagnesemia was 5.3% (8 cases). Of these, 7 cases were associated with hypocalcemia and 1 was isolated hypomagnesemia. Out of 7 cases of hypocalcemia –hypomagnesemia, metabolic disturbance was the primary cause of seizures in 6 neonates and it was an associated abnormality (with sepsis) in one case [12]. Hypomagnesemia is also associated with febrile seizures. In a study that was done in children with febrile seizures, hypomagnesemia was seen in 19 (16%) children [13]. A local study done on status epileptic

children. Both calcium & magnesium levels were low in 7 (10%) patients. The frequency was higher as compare to our study that may be due to inclusion of only status epileptic children in their study [14].

## 6. CONCLUSION

Magnesium levels should always be measured when trying to determine the etiology of seizures. In our study, a positive relation was found between low levels of serum magnesium and hypocalcemic convulsion.

## CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Schafer AL, Shoback DM. Hypocalcemia: diagnosis and treatment
2. Pepe J, Colangelo L, Biamonte F, Sonato C, Danese VC, Cecchetti V, Occhiuto M, Piazzolla V, De Martino V, Ferrone F, Minisola S. Diagnosis and management of hypocalcemia. *Endocrine*. 2020;1-1.
3. Wilhelm JD, Ketteler M. Magnesium basics. *Clin Kidney J*. 2012;5(1):i3-14.
4. DiNicolantonio JJ, O'Keefe JH, Wilson W. Subclinical magnesium deficiency: a principal driver of cardiovascular disease and a public health crisis. *Open heart*. 2018;5(1):e000668.
5. Chen BB, Prasad C, Kobrzynski M, Campbell C, Filler G. Seizures related to hypomagnesemia: a case series and review of the literature. *Child neurology open*. 2016;3:2329048X16674834.
6. Dawrant J, Pacaud D. Pediatric hypocalcemia: making the diagnosis. *Cmaj*. 2007;177(12):1494-7.
7. ASADI F. Hypomagnesemia: an evidence-based approach to clinical cases.
8. Cheung EN, George SR, Costain GA, Andrade DM, Chow EW, Silversides CK, Bassett AS. Prevalence of hypocalcaemia and its associated features in 22q11.2 deletion syndrome. *Clinical endocrinology*. 2014;81(2):190-6.
9. Kamate M, Sharma K, Patil V. Prevalence of hypocalcemia in seizures in infancy. *The Indian Journal of Pediatrics*. 2018;85(4):307-8.
10. Kamate M, Singh N, Patil S. Familial hypomagnesemia with secondary hypocalcemia mimicking neurodegenerative disorder. *Indian Pediatr*. 2015;52:521-2.
11. Oladipo OO, Lesi FE, Ezeaka VC. Plasma magnesium and calcium levels in children with epilepsy in lagos. *The Nigerian postgraduate medical journal*. 2007;14(1):26-9.
12. Suganthi V, Vinkeswari K, Thivya G. Prevalence of hypomagnesemia in neonatal seizures in a tertiary care hospital in South India. *J PediatrRes*. 2017;4(01):64-8.
13. Bharathi S, Chiranjeevi K. Study of serum magnesium levels and its correlation with febrile convulsions in children aged 6 months to 5 years of age. *IAIM*. 2016;2(11):61-8.
14. Jamil U, Badshah M, Nomani AZ, Irshad M, Janjua J. Serum calcium and magnesium abnormalities in patients with status epilepticus: a single centre tertiary care experience. *Pakistan Journal of Neurological Sciences (PJNS)*. 2015;10(3):22-6.

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