

Frequency of Hypomagnesemia in Children with Malnutrition

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ABSTRACT

Objective: To determine the hypomagnesemia in children with malnutrition at tertiary care Hospital.

Patients and methods: This study was conducted in the department of paediatrics at Liaquat University Hospital Hyderabad from August 2013 to February 2014. All the children aged 06 to 59 months, of either gender had > 06-month duration of malnutrition were recruited and evaluated for hypomagnesaemia. The serum magnesium value < 1.8 mg/dL was considered as hypomagnesaemia. All the information was collected via study proforma and analysis of data was done by SPSS version 26.

Result: During six month, 159 children with malnutrition were studied for their magnesium level, of which 70.4% were males and 29.6% were females. The overall mean age of patients was 35.97±12.72 month and mean duration of disease was 9.83±1.41 months. Overall hypomagnesemia was found in 72% children with malnutrition. The overall average of hypomagnesemia was 31.63±10.92 and hypomagnesaemia was observed significantly higher among male children compared to females ($p=0.02$), and was statistically significant according to the disease duration ($p=0.05$).

Conclusion: As per study conclusion the hypomagnesaemia observed to be highly frequent (72%) among children with malnutrition.

Keywords: Malnutrition, Hypomagnesaemia, Mid-upper arm circumference

INTRODUCTION

Malnutrition is a major public health concern and a major contributor to the global burden of childhood diseases, impacting between 50 and 150 million children with the age of five years throughout the world.¹ Undernutrition is responsible for around 33% of fatalities among children under the age of five worldwide. South Asia alone accounts for 50 percent of the world's wasted children and 38.8% of the world's stunted children.¹ Malnutrition is the major cause of childhood mortality in Pakistan, accounting for approximately a third of all fatalities in children under the age of five.¹ The most severe form of malnutrition, severe acute malnutrition (SAM), is frequently accompanied with electrolyte abnormalities. Deficiency of magnesium is commonest among children having severe acute malnutrition (SAM).² Hypomagnesaemia is known to increase mortality among child population having severe acute malnutrition. Magnesium deficiency in malnourished children can be asymptomatic or can produce symptoms like loss of appetite, lethargy, weakness of muscles, tremor, weight loss, psychomotor changes and the seizures.^{2,3} Magnesium shortage occurs frequently in a range of clinical disorders prevalent in low and middle income countries, like as protein-energy malnutrition, hypoalbuminemia, malabsorption and sepsis etc.^{2,3} Magnesium insufficiency is widespread in serious illnesses, and it's linked to mechanical ventilation, death, and long-term intensive care.⁴ Magnesium is the second most essential intracellular cation in the body of human after potassium, and it is required for numerous cellular functions. It is a cofactor in about 300 enzymatic reactions that occur in human bodies.^{5,6} One of the most prevalent observations among malnourished children admitted to

hospitals is magnesium insufficiency. Deficiency of magnesium in the blood can be caused by a lack of nourishment, insufficient nutritional intake, malabsorption, diarrhea, and infections.⁵ World Health Organization (WHO) and national guidelines recommend the routine use of magnesium supplementation in children with SAM.² Previous studies reported that the among children having moderate - to - severe malnutrition, serum magnesium concentrations are stated to be significantly low, and hypomagnesemia among children of malnutrition may be caused by insufficient intake, malabsorption, infection and the diarrhoea.⁷ Though in another study found there was no link between severe acute malnutrition and serum magnesium levels.⁸ After taking above controversial findings and inadequate recent data, this study has been done to determine the hypomagnesemia in children with malnutrition at tertiary care Hospital.

MATERIAL AND METHODS

This cross-sectional study was done at Paediatric Department, Liaquat University of Medical & Health Sciences, Jamshoro/Hyderabad. Duration of study was six months August 2013 to February 2014. Non-probability consecutive sampling technique was used. The children, from 06 to 59 months of age and of either gender with malnutrition of > 06 months duration were included. Children having chronic or recurrent urinary tract infection, respiratory tract infection, gastrointestinal tract infection, congenital abnormalities, children with history of nasogastric suction, vomiting and gastrointestinal fistulas and ostomies (as such results in gastrointestinal magnesium loss) and the children already on antibiotic, diuretics, chemotherapeutic agents were also excluded.

The malnutrition was evaluated through weight for height ratio (W/H) and mid-upper arm circumference (MUAC). The W/H index was measured by weight-for-height chart and the malnutrition was labeled when Z-score was less than -2 and Mid-Upper Arm Circumference (MUAC) was measured through clinical examination by using measuring tape, and it was considered as low when MUAC was \leq 12.5 cm. The weight of the children was measured using pan weight scale. To measure the length, the measuring board was used with a headboard and sliding foot piece. All of the children were assessed for mid upper arm circumference (MUAC), which was measured with a plastic measurement tape at eye level and sat down when practicable. All the children with malnutrition were evaluated for their serum magnesium level, for that 5cc venous samples taken by disposable syringe as per aseptic protocol and serum was separated via centrifuge machine and at -20°C it was stored until analysis. Serum magnesium level was measured by Atomic Absorption Spectrophotometer in laboratory by a senior pathologist has >05 years' experience. The serum magnesium value < 1.8 mg/dL was considered hypomagnesaemia. Data were collected on a pre-designed proforma, and all maneuvers were done in accordance with medical ethics. Analysis of data was done by SPSS version 26.

RESULTS

A total of 159 malnourished children were evaluated for their serum magnesium levels over the course of six months, with 112 (70.4%) males and 47 (29.6%) girls. The average age of the children was 35.97 ± 12.72 month and the mean duration of disease was 9.83 ± 1.41 months. Regarding the magnesium level, it was low (hypomagnesemia) in 115(72%) children with malnutrition. Table.1

Table 1: Descriptive statistics of age, gender and hypomagnesemia n=159

Variables		Statistics
Age		35.97±12.72 month
Duration of disease		9.83±1.41 months
Gender	Males	112(70.4%)
	Females	47(29.6%)
	Total	159(100.0%)
Hypomagnesemia	Yes	115(72.3%)
	No	44(27.7%)
	Total	159(100.0%)

Table 2: The age, gender and duration of disease in relation to hypomagnesemia n=159

Variables		Hypomagnesemia		p-value
		Yes	No	
Age groups	06-09	26 (22.6%)	03(6.8%)	0.04
	10-19	21(18.3%)	16(36.4%)	
	20-29	27(23.5%)	8(18.2%)	
	30-39	18(15.7%)	11(25.0%)	
	40-49	15(13.0%)	04(09.1%)	
	50-59	08(7.0%)	02(4.5%)	
Gender	Male	87 (75.7%)	25(56.8%)	0.02
	Female	28(24.3%)	19(43.2%)	
Duration of disease (months)	6-9	73(63.5%)	18(40.9%)	0.02
	9-12	29(25.2%)	16(36.4%)	
	>12	13(11.3%)	10(22.7%)	

Hypomagnesemia was statistically significant according to age, gender and duration of disease ($p < 0.05$) as shown in table.2

DISCUSSION

Magnesium (Mg^{2+}) is becoming recognized as a clinically significant electrolyte among key micronutrients.⁹ Magnesium is required for the production of energy from ATP in various cellular reactions, including oxidative phosphorylation, enzymatic reactions, synthesis of proteins, nucleic acid metabolism and others.^{9,10} In this hypomagnesemia was in 115(72%) children with malnutrition. Consistently Zafar S et al¹¹ reported that when compared to children of normal weight, blood magnesium levels in children with PEM were significantly lower ($P < 0.000$). Consistently Hother AL et al¹² demonstrated that during recovery, children having severe acute malnutrition (SAM) have higher phosphorus and magnesium requirements. Electrolyte alteration are frequent in malnourished individuals and are still a major health problem in the developing nations. Serum electrolyte concentrations, rather than the whole-body content, represent the circulating electrolytes concentration in malnutrition. Although in the study of Raza M et al¹ observed that the electrolyte imbalance was found in 93.5 percent of children admitted with SAM. Inconsistently Khan S et al⁵ reported that the serum level of magnesium was low in 16 (16%), this incidence was lower from this study. One of the prognostic indicators in severe malnutrition is electrolyte disturbance. Excessive body sodium and chloride exist in children having malnutrition (even though plasma sodium and chloride may be minimal), as well as potassium and magnesium deficiencies, which necessitate supplementation over weeks.^{2,13}

In this study the mean age of overall study population was 35.97 ± 12.72 month and 112(70.4%) were males and 47(29.6%) were females. On other hand Madhusudhan K et al¹⁴ reported that the average age of the patients was 25.5 ± 15.6 months. In the study of Khan S et al⁵ reported that the average age of the children was 18.4 ± 2.8 and males were in majority compared to females. Other AL et al¹² found average age of children as 32 ± 14 months. One of the most prevalent findings among children having malnutrition admitted to hospitals is magnesium insufficiency. Magnesium deficiency in the blood can be caused by a lack of nourishment, insufficient nutritional intake, malabsorption, diarrhea, and infections.⁵ When hypocalcemia is combined with hypomagnesemia, it can cause deadly convulsions in children.¹⁵ Magnesium insufficiency can produce convulsions and cardiac arrhythmias because it is required for bioenergetic processes, membrane stability, and nerve conduction.¹⁶ Hypomagnesaemia is common in the hospital settings^{17,18} and is connected to a high mortality rate. Serum magnesium levels of 1.5 mg/dL can cause kidney stones, tetany, brittle bones, and abrupt death.^{5,19}

CONCLUSION

As per study conclusion the hypomagnesaemia observed to be highly frequent (72%) among children with malnutrition. The findings of the present study call for focusing on hypomagnesaemia as a mortality risk factor in

children with malnutrition. Although magnesium supplementation may significantly improve the symptoms of malnutrition like vomiting, nausea, general weakness, weight gain and the loss of appetite. Hence, it should be screened and managed in every malnourished child to decrease the morbidity and mortality.

Conflict of interest: None

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