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General Medicine

SERUM MAGNESIUM LEVELS IN CRITICALLY ILL PATIENTS

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ABSTRACT **INTRODUCTION-** Magnesium being the fourth most populous cation in the human body, and the second most populous intracellular cation next to potassium; it plays an essential physiological role in many functions of the body.

MATERIAL AND METHOD- A total of 96 critically ill medical patients, presenting to the Himalayan Hospital were recruited in the study. On admission, serum magnesium levels were recorded. All cases were followed until discharge/death, to study correlation between serum magnesium levels and outcome of the patient.

RESULT- 96 patients were enrolled in the study out of which 57.29 % patients were male and 42.7 % patients were female. Hypomagnesemia was observed in 12.5% patients and Hypermagnesemia in14.58 % patients. There was a significant association between hypomagnesemia and duration of ventilatory support, ICU stay and clinical outcome.

CONCLUSION- Hypomagnesemia was significantly associated with duration of ICU stay, clinical outcome (mortality) and duration of ventilator support in critically ill patients. Thus hypomagnesemia is common in the critical care setting and should be looked for as it has an impact on the clinical outcome.

KEYWORDS : Hypomagnesemia, Hypermagnesemia, Apache II Score

INTRODUCTION-

Magnesium plays an essential physiological role in many functions of the body. The incidence of hypomagnesaemia is reported in 20-65% of critically ill patients (1) and the occurrence of magnesium deficiency has also been related with mortality (2). Hypomagnesemia is common in all hospitalized patients, especially in critically ill patients with coexisting electrolyte abnormalities. The importance of magnesium has been observed in critically ill patients and magnesium has been dubbed as the "forgotten cation." (3) Hence, we set out with an objective of studying serum magnesium levels in critically ill patients. Serum magnesium monitoring may have prognostic and perhaps therapeutic implications because critically ill-patients are predisposed to both symptomatic or asymptomatic magnesium deficiency that can lead to some important clinical consequences (such as hypokalemia, cardiac arrhythmias, hypocalcemia, neurotoxicity and psychiatric problems), ultimately increasing the morbidity and mortality. Magnesium is mostly located in bone or within the cells. Assessment of magnesium status in either of these compartments in critical illness is impractical. The physician must therefore rely on determination of serum magnesium to determine if a patient is magnesium deficient. (4)

AIMS AND OBJECTIVES-

(1)To estimate Serum Magnesium levels in critically ill patients. (2) To determine the association of hypomagnesemia with clinical outcome, need of ventilator support, length of stay in ICU and Apache II score.

MATERIAL AND METHOD-

A total of 96 critically ill medical patients, presenting to the Himalayan Hospital were recruited in the study. **Inclusion Criteria -** Patients above 18 years of age, patients who are not on any prior magnesium supplements and critically ill patients admitted to medical intensive care units with APACHE II scores > 20. **Exclusion Criteria -** Patients with age less than 18 years, patients who were on magnesium supplementation, patients having undergone GI surgery or under post-operative care & polytrauma patients and pregnant females. On admission, serum magnesium levels were recorded at entry. Normal serum magnesium levels limits were taken as 1.7 to 2.4 mg/dl. All cases were followed until discharge/death from Himalayan Hospital to study correlation between serum magnesium levels and outcome of the patient. The following variables were recorded for each patient in the study group to assess outcome of the patient: Need of ventilator support /Number of ventilator days/ Number of days of ICU stay / In hospital mortality. Following investigations were done for the patients included in this study: Complete Haemogram, HbA1c Levels, RBS, Serum magnesium levels, Serum potassium levels, Serum calcium levels, Serum phosphorus levels, Serum sodium levels, Serum creatinine levels, Serum BUN levels, Serum CRP Levels, Serum procalcitonin levels, Arterial Blood Gas analysis and ECG.

Data were analyzed by using statistical software SPSS 22. Chi-square test and Fisher's exact test were used to test the significance of difference between proportions and association between qualitative variables. Unpaired Student's t-test was used for comparison of parametric variables. Correlations between different parameters were assessed by Pearson product moment correlation coefficient.

RESULTS-

Table 1. Distribution of study subjects according to serum magnesium Level

Serum Magnesium Level	No. of Patients	Percentage
0-1.70 (mg/dl)	12	12.5
1.71-2.4 (mg/dl)	70	72.91
>2.4 (mg/dl)	14	14.58

Table 1 shows the distribution of study subjects according to magnesium level. Hypomagnesemia was observed in 12 (12.5 %) patients and Hypermagnesemia in 14 (14.58 %) patients.

Table 2. Association of Hypomagnesemia with Need of Ventilatory Support

Hypomagnesemia	Need of Ventilatory Support		p-value
	Yes	No	
Present	10 (12.2)	2 (14.3)	0.685

Absent	72 (87.8)	12 (85.7)	

Statistical test used: Fisher's exact test.

The above table shows the association of Hypomagnesemia with the need of ventilatory support. There was no significant association between hypomagnesemia and need of ventilatory support among critically ill patients.

Table 3. Association of Hypomagnesemia with Duration of Vent ila tory Support

Hypomagnesemia	Duration of ventilatory support			p-value
	1-5 Days	6-10 Days	>10 Days	
Present	2 (3.4)	3 (17.6)	5 (71.4)	0.000
Absent	56 (96.6)	14 (82.4)	2 (28.6)	

Statistical test used: Fisher's exact test.

Table 3 shows the association of Hypomagnesemia with duration of ventilator support. There was a significant association between hypomagnesemia and duration of ventilatory support.

Table 4. Association of Hypomagnesemia with Duration of ICU stay

Hypomagnesemia	Duration of ICU stay			p-value
	1-5 Days	6-10 Days	>10 Days	
Present	0 (0)	7 (14.9)	5 (71.4)	0.000
Absent	42 (100)	40 (85.1)	2 (28.6)	

Statistical test used: Fisher's exact test.

Table 4 shows the association of Hypomagnesemia with duration of ICU stay. Hypomagnesemia was significantly associated with duration of ICU stay. The test used was ANOVA test.

Table 5. Association of Hypomagnesemia with APACHE II Score

Hypomagnesemia	APACHE II Score			p-value
	No. of patients (%)			
	20-30	30-40	>40	
Present	9 (13.2)	3 (12.0)	0 (0)	0.791
Absent	59 (86.8)	22 (88.0)	3 (100)	

Statistical test used: Fisher's exact test.

Table 5 shows the association of Hypomagnesemia with APACHE II score. There was no association between Hypomagnesemia and Apache II score.

Table 6. Association of Hypomagnesemia with Clinical Outcome

Hypomagnesemia	Clinical Outcome		p-value
	No. of Patients Expired	No. of Patients Survived	
Present	8 (33.3)	4 (5.6)	0.001
Absent	16 (66.7)	68 (94.4)	

Statistical test used: Fisher's exact test.

Table 6 shows the association of Hypomagnesemia with Clinical Outcome. There was a significant association between hypom agne semia and Clinical Outcome. The test used was Chi square test.

DISCUSSION-

Magnesium deficiency is one of the most frequent electrolyte imbalance present among patients who are critically ill. In this prospe ctive observational study, the prevalence of hypomagnesemia was 12% among 96 critically ill patients and it was also observed that those with hypomagnesemia had a poor prognosis and increased mortality. The results of the study were found slightly similar to the results of the study conducted by Rubeiz et al (5), in which they evaluated 381 patients who were acutely ill and found to have a prevalence of around 20% in patients admitted to the CCU and ICU.

In our study, we found that patients admitted with hypomagnesemia had a prolonged duration of ICU stay with a mean of 9.5 days. In the previous study carried out by Soliman et al (6), there was no difference of hypomagnesemia in the length of ICU stay. However the patients who developed hypomagnesemia during their ICU stay had longer duration of stay in the ICU.

It was seen that the stay in ICU, days and the duration of ventilatory support increased in the hypomagnesemic critically ill patients which was found to be highly statistically significant. It also illustrates that 5 hypomagnesemic patients (71.4%) stayed for more than 10 days in the ICU which shows that hypomagnesemia was associated with increased duration of stay in the ICU (p value <0.05).

This study stated that patients with magnesium deficiency require more frequent and longer duration of ventilator support i.e around 8 days. Fiaccordori et al (7) conducted a study in which they found that the patients who have low magnesium concentration in the muscles require longer duration of ventilator support. It was therefore found to be negatively correlated with statistical significance. The study performed by Safavi et al (8) also concluded that longer duration of ventilatory support was required in patients with magnesium deficiency i.e 7 days. Whang et al (9), had found hypomagnesemia in around 41 percent patients with hypokalemia, around 30 percent of patients with phosphate deficiency, around 28 percent of patients with hyponatremia and twenty percent of patients with hypocalcemia.

In the present study, the prevalence of hypomagnesemia was found to be 12.5%. 13.2 % hypomagnesemic patients had associated hypocal ce mia. Hypomagnesemia with associated hypokalemia was seen in 20% patients which was slightly different from other studies.

Out of 96 critically ill patients, the average APACHE II Score was higher in elderly patients of more than 50 years of age. There was a significant association of hypomagnesemia with APACHE II score and was found to be statistically significant (p-value = <0.05) among the critically ill patients of ICU.

We observed that the mortality rate was 25%, among critically ill patients. Meanwhile, among hypomagnesemic patients mortality rate was 33.33%. Many workers like Limaye et al,(10) Safavi et al,(11) Rubiez et al (12) also found similar observations in their study.

CONCLUSION-

Hypomagnesemia was common in critically ill patients though hypermagnesemia was equally common. Hypomagnesemia did not show a significant association with need of ventilator support but had a significant association with duration of ventilator support in critically ill patients. Magnesium deficiency was significantly associated with duration of ICU stay but not with APACHE II score.

Hypomagnesemia had a significant association with clinical outcome. Thus it is common in the critical care setting and should be looked for as it has an impact on the clinical outcome.

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