Prevalence Of Hypomagnesaemia In Critically Ill Patients Admitted In Medical Intensive Care Unit

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Abstract

Objective: We conducted this study to determine the frequency of hypomagnesaemia in critically ill medical patients.
Methods: This is a Descriptive cross-sectional study involving 120 patients admitted in medical intensive care unit (MICU) of Holy Family Hospital, Rawalpindi, Pakistan. The study was conducted from July 2018 to September 2019. About 1ml sample of blood was taken from each p atient included and sent to hospital laboratory for evaluation of serum magnesium levels. All the collected data was entered and analyzed on SPSS v. 23. A p-value of ≤ 0.05 was taken significant.
Results: In our study the mean age of the patients was 42.76 ±12.77 years, the male to female ratio of the patients was 1:1. The mean value of APACHE II score of the patients was 29.68±2.571. The hypomagnesaemia was found in 28(23.33%) patients.
Conclusion: According to our study the frequency of hypomagnesaemia in c ritical ill medical patients was 28(23.33%)
Keywords: Critical, Medically Ill, Hypomagnesaemia, Patients.

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1. Introduction

Magnesium is fourth most abundant cation in human body and it is the second most cation inside the cells after potassium.[1] It is vital in electrolyte homeostasis, intracellular calcium regulation, energy storage and utilization, protein synthesis regulation, and neurotransmitter release.[1,2] Adequate magnesium balance has been reported to reduce the risk of inflammation, diabetes, colorectal cancer, stroke, and cardiovascular disease events.[2] It has significant role in oxidative metabolism.[1] It serves as cofactor for more than 300 enzymatic reactions.[3] It serves its role in maintaining neuromuscular excitability and cardiac function.[3] The incidence of hypomagnesaemia is reported as, 10–20% in hospitalized patients, 50– 60% Intensive Care Unit (ICU) patients, and 30– 80% in persons with alcoholism, and 25% in outpatients with diabetes.[2] In one study prevalence of hypomagnesaemia in critically ill medical patients was found to be 24.29 %. The monitoring of serum magnesium levels has prognostic and therapeutic value.[4] The normal magnesium plasma concentration is from 1.7 mg/dl to 2.55mg/dl.[4]

Long term total parenteral nutrition, hypoalbuminemia, diarrhea, vomiting, sepsis, use of loop diuretics and aminoglycosides can lead to increased frequency of hypomagnesaemia in critically ill patients at various settings.[5,6] Magnesium deficiency can lead to important clinical consequences like hypocalcemia, cardiac arrhythmias, neurotoxicity and hypokalemia.[7,8] When serum magnesium is below 1.2mg/dl then symptoms like confusion, nystagmus, ataxia, convulsions, comma, prolonged QT interval on ECG and atrial and ventricular arrhythmias can occur.[9] Purpose of conducting this study is to evaluate magnitude of hypomagnesaemia in critically ill hospitalized medical patients. By timely identifying the patients with hypomagnesaemia who are at risk of developing neurological and cardiovascular complications we can prevent and address these complications that may aggravate medical ailment.

2. Materials & Methods

This is a Descriptive cross-sectional study involving 120 patients admitted in medical intensive care unit (MICU) of Holy Family Hospital, Rawalpindi, Pakistan. WHO sample size calculator was used to determine sample, using anticipated population proportion of 24.29%[4], keeping level of confidence 95%, and absolute precision of 8%, the minimal required sample size was calculated out to be 120. Both male and female patients of age 15 to 70 years who are suffering from life threatening diseases like sepsis, septic shock, cardiogenic shock, hepatic failure, renal failure, congestive cardiac failure, diabetic ketoacidosis, acute lung injury, acute exacerbation of asthma, acute exacerbation of COPD, multiorgan failure and status epilepticus with APACHE SCORE II more than 25 and duration of illness for more than 24 hours were included in our study. Patients with documented hypomagnesaemia before admission, and who were taking drugs causing hypomagnesaemia diuretic therapy (loop diuretics, thiazide diuretics) and nephrotoxic drugs like aminoglycosides, cisplatin,

amphotericin B and pentamidine were excluded from our study. The study was conducted from July 2018 to September 2019. About 1ml sample of blood was taken from each patient included and sent to hospital laboratory for evaluation of serum magnesium levels. Serum magnesium level on day 1 and day 4 of hospital admission below 1.7mg/dl was considered hypomagnesaemia.

Statistical Analysis

For categorical variables like gender, type of medical illness and presence or absence of hypomagnesaemia, frequencies along with percentages will be calculated. For continuous variables like age, duration of disease, Apache II score and serum magnesium levels, means along with standard deviations was calculated. Effect modifiers like age, gender, duration of disease, type of medical illness was controlled by stratification and Chi-square analysis was applied. All the collected data was entered and analyzed on SPSS v. 23. A p-value of ≤ 0.05 was taken significant.

3. Results

In our study total 120 patients were enrolled. The mean age of the patients was 42.76±12.77 years. The study results also showed that the mean value of APACHE II score of the patients was 29.68±2.571. The study results showed that the mean value of serum magnesium level at day 1 was 2.102±0.51. The study results showed that the mean value of serum magnesium level at day 14 was 2.05±0.43 as shown in Table 1.

Table 1: Descriptive statistics of age, APACHE II score and Magnesium Levels at Day 1 & 14

variables	N	Mean	SD	Minimum	Maximum
Age in years	120	42.76	12.77	17	67
APACHE II score	120	29.68	2.571	25	34
Serum Magnesium Level At Day 1	120	2.10	0.51	1.2	3.0
Serum Magnesium Level At Day 14	120	2.05	0.43	1.3	2.9

this study the male patients were 60(50%) and the female patients were also 60(50%). The male to female ratio of the patients was 1:1 (Figure 1). In figure 2 our study showed the final medical diagnosis of the patients in which the most common diagnoses were congestive heart failure, viral meningitis, sepsis leading to multiple organ failure and acute renal failure.

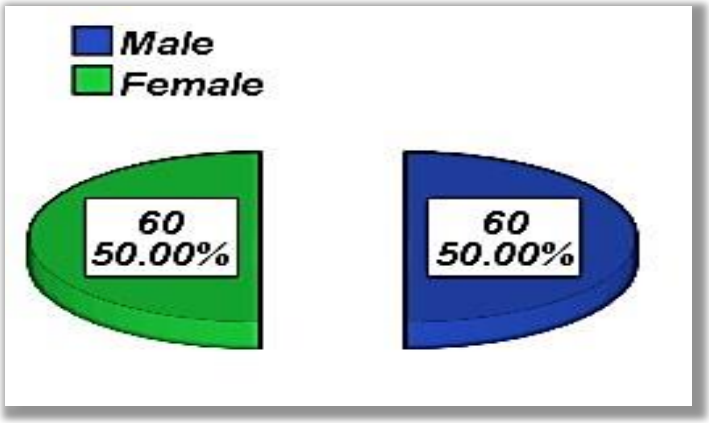

Figure 1: Frequency distribution of gender

In our study the figure 2 showed the final medical diagnosis of the patients in which the most common diagnoses were congestive heart failure, viral meningitis, sepsis leading to multiple organ failure and acute renal failure.

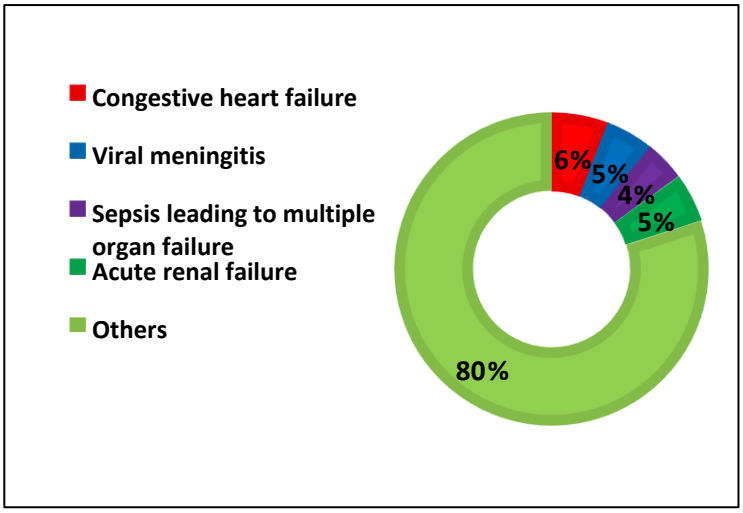

Figure 2: Frequency distribution of final medical diagnosis

In this study the hypomagnesaemia was found in 28(23.33%) patients and it was not found in 92(76.67%) patients as shown in figure 3.

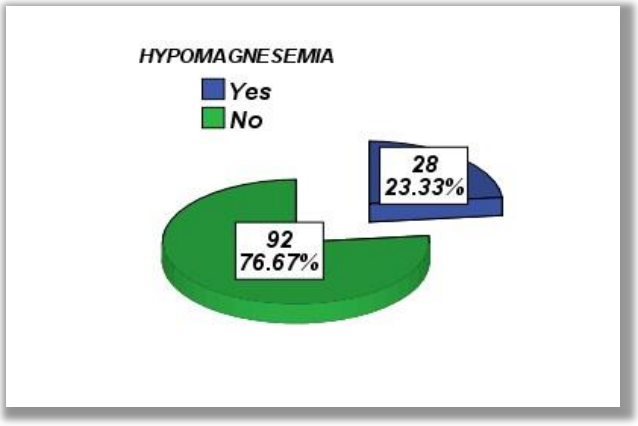

Figure 3: Frequency distribution of hypomagnesaemia

In our study ≤ 40 years patients were 42 in which hypomagnesaemia was noted in 13 cases and it was not found in 29 cases, similarly > 40 years patients were 78 in which hypomagnesaemia was noted in 15 cases and it was not found in 63 cases. Statistically insignificant difference was found between the hypomagnesaemia with age (pvalue=0.148). The study results showed that the male patients were 60 in which hypomagnesaemia was noted in 18 cases and it was not found in 42 cases, similarly female patients were 60 in which hypomagnesaemia was noted in 10 cases and it was not found in 50 cases. Statistically insignificant difference was found between the hypomagnesaemia with gender (pvalue=0.350).

Table 2: Showing the Correlation between Age, Gender and Hypomagnesaemia

Variables		Hypomagnesaemia		Total	p-value
		Yes	No		
Age (years)	≤ 40	13	29	42	0.148
	> 40	15	63	78	
	Total	28	92	120	
Gender	Male	18	42	60	0.350
	Female	10	50	60	
	Total	28	92	120	

The study results showed that the congestive heart failure was noted in 7 cases in which hypomagnesaemia was not found in all 7 cases, viral meningitis was found in 6 cases and hypomagnesaemia was found in 1 case, sepsis leading to multiple organ failure patients were 5 in numbers and hypomagnesaemia was noted in 3 cases, acute renal failure was found in 6 cases and hypomagnesaemia was not found in all 6 cases, 96 cases had other type of medical illness in which hypomagnesaemia was found in 24 cases. Statistically insignificant difference was found between the hypomagnesaemia and types of medical illness (p-value=0.091).

Table 3: Showing association of medical illnesses with Hypomagnesaemia

Variables		Hypomagnesaemia		Total	P value
		Yes	No		
Medical Illness	Congestive heart failure	0	7	7	0.091
	Viral meningitis	1	5	6	
	Sepsis leading to multiple organ failure	3	2	5	
	Acute renal failure	0	6	6	
	Others	24	72	96	
	Total	28	92	120	

4. Discussion

This present descriptive cross-sectional study was conducted at Department of Medicine Unit 2, Holy Family Hospital Rawalpindi to determine the frequency of hypomagnesaemia in critically ill medical patients. Terms hypomagnesaemia and magnesium deficiency are commonly used interchangeably. However, total body magnesium depletion can be present with normal serum magnesium concentrations and there can be significant hypomagnesaemia without total body deficit. In our study the frequency of hypomagnesaemia in critically ill medical patients was 28(23.33%). Some of the studies are discussed below are validating our findings by showing the Prevalence of hypomagnesaemia from 7% to 11% in hospital patients.[10,11,12] In patients with other electrolyte abnormalities hypomagnesaemia is more frequent, 40% in hypokalemic patients, 30% in hypophosphataemic patients, 23% in hyponatremic patients and 22–32% in hypocalcemia patients.[10,13,14] Different studies showed that the prevalence of hypomagnesaemia in critically ill patients is even higher, ranging from 20% to 65%[15,16,17], these findings are in concordance with our study finding of 23.33% prevalence of hypomagnesemia in critically ill patients. The role of hypomagnesaemia in intensive care patients is of paramount significance because it helps in not only from weaning off the patients from ventilatory support but also associated with increased mortality.[18]

The incidence of hypomagnesaemia is reported as, 10–20% in hospitalized patients, 50–60% ICU patients, and 30–80% in persons with alcoholism, and 25% in

outpatients with diabetes[2], however, the prevalence of hypomagnesaemia is towards lower side (23.33%) as compared to above mentioned study involving critically ill patients. Knowing the paramount significance of hypomagnesaemia, the monitoring of serum magnesium levels has prognostic and therapeutic value4.[4] Another prospective observational study by Soliman et al [19], measured ionized Magnesium levels on 446 patients admitted to a university hospital ICU over 3 months and showed that on admission to ICU, 18% of patients had ionized hypomagnesaemia, 14% had ionized hypermagnesemia and 68% had normal ionized Magnesium levels, but there was no association between ionized Magnesium levels on admission and length of stay or mortality. Similarly, two more recent large studies from India and China also showed association between hypomagnesaemia and outcome. A prospective observational study on 601 medical ICU patients showed that 25% of patients had hypomagnesaemia on admission. Hypomagnesaemia was associated with longer medical ICU stay (5.46 ± 5.75 days vs. 3.93 ± 3.88 days, P = 0.0002), need for mechanical ventilation (56.86% vs. 24.33% P<0.0001) and mortality (38.56% vs. 14.73% P < 0.0001), but was not associated with duration of mechanical ventilation [20]. Another prospective observational study on 374 critically ill patients showed that hypomagnesaemia was present in 102 patients (27.27%). Hypomagnesaemia was associated with longer ICU stay (15.98 ± 13.29 days vs. 12.43 ± 7.14 days, P = 0.034), higher SOFA scores (6.86 ± 3.12 vs. 5.46 ± 2.75, P = 0.004), and higher mortality (54.90% vs. 33.88%, P = 0.010).[21] A retrospective study by Safavi et al. evaluated serum Magnesium levels on admission to the ICU in 100 patients, and showed that patients who developed hypomagnesaemia during ICU stay had higher APACHE and SOFA scores on admission, higher maximum SOFA score during ICU stay, greater need for ventilator support and higher mortality, these finding are also validating our finding that is showing the significant association of hypomagnesemia in patients with high APACHE score (29.68±2.571) with increased mortality risk of greater than 50% .[22]

5. Conclusion

According to our study the frequency of hypomagnesaemia in critical ill medical patients was 28(23.33%). Our study is also showing the significant rise in incidence of hypomagnesemia with increasing number days following intensive care unit admission with mean value of 2.10 on day 1 of admission to 2.05 on day 14th of the admission. Similarly, higher APACHE score was also associated with higher prevalence of hypomagnesemia.

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