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Original Research Article

Study of Serum Magnesium in Critically Ill Patients Admitted in Tertiary Care Hospital

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Abstract

Introduction: Electrolyte disturbances, particularly involving magnesium, are frequent yet under-recognized in intensive care settings. As a vital intracellular cation and enzymatic cofactor, magnesium is essential for cardiovascular stability, neuromuscular transmission, and metabolic processes. This study aimed to evaluate serum magnesium levels at the time of ICU admission and determine their association with clinical outcomes, including mechanical ventilation requirements, length of stay, and mortality.

Materials & Methodology: This prospective observational study was conducted over two years (2023–2025) at MGM Medical College and Hospital, Aurangabad. A total of 179 critically ill adult patients (APACHE II score >10) were enrolled. Serum magnesium was measured on Day 1 and Day 5 using the colorimetric endpoint method, with levels <1.7 mg/dL defined as hypomagnesemia. Primary outcomes included the duration of mechanical ventilation, length of ICU stay, and in-hospital mortality.

Results: Hypomagnesemia was highly prevalent, affecting 77.09% of the study population. While age and gender showed no significant correlation with magnesium levels, hypomagnesemia was strongly associated with adverse clinical outcomes. Patients with low magnesium had a significantly longer mean ICU stay (5.87 ± 4.13 days vs. 4.13 ± 3.98 days; P = 0.048) and a higher requirement for mechanical ventilation (72.46% vs. 42.31%; P = 0.0025). Furthermore, mortality was significantly higher in the hypomagnesemic group (61.59%) compared to the normomagnesemic group (30.77%; P = 0.0036). Significant associations were also observed between hypomagnesemia and other electrolyte imbalances, specifically hypokalemia (P < 0.0001) and altered calcium levels (P = 0.001).

Conclusion: Hypomagnesemia is a significant predictor of poor prognosis in critically ill patients, associated with prolonged hospitalization, increased ventilatory support, and higher mortality rates. These findings suggest that serum magnesium monitoring should be a routine part of ICU admission protocols to facilitate early detection and timely intervention, potentially improving clinical outcomes in high-risk patients.

Keywords: Hypomagnesemia, Critically Ill, ICU, Mechanical Ventilation, Mortality, Electrolyte Imbalance.

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Introduction

Electrolytes are essential for maintaining cellular function, neuromuscular activity, cardiovascular stability, acid–base balance, and fluid homeostasis [1,2]. Disturbances in electrolyte balance are frequently encountered in critically ill patients and are associated with increased morbidity and mortality [3]. Among these, magnesium abnormalities are particularly important yet often under-recognized in intensive care unit (ICU) settings. Magnesium is the second most abundant intracellular cation after potassium and serves as a cofactor in numerous enzymatic and metabolic processes [4]. It plays a crucial role in membrane stability, neuromuscular transmission, myocardial excitability, vascular tone, and immune function. Despite its physiological importance, serum

magnesium constitutes only a small fraction of total body magnesium, making magnesium deficiency difficult to detect clinically. Under normal conditions, magnesium homeostasis is maintained primarily by intestinal absorption and renal excretion.

Hypomagnesemia is common in hospitalized and critically ill patients, with a substantially higher prevalence in ICU populations compared with the general population [5]. It may result from inadequate intake, gastrointestinal losses, renal wasting, use of certain medications, sepsis, diabetes mellitus, alcoholism, or acute kidney injury [6,7]. Clinically, magnesium deficiency may manifest as neuromuscular irritability, seizures, cardiac arrhythmias, QT prolongation, and associated electrolyte abnormalities such as hypokalemia and hypocalcemia [8,9,10]. Hypermagnesemia, although less common, may occur in renal dysfunction or following excessive magnesium administration and can also lead to serious cardiovascular and neuromuscular complications [11]. In critically ill patients, magnesium disturbances have been linked to adverse outcomes including increased need for mechanical ventilation, prolonged ICU stay, higher incidence of arrhythmias, and mortality [11]. However, serum magnesium is not included in commonly used prognostic scoring systems such as the Acute Physiology and Chronic Health Evaluation II (APACHE II), despite its potential clinical relevance.

Given the high burden and possible prognostic significance of magnesium imbalance in critically ill patients, the present study was undertaken to evaluate serum magnesium levels at ICU admission and their association with important clinical outcomes. Specifically, this study aims to assess the relationship between admission serum magnesium levels and the need for mechanical ventilation, duration of ventilatory support, length of ICU stay, occurrence of cardiac arrhythmias, and in-hospital mortality.

Materials & Methodology

This prospective observational study was conducted in the Intensive Care Unit (ICU) of the Department of Medicine, MGM Medical College and Hospital, Aurangabad, over a period of two years (2023–2025), after obtaining approval from the Institutional Ethics Committee.

A total of 179 critically ill adult patients admitted to the ICU were included in the study. The sample size was calculated using the formula N = Z^2 \times P(1-P)/d^2, taking P = 0.65, Z = 1.96, and d = 0.07, yielding a minimum required sample size of 179. Patients aged 18–80 years with an APACHE II score >10 were included. Patients receiving magnesium supplementation or magnesium-containing therapy, as well as pregnant and lactating women, were excluded.

Written informed consent was obtained from the patient or the legally authorized first-degree relative. Demographic and clinical details including age, sex, diagnosis, presenting features, comorbidities, laboratory findings, treatment details, duration of ICU stay, requirement and duration of mechanical ventilation, complications, and outcome were recorded in a structured case record form. Severity of illness was assessed using the APACHE II score within the first 24 hours of ICU admission.

Serum magnesium levels were measured on Day 1 and Day 5 of ICU stay by the colorimetric endpoint method using xylidyl blue reagent. Serum magnesium levels of 1.7–2.4 mg/dL were considered normal; values <1.7 mg/dL were classified as hypomagnesemia and values >2.4 mg/dL as hypermagnesemia. Approximately 2 mL of venous blood was collected, centrifuged, and analyzed spectrophotometrically at 545 nm using non-hemolyzed serum samples.

Routine investigations including complete blood count, renal and liver function tests, serum electrolytes, arterial blood gas analysis, electrocardiography, chest radiography, and ultrasonography (where indicated) were also recorded.

The primary outcomes studied were the association of serum magnesium levels with mechanical ventilation requirement, duration of ventilation, length of ICU stay, cardiac arrhythmias, and in-hospital mortality.

Statistical analysis was performed using SPSS software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequency and percentage. Associations were analyzed using appropriate statistical tests, including binary logistic regression. A p-value <0.05 was considered statistically significant.

Results

The study included critically ill ICU-admitted patients with ages ranging from 18 to 80 years. The majority of patients (26.82%) were in the 71–80 age group, followed by 41–50 years (19.55%) and 61–70 years (16.76%). The mean age of the study population was 53.03 ± 12.33 years. Among the 179 critically ill ICU-admitted patients, 66.48% were male (119 cases), while 33.52% were female (60 cases), indicating a higher proportion of male patients in the study population.

Table 1 : Distribution according to Magnesium Level

Magnesium level	Range (mg/dL)	Percentage	Mean ±SD
Normal magnesium	1.7-2.4	14.53%	2.01 ± 0.23
Hypo-magnesium	<1.7	77.09%	1.4 ± 0.22
Hyper-magnesium	>2.4	8.38%	2.73 ± 0.18
Total		100%	1.95 ± 0.37
P-value	<0.0001		

In the study group, 77.09% of critically ill ICU-admitted patients had hypomagnesemia (serum magnesium <1.7 mg/dL, mean ± SD: 1.4 ± 0.22 mg/dL), while 14.53% had normal magnesium levels (1.7–2.4 mg/dL, mean ± SD: 2.01 ± 0.23 mg/dL). Hypermagnesemia (>2.4 mg/dL) was observed in 8.38% of cases, with a mean ± SD of 2.73 ± 0.18 mg/dL.

The overall mean serum magnesium level was 1.95 ± 0.37 mg/dL, and the distribution was statistically significant (P < 0.0001).

Table 2 : Comparison of Gender among Magnesium Level

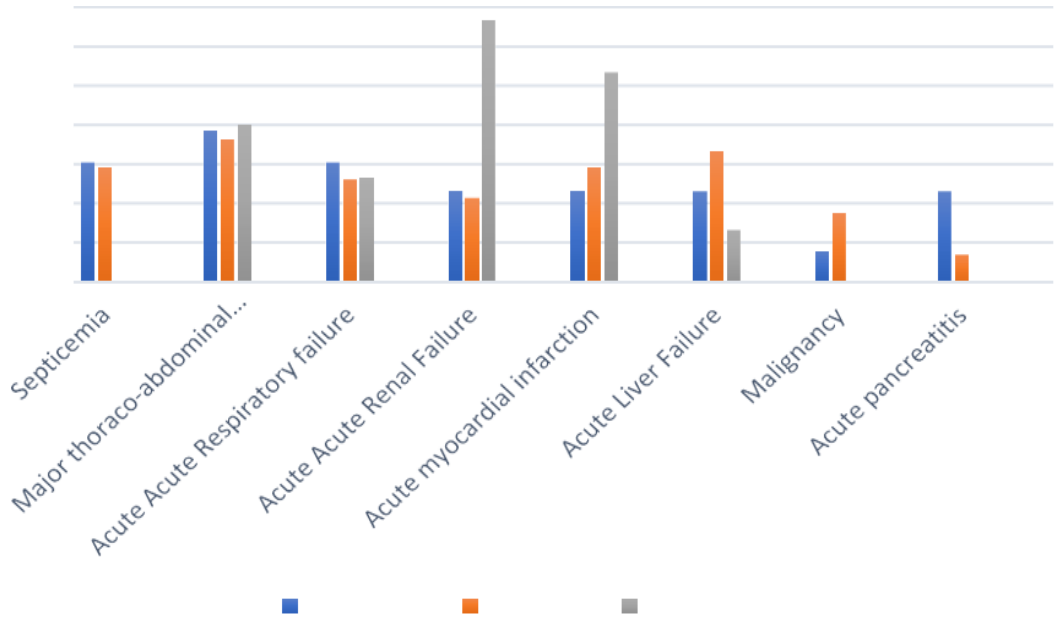
	Male	Female	P-value
Normal magnesium	14.29%	15.00%	0.89
Hypo-magnesium	77.31%	76.67%	
Hyper-magnesium	8.40%	8.33%	

The distribution of serum magnesium levels among male and female patients showed no significant difference (P = 0.89). Hypomagnesemia was the most prevalent condition in both genders, affecting 77.31% of males and 76.67% of females. Normal magnesium levels were observed in 14.29% of males and 15.00% of females, while hypermagnesemia was present in 8.40% of males and 8.33% of females.

Table 3 : Comparison of Age among Magnesium Level

Magnesium level	Age (Mean ± SD)	P-Value
Normal magnesium	53.38 ± 11.92	0.46
Hypo-magnesium	57.53 ± 17.00	
Hyper-magnesium	58.98 ± 22.23	

The comparison of age among different serum magnesium levels revealed no statistically significant difference (P = 0.46). The mean age of patients with normal magnesium levels was 53.38 ± 11.92 years, while those with hypomagnesemia had a mean age of 57.53 ± 17.00 years, and patients with hypermagnesemia had a mean age of 58.98 ± 22.23 years.



Graph 1: Distribution according to Diagnosis in the Study Group

In the study group, hypomagnesemia was predominantly observed in patients with septicemia, major thoraco-abdominal surgery, and acute myocardial infarction, comprising 14.49% to 18.12% of cases.

Acute Renal Failure patients had the highest percentage of hypermagnesemia (33.33%), followed by those with acute myocardial infarction (26.67%). Normomagnesemia was most common in patients with major thoraco-abdominal surgery (19.23%), acute Acute Respiratory failure (15.38%), and septicemia (15.38%).

Overall, hypomagnesemia was the most common magnesium imbalance, while hypermagnesemia was primarily seen in Acute Renal Failure and acute myocardial infarction cases.

Table 4: Comparison of APACHE-II Score

Magnesium level	APACHE-II (Mean ± SD)	P-value
Normal magnesium	22.58 ± 4.42	0.15 (**NS**)
Hypo-magnesium	24.14 ± 5.17	

The comparison of APACHE-II scores between patients with different magnesium levels revealed no statistically significant difference (P = 0.15). The mean APACHE-II score for normomagnesemic patients was 22.58 ± 4.42, while for hypomagnesemic patients, it was 24.14 ± 5.1

Table 5 : Distribution according to Mechanical Ventilation Need

Mechanical ventilation (MV)	Yes	No	P-value
	Percentage	Percentage	
Normal magnesium	42.31%	57.69%	0.0025
Hypo-magnesium	72.46%	27.54%	
MV (Mean ± SD) (days)	2.38 ± 3.73	3.87 ± 4.52	

In the study, the need for mechanical ventilation (MV) was compared between patients with different magnesium levels, and a statistically significant difference was found (P = 0.0025). Among patients with normal magnesium levels, 42.31% required MV, while 57.69% did not. In contrast, a higher percentage of patients with hypomagnesemia required MV, with 72.46% needing ventilation and 27.54% not. The mean duration of MV was 2.38 ± 3.73 days in the normomagnesemic group and 3.87 ± 4.52 days in the hypomagnesemic group. These results showed that hypomagnesemia was associated with an increased need for mechanical ventilation.

Table 6: Distribution of Outcome According to Level of Magnesium

Outcome	Discharged	Death	P-value
	Percentage	Percentage	
Normal magnesium	69.23%	30.77%	0.0036
Hypo magnesium	38.41%	61.59%	

Outcome based on serum magnesium levels demonstrated a statistically significant difference (P = 0.0036). Among patients with normal magnesium levels, 30.77% died, while 69.23% were discharged. In contrast, the hypomagnesemic group had a higher mortality rate, with 61.59% of patients dying and only 38.41% being discharged. The results showed that hypomagnesemia was associated with a higher mortality rate

Table 7 : Association of Serum Potassium with Serum Magnesium

Serum potassium	Normal magnesium	Hypo-magnesium	Hyper-magnesium	Total	P-Value
	1.7-2.4	<1.7	>2.4		
	N (%)	N (%)	N (%)	N (%)	
				25	<0.0001
Hypokalaemia	10	110	5		
				(69.83%)	
(<3.4mg/dL)	(38.46%)	(79.71%)	(33.33%)		
				37	
Normal (3.5-	12	18	7		0.08
				(20.67%)	
5.5mg/dL)	(46.15%)	(13.04%)	(46.67%)		
				17	
Hyperkalaemia		10	3		0.079
	4 (15.38%)			(9.50%)	
(≥5.6 mg/dL)		(7.25%)	(20.00%)		

The association between serum potassium and serum magnesium in the study revealed a statistically significant relationship between hypokalemia and hypomagnesemia. A total of 125 cases had hypokalemia (<3.4 mg/dL), with 79.71% of these cases exhibiting hypomagnesemia (serum magnesium <1.7). The P-value for this association was <0.0001, indicating a strong statistical significance. In contrast, the relationship between normal or hyperkalemia levels and serum magnesium did not show statistical significance, with P-values of 0.08 and 0.079, respectively.

Table 8 : Association of Serum Calcium with Serum Magnesium

Serum calcium	**Normal magnesium**	**Hypo magnesium**	**Hyper-magnesium**	**Total**	**P-value**
	1.7-2.4	**<1.7**	**>2.4**		
	N (%)	**N (%)**	**N (%)**	**N (%)**	
				34	
Hypocalcaemia		28	2		0.001
	4 (15.38%)			(18.99%)	
(<8.1mg/dL)		(20.29%)	(13.33%)		
Normal (8.2-10.2 mg/dL)	17	100	8	125	<0.001
				(69.83%)	
	(65.38%)	(72.46%)	(53.33%)		
Hypercalcemia		10	5	20	<0.28
	5 (19.23%)			(11.17%)	
(≥10.3mg/dL)		(7.25%)	(33.33%)		

The study assessed the association between serum calcium and serum magnesium levels in critically ill ICU patients. Hypocalcemia (<8.1 mg/dL) was observed in 18.99% of cases, with 15.38% having normal magnesium, 20.29% having hypomagnesemia, and 13.33% having hypermagnesemia. Among patients with normal calcium levels (8.2–10.2 mg/dL), 69.83% had normal magnesium, while 72.46% had hypomagnesemia and 53.33% had hypermagnesemia. Hypercalcemia (≥10.3 mg/dL) was seen in 11.17% of cases, with a higher prevalence in hypermagnesemia (33.33%). A significant correlation was noted (P = 0.001), indicating the association between calcium and magnesium levels.

Table 9 : Association of Serum Magnesium with Hypertension

			Serum magnesium		
			<1.6	**>/=1.6**	**Total**
HYPERTENSION	No	count	15	87	102
		%	25.80%	71.90%	57.10%
	Yes	count	43	34	77
		%	74.20%	28.10%	42.90%
Total		count	58	121	179
		%	100.00%	100.00%	100.00%

Among individuals with magnesium levels below 1.6, 74.2% had hypertension, whereas only 28.1% of those with levels at or above 1.6 were hypertensive. In contrast, 71.9% of individuals with normal or high magnesium levels did not have hypertension. Overall, 42.9% of the total population studied had hypertension. These findings suggest that lower serum magnesium levels may be linked to a higher risk of developing hypertension.

Table 10: Association of Serum Magnesium with Diabetes Mellitus

			Serum magnesium		
			<1.6	**>/=1.6**	total
Diabetes Mellitus	No	Count	36	91	127
		%	62.10%	75.20%	70.70%
	Yes	Count	22	30	52
		%	37.90%	24.80%	29.30%
Total		Count	58	121	179
		%	100.00%	100.00%	100.00%

Among individuals with magnesium levels below 1.6, 37.9% had diabetes, compared to only 24.8% of those with levels at or above 1.6. Conversely, 75.2% of individuals with higher magnesium levels did not have diabetes. Overall, 29.3% of the total population had diabetes. This suggests that lower serum magnesium levels may be associated with a higher prevalence of diabetes mellitus.

Table 11 : Association of Serum Magnesium with Ischemic Heart Disease

			Serum magnesium		
			<1.6	**>/=1.6**	**total**
Ischemic Heart Disease	No	count	47	96	143
		%	81.03%	79.3%	80%
	Yes	count	11	25	36
		%	18.97%	20.7%	20%
Total		count	58	121	179
		%	100.00%	100.00%	100.00%

Among individuals with magnesium levels below 1.6, 18.97% had IHD, while 20.7% of those with levels at or above 1.6 had the condition. The majority in both groups did not have IHD—81.03% in the low magnesium group and 79.3% in the normal/high group. Overall, 20% of the total population had IHD. This suggests that serum magnesium levels do not show a strong association with the presence of ischemic heart disease in this sample.

Table 12: Association of Serum Magnesium with Cerebrovascular Accident

			Serum magnesium		
			<1.6	**>/=1.6**	**total**
Cerebrovascular Accident	No	count	52	113	165
		%	89.6%	93.3%	92.1%
	Yes	count	6	8	14
		%	10.4%	6.7%	7.9%
Total		count	58	121	179
		%	100.00%	100.00%	100.00%

Among individuals with magnesium levels below 1.6, 10.4% experienced a CVA, compared to 6.7% of those with levels at or above 1.6. In both groups, the majority did not have a CVA—89.6% in the low magnesium group and 93.3% in the higher magnesium group. Overall, only 7.9% of the total population had a CVA. These findings suggest a slightly higher prevalence of cerebrovascular accidents among individuals with lower serum magnesium levels.

Table 13 : Association of Serum Magnesium with Duration of Ventilatory Stay of Critically Ill Patients

Ventilator Duration in days		**Serum magnesium**		
		<1.6	**>/=1.6**	**Total**
2-4	Count	16	6	22
	%	16%	54.5%	19.8%
5-7	Count	29	4	33
	%	29%	36.4%	29.7%
8-10	Count	44	1	45
	%	44%	9.1%	40.5%
>/= 11	Count	11	0	11
	%	11%	0%	9.9%
Total	Count	100	11	111
	%	100.0%	100.0%	100.0%

Among patients with low magnesium levels (<1.6), longer ventilator support was more common—44% required 8–10 days and 11% needed ≥11 days. In contrast, patients with normal or high magnesium levels (≥1.6) had shorter ventilator durations, with 54.5% requiring only 2–4 days and none needing ≥11 days. Overall, lower serum magnesium levels appear to be associated with longer durations of ventilator support.

Table 14 : Comparison of Qualitative Data in Patients with Hypomagnesemia and Normomagnesemia

		N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**P - value**
Age	Hypomagnesemia <1.6	138	19	80	57.53	11.92	P > 0.001
	Normomagnesemia ≥ 1.6	26	28	75	53.38	17	
Sr. Potassium	Hypomagnesemia <1.6	138	2.5	6.5	3.37	0.94	P > 0.001
	Normomagnesemia ≥ 1.6	26	2.8	6.2	4.07	1.12	
Sr. Calcium	Hypomagnesemia <1.6	138	6.5	13.3	10.10	1.44	P < 0.05
	Normomagnesemia ≥ 1.6	26	6.8	12.6	10.43	1.43	

APACHE – II Score	Hypomagnesemia <1.6	138	12.2	35	24.14	4.42	P > 0.05
	Normomagnesemia ≥ 1.6	26	13.8	33.6	22.58	5.17	
Ventilator Duration in Days	Hypomagnesemia <1.6	138	0	12	3.39	3.94	P < 0.001
	Normomagnesemia ≥ 1.6	26	0	8	1.80	2.53	
ICU Duration in Days	Hypomagnesemia <1.6	138	1	16	5.87	4.13	P > 0.001
	Normomagnesemia ≥ 1.6	26	1	12	4.13	3.98	

This table shows the comparison of qualitative data in patients with hypomagnesemia and normomagnesemia. It was observed that Mean Age, Serum Potassium, Serum Calcium, APACHE-II score, ventilator days and ICU stay differed significantly in between both groups.

Discussion

Based on serum magnesium levels, 77.09% of the study population exhibited hypomagnesemia (serum magnesium <1.7 mg/dL), with a mean ± SD of 1.4 ± 0.22 mg/dL. Normal magnesium levels (1.7–2.4 mg/dL) were observed in 14.53% of the patients, with a mean ± SD of 2.01 ± 0.23 mg/dL. Hypermagnesemia (serum magnesium >2.4 mg/dL) was noted in 8.38% of cases, with a mean ± SD of 2.73 ± 0.18 mg/dL. The overall mean serum magnesium level in the study group was 1.95 ± 0.37 mg/dL, and the distribution was found to be statistically significant (P < 0.0001). When analyzing magnesium status by gender, no statistically significant difference was noted (P = 0.89). Hypomagnesemia was the most frequently encountered abnormality in both sexes, affecting 77.31% of male and 76.67% of female patients. Normal serum magnesium levels were found in 14.29% of males and 15.00% of females, while hypermagnesemia was observed in 8.40% of males and 8.33% of females. These findings align and contrast with previously published studies. For instance, Kumar et al. reported low serum magnesium levels in 59.30% of critically ill elderly patients, underscoring the frequent occurrence of hypomagnesemia in this subgroup, although the prevalence in the current study (77.09%) was notably higher [12]. Similarly, Safavi et al. reported a mean serum magnesium level of 1.08 ± 0.02 mg/dL, which is lower than the mean observed in the present study (1.95 ± 0.37 mg/dL), potentially reflecting differences in patient demographics or illness severity [13]. In contrast, Subhraprakash Pramanik et al. found the mean serum magnesium level in critically ill patients to be 1.98 ± 0.06 mg/dL, which is comparable to the mean magnesium level recorded in the current study [14].

Hypermagnesemia, though less prevalent overall, was markedly higher among patients with Acute Renal Failure (33.33%), followed by those diagnosed with acute myocardial infarction (26.67%), suggesting a possible association with impaired renal excretion and cardiovascular dysfunction. Normomagnesemia was most commonly seen in patients who had undergone major thoraco-abdominal surgeries (19.23%), and also among individuals with Acute Respiratory failure and septicemia (15.38% each). Overall, hypomagnesemia remained the predominant form of magnesium imbalance in the critically ill, while hypermagnesemia was largely confined to renal and cardiac pathologies. These findings are consistent with the observations reported by Zafar et al., [15] who examined 70 critically ill patients and demonstrated a comparable pattern in the distribution of serum magnesium levels across various clinical conditions. In their analysis, normomagnesemia was most frequently observed in cases of septicemia, major thoraco-abdominal surgery, Acute Respiratory failure, Acute Renal Failure, and acute myocardial infarction. Hypomagnesemia was also recorded in several critical conditions, including septicemia, Acute Respiratory failure, and fulminant hepatic failure, whereas hypermagnesemia remained uncommon but notable in cases such as Acute Renal Failure, malignancy, and acute pancreatitis. The diagnostic associations noted in Zafar et al.'s study resonate with the present investigation, particularly the strong correlation between Acute Renal Failure and hypermagnesemia, as well as the frequent occurrence of hypomagnesemia among patients with infectious and postsurgical complications [15]

In the present study, a notable association was observed between the duration of ICU Stay in Normomagnesemic group & Hypomagnesemic group. Patients with hypomagnesemia had a prolonged mean ICU stay of 5.87 ± 4.13 days, compared to 4.13 ± 3.98 days in those with normal magnesium levels (P = 0.048), suggesting that low serum magnesium levels may contribute to extended critical care requirements. These findings align closely with the results of Kumari VR et al.,[16] who similarly reported longer ICU stays in patients with hypomagnesemia .The extended duration of ICU admission in patients with low magnesium levels was further corroborated by studies conducted by Maria Paz Escuela et al., [17] Soliman et al., [18] all of whom emphasized the significant role magnesium plays in essential physiological processes, including DNA and RNA synthesis, protein synthesis, and the transport of calcium and potassium ions across cellular membranes.

In the present study, no statistically significant difference was observed in APACHE-II scores

between patients with varying serum magnesium levels (P = 0.15). The mean APACHE-II score for normomagnesemic patients was 22.58 ± 4.42, while for those with hypomagnesemia, it was slightly higher at 24.14 ± 5.17, though not reaching statistical significance. However, when evaluating the need for mechanical ventilation (MV), a statistically significant difference was evident (P = 0.0025). Among patients with normal magnesium levels, 42.31% required ventilatory support, while 57.69% did not. hese findings are consistent with those reported in earlier studies. Roopa et al. [19] documented a lower mean APACHE-II score of 14, whereas Siddique S. Khan et al., [20] in their study conducted in the, reported a mean APACHE-II score of 20.84. Interestingly, Khan et al. [20] also noted that ICU stay decreased by 0.22 days for each unit increase in serum magnesium, implying a protective role of magnesium against prolonged critical illness. Moreover, their study revealed that among 206 ICU patients, 51 required ventilator support, with 32 of those cases occurring in patients with hypomagnesemia. They observed a 30% reduction in the need for mechanical ventilation for every 0.1 mEq/L increase in serum magnesium concentration, reinforcing the inverse relationship between magnesium levels and ventilator dependency.

Of these, 15.38% had normal serum magnesium levels, 20.29% had hypomagnesemia, and 13.33% had hypermagnesemia. Among patients with normal calcium levels (8.2–10.2 mg/dL), the majority across all magnesium categories fell within this range—69.83% of normomagnesemic patients, 72.46% of hypomagnesemic patients, and 53.33% of hypermagnesemic patients exhibited normal calcium. Hypercalcemia (≥10.3 mg/dL) was noted in 11.17% of cases and was most frequently associated with hypermagnesemia, accounting for 33.33% in that group. A statistically significant correlation was found between serum calcium and magnesium levels (P = 0.001), suggesting a strong interdependence between these two electrolytes in critically ill individuals. These findings are consistent with earlier research. Whang et al. (1985) [21] reported electrolyte disturbances in hospitalized patients and found hypomagnesemia to be present in 22% of those with hypocalcemia, highlighting the co-existence of magnesium and calcium imbalances. Although the present study focused more specifically on calcium-magnesium correlation rather than broader electrolyte interactions, the association reported aligns with Whang's observations that hypomagnesemia often accompanies other electrolyte deficiencies. Additionally, while studies by Mayee et al. [22] explored hypokalemia and its predominant gastrointestinal causes, their data further reinforce the theme of multifactorial and interconnected electrolyte disturbances in critically ill populations.

Among these, 15.38% had normal magnesium levels, 20.29% had hypomagnesemia, and 13.33% had hypermagnesemia. In patients with normal calcium levels (8.2–10.2 mg/dL), the majority were found across all magnesium categories—69.83% of normomagnesemic, 72.46% of hypomagnesemic, and 53.33% of hypermagnesemic individuals exhibited normocalcemia. Hypercalcemia (≥10.3 mg/dL) was observed in 11.17% of patients and was more prevalent among those with hypermagnesemia (33.33%).

A statistically significant correlation was established between serum calcium and magnesium levels (P = 0.001), underscoring a strong interrelationship between these two electrolytes in the critical care setting. hese findings align with and further substantiate the results of previous studies. In the investigation by Stephanos J. et al.,[23] hypocalcemia emerged as the most frequently encountered electrolyte abnormality in patients with hypomagnesemia, with 25% of patients in both the normomagnesemic and hypermagnesemic groups also displaying hypocalcemia. Similarly, the study conducted by Saleem et al. [24] reported that 56% of individuals with hypomagnesemia concurrently suffered from hypocalcemia.

Conclusion:

Hypomagnesemia is highly prevalent among critically ill ICU patients and is significantly associated with prolonged ICU stay, increased requirement and duration of mechanical ventilation, higher mortality, hypokalemia, and altered serum calcium levels. Although no significant association was observed with gender or APACHE-II score, low serum magnesium was strongly associated with adverse clinical outcomes. These findings suggest that serum magnesium estimation should be included as a routine investigation in critically ill patients, as early detection and timely correction of hypomagnesemia may help improve prognosis and reduce ICU-related morbidity and mortality.

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