



## CORRELATION OF SERUM MAGNESIUM LEVELS WITH SEPSIS IN CRITICALLY ILL PATIENTS ADMITTED TO MEDICAL ICU

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**ABSTRACT** Hypomagnesemia is so common in critically ill patients, is frequently under diagnosed in clinical practice. It is a critical ion essential for life, serving as a cofactor for more than 300 enzymatic reactions, with involvement in the formation of ATP. It has been estimated that 20 to 65% patients with critical illnesses admitted to medical Intensive Care units (ICU) develop hypomagnesemia, thus emphasizing importance of its detection and correlation with sepsis. This was a prospective observational study. A total of 50 critically ill patients who were admitted to the Intensive Care units (ICU) under the department of general medicine Hamidia hospital Bhopal and who fulfilled inclusion and exclusion criteria were studied. Serum magnesium levels along with other investigations were done within first 24 hours of admission. It was found in the study that 30 out of 50 such patients (i.e. 60%) had hypomagnesemia, 15 out of 50 patients (i.e. 30%) had normomagnesemia and 5 out of 50 patients (i.e. 10%) had hypermagnesemia. The patients with hypomagnesemia compared with normomagnesemia, had a higher sepsis rate (43.33% vs 33.33%). Thus, Hypomagnesemia was seen to be associated with a higher sepsis rate in critically ill patients admitted in medical ICU, compared to patients with normal magnesium levels.

**KEYWORDS** : ICU, hypomagnesemia, ATP, mortality.

### INTRODUCTION:

Magnesium is the fourth most abundant cation in human body and the second most intracellular cation after potassium. Hypomagnesemia, can result in disturbances in nearly every organ system and can cause potentially fatal complications (eg- ventricular arrhythmia, coronary artery vasospasm, sudden death). Despite the well-recognized importance of magnesium, low and high levels have been documented in ill patients<sup>1</sup>, as a result of which, magnesium has occasionally been called the "forgotten cation"<sup>2,3</sup>. Magnesium deficiency induces a systemic stress response through activation of Neuroendocrine pathway, has been implicated in pathophysiology of many diseases. The total body magnesium content of an average adult is 25 g, or 1000 mmol. Approximately 60% of the body's magnesium is present in bone, 20% is in muscle, and another 20% is in soft tissue and the liver. Normal plasma magnesium concentration is 1.7-2.4 mg/dL (0.7-0.9 mmol, or 1.4-1.8 mEq/L)<sup>4</sup>. In various studies, Hypomagnesemia has been linked to poor outcome in several different patient populations, a study of 21,534 patients on maintenance dialysis, it was found that patients with the lowest serum magnesium levels (<1.30 mEq/L) were at highest risk for death<sup>5</sup>. Hypomagnesemia is a common development in critically ill sepsis patients, and indicates a poor prognosis. Range of WBC Count is 4000 to 11000, counts below 4000 and above 11000 are noticed as sepsis patients. Although evidence is derived largely from observational studies, it shows a significant association between hypomagnesemia with increased need for mechanical ventilation, prolonged intensive care unit stays, and increased mortality<sup>6</sup>. In a Mayo Clinic review of 65,974 hospitalized adult patients, hypomagnesemia on admission was associated with increased in-hospital mortality. Death rates were found to be 2.2% in patients with magnesium levels of 1.5-1.69 mg/dl and 2.4% in those with levels below 1.5 mg/dl; by comparison, mortality in patients with levels of 1.7-1.89 mg/dl were 1.8%<sup>7</sup>. Another study by Rubeiz GJ et al<sup>8</sup> found that in a total of 381 consecutive acutely ill medical patients, the normomagnesemic and hypomagnesemic groups had comparable APACHE II scores but mortality rates were twice in hypomagnesemic than the normomagnesemic patients. A retrospective study conducted on 100 critically ill patients found that development of hypomagnesemia in ICU was associated with a guarded SOFA score,

more need for ventilator (58.6% vs. 41.4%) and longer duration of mechanical ventilation (7.2 vs. 4.7 days)<sup>9</sup>. A recent study evaluating hospitalized AIDS patients found that hypomagnesemia is a risk factor for nonrecovery of renal function and for in-hospital mortality. The risks for nonrecovery of renal function and for death were 6.94 and 6.92 times greater, respectively, for patients with hypomagnesemia<sup>10</sup>. In an observational study Indian conducted by Limaye et al<sup>11</sup> on hypomagnesemia in critically ill medical patients, it was found that on admission to MICU, 52% had hypomagnesemia. Patients with hypomagnesemia had higher mortality rates (57.7% vs. 31.7%), more frequent need for ventilatory support (73% vs. 53%), longer duration of mechanical ventilation (4.27 vs. 2.15 days), more frequently had sepsis (38% vs. 19%), hypocalcemia (69% vs. 50%) and hypoalbuminemia (80.76% vs. 70.8%). Patients with diabetes mellitus had hypomagnesemia more frequently (27% vs. 14%), although many studies have been done previously showing varied prevalence and increased association with mortality and morbidity in patients with hypomagnesemia, there is a definite lack of studies in central India, thus this particular study was done to correlate serum magnesium levels with sepsis in critically ill patients admitted to medical ICU.

### MATERIALS AND METHODS

A prospective observational study was conducted in the medical ICU of a tertiary care hospital after approval from medical ethical committee. Fifty patients were selected for study whom requiring intensive care for more than at least two days with age more than twelve years with detailed informed consent. Patient receiving magnesium supplementation prior to admission to ICU were excluded. A blood sample was collected for estimation of serum total magnesium level on the day of admission in ICU. A detailed history and relevant investigation including WBC counts were done in every patient. Patient were classified into two groups according to their initial total serum magnesium level: hypomagnesemia and normomagnesemia.

### OBSERVATION AND RESULTS

The present study was conducted in the department of medicine Hamidia hospital Bhopal from 1 March 2018 to 30 August 2018. Total no. of cases in this study is- 50

**Table No. 1 AGE WISE DISTRIBUTION OF PATIENTS**

S. No.	Age	No. of cases	Normomagnesemia	Hypomagnesaemia	Hypermagnesaemia
1	10-20	2	1	1	0
2	21-30	2	1	1	1
3	31-40	6	0	5	3
4	41-50	8	6	3	0
5	51-60	15	6	10	0
6	61-70	11	2	8	1
7	71-80	2	1	2	0
		Total	15	30	5

Table no 1 shows proportion of hypomagnesemia(60%), hypermagnesemia(10%), normomagnesemia (30%).

**TABLE -2 This Table Showing Low Serum Magnesium Level With Sepsis In Case Of Critically Ill Patients.**

s.no	Case No.	Hypomagnesaemia	Sepsis
1	6	0.8	8500
2	7	0.9	5000
3	9	1.4	26510
4	10	1	14000
5	12	1.2	5600
6	15	1.1	3000
7	16	1.2	4200
8	18	1.1	10800
9	19	1	10000
10	20	1.08	6900
11	21	1.03	6000
12	22	1.08	4700
13	23	1.6	3400
14	24	0.9	16000
15	25	0.8	3600
16	26	1.2	13000
17	27	1.6	13400
18	29	0.7	4800
19	31	0.9	3400
20	32	0.9	11700
21	33	0.4	10100
22	34	1.1	5680
23	35	1	12100
24	36	0.9	5200
25	37	1.3	19600
26	38	1.08	6800
27	40	1.6	5200
28	41	0.3	12200
29	48	0.8	8200
30	50	1.3	13500
	Mean	1.04233	13patients. 43.3%

Normal wbc count is 4000 to 11000. below 4000 and above 11000 include as sepsis.

**Table No. 3 this Table Showing Normal Serum Magnesium Level With Sepsis In Case Of Critically Ill Patients.**

s.no	Case No.	Normomagnesemia	Sepsis
1	2	1.8	5000
2	3	1.8	4000
3	5	1.9	8000
4	8	1.7	13500
5	11	1.8	6400
6	13	1.8	3800
7	14	1.8	4000
8	28	1.8	6600
9	30	1.8	7000
10	39	1.9	7800
11	42	1.9	4200
12	44	1.8	3900
13	45	1.9	3900
14	47	1.8	5100
15	49	1.9	3900
	Mean	1.82667	33.3%

Above Table shows 5 out of 15 as sepsis. Above two consecutive tables indicate sepsis more prevalent in hypomagnesemic patients.

#### CONCLUSION:

This study shows strong correlation of serum magnesium level with sepsis in critically ill patients admitted to medical ICU. It was concluded that low magnesium level was associated with higher sepsis rate (43.3%) as compared to normal magnesium levels (33.3%). This study shows low serum magnesium level more frequently found in

critically ill sepsis patients. This study emphasizing the importance of estimating of serum magnesium level in ICU patients and provide a potential measure to reduce sepsis rate by correction of low serum magnesium which would require more studies in future.

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