

## Significance of the Estimation of Serum Magnesium Level in Critically Ill Patients

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### Abstract

*Background and Aim:* Magnesium monitoring among critically ill patients have prognostic and therapeutic implications as they are predisposed to symptomatic and asymptomatic magnesium deficiency which may lead to the development of neurotoxicity, psychiatric problems and leading to increased morbidity and mortality. Hence the aim of the present study was to study the serum magnesium levels in critically ill patients. *Materials & Method:* Total of 120 cases was included in the study. They were divided into two groups: cases were 60 and controls were 60. The serum magnesium of the included patients was estimated with Colorimetry method. *Results:* Among the 60 cases, it was found that 45 patients were males and the remaining 15 were females. Among the 60 controls, 45 patients were males and 15 were females. Among the cases, 18 patients had diabetes mellitus whereas 12 patients out of 60 controls had association of diabetes mellitus. In our present study, the mortality rate was higher in cases i.e 30% as compared to 2% in controls. *Conclusion:* Hypomagnesemia is common in hospitalized patients, especially the critically ill. It has a higher morbidity and mortality among these patients. The assessment of serum magnesium concentration is inexpensive and easy to employ and provides important information about magnesium status in patients. Hypomagnesemia, when detected, may require correction for the management of those with critical illness for better outcomes.

**Keywords:** Hypomagnesium; ICU; Ill patients; Mortality rate.

### Introduction

Magnesium is the fourth abundant cation in the human body and second most abundant intracellular cation after potassium and also serving as cofactor in more than 300 enzymatic reactions [1]. Magnesium maintains neuromuscular excitability and it's important in maintenance of cardiac function. Magnesium deficiency is the most commonly overlooked condition in critically ill patients and associated with other coexisting electrolyte abnormalities commonly confused with hypokalemia. Various studies have reported the incidence of hypomagnesemia as 65% in critically ill patients [2,3].

Hypomagnesemia, though so common in critically ill, is frequently overlooked. Hypomagnesemia is easily mistaken for potassium

deficit, a condition with which it is often associated. Magnesium depletion is described as the most under diagnosed abnormality in clinical practice [4]. Many factors contribute to hypomagnesemia and magnesium deficiency in critically ill patients; like impaired GI absorption, nasogastric suction, poor content of magnesium in feeding formulae or TPN solutions, administration of drugs like diuretics, aminoglycosides, Hypomagnesemia in critically ill patients has many potential ramifications [5].

Magnesium deficiency has a dubious credit of being the most unrecognized electrolyte disorder in routine clinical practice. Though the importance of magnesium has been observed in ill patients, magnesium has been dubbed as the "forgotten cation" [6].

The incidence of hypomagnesemia is reported as 2% in general population, 10-20% in hospitalized



patients, 50-60% in ICU patients, and 25% among out patients with diabetes and alcoholism [7]. Hypomagnesemia can induce fatal complications which include coronary artery spasm, ventricular arrhythmias and sudden cardiac death. Magnesium monitoring among critically ill patients have prognostic and therapeutic implications as they are predisposed to symptomatic and asymptomatic magnesium deficiency which may lead to the development of neurotoxicity, psychiatric problems and leading to increased morbidity and mortality [8]. Hence, the aim of the present study was to study the serum magnesium levels in critically ill patients.

### Materials & Methods

The present study was an observational case control study. All the patients who were critically ill admitted to the medical institute were included in the study. All the patients were informed about the purpose and methodology of the study and written informed consent was obtained before their inclusion. Also the institute ethical committee was informed about the study and the ethical clearance certificate was obtained from them.

Inclusion criteria were as follows: patients having severe infections, including sepsis, patient having respiratory failure, cardiac failure and renal failure. Patient having cerebrovascular accidents, having any poisonings. Patient who already had received magnesium prior to the admission to the ICU were included in the present study.

Total of 120 cases were included in the study. They were divided into two groups: cases were 60 and controls were 60. In our study, we have compared morbidity and mortality among ICU patients with hypomagnesemia (who are referred as cases) to that of patients with normal magnesium. (who are referred as controls). The serum magnesium of the included patients was estimated with Colorimetry method. Magnesium combines with calmagite in alkaline medium to form a red coloured complex. Specific chelating agents were added to eliminate the interference of calcium and protein. Intensity of colour formed is directly proportional to the amount of magnesium present in the sample.

### Results

In our prospective observational case control study, we analyzed 60 cases and 60 controls. In our study, we found that the maximum number

of cases and controls were from the 61-70 group. The minimum age in the case group was 22 yrs and the maximum age was 87 yrs, with the mean being 53 yrs, minimum age in the control group was 18 yrs and the maximum age was 80 yrs with the mean being 54 yrs (Table 1).

**Table 1:** Age distribution among the study participants

Age in years	Cases	Controls
< 20	2	3
21 - 30	5	5
31 - 40	10	12
41 - 50	8	9
51 - 60	8	8
61 - 70	15	15
>70	12	8
Total	60	60

Among the 60 cases, it was found that 45 patients were males and the remaining 15 were females. i.e 70% of the cases were males and 30% were females. Among the 60 controls, 45 patients were males and 15 were females, i.e 70% were males and 30% females. There was no difference between the sex distributions between the groups (Table 2).

**Table 2:** Sex distribution among the study participants

	Male	Female
Case	45	15
Control	45	15
Total	90	30

**Table 3:** Distribution of cases and controls

	Cases	Control
Poisoning	14	14
Sepsis	15	15
DKA	5	5
CVA	7	7
Organ Failure	19	19

Among the cases, 18 patients had diabetes mellitus whereas 12 patients out of 60 controls had association of diabetes mellitus (Table 3).

**Table 4:** Association of Diabetes Mellitus

Cases	Controls
18	12

In our present study, the mortality rate was higher in cases i.e 30% as compared to 2% in controls (Table 4).

**Table 5:** Comparison of mortality between the groups

	No.	%
Case	18	30
Control	6	1

## Discussion

In our study, we have compared morbidity and mortality among ICU patients with hypomagnesemia, to that of patients with normal magnesium. We have taken a total of 120 patients, in which 60 were cases and 60 were controls. Various studies have been done in the past, which assessed the prevalence of hypomagnesemia in critically ill patients [9]. The range of hypomagnesemia varies between 14% to 70%. Most of the studies have measured the total serum magnesium, some have measured RBC magnesium. However, in few studies ionized magnesium were measured. In those studies, it has been found that the prevalence of hypomagnesemia was very low.

Soliman et al. had noted hypomagnesemia in one-third of patients with chronic liver disease and alcoholism. In a study by Limaye et al. [2] hypomagnesemia was observed in one-half of alcoholic patients. In the present study, hypomagnesemia was seen in 24% of patients with alcohol intake in both case and control group. Chronic alcoholism is one of the predisposing factors for magnesium deficiency [10]. Magnesium depletion in alcoholic individuals is due to a number of factors including poor nutrition, alcohol-induced renal tubular dysfunction leading to renal magnesium wasting, pancreatitis, and intracellular shift in alcohol withdrawal syndrome [11].

In a study conducted by Limaye et al, it was found that, hypomagnesemia was more common among the diabetic patients, 27% vs 17%, and it was statistically significant. In the present study hypomagnesemia was more common in diabetic patients (26% vs. 16%), but it was not statistically significant. Various studies have shown a varying relationship between hypomagnesemia and mortality/morbidity rates. On average, a higher mortality rate was detected in hypomagnesemia patients irrespective of their age when compared with normomagnesemic patients, as reported by Kumar et al. [12] (38.56% vs. 14.73%), Limaye et al. [13].

Hypomagnesemia has been known to be associated with Diabetes Mellitus (DM). Though multifactorial in etiology, it is mainly due to increased renal losses of magnesium that accompany glycosuria.

## Conclusion

Hypomagnesemia is common in hospitalized patients, especially the critically ill. It has a higher

morbidity and mortality among these patients. The assessment of serum magnesium concentration is inexpensive and easy to employ and provides important information about magnesium status in patients. Hypomagnesemia, when detected, may require correction for the management of those with critical illness for better outcomes.

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## References

1. Elin RJ. Magnesium: the fifth but forgotten electrolyte. *American journal of clinical pathology* 1994;102:616-22.
2. Touyz RM. Magnesium in clinical medicine. *Front Biosci.* 2004;9:1278-93.
3. Toto KH, Yucha CB. Magnesium: Homeostasis, imbalances, and therapeutic uses. *Critical Care Nursing Clinics.* 1994;6:767-83.
4. Limaye C, Londhey V, Nadkart M, Borges N. Hypomagnesemia in critically ill medical patients. *J Assoc Physicians India.* 2011;59:19-22.
5. Demircan F, Altun Y, Kilinc F. Hypomagnesemia In Internal Care Unit. *IJBCS.* 2013;1:180-9.
6. Kiran H, Sriramachandrudu A, Murthy KS, Gowdappa HB. Serum Magnesium Levels in Critically Ill Patients: A Prospective Study. *Int J Sci Study.* 2015;3:241-4.
7. Kumar S, Honmode A, Jain S, Bhagat V. Does magnesium matter in patients of Medical Intensive Care Unit: A study in rural Central India. *Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine.* 2015;19:379.
8. Swaminathan R. Magnesium metabolism and its disorders. *The Clinical Biochemist Reviews.* 2003;24:47.
9. Escuela MP, Guerra M, Añón JM, Martínez-Vizcaíno V, Zapatero MD, García-Jalón A, Celaya S. Total and ionized serum magnesium in critically ill patients. *Intensive care medicine.* 2005;31:151-6.
10. Dhiviya M. Hypomagnesemia in critically ill medical Patients. 2014.
11. Barclay G, Barbour J, Stewart S, Day C, Gilvarry E: Adverse physical effects of alcohol misuse. *Advances in psychiatric treatment.* 2008;14:139-51.
12. S. Kumar, A. Honmode, S. Jain, V. Bhagat Does magnesium matter in patients of medical intensive care unit: a study in rural central India *Indian J Crit Care Med.* 2015;19:379-83.
13. CS Limaye, VA Londhey, MY Nadkart, NE Borges Hypomagnesemia in critically ill medical patients *J Assoc Physicians India.* 2011;59:19-22.