STUDY OF PREVALENCE OF HYPOMAGNESEMIA AND CLINICAL OUTCOME IN CRITICALLYILL-PATIENTS IN TERTIARY CARE CENTER IN ANDHRA PRADESH

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ABSTRACT

BACKGROUND

Magnesium is the second most prevalent intracellular cation. Hypomagnesemia is common, occurring in approximately 12% of hospitalized patients. Among ICU patients, prevalence of hypomagnesemia ranges from 11% to 65%.

MATERIALS AND METHODS

A prospective study was conducted at tertiary care teaching hospital (Rangaraya Medical College) of Andhra Pradesh from January 2018 to December 2018. 100 patients admitted in intensive care units were selected for the study. After obtaining a written informed consent and ethical clearance patients were subjected to clinical examination and investigated for serum magnesium, serum calcium, serum potassium, serum sodium, blood urea nitrogen, serum creatinine.

RESULTS

The data was analysed, and results were tabulated. Patients were divided into two groups based on the magnesium levels less than 1.8mg/dl hypomagnesemics, n = 50 and more than 1.8 normomagnesemics, n=50. Results were compared between two groups. The following results were observed.

In this study 48% of patients aged more than 60 years with serum magnesium levels less than 1.8mg/dl, 52% was age less than 60 years. 26% of patients with magnesium levels of more than 1.8mg/dl aged more than 60 years and 74% less than 60 years. In the present study among the patients with magnesium levels less than 1.8mg/dl, 62% of patients are males and 38% are females and male to female ratio 1.63:1 while in those with magnesium levels of more than 1.8mg/dl, 74% were males and 26% females with male to female ratio 2.84:1. However this difference was statistically not significiant (P=0.198) (table 1, 2). 16% of the patients had APACHE ll SCORE more than 30 with magnesium levels less than 1.8mg/dl and remaining 84% APACHE ll SCORE was less than 30. 2% of patients with magnesium levels more than 1.8mg/dl APACHE ll SCORE was more than 30 and remaining 98% less than 30(P=0.037).

CONCLUSION

Hypomagnesemia is a common electrolyte imbalance in the critically ill patients and is associated with higher mortality rate, more frequent and more prolonged ventilator support. So early diagnosis and treatment of hypomagnesemia is necessary.

KEYWORDS

Hypomagnesemia, Critical Care, Hypokalaemia, Hypocalcaemia, Apache 2 Score, Mortality.

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BACKGROUND

Magnesium is the second most prevalent intracellular cation. It is a critical cofactor in any reaction powered by ATP, so deficiency of this ion can have dramatic effects on metabolism. Magnesium also acts as a calcium channel antagonist and plays a role in the modulation of in any activity governed by a intracellular calcium. Hypomagnesemia is common, occurring in approximately 12% of hospitalized patients. Among ICU patients, prevalence of hypomagnesemia ranges from 11% to 65%.

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The present study was conducted with an aim to determine the impact of serum magnesium levels with regard to patient outcome considering mortality, need and duration of ventilator support, length of stay in ICU and APACHE ll SCORE.

MATERIALS AND METHODS

A prospective study was conducted at tertiary care teaching hospital (Rangaraya Medical College) of Andhra Pradesh from January 2018 to December 2018. 100 patients admitted in intensive care units were selected for the study. All patients with APACHE ll SCORE of more than 20 or less than 6, patients aged more than 18 were included in the study. All the patients who are received magnesium prior to admission, chronic alcoholism, those who receiving diuretics, aminoglycosides, cisplatin, amphotericin excluded.

Sampling Procedure

A study has reported mortality rate in hypomagnesemia as 54% and in normomagnesemics as 30% (considering mortality as important outcome). Based on these findings mortality rates hypomagnesemics was nearly twice the normomagnesemics. Hence the sample size was calculated by applying these values in following formula.

$n=2(Za+Zb)\ 2xpxq/(P0-P1)^2$

n= sample size, p= mean of mortality rate in both hypomagnesemics and normomagnesemics group (42), P0= mortality rate in hypomagnesemics (54), P1= mortality rate in normomagnesemics (30) q=100-42=58, za & zb = constants, a= 0.5, b-0.2 or power=80%, za=1.65, zb = 0.84. Based on these values, the sample size was calculated as 100 patients that is, 50 in each group.

After obtaining a written informed consent and ethical clearance patients were subjected to clinical examination and investigated for serum magnesium, serum calcium, serum potassium, serum sodium, blood urea nitrogen, serum creatinine.

Statistical Analysis

The data obtained was coded and entered into MicrosoftExcel worksheet. The categorical data was expressed as rates, ratios and proportions and comparison was done using chi-square test. The continuous data was expressed as mean ± standard deviation (SD) and comparison was done by student 't' test. A probability value ('p' value) of less than or equal to 0.05 was considered statistically significant.

RESULTS

The data was analysed, and results were tabulated. Patients were divided into two groups based on the magnesium levels less than 1.8mg/dl hypomagnesemics, n = 50 and more than 1.8 normomagnesemics, n=50. Results were compared between two groups. The following results were observed.

In this study 48% of patients aged more than 60 years with serum magnesium levels less than 1.8mg/dl, 52% was age less than 60 years. 26% of patients with magnesium levels of more than 1.8mg/dl aged more than 60 years and 74% less than 60 years. In the present study among the patients with magnesium levels less than 1.8mg/dl, 62% of patients are males and 38% are females and male to female ratio 1.63:1 while in those with magnesium levels of more than 1.8mg/dl, 74% were males and 26% females with male to female ratio 2.84:1. However this difference was statistically not significiant (P=0.198) (table 1, 2). 16% of the patients had APACHE ll SCORE more than 30 with magnesium levels less than 1.8mg/dl and remaining 84% APACHE ll SCORE was less than 30 . 2% of patients with magnesium levels more than 1.8mg/dl APACHE ll SCORE was more than 30 and remaining 98% less than 30(P=0.037).

Author	Mean age
Safavi M et al[3]	60.27±0.82
Mousavi SAJ et al[6]	66.57±1.78
Kumar S et al[7]	47.08±17.18
Present study	56.12±17.64

Table 1.Comparison of Age Incidence Among Hypomagnesemics in Various Studies

Author	Male to Female ratio
SafaviM et al[3]	2:1
Soliman HM et al[2]	1:1
Kumar S et al[7]	1.6:1
Mousavi SAJ et al[6]	1:1
Present Study	1.63:1

Table 2. Comparison of Sex Ratio among Hypomagnesemics in Various Studies

In the present study the prevalence of hypomagnesemia was 50% in critically ill patients. Similar observation was seen in previous studies.[1,2,3,4,5] (Table 3). Among the patients with hypomagnesemia 62% were males and 38% were females and male to female ratio is 1.63:1. Out of 100 patients 48% were aged more than 60 years, 26% and 30% of patients were aged between 31 to 45 and 45 to 60 years respectively. 44% of patients were reported with diabetes and 48% hypertension. It was due to glycosuria, increased renal loss of magnesium.[4,8] There was a strong relationship between hypomagnesemia and insulin resistance.[9] (Table 4)

Study	No. of Patients	Low Magnesium	High Magnesium
Guerin et al[1]	179	44%	6%
Soliman et al[2]	422	18%	14%
Safavi et al[3]	100	51%	---
Limaye et al[4]	100	52%	7%
Kiran et al[5]	150	30%	7.33%
Present Study	100	50%	---

Table 3.Comparison of Prevalence of Hypomagnesemia in Critically Ill Patients in Various Studies

Author	Hypomagnesemics	Normomagnesemics	Significance
SafaviM et al[3]	84.6%	15.4%	Yes: p<0.05
Limaye et al[4]	27%	14%	Yes: p<0.05
Bharat et al[10]	33.8%	15.7%	Yes: p<0.05
Kiran et al[5]	49%	21%	Yes: p<0.05
Present Study	42.22%	24.44%	Yes: p=0.034

Table 4. Comparison of Past History of Diabetes Mellitus Among Hypomagnesemics and Normomagnesemics in Various Studies

DISCUSSION

Hypomagnesemia patients have more severe organ dysfunction and higher APACHE ll SCORE. In the present study APACHE ll SCORE was more than 30. This may be explained by a strong association of hypomagnesemia with sepsis and septic shock, a common cause of death in ICU patients.[3] (Table 5). In the present study more than 48% of patients were diagnosed with septicaemia. Safavi M et al,[3] Soliman HM et al[2] also showed increased incidence of sepsis in patients with hypomagnesemia (table 6).

Author	Hypomagnesemics	Normomagnesemics	Significance
SafaviM et al[3]	14.16	10.08	Yes: p<0.05
Kumar S et al[7]	21.20	19.60	No: p=0.67
Limaye et al[4]	14.52	15.75	No: p>0.05
Present Study	26.36	24.73	Yes: p=0.049

Table 5. Comparison of Mean Apache II Score Among Hypomagnesemics and Normomagnesemics in Various Studies

Author	Hypomagnesemics	Normomagnesemics	Significance
Limaye et al[4]	38%	19%	Yes: p<0.05
Soliman et al[2]	57%	11%	Yes: p<0.01
Kiran et al[5]	47%	21%	Yes: p=0.015
Present Study	48%	28%	Yes: p=0.039

Table 6. Comparison of Sepsis among Hypomagnesemics and Normomagnesemics in Various Studies

In the present study 86% of patients required ventilator support and prolonged duration of ventilation. Safavi M et al, [1 2] Mousavi SAJ et al[6] showed similar results.

Hypomagnesemia is commonly associated with electrolyte disturbances.[8,11,12] Hypokalaemia was 54% in this study with hypomagnesemia. Hypokalaemia is refractory to potassium correction until magnesium deficiency is corrected. Renal potassium losses are increased in hypomagnesemiapatients.[13,14] Hypocalcaemia was observed in 52% of patients with hypomagnesemia.[15] This is due to defects in the release and synthesis of parathyroid hormone and resistance to parathyroid hormone.[12] In this study there was a significant association between hypomagnesemia with hypocalcaemia, hypokalaemia and hypoalbuminaemia, 52%, 54% and 88% respectively which was statistically significant except hypoalbuminaemia (Table 7).

Author	Hypomagnesemics	Normomagnesemics	Significance
SafaviM et al[3]			
Hyponatremia	67.6%	32.4%	Yes: p<0.05
Hypokalaemia	84.6%	15.4%	Yes: p<0.05
Hypocalcaemia	67.6%	32.4%	Yes: p<0.05
Limaye et al[4]			
Hypocalcaemia	69%	50%	Yes: p<0.05
Hypoalbuminemia	80.76%	70.8%	Yes: p<0.05
Hypokalaemia	23%	23%	No: p>0.05
Present Study			
Hyponatremia	64%	40%	Yes: p=0.031
Hypokalaemia	54%	18%	Yes: p=0.0007
Hypocalcaemia	52%	32%	Yes: p=0.042
Hypoalbuminaemia	88%	36%	Yes: p=0.00001

Table 7. Comparison of Electrolyte Disturbance Among Hypomagnesemics and Normomagnesemics in Various Studies

In this study 54% of patients expired with magnesium levels less than 1.8mg/dl compared to 30% of the patients with the magnesium levels of more than 1.8mg/dl. The mortality rate in the studies of Safavi M et al,[3] Guerin et al[1] and Limaye et al[4] was 55%, 18% and 57.7% respectively. The higher mortality in our study can be ascribed to greater incidence of electrolyte abnormalities especially hypokalaemia cardiac arrhythmias and a strong association of hypomagnesemia with sepsis (Table 8).

Author	Hypomagnesemics	Normomagnesemics	Significance
SafaviM et al[3]	55%	33%	Yes: p<0.05
Limaye et al[4]	57.7%	31.7%	Yes: p<0.05
Guerin et al[1]	18%	17%	No: p>0.05
Kiran et al[5]	51.1%	36.2%	Yes: p=0.02
Present Study	54%	30%	Yes: p=0.015

Table 8. Comparison of Mortality Among Hypomagnesemics and Normomagnesemics in Various Studies

Limitations of Study

Total serum magnesium was measured instead of ionized magnesium. Determining the clinical consequences of isolated hypomagnesemia is difficult, because patients with hypomagnesemia typically also have hypokalaemia, hypocalcaemia and hyponatremia.

CONCLUSION

Hypomagnesemia is a common electrolyte imbalance in the critically ill patients and is associated with higher mortality rate, more frequent and more prolonged ventilator support. So early diagnosis and treatment of hypomagnesemia is necessary.

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