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General Medicine

MAGNESIUM LEVELS IN PATIENTS ADMITTED TO ICU AND ITS IMPACT ON VARIOUS OUTCOMES.

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ABSTRACT ***Background:*** Role of magnesium therapy is very well known in torsades de pointes and preecllampsia. For other illnesses, the evidence is lacking . 1There is a lack of consenensus as to the incidence of hypomagnesemia and hypermagnesimia, its association with mortality and morbidity. This study was undertaken with a view of addressing some of these issues.

Methods - A total of 100 consecutive patients admitted in ICU of a tertiary care hospital from Jan 16 to Dec 16 were submitted for estimation of serum magnesium levels.

Results- Sixty two (62%) were males and thirty two (38%) females. Mean age was 59.02 years (range 22-90). No patient was detected to have hypomagnesemia and 30 patients were detected to have hypermagnesemia. Mean Mg level of 2.337 mg/dl was found in the age group 22-53 years, 2.258 mg/ dl in age group 53-72 yrs and 2.329 mg/dl in the age roup of 72-90 yrs. Average duration of ICU stay ranged from 1 to 180 days with a mean of 6.025 with no correlation being found between duration of ventilatory support and magnesium levels (p=0.9363), Disease severity was assessed by APACHE II (range 0to 40), mean 20.21) and SOFA scores(range 0to 24, mean 7.42). No correlation was found between APACHE II (p=0.6403) and SOFA (p=0.9497) score with magnesium levels. Fiftyseven 57% survived while 43patients (43%) died. Mean Magnesium level in survivors was 2.3 mg/dl. And in deceased was 2.2 mg/dl. No corelation was found between hospital stay, requirement of ventilatory support, disease severity and patient survival with magnesium levels.

KEYWORDS : Magnesium levels, ICU, APACHE score, SOFA score, outcomes

Introduction:

Magnesium is the fourth important cation in the human body and is second important intracellular cation after potassium.[1] It acts as a cofactor in more than 300 enzymatic reactions invoving transfer of phosphate group for example in formation of ATP, has a role in hemostasis by mainatining intracellular cation status. It maintains neuromascular excitabilty and its role in maintenance of cardiac functions is well known. Hypomagnesemia is a common electrolyte imbalance in critically ill aptientss, yet it is frequently overlooked.[2] Many factors contribute to magnesuium defiiciency in critically ill patients, like impaired GI absorption, nasogastric suction, deficieny of magnesium in feeding formulae, drugs like diuretics, amino glycosides and AmphotercinB which causes renal wasting of magnesuium. [3,4]. Hypomagnesaemia is commonly associated with sepsis.[5]

AIMS AND OBJECTIVES:

To estimate the prevalence of magnesium levels in critically ill patients, its corelation with need & duration of mechanical ventilation, ICU, stay, APACHE-II, SOFA scores & mortality.

Materials & Methods

This prospective descriptive study was carried out in a tertiary hospital in the period from Jan 16-dec 16. Instituional ethical committee clearance and informed consent of all patients were obtained.

One hundred patients admitted consecutively to the ICU for critical illness were included in the study .A blood sample was collected for estimation of serum magnesium levels on admission to ICU.history and clinical findings were noted for each patient. Other haematological, biochemical and radiological investigations were performed as indicated in every patient, APACHE II & SOFA, scoring was calculated for each patient.

The study did not interfere with patient management in ICU, Serum total magnesium was taken to be between 1.7 to 2.4 mg %.

Patients were investigated for need for mechancial ventilation, duration of mechanical ventilation and ICU stay along with final outcome and its corelation with magnesuim levels.

Inclusion criteria: Patients suffering from various medical condtions admitted to ICU of needing advanced life support for more than 24 hours.

Exclusion criteria: Patients who had received magnesium prior to admission.

Statistical analysis: For quantitative data the normal device (z) test was applied to find the significance of difference between two means. For quantitative data chi-square test was applied to find the significance of difference between two proportions and to find the association between two variables.

Results and observations:

A total of 100 consecutive patients admitted in ICU of a tertiary care hospital in the period of Jan16 to Dec 16 were submitted for estimation of serum magnesium levels.

The population studied included a spectrum of conditions like complicated malaria, leptospirosis, urinary tract infections, cellulitis, meningitis, pneumonia, tuberculosis and histoplasmosis, hepatic failure, acute renal failure, chronic renal failure, respiratory failure due to COPD, interstttial lung disease and ARDS, congestive cardiac failure due to IHD or valvular heart disease, CVA, poisonings, acute pancreatitis, Guillian Barre syndrome,malignancy, status epilepticus and diabetic ketoacidosis. Surgical patients including post-operative, preoperative conditions of various speciailities like gastrosurgical, neurosurgical, polytraumaa, tumours, SAH, SDH, obstructive hydrocephalus acute abdomen, and gastrointestinal perforation were also included.

Sixty two (62%) were males and thirty eight (38%) females, Mean age was 59.02 years (range 22-90) years). No patient was detected to have hypomagnesemia although 30 patients were detected to have hypermagnesemia. Rest had normal magnesuium levels.

The study cohort included serving presonnel, representing both urban and rural populations. This study population was analyzed to estimate the prevalence of magnesium levels in critically ill patients and it's corelation with need & duration of mechanical ventilation, ICU stay, APACHE -II, SOFA score & mortality Mean Mg was level was 2.337 mg/dl, in the age group 25-53 yrs, 2.2258 mg/dl in the age group 72-90 yrs.

Of the 100 patients studied 30% were detected to have hypermagnesemia (using a cut off 2.4 mg/dl) and 70% normo-magnesemia . Prevalence was of hypomagnesemia was nil. Mg level

ranged from 1.8 to 3.1 mg/dl, with a mean of 2.3 mg/dl.

ICU and ventilatory support: average duration of icu stay ranged from 1-180 days with a mean of 11.38 days. Duration of ICU stay was not corelated with magnesium levels (p=0.3315). Sixty patients (60%0 had respiratory failure. Mean Magnesium level in respiratory failure cases was 2.31 mg/dl. In other cases mean magnesium level was 2.29 mg/dl. No correlation was found between respiratory failure and magnesium level (p=0.76). Duration of ventilatory support varied from 0 to 18 days with mean of 6.025 days with no corerelation being found between duration of ventilation support and magnesium level (p=0.9363)

Disease severity was assessed using APACHE –II score (range 0 to 40), mean 20-21) and SOFA score (range 0 to 25, mean 7.42). No corelation was found between APACHE II (P=0.6403) and SOFA (p=0.9497) score with magnesium levels.

Mortality out comes:
Magnesium level in survivors was 2.3 mg/dl, and in deceased it was 2.2 mg/dl. No corelation was found between mortality and magnesuim level (p 0.53)

DISCUSSION

The relationship between hypomagnesemia or hypermagnesemia and mortality rate has been variably reported. A higher mortality was detected in patients with hypomagnesemia compared to patients with normo-magnesemia by some. [6-10]. However no difference in ICU mortality bteween hypomagnesemia and normomagnesemia groups , but a higher mortality rate among hypermagensemia patients has been reoprted by others.[11]. Normomagensemia patients have also been reported to have higher mortality.[12]. In critically ill pediatric paatients, a mortality rate of 8% in both the hypomagnesemia and normomagnesemia groups, with a significantly higher mortality in the hypermagnesemia patients has been reported.[13].

In our study 57 patients (57%) survived and 43 patients (43%) died at the end of study period. Mean magnesium level in survivors patients was 2.3244 mg/dl. Compared to non survivors whose level was 2.2437 mg/dl. No co relation was found between mortality and magnesium levels (p=0.5366), which corroborates with findings of Guerin et al.[11]

The higher reported mortality rates in the hypomagnesemia patients can be explained by greater incidence of electrolyte abnormalities especially hypokalaemia, cardiac arrhythmias and astrong assoication of hypomagnesemia with sepsis and septic shock which is a common cause of death in ICU patients. Hypermagnesemia is found less commonly than hypomagensemia. It is reported in the range of 4 to 145 in literature, we detected 30 patients (30%) to have hypermagnesemia 70% normomagnesemia, and nil hypomagnesemia.

Hypomagnesemia is known to cause muscle weakness and respiratory failure. It is important factor causing difficulty in weaning the patient from ventilator.[14]. Administration of magnesium to hypomagnesemia patients improves respiratory muscle weakness.[15]. A more frequent and longer duration of need for ventilatory support has been reported in hypomagnesemia patients as compared to normomagnesemia patients.[16]. In our study, the duration of patients on ventilatory support ranges from 0 to 18 days with a mean of 6.025 days. No corelation was found between duration of ventilatory support with serum magnesium level (p=0.9363). Duration of ICU stay ranges dfrom 1 to 18 days with mean of 11.38 days, No corelation was found between duration of ICU stay and mgnesium levels (p=0.3315). This is in concordance with studies conducted by Chernow et al16 and Soliman et al [17] and APACHE score on admission has been reported to differ significantly with magnesium level. [18-21] Those patients developing ionized hypomagnesemia during their ICU stay have been noted to have higher APACHE score on admission.[17]. In our study no co relation was found between SOFA score and magnesium level (p=0.9497) as well between APACHE II score and magnesium levels(p=0.6403). This is comparable with the findings of other studies. [6,11,16,17]

CONCLUSIONS

In the present study, range of serum magnesuium level is 1.8 to 3.1 mg/dl. The prevalence of hypomagnesaemia in this study is nil. Prevalence of hypermagnesemia in this study population is 30%, however no corelation exists between hypermagensemia with need of mechanical ventilation duration of ICU stay APACHE II score, SOFA score and mortality along with final outcome. There may be many unmeasured confounders in this complicated population of critically ill patients admitted in ICUs. Presence of hypo or hypermagnesemia in critically ill patients may be an epiphenomenon which may not have bearing on the survival outcomes. This being single centre study with small sample size, hence large multicenter studies are required to know the exact prevalence and various outcomes. This been a single centre study with a small sample size, hence large multicentre studies are required to know the relation with different magnesium levels.

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