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**Original Research Article**

# Occurrence of hypomagnesemia in children admitted to paediatric intensive care unit

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## ABSTRACT

**Background:** To determine the occurrence of hypomagnesemia in children admitted to paediatric intensive care unit in tertiary care centre.
**Methods:** It is a prospective chart review of 250 children aged 1 month to 17 years admitted in paediatric intensive care unit of Kempegowda Institute of Medical Sciences during 12 months from January 2022 to December 2022 and recorded serum Mg level on admission. Patients were divided into two groups according to their Mg level (Normo-magnesemic and Hypomagnesemic) and their p value, crude and adjusted odds ratios were calculated.
**Results:** Upon admission in PICU 100 (40%) patients were found hypomagnesemia. There was no difference in age and gender between two groups. The important risk factors identified were age greater than 2 years (p=0.05, AOR 3.71), sepsis (p=0.03, AOR-3.11), hypokalemia (p=0.06, AOR-1.8), hypocalcemia (p=0.03, AOR-1.6), diuretic use (p=0.05, AOR-1.37), Aminoglycoside use (p=0.003, AOR-3.12), and hospitalization greater than 5 days (p=0.05, AOR-1.71). Those with normomagnesemic had higher mortality rate (32/100 or 32%) than those with hypomagnesemia (22/79 or 27.8%)
**Conclusions:** The present finding indicates that hypomagnesemia is common among PICU patients.

**Key words:** Hypomagnesemia, Paediatric intensive care unit, Normo-magnesemic, Hypomagnesemic

## INTRODUCTION

Magnesium (Mg) is a second most abundant intracellular cation. Intracellular magnesium is an important co factor for various enzymes, transporters, nucleic acids that are essential for normal cellular functions, replication and energy metabolism. In the serum; Mg is divided into three fractions: ionized or active form (65%), protein bound (27%) mainly to albumin. while a small fraction is also complex to citrate, phosphate and bicarbonate (8%).[1,2] Serum magnesium concentration is regulated by renal magnesium reabsorption.[1,2] Hypomagnesemia (Serum Mg level <1.7 mEq/l) is electrolyte disturbance in which there is abnormally low levels of magnesium in the blood. It's mostly asymptomatic but often present as tetany, cardiac arrhythmia, decreased bone stability, increased susceptibility to epileptic seizures in children and also associated with high incidence of renal kidney stones. Magnesium (Mg) deficiency is a common phenomenon in critical care setting and is associated with high mortality.[3] The etiology of hypomagnesemia in critical illness is complex and may involve a number of mechanisms such as decreased intake, increased renal or gastrointestinal losses and altered distribution. The present study is aimed to determine the occurrence of hypomagnesemia in children admitted to pediatric intensive care unit on admission.

## METHODS

The study participants were of age 1 month to 17 years, and including all patients who were admitted in the Pediatric intensive care unit (PICU) of KIMS, hospital during the period of 12 months (January 2022 till December 2022). Patients on magnesium replacement therapy, known congenital renal magnesium wasting syndromes, post cardiac surgery patients were excluded from the study. Patients were identified by using medical records of all PICU admissions during this period, and later on by using hospital's health information system by using term hypomagnesemia in ICD coding, 275.2 (ICD9 C.M.). Upon screening of 380 files of PICU admission, we have identified 250 patients with recorded serum Mg level during the specified period. Medical records were reviewed for study. Information was extracted on: age, gender, weight, admission category (cardiac disease, sepsis, renal failure, CNS related diseases, Trauma and others), co-morbid, metabolic profile (Serum sodium, potassium calcium, magnesium, blood urea nitrogen, creatinine and blood pH). Total serum magnesium assay was measured by (lab) and its precision performance is according to guidelines. Information was also obtained on the use of diuretics and aminoglycoside. Outcome (alive/died) was also reported. Later the study participants were divided into two groups on the basis of serum magnesium level (normal or low <1.5 mEq/l). Hypomagnesemia patients were treated. Statistical analyses were performed in 250 patients. The retrieved data was analyzed on SPSS version 16. Crude and stratified (the study cohort was divided into two groups; Normo-magnesemic group and Hypomagnesemia) analyses were performed. Continuous variables (age, weight and length of stay in PICU) were dealt with mean and standard deviation, while categorical variables (gender, metabolic profile, sepsis and use of medications) were analyzed by frequency and percentage. We set Alfa level of significance at 0.05. Crude odds ratios were calculated and the variables which were found significant (p<0.05) at univariate level were later entered and analyzed with multivariate logistic model to calculate adjusted odds ratio.

## RESULTS

Final analyses were performed on 250 patients. Infants were found to be 20% in the cohort, with male preponderance of 60%. Mean weight was 14.7±13 kgs (30% severely malnourished). In the disease category of admission seizures, dengue fever, pneumonia, sepsis was responsible for 80% of admissions (Table 1). Mean length of stay in PICU of this cohort is 2-3 days. Mortality rate of the cohort was found to be 20%. The frequency of hypomagnesemia was found to be 40%. The important risk factors identified were age greater than 2 years (p=0.05, AOR-3.71), sepsis (p=0.03, AOR-3.11), hypokalemia (p=0.04, AOR-1.8), hypocalcemia (p=0.03, AOR-1.6), diuretic use (p=0.05, AOR-1.37), and hospitalization greater than five days (p=0.05, AOR-1.71) (Table 3).

**Table 1: Occurrence and incidence of hypomagnesemia in admitted PICU patients with respect to their primary diagnosis category (n=250).**

| Diagnosis category | N | Hypomagnesemia (n=100), frequency |
|---|---|---|
| **Seizures** | 100 | 45 |
| **Dengue** | 75 | 30 |
| **Pneumonia** | 25 | 5 |
| **Others (sepsis, DKA, gastroeneteritis, poisoining, ARDS)** | 50 | 20 |
| **Total** | 250 | 100 |

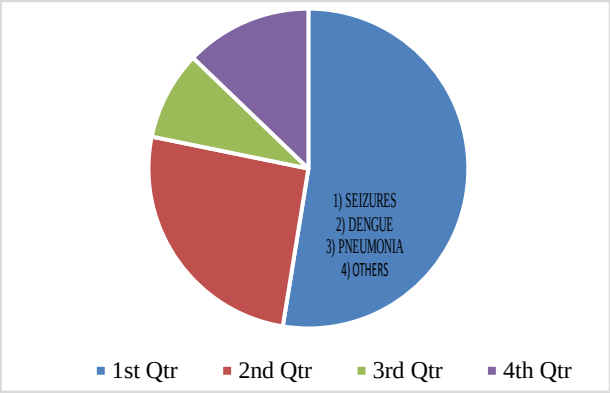


**Figure 1: Distribution as per incidences.**

**Table 2: Distribution as per age group.**

| Age group (years) | Normal Mg | Hypomagnesemia | P value |
|---|---|---|---|
| **<1** | 20 | 5 | 0.06 |
| **1-17** | 130 | 95 | 0.05 |

**Table 3: Distribution as per gender.**

| Gender | Normal Mg | Hypomagnesemia | P value |
|---|---|---|---|
| **Male** | 90 | 65 | 0.04 |
| **Female** | 60 | 35 | 0.05 |

There was no difference in mortality between two groups (p=0.6). Hypomagnesemia is more common in seizure disorder When compared to other diseases. Results showed age more than 1 year has more hypomagnesemia When compared to male and female hypomagnesemia was more common in males compared to females. There is significant association between hypokalemia and hypomagnesemia

## DISCUSSION

Hypomagnesemia is a frequent metabolic abnormality of ICU patients.[4] The reported incidence in the literature varies from 20-70%. The frequency of hypomagnesemia

in the present cohort was 40%. Hypomagnesemia was found more in boys than girls as found in earlier studies.[5] Hypomagnesemia is commonly associated with other metabolic imbalances in the body.[6]

**Table 4: Distribution as per clinical conditions.**

| Condition | Hypokalemia | Hypomagnesemia | P value |
|---|---|---|---|
| **Weight (10kg)** | 100 | 65 | 0.05 |
| **Seizures** | 100 | 45 | 0.02 |
| **Dengue fever** | 75 | 30 | 0.02 |
| **Pneumonia** | 25 | 5 | 0.03 |
| **Sepsis** | 40 | 10 | 0.05 |
| **Anemia (hb <11)** | 10 | 10 | 0.05 |
| **Metabolic** | | | |
| Hyponatremia | 40 | 70 | 0.04 |
| Hyocalcemia | 50 | 80 | 0.03 |
| Hypokalemia | 30 | 85 | 0.02 |
| **Length of stay in PICU** | 50 | 60 | 0.06 |
| **Mortality** | 60 | 40 | 0.06 |

Hypocalcemia is one of the commonly observed in electrolyte imbalance 40-60% of patients, followed by hypokalaemia. These relations can be due to underlying disorders that cause both magnesium and potassium loss, such as diuretic therapy, vomiting and diarrhea or nasogastric suctioning. Moreover, renal potassium losses are increased in hypomagnesemia patients. Sometimes, hypokalaemia is relatively refractory to isolated potassium supplementation until magnesium deficiency has been corrected. [7]The literature supports hypocalcaemia is one of the frequently associated electrolyte abnormalities as magnesium deficiency impairs parathyroid glandular function and may lower serum concentrations of vitamin D, leading to hypocalcaemia, hypomagnesemia group received diuretics and aminoglycosides more often than normo-magnesemic group.[7,8] Diuretic use both loop and thiazide diuretics can inhibit net magnesium reabsorption and causing hypomagnesemia.[9] It is reported that hypomagnesemia was disclosed in 19.4-23% who were on thiazide diuretics alone.[10] Many nephrotoxic agents are responsible for urinary magnesium wasting via impairing magnesium reabsorption in loop and distal tubules i.e., Aminoglycoside.[11] Magnesium deficiency should be suspected even when serum magnesium is normal in patients with unexplained hypocalcemia or refractory hypokalemia.

### *Limitations*

Limitations were; it was single Center study and Sample size was relatively small of 100.

## CONCLUSION

From this study we can conclude that hypomagnesemia is a common finding seen in children admitted to PICU. Magnesium is a important electrolyte and its deficiency needs to be corrected and treated immediately. Magnesium directly affects various other electrolytes. Hypomagnesemia is correlated to many factors as described above and its outcome has been described. Untreated hypomagnesemia can lead to many complications such as neuromuscular hyperexcitability-such as tetany, convulsions, apathy, delirium, agitation, psychosis, coma leading to death; cardiovascular manifestation-arial fibrillation, arrhythmias, cardiac ischemia. Hence treatment has to be started immediately. Asymptomatic patients can be managed with supplements and symptomatic patients need admission and treatment. Patients are treated with oral or parenteral magnesium sulphate. After replenishing magnesium levels other electrolytes should be checked. Prognosis depends on the underlying cause of hypomagnesemia. If the cause is identifiable cause have a good prognosis for complete recovery. Magnesium deficiency is commonly encountered in ICU and the key is to find the primary cause and treat.

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