IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 4 Ser. 4 (April. 2025), PP 28-31
www.iosrjournals.org

Hypermagnesaemia And Hypomagnesaemia In A Tertiary Hospital In Southern Nigeria.

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Abstract
Background*: Magnesium is an essential ion in the body, playing a crucial role in various physiological processes, including enzyme function, blood pressure regulation, and neuromuscular conduction. Disruptions in magnesium balance, such as hypomagnesaemia and hypermagnesaemia, are frequently encountered in clinical practice and can complicate patient management. However, magnesium disorders are often overlooked.*
Aim*: This study aimed to assess the prevalence of magnesium disorders, - hypomagnesaemia and hypermagnesaemia - at the University of Port Harcourt Teaching Hospital (UPTH) in southern Nigeria and identify the major clinical conditions associated with these imbalances.*
Methods*: A retrospective, descriptive study was conducted, examining all magnesium-related laboratory requests from April to September 2024. Data was extracted from the hospital's Chemical Pathology laboratory records, and the prevalence of magnesium imbalances was calculated, with a focus on the clinical categories most commonly associated with these disorders.*
Results*: The study revealed that 32% of patients had hypomagnesaemia, 22% had hypermagnesaemia, and 46% had normal magnesium levels. The disorders were more prevalent among paediatric patients and renal failure was identified as the most common diagnosis.*
Conclusion*: More than half of the cases had a magnesium disorder. This underscores the importance of monitoring magnesium levels, particularly in high-risk populations such as paediatric, renal failure and surgical patients. Increased awareness and appropriate magnesium requests in clinical practice are essential for improving patient outcomes.*
Keywords: *Magnesium, Hypomagnesaemia, Hypermagnesaemia, Paediatrics,*

Date of Submission: 14-04-2025 Date of Acceptance: 24-04-2025

I. Introduction

Magnesium is a critical ion and is necessary for many body functions. Quantitatively it is the fourth ion and the second most abundant intracellular cation. Potassium being the first. [1] Magnesium functions as a co-factor for over 300 enzymes, this makes it difficult to list all the functions of magnesium in the body. However, they can be outlined in groups. The role of magnesium includes being a cofactor for many body processes including protein synthesis, blood pressure regulation, blood glucose regulation and neuromuscular conduction. It plays a structural role in bone, DNA and RNA, it has transport functions, it is involved in calcium and potassium metabolism as well as immunologic functions. [2]

Magnesium deficiency is usually asymptomatic. When symptomatic the features can be non-specific and a misleading, because there is an overlap with other electrolyte imbalances such as hypocalcaemia and hypokalaemia. Common manifestations include nausea, fatigue, muscle contractions and seizures.

Hypomagnesaemia (and hypermagnaesaemia) and the need to treat is often over looked by clinicians. [3] It is important to note that often times blood levels of magnesium do not always completely reflect the total body magnesium stores.

A patient may present with normal serum levels despite being magnesium-depleted, and biochemically confirmed hypomagnesaemia can indicate a more severe systemic deficiency. A term for this is subclinical hypomagnesaemia. This has been associated with cardiovascular disorders in affected individuals. [4]

A study done in a tertiary hospital in Ogun State Nigeria found out that one out of four adult diabetes patients had hypomagnesaemia. [5] This was consistent with a study done in an intensive care unit in India [6] and similar to another done in Israel where an approximate one out of five patients hospitalised for Type 2 Diabetes Mellitus were found to have hypomagnesaemia. [7] Similarly a study conducted in Ile-Ife Nigeria established that 35.3% of term babies with birth Asphyxia had hypomagnesaemia. [8]

Hypermagnesemia in contrast is less common than hypomagnesaemia. [9] It occurs more commonly in renal dysfunction and magnesium administration. [10] Symptoms of hypermagnesaemia are usually present when the magnesium levels are above 2.0mmol/L. The hospital-based prevalence of hypermagnesaemia ranges from 5.7% to 9.3%, though the rate is significantly higher among patients with renal failure. [9].

The aim of this study was to determine the rate of occurrence of magnesium disorders and clinical categories of patients affected. This information is intended to guide clinicians in the diagnosis and management of magnesium imbalances.

II. Method

This study adopted a retrospective descriptive design and was conducted at the Chemical Pathology Laboratory of the University of Port Harcourt Teaching Hospital, the foremost tertiary hospital in Rivers State, Nigeria. The hospital, with an 800-bed capacity, serves a diverse population. The study included all consecutive laboratory requests that included magnesium estimations between April and September 2024. Requests that did not contain magnesium parameters were excluded. A total of 536 requests met the inclusion criteria during the six-month study period. Data were extracted from the laboratory day sheets, entered into Microsoft Excel, and subsequently analysed using SPSS version 23. Descriptive statistics, including frequencies and percentages, were employed, and statistical significance was set at a p-value less than 0.05.

III. Results

A total of 536 requests for magnesium came into the laboratory over a period of six months. The average frequency per month was between 80 and 107.

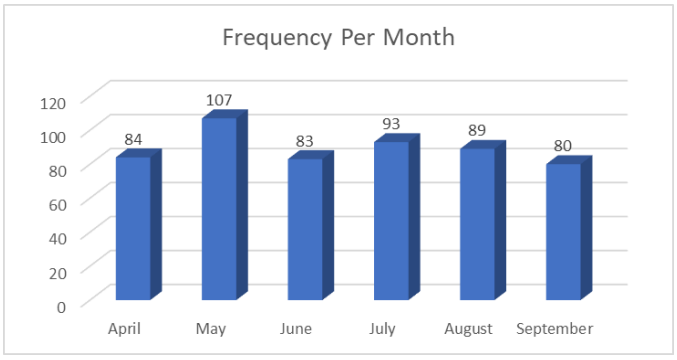

Figure 1. Frequency of distribution requests per month.

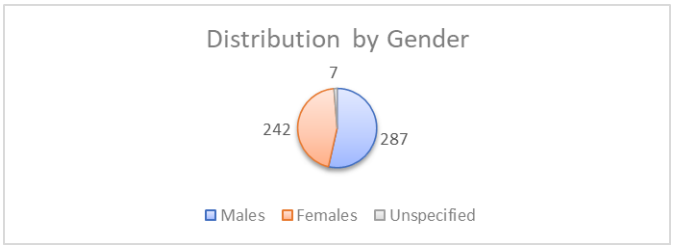

Figure 2: Distribution by Gender.

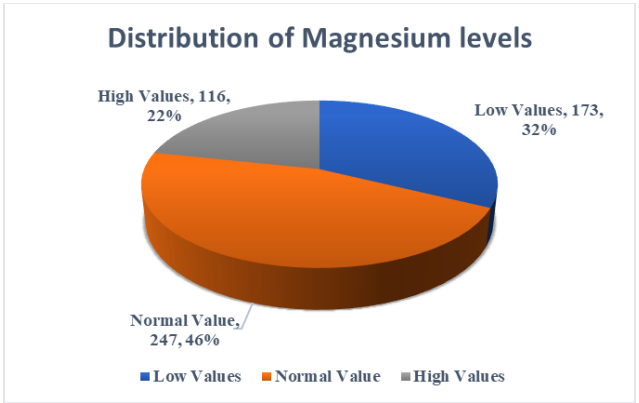

Figure 3: Distribution of plasma magnesium values.

The ten most common diagnosis in descending order were: Chronic Kidney Disease, seizures from all causes, sepsis, routine requests, meningitis, preterm, rickets, other forms of nephropathy, cerebral palsy and hypocalcaemia.

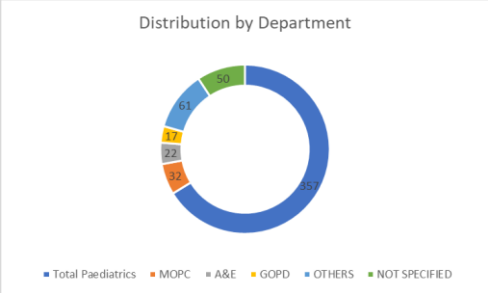

Figure 4. Distribution by department.

Sixty-one of the specimen were classified as others representing over 30 other wards and clinics with request frequencies ranging from one to six. The High Dependency Unit having the highest number among these, with six requests, while several units recorded just one.

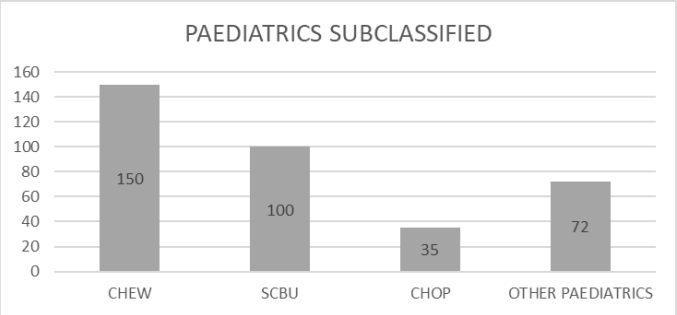

Figure 5. Paediatrics Subclassified.

IV. Discussion

The average number of magnesium request per month ranged from 80 and 107. Currently there is no Nigerian data available for comparison. However, from the laboratory records, compared to other electrolytes, the frequency of magnesium requests is much lower. The average number of sodium and potassium individually range from 1000 to 1279. Making magnesium requests averagely a twelfth (0.08%) of either sodium or potassium requests.

A majority (66.6%) of the total request came from the department of paediatrics. This is not surprising as children, the elderly and the critically ill are particularly vulnerable to magnesium disorders especially hypomagnesaemia. [11] In India a prevalence rate of up to 35.3% was found in paediatric patients that were critically ill. [12] Several factors contribute to this. Chief on the list is insufficient intake which has been observed in children. [13] This is further compounded by poverty, 'irrational eating' ignorance, acute and chronic illnesses, including diarrhoea and malabsorption. Gromova noted that magnesium is a common micronutrient deficiency in the diet of modern children in many countries of the world. [14] Most of the diagnosis necessitating requests are peculiar or more common to the paediatric population. They include sepsis, meningitis, preterm, and cerebral palsy. [11] Omotosho et al in a study done on 26 children with Autism and Cerebral Palsy in Ibadan established that all of them had lower levels of magnesium than their age matched counterparts. [15]. All these emphasizes the fact that the paediatric age group is more affected.

Most (46%) of the requests that came into the laboratory were within the normal range, the hypomagnesaemia cases were higher (32%) than the hypermagnesaemia (22%) cases. This is the usual picture all around the world. [9,10, 11] The reference range used in this study was 0.73-1.1mmol/L. (Though there is a slight variation between the male and female reference range). This is close to that used in the USA. [11]

Hypomagnesaemia is frequently associated with concurrent hypocalcaemia and hypokalaemia and vice-versa. [12,16] An interventional study carried out among patients with hypocalcaemia and hypokalaemia in Spain established a prevalence rate of hypomagnesaemia of 56.3% among this subgroup. [3] One mechanism by which hypomagnesaemia causes hypokalaemia is by acting on the renal tubules causing kaliuresis. This is particularly important in pre-surgical assessment and correction of hypokalaemia. It will be largely ineffective if the hypomagnesaemia is not corrected. [17] This also applies to hypocalcaemia caused by hypomagnesaemia. It

will be irretractable till magnesium is corrected. Persistent hypokalaemia is an anaesthetic challenge that can lead to delayed in surgical procedures. [18] One way to identify more persons with magnesium disorders is to assay for magnesium in all patients with disorders in calcium and potassium at the time of second request.

Seizure disorders and seizures from all causes had a slightly lower frequency than renal diseases. Lower levels of magnesium have been associated with seizure disorders. [19] Magnesium administration is being explored as a treatment for epilepsy. [20] Magnesium is essential for effective central nervous system functioning. [20] Magnesium administration to mothers when preterm delivery is imminent is beneficial in the prevention and severity of cerebral palsy neonates. [21]

The most common diagnosis in this study was renal failure and it is a key causative factor for hypermagnesaemia. Studies have revealed that 70-85% of patients with hypermagnesaemia have renal disease. [16] The rate of hypermagnesaemia in this study was higher than the 10-15% and sometimes less reported among many subgroups [9,10, 16] especially those with renal failure. The reason for this needs to be further investigated.

Though the overall request for magnesium tests in the laboratory is low when compared to other electrolytes, the prevalence of magnesium disorders is high.

V. Limitation

This was a retrospective study, and some information were lacking ab initio in the original request forms.

VI. Conclusion

More than half of the patients had magnesium disorders with hypomagnesaemia being more common. Over 60% of the requests were from the department of paediatrics. The most common diagnosis were renal disorders and seizure disorders.

VII. Recommendation

Better synergy between the clinicians and the pathologist.
All cases of hypocalcaemia and hypokalaemia should be screened for hypomagnesaemia on second request.

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