Original Article

Prevalence and Clinical Correlates of Dysmagnesemia among Medically Hospitalized Patients at Shar Hospital, Sulaimani, Iraq: A Cross- Sectional Study

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Abstract

Background: In more than 300 enzymatic reactions, magnesium (Mg) is the fourth most prevalent cation cofactor. **Objectives:** to explore dysmagnesemia prevalence and its related clinical characteristics among hospitalised patients at Shar Hospital, Sulaimani, Iraq. **Materials and Methods:** A cross-sectional study was employed on 252 patients, adults thier ages (≥18 years), over six months duration. In the current study, information on patients' comorbidities, characteristics, medications, and seruim magnisium were obtained. Analytical statistics were performed to find the association, including chi-square . The p-value < 0.05 was considered significant. **Results:** The prevalence of dysmagnesemia among the cohort group was 50.0%; 18.3% had hypermagnesemia (>2.2 mg/dL), and 31.7% had hypomagnesemia (<1.7 mg/dL). Renal diseases were found to be a significant pathology causing the disturbance in magnesium level, as it founf that sginificant (*P* 0.021), with 41.3% of hypermagnesemic patients having renal pathology. Hypertension was found to be a borderline significant association (P ≤ 0.056). Other morbidities, suchas cardiac, pulmonary diseases, diabetes, metabolic acidosis, or ECG abnormalities, were found to be not significant. Exposure to proton pump inhibitors and loop diuertics were found to be common among these patients (18.3%) and (24.2%), respectively. **Conclusion:** Renal diseases were considered the main morbidity associated with dysmagnesemia. The current study underscores the important monitor for the magnesium level among high risk groups.

Keyword: Hypermagnesemia, Hypomagnesemia, Dysmagnesemia, Renal Disease, Electrolyte Disorders.

Introduction

As the fourth most common cation in the human body, magnesium is an essential cofactor in many enzymatic processes. It has the role in contributing many functions, including cardiac contraction, neuromuscular transmission, blood pressure regulation, protein biosynthesis, energy production, and the function of the immune system [1]. Magnisuim found to be responsible for more than 300 enzymatic reactions relevant to the mitocondria, protien and nucleic acid structural integrity [2]. In addition, it was found that magnesium has a great role in maintaining plasma glucose level through changing the responsiveness to the insullin [3]. Evidence shows the critical role of the level of normal magnesium and the decreasing risk of many diseases: cardiovascular and cerebrovascular events, osteoporosis, preeclampsia, asthma, diabetes, colorectal cancer, and inflammation [4]. The normal range of magnesium in body is from 0.7 to 1.0 mmol/L (1.7–2.2 mg/dL). It is more concentrated in muscle, bones, and soft tissue, with the least amount in the circulatory system, less than 2% [5]. Both the renal excretion process and intestinal absorption played a major role in the regulation of serum magnesium [6]. A common electrolyte imbalance among hospitalized patients, especially in the ICU, is hypomagnesemia, which has been related to a higher death rate, shorter hospital stay, and numerous chronic health problems [2]. The prevalence of hypomagnesemia in hospitalised patients ranged from 3 to 29% of patients [3, 7]. A magnesium level below 0.5 mmol/L is considered dangerous as it is associated with seizures, muscular weakness, tremor, cardiac ischemic event, and might lead to death [8]. On the other hand, hypermagnesemia is also prevalent among hospitalised patients ranges 5-27% with serious complications such as muscular paralysis, respiratory distress, renal impairment, elevated serum phosphorus levels, parathyroid hormone suppression, intensification of neurohormonal activation, and cardiac arrest [9, 10]. Evidences show that the main concerns related to dymagnisemai were cardiac arrhythmias, septic shock, respiratory failure, and acute kidney injury [6, 11]. Regular montoring serum magnesium in hospitalised patients is crucial to predict the patients' outcome and prognosis, and provide a practical method to avoid these results [6]. Although the relevance of magnesium in the physiological functioning of the human body has been well-documented, the issue of Dysmagnesemia in patients undergoing hospitalization and its implications for clinical procedures necessitate additional scholarly investigation. However, most previous studies have focused primarily on patients having surgery or those hospitalized in intensive care units. Despite the well-established physiological significance of magnesium, there is little information on Dysmagnesemia in general medical wards, especially in the Middle East. The majority of the literature currently in publication focuses on surgical or intensive care unit populations. Thus, the purpose of this study was to evaluate the prevalence and clinical correlates of Dysmagnesemia in medically hospitalized, non-critically ill patients in Sulaimani, Iraq.

Materials and Methods

Study Design and Setting

The study was a cross-sectional study that took place at Shar Hospital, a tertiary care medical center in Sulaymaniyah, Iraq, during a 6-month time frame. This research was designed to establish the occurrence of dysmagnesemia among hospital patients and to establish the clinical and biochemical profile of it.

Study Population

Eligibility of the study was all adult patients aged over 18 years old and were admitted to the center due to non-surgical and non-obstetric medical reasons. The study was not allowed in patients who had incomplete clinical or biochemical data, or those admitted into surgery/ obstetric care. The sample size was calculated to be 252 patients on which the prevalence of dysmagnesemia would be identified. The required sample size was estimated using the single-proportion formula ($n = Z^2 \times P[1-P] / d^2$), where $Z = 1.96$ for a 95% confidence interval, P represents the expected prevalence derived from previous literature, and d was set at 0.05.

Data Collection

A review of hospital records and a researcher prepared, structured questionnaire were used to collect the study data. The questionnaire was divided into five major areas: Demographic and lifestyle information: age, gender, occupation, socioeconomic status, smoking and alcohol consumption. Family history, medical history:

comorbidities, e.g. high blood pressure, diabetes mellitus (type and duration), heart disease, lung or kidney disease, other chronic diseases. Medication history: any current and/or past medications, medications that influence magnesium balance like loop diuretics, thiazides, proton pump inhibitors and calcineurin inhibitors. Data about the hospitalization of the patient including the primary cause of the hospitalization, the duration of hospitalization, and the medications given to the patient during the hospitalization. Data on biochemical and clinical analysis like serum magnesium levels, calcium, phosphate, potassium, sodium, albumin, creatinine, estimated glomerular filtration rate (eGFR), and ECG results that were indicative of dysmagnesemia. The first outcome was to find out the occurrence of hypomagnesemia or hypermagnesemia in hospitalized patients. Secondary outcomes included determining the clinical and biochemical characteristics associated with dysmagnesemia, risk factors such as comorbidities and drug interactions, the impact of dysmagnesemia on hospitalization outcomes such as length of stay, and complications. Data were collected from June 2025 to December 2025

Statistical Analysis

The analysis of the data was conducted with the help of descriptive and inferential statistics. The rates of dysmagnesemia were obtained using 95% confidence intervals. Chi-square tests were used to analyze categorical variables and t or Mann-Whitney U tests were used to analyze continuous variables.A p value of <0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the ethics committee college of Medicine, refrence N466. Written informed consent was obtained from all participants. Confidentiality of patient information was maintained and data were analyzed anonymously.

Results

Out of 252 patients the average age of the patients was 55.92 ± 20.50. The number of male and female participants was 108 (42.9%) and 144 (57.1%) respectively. There were 37 (14.7%) current smokers, and 28 (11.1%) former smokers. Concerning the use of alcohol, 2 (0.8%) patients indicated that they current use it, and 2 (0.8%) other patients, were ex-drinkers. Regarding the socioeconomic status, 34 (13.5%) patients were categorized to have a low status, 213 (84.5%) patients moderate and 5 (2%) patients high. Only 1 (0.4%) patient had a family history of dysmagnesemia or dysmagnesemia-related conditions reported on the father side but not on the mother side. A demographic characteristic of the patients is presented in Table 1.

Table 1: Demographic characteristics of hospitalized patients

Variable		No.	%
Age		55.92 ± 20.501	
Sex	Male	108	42.9%
	Female	144	57.1%
Smoking status	Yes	37	14.7%
	Former smokers	28	11.1%
	No	187	74.2%
Alcohol consumption	Yes	2	0.8%
	Ex drinker	2	0.8%
	No	248	98.4%
Socioeconomic Status	Low	34	13.5%
	Moderate	213	84.5%
	High	5	2%
Family History of Dysmagnesemia or Related Condition [Father's side]	Yes	1	0.4%
	No	251	99.6%
Family History of Dysmagnesemia or Related Condition [Mother's side]	Yes	0	0
	No	252	100%

Among the patients, 133 (52.8%) had hypertension, 93 (36.9%) had diabetes mellitus II, 78 (31%), 45 (17.9%) had pulmonary disease, heart disease, 75 (28.9%) had renal disease, 13 (5.2%) had proteinuria, 52 (20.6%) had hyperaldosteronism, and 112 (44.4%) had volume expansion. (Figure.1)

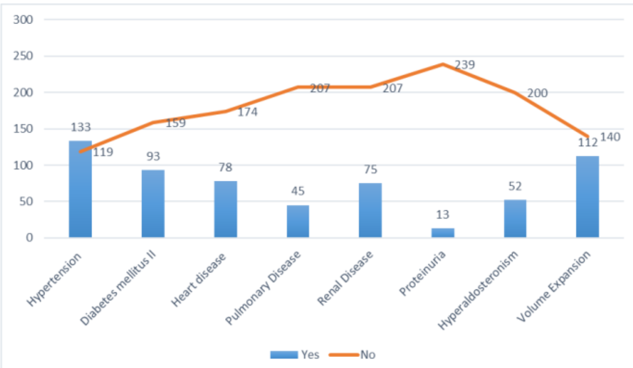

Figure 1: Underlying diseases of the hospitalized patients.

Regarding drug history, 61 (24.2%) patients had a history of using loop diuretics, 46 (18.3%) patients had a history of using proton pump inhibitors (PPI), 14 (5.6%) patients had a history of using thiazide diuretics, and 10 (4%) patients had a history of using calcineurin inhibitors, all of which are medications known to potentially cause dysmagnesemia (Table 2).

Table 2: History of drug known to cause Dysmagnesemia of hospitalized patients

Variable		No.	%
Hx of drug known to cause Dysmagnesemia [Loop Diuretics]	Yes	61	24.2%
	No	191	75.8%%
Hx of drug known to cause Dysmagnesemia [PPI]	Yes	46	18.3%
	No	206	81.7%
Hx of drug known to cause Dysmagnesemia [Thiazide Diuretics]	Yes	14	5.6%
	No	238	94.4%
Hx of drug known to cause Dysmagnesemia [Calcineurin Inhibitors]	Yes	10	4%
	No	242	96%

The most common length of stay was 89 (35.2%) patients who stayed a single day at the hospital. Moreover, 64 (25.4%) patients, 58 (23%) patients, and 19 (7.5%) patients, were admitted in two, three, and four days, respectively. Table 3 gives further information on the length of hospitalization.

Table 3: Duration of admission/ day of patients

Variable		No.	%
Duration of admission/ day	1	89	35.2%
	2	64	25.4%
	3	58	23%
	4	19	7.5%
	5	7	2.8%
	6	4	1.6%
	7	1	0.4%
	8	2	0.8%
	9	1	0.4%
	10	4	1.6%
	11	1	0.4%
	12	1	0.4%
	30	1	0.4%

Mean ± SD ،Ionized calcium 1.0965 ± 0.103, Total calcium 8.1991 ± 1.141, Phosphate 3.6738 ± 1.489, Potassium 5.5903 ± 22.429, Sodium 139.955 ± 4.505, Serum Albumin 2.9983 ± 0.790, Serum Creatinine 2.10889 ± 2.352, eGFR 69.7560 ± 48.294 and 1.8206 ± 0.516 were (Table 4).

Table 4: Blood test information of hospitalized patients.

Variable	N	Mean ± SD
Ionized calcium	17	1.0965 ± 0.103
Total calcium	252	8.1991 ± 1.141
Phosphate	251	3.6738 ± 1.489

Potassium	252	5.5903 ± 2.429
Sodium	249	139.955 ± 4.505
Serum Albumin	252	2.9983 ± 0.790
Serum Creatinine	247	2.10889 ± 2.352
eGFR	252	69.7560 ± 48.294
Mg Level	252	1.8206 ± 0.516

As shown in Table 5, the majority of patients had a normal QT interval (249, 98.8%), while QT prolongation was observed in only 3 patients (1.2%). No cases of QT shortening were detected.

Table 5: QT Interval Status among Hospitalized Patients (n = 252)

QT Interval Status	No.	%
Normal	249	98.8
Prolonged	3	1.2
Shortened	0	0

Note: QT interval categorized based on standard clinical reference ranges.

Figure 2 shows the frequency of the distribution of serum magnesium in the study group. Overall, dysmagnesemia was observed in 126 patients (50.0%; 95% CI: 43.8–56.2). Hypomagnesemia was present in 80 patients (31.7%; 95% CI: 26.0–37.4), while hypermagnesemia was identified in 46 patients (18.3%; 95% CI: 13.5–23.1).

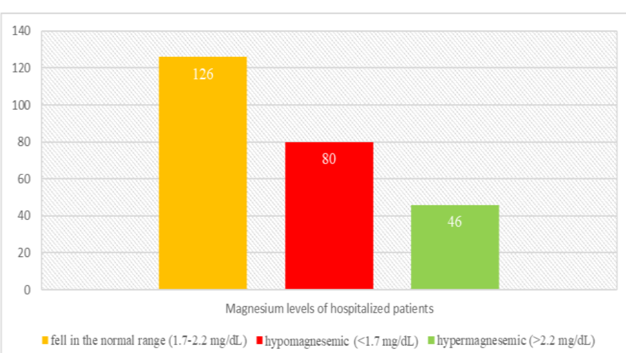

Figure 2: Magnesium levels of hospitalized patients

Table 6 shows the association between magnesium levels and comorbid diseases. The serum magnesium levels were not significantly associated with hypertension ($p < 0.056$). In hypertensive patients, 38 (44.2%) individuals were observed to have hypomagnesemia, 68 (54.4%) were normomagnesemic (1.72.2 mg/dL), and 32 (69.6%) were hypermagnesemic (>2.2mg/dl). Similarly, the renal disease was also closely linked to the serum magnesium levels ($p<0.021$). Hypomagnesemia (36.3%) occurred in 29, normomagnesemia (1.7–2.2 mg/dL) in 28 and hypermagnesemia (> 2.2 mg/dl) in 19 patients with renal disease.

Table 6: Association of magnesium levels with diseases studied in hospitalized patients

Diseases		Mg Level			P value*
		1.7 mg/dL	1.7 – 2.2 mg/dL	2.2 mg/dL	
Hypertension	**Yes**	38 (44.2%)	68 (54.4%)	32 (69.6%)	0.056
	No	48 (55.8%)	57 (45.6%)	14 (30.4%)	
Diabetic II	**Yes**	27 (33.8%)	46 (36.8%)	20 (43.5%)	0.540
	No	53 (66.3%)	79 (63.2%)	26 (56.5%)	
Heart disease	**Yes**	27 (33.8%)	32 (25.6%)	19 (41.3%)	0.115
	No	53 (66.3%)	93 (74.4%)	27 (58.7%)	
Pulmonary Disease	**Yes**	11 (13.8%)	22 (17.6%)	12 (26.1%)	0.220
	No	69 (86.3%)	103 (82.4%)	34 (73.9%)	
Renal disease	**Yes**	29 (36.3%)	28 (22.4%)	19 (41.3%)	0.021
	No	51 (63.7%)	97 (77.6%)	27 (58.7%)	
Proteinuria	**Yes**	6 (7.5%)	7 (5.6%)	0	0.163
	No	74 (92.5%)	118 (94.4%)	46 (100%)	
Hyperaldosteronism	**Yes**	14 (17.5%)	31 (24.8%)	7 (15.2%)	0.292
	No	66 (82.5%)	94 (75.2%)	39 (84.8%)	

Volume Expansion	**Yes**	38 (47.5%)	54 (43.2%)	22 (47.8%)	0.766
	No	42 (52.5%)	71 (56.8%)	24 (52.2%)	
Metabolic Acidosis	**Yes**	2 (2.5%)	2 (1.6%)	1 (2.2%)	0.853
	No	78 (97.5%)	123 (98.4%)	45 (97.8%)	
ECG changes	**Yes**	26 (32.5%)	35 (27.8%)	13 (28.9%)	0.793
	No	54 (67.5%)	91 (72.2%)	32 (71.1%)	

*** P-value based on chi-square and fisher exact test**

Table 7 lists the correlation coefficients for individual serum electrolytes with serum magnesium. Serum magnesium was positively correlated with serum creatinine ($r = 0.45$, $p < 0.001$) and negatively correlated with e GFR ($r = 0.40$, $p < 0.001$). Though weak, there was a positive correlation with total calcium ($r = 0.15$, p 0.018) and phosphate (r= 0.20, p 0.002). Correlation between serum magnesium and potassium was not statistically significant (p 0.115).

Table 7: Correlation between Serum Magnesium and Selected Continuous Variables.

Variable	Correlation coefficient (r)	P-value
Serum creatinine	0.45	<0.001
eGFR	-0.40	<0.001
Total calcium	0.15	0.018
Phosphate	0.20	0.002
Potassium	0.10	0.115

Discussion

The current research was carried out to determine the prevalence of dysmagnesemia in hospitalized patients of a tertiary hospital in Sulaimani, Iraq, and outline the related clinical and biochemical features. Magnesium is a vital intracellular cation, which is utilized in over 300 biochemical processes, including energy metabolism, neuromuscular activity, and blood pressure [12, 13]. The changes in magnesium homeostasis can cause serious clinical effects because of its extensive physiological roles [14]. Despite its clinical meaning, dysmagnesemia, and particularly hypomagnesemia, is not always detected and identically identified in the routine medical practice [15]. These results, which are a preliminary study of the condition in the local context, will provide good information on its prevalence in a hospitalized group. Based on the achieved outcomes, 50% of the hospitalized participant's population had dysmagnesemia; 31.7% of them had hypomagnesemia, and 18.3% were hypermagnesemic. The correlation between magnesium levels and renal disease was statistically significant whereas the correlation between magnesium levels and hypertension was found to be trend to be association significant. There were no important connections between the level of magnesium and either diabetes mellitus or cardiovascular disease. The prevalence of dysmagnesemia, which is currently studied, is quite close to the results of the study in Australia [16] where they reported a prevalence of dysmagnesemia in patients 31.75. Among that group, hypomagnesemia was reported to be 29.62 percent with hypermagnesemia constituting 2.13%. Their review study indicated further that not only dysmagnesemia predominated in inpatients, but it was also linked to the higher risks of mortality. In a like manner, a study by Upala et al. in the United States established a hypomagnesemia range of between 5 percent and 20 percent in the general hospital wards, with hypermagnesemia reaching between 5.7 and 23.6% [17]. Comparing these figures with those, the dysmagnesemia rate in the current study appears to be larger. Interestingly, current study was also higher than prevalence rates reported by Al

Shukri et al. in Iraq [3] where prevalence of dysmagnesemia was 22% (17.4-percent and 4.6-percent prevalence of hypomagnesemia and hypermagnesemia, respectively). Similar results have been reported in the neighboring Middle East countries where magnesium imbalance has been observed in a significant percentage of hospitalized patients. Regional studies have also highlighted renal impairment as well as multiple coexisting disease as important predictors of magnesium imbalance [3, 30]. The prevalence of these drastic discrepancies, particularly in the case of hypermagnesemia are worthy of further research. These variations may be explained by a number of hypotheses. To begin with, inpatient population in Shar Hospital can have specific features when compared with other settings, since tertiary referral centers tend to accept patients with more severe clinical conditions or more comorbidities. Secondly, differences in diagnostic criteria might have also led to the difference in prevalence estimates, as, whereas the current study considered hypomagnesemia below 1.7 mg/dL and hypermagnesemia above 2.2 mg/dl, other studies might have used slightly different levels, thus affecting the prevalence reports. Lastly, such ecological or nutritional properties of the area may influence magnesium levels in the wider populace, but this suggestion will have to be empirically validated further. Also many of the patient population had pre, existing renal disease which is integral to magnesium elimination and liable to magnesium retention. As a tertiary referral hospital, sicker patients with more complex medical conditions may be referred, resulting in a higher prevalence of electrolyte abnormalities. Characteristics of the patients, severity of their illnesses and clinical practices may also differ from those in the regional studies. This study also investigated the relationship between the serum magnesium levels and a variety of comorbidities. The results showed that magnesium levels and renal disease were statistically associated. This fact conforms to the accepted physiological concepts and the available medical knowledge. Magnesium homeostasis depends on the kidneys, which in cases of the early renal impairment, the initial stages will be compensated by an increase in tubular reabsorption [18]. Nevertheless, this compensatory control fails at CKD progression, especially in situations when the estimated glomerular filtration rate (eGFR) is lower than 30 mL/min (minutes), and the patient is experiencing overt hypermagnesemia [19]. The fact that the number of patients with hypermagnesemia in the current cohort is high, accompanied by the fact that the incidence of renal disease is also high, seems to reflect this physiological association. Concurring with the findings, other works by H. Zhao et al. [20] and J. A. Neyra et al. [21] have also demonstrated that magnesium imbalances have a high correlation with the outcome of renal diseases.

Moreover, there was a near significant correlation between the magnesium levels and hypertension. This observation has a significant clinical meaning and concurs with the well-defined physiological processes. Magnesium has also been used as a natural calcium channel blocker that will relax vascular smooth muscle and, in effect, lower vascular resistance and blood pressure regulation [22]. In line with the results of the current study, the relationship between reduced magnesium levels and hypertension was also found by M. C. Macias Ruiz et al. [18] and J. C. Schutten et al. [23]. Quite the opposite, the magnesium levels were not significantly associated with type 2 diabetes mellitus, cardiovascular disease, pulmonary disease, proteinuria or metabolic acidosis. Smallness of the sample or heterogeneity in the underlying conditions of the study population can explain this outcome. In addition, changes in

ECG like QT prolongation or atrial fibrillation did not significantly correlate with the serum magnesium level in this research; however, the medical literature has always determined a hypomagnesemia to be a factor that causes life-threatening arrhythmias [24, 25]. This discrepancy might be explained by absence of ECG recording or absence of continuous monitoring of cardiac rhythm in the hospital. The study established a very high rate of drugs that are known to cause dysmagnesemia; loop diuretics and proton-pump inhibitors (PPIs). The results are of concern as a long-term use of these agents without proper monitoring of the state of electrolytes may increase the likelihood of adverse clinical outcomes, which are reported by previous studies [26, 27]. In this study, however, no direct relationship was discovered between exposure to drugs and serum magnesium levels, maybe due to the study design, being cross-sectional in nature, or due to absence of records of dose and period of medication. This study did not directly measure the clinical outcomes but both hypomagnesemia and hypermagnesemia are well described in terms of being linked to bad outcomes in hospitalised patients. Prolonged hospital stay, increased use of the intensive care facility, and death risk have been associated with such magnesium imbalances in the past [28, 29].

This study has a number of methodology strengths. It is also among the first studies to directly examine the presence of dysmagnesemia among patients admitted in this geographical region and, therefore, fills a knowledge gap. Also, the large sample size was adequate in establishing major associations. There are some limitations in our study. Firstly, this was performed at a single tertiary care center, and our results may not be applicable in other types of health care settings. Secondly, because of the cross, sectional design of the study, causal relationships between dysmagnesemia and clinical factors cannot be demonstrated. Thirdly, serum magnesium concentrations were only taken once, and serial magnesium measurements during the course of hospitalization were not available. Fourthly, some clinical and drug specifics such as duration of drug exposure and serum drug concentrations were not evaluated.

Conclusion

In this study we found high prevalence of dysmagnesemia among hospitalized patients. Serum Mag levels were significantly associated with renal disease, but no statistically significant association was seen with hypertension or other comorbidity. Underlining these observations is the clinical significance of magnesium measurement, especially among patients with renal disease. Additional prospective studies are required to show the effects of dysmagnesemia on clinical outcomes and to assess the usefulness of screening for initial patients.

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