



ROLE OF SERUM MAGNESIUM LEVELS IN CHRONIC RENAL DISEASE PATIENTS

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ABSTRACT

Introduction: The incidence of chronic kidney disease is increasing in the recent times. Approximately 10% of the population of USA has chronic kidney disease stage 1 to 4. The most common cause of chronic kidney disease is diabetic nephropathy most likely due to long standing diabetes mellitus². Hence it is important to find more parameters which can be used for chronic kidney disease assessment. In this study, we tried to find a correlation of Magnesium levels in chronic kidney disease. **Materials and Methods:** This was an observational study in a tertiary institute. A total of 100 patients with chronic renal failure were taken in the study. **Results:** The majority of the patients with chronic renal failure were males. Among our study population, 38.9% of patients had renal disease due to chronic hypertension and 42.7% patients had renal disease due to uncontrolled diabetes mellitus. Our study showed that majority of the patients had hypermagnesaemia. Patients on regular dialysis had low levels of serum magnesium. **Conclusion:** Serum magnesium may be used as a tool in assessing the morbidity and mortality in patients with chronic renal failure.

INTRODUCTION

Chronic kidney disease is a common prevalent disease in the whole world and affects millions of people worldwide.^[1] Chronic kidney disease is defined as kidney damage or an estimated glomerular rate (eGFR) below 60ml/min/1.73m². Magnesium is the second most abundant cation in the intracellular compartment and the fourth most abundant cation in the body. Many studies have found that in patients with end stage renal disease, there are changes in Mg hemostasis. This makes it an important aspect to understand the physiology of Magnesium homeostasis in patients with end stage renal disease.^[2] The kidney plays a pivotal role in the management of magnesium and as the kidney function decreases, the ability to excrete Magnesium also decreases.^[2] IN CKD stages 1-3, due to compensatory mechanisms, the magnesium levels are maintained in the normal range.^[3] IN the advance stages, the compensatory mechanisms become insufficient due to the impaired tubular reabsorption and marked reduction in the glomerular filtration rate. This in turn leads to increase in Magnesium concentration. It has been found that low levels of Magnesium can lead to calcification of the blood vessels and increase in cardiovascular mortality in chronic kidney patients. On the contrary,

hypermagnesaemia can lead to inhibition of parathyroid hormone secretion which is considered an important risk factor for vascular calcification, left ventricular hypertrophy and mortality in chronic kidney disease.^[4] In this study, we tried to find a co-relation between Magnesium levels in chronic kidney disease patients and to detect a correlation of serum magnesium levels with clinical features and severity of impairment of renal disease.

MATERIALS AND METHODS

Our study was carried out at a tertiary level institute. All patients who were admitted to the hospital with chronic kidney disease were enrolled in the study. A detailed history and physical examination was done in all the patients. Serum Magnesium levels were measured in all the participants. The prevalence of CKD according to our study in our hospital was 4.9%. The study was conducted from a period of May 2020 to April 2021. A total of 100 patients were taken in our study. All patients were above 18 years of age and had abnormal creatinine for >3 months along with abnormal renal size on ultrasound, or large polycystic kidneys. Patients with chronic kidney disease with diarrhoea, pancreatitis on Magnesium treatment and age less than 18 years were excluded from

the study. All the statistical analysis were performed using the SPSS software for windows. A p-value of <0.05 was considered as statistically significant.

RESULTS

Table 1: Distribution of patients according to the stages of CKD.

Stage	No of Patients	Percentage
1	4	4%
2	18	18%
3	15	15%
4	28	28%
5	35	35%

Table 2: Presentation of the complaints of the patients.

Clinical features	No of patients	Percentage
Nausea	68	68%
Vomitting	27	27%
Fatigue and weakness	61	61%
Oliguria	44	44%
Confusion	12	12%
Edema	52	52%

Table 3: Distribution of the patients according to the serum Magnesium levels.

Magnesium levels	No of patients	Percentage
Hypomagnesemia (<1.2)	2	2%
Normal	43	43%
Hypermagnesemia(>4.8)	55	55%
Total	100	100%

Table 4: Co-relation of serum magnesium levels with other parameters.

Serum Magnesium	Co-relation	P Value
Hemoglobin	0.24	0.05
Blood Urea	0.18	0.07
Serum Creatinine	0.81	<0.001
Serum Calcium	0.005	0.09
Serum Phosphorus	0.023	0.06

Table 5: Effect of hemodialysis on serum Magnesium levels

Serum Magnesium levels	Before Hemodialysis	After Hemodialysis	P value
Mean ± SD	4.32±1.48	2.76±0.95	<0.001

In our study, we found that majority of the patients were in the age group >50 years of age followed by 40-50 years of age. Distributing the patients according to gender showed that 62 of the patients were males and 38% of the patients were females.

In table1, we have showed the distribution of all the patients of chronic kidney disease according to the stages of chronic kidney disease. There were 4 patients who were in the stage 1 of CKD. 18 patients were in stage 2 of CKD, 15 patients were in the stage 3 of CKD. 28 patients were in stage 4 of CKD and 35 patients were in stage 5 of CKD.

The presenting complaints of the patients are shown in table 2. 68% of the patients had nausea and 27% of the patients had vomiting. 61% of the patients had fatigue and weakness while 44% of the patients had oliguria.

12% of the patients presented with confusion and 52% of the patients presented with bilateral pedal edema.

Only 2% of the study population had hypomagnesemia, 43% of the patients had normal magnesium and 55% of the patients had hypermagnesemia.

The co-relation of serum Magnesium with other parameters is shown in table 4. The co-relation is statistically significant only with serum creatinine. The other parameters in our study failed to show a statistically significance with serum Magnesium levels. Serum Magnesium levels were 4.32±1.48mg/dl before dialysis and 2.76±0.95mg/dl in the same group of patients after dialysis and the p value was <0.001.

DISCUSSION

In the recent times, electrolytes and metabolic disturbances are being paid a great importance in the

management of many diseases especially for chronic kidney disease. Magnesium is being paid a great importance in the recent times as there is not a lot of study on Magnesium till now. In our study, we found that the majority of the patients were >50 years of age. The mean age of the study population was $55.262.76 \pm 15.46$. The study done by Amit et al showed similar results.^[4] In the study by Ahmed et al.^[5] for studying magnesium levels in chronic renal failure, the average age of the population was 49.16 ± 18.25 years. In our study, 62% of the patients were males and 38% of the patients were females. In the study by Amit et al, 72% of the patients were males and 28% of the patients were females and the male to female ratio was 2.57:1. The study done by Ahmed et al showed also showed the same gender and age distribution as seen in our study.^[5] On studying the co-morbidities of the patients, 58% of the patients had hypertension, 44% of the patients had diabetes mellitus and 24% of the patients had uropathy. The distribution of the patients according to the stages showed that majority of the patients were in the stage 5 followed by majority of the patients in stage 4. It was also concluded that majority of the patients presented with nausea (68%), followed by fatigue and weakness (61%), followed by oliguria (44%) and then the other complaints. The mean haemoglobin of the patients in our study was 9.78 ± 2.45 . The mean blood urea was 94.45 ± 34.15 . Mean creatinine was 6.12 ± 2.98 . The mean Sodium was 142.17 ± 4.56 . The mean Potassium was 4.47 ± 1.32 . The mean Calcium was 9.50 ± 0.61 and the mean phosphorus was 5.42 ± 0.78 . The mean Magnesium level in our study was 4.32 ± 1.48 mg/dl. In the study by Sharma et al, the mean magnesium levels were 4.10 ± 0.85 in the patient group and in the control group it was 2.40 ± 0.14 (p value <0.001). The levels of Magnesium would rise progressively with the deterioration in renal function. Significantly higher serum Magnesium levels were observed in patients of chronic renal failure with encephalopathy than in those without encephalopathy. In the study by Amit et al, the mean serum Magnesium levels were 3.61. The serum Magnesium levels showed that majority of the patients had hypermagnesemia (55%), followed by normal Magnesium levels (43%) followed by hypomagnesemia (2%). In the study by Ahmed et al, 8.7% of the patients had serum Magnesium levels <0.7 and 23.9% of the patients had serum Magnesium levels less than 1.1. One observation in our study was that serum Magnesium was higher in patients before dialysis, the level being 4.32 ± 1.48 and post dialysis the Magnesium was 2.76 ± 0.95 with the p value being <0.001 which shows that the reduction of the Magnesium level fall after hemodialysis was statistically significant and not due to a chance. In our study, the co-relation of serum urea, serum Hemoglobin, serum calcium and serum potassium showed no significant co-relation with serum Magnesium levels. In our study, the co-relation that was statistically significant was serum Creatinine and serum Magnesium (p value <0.001). In living human beings, it is not possible to determine whether tubules are more

injured or glomeruli but it can be inferred that in patients with Hypermagnesemia tubules are more injured as compared to glomeruli. This mechanism also explains why in some patients of CKD, there is hypomagnesemia while in some patients there is hypermagnesemia as in some patients tubules might be more damaged than glomeruli and vice versa. In the study by Robinson et al, he concluded that there was hypermagnesaemia in patients with $GFR < 30, l/min/1.73m^2$.^[8]

CONCLUSION

Most of the patients with Chronic Kidney Disease have hypermagnesemia. Thus all patients with CKD should be advised a low magnesium diet similar to low Potassium diet to prevent CNS depression and to prevent potential arrhythmias. Serum Magnesium is a useful tool and may be used in assessing the duration of disease, morbidity and mortality in patient with chronic renal failure.

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