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Original Article

Biochemistry Section

Correlation between Postdialysis Serum Magnesium Levels and Atherosclerosis Risk among Chronic Kidney Disease Patients: A Cross-sectional Study

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ABSTRACT

Introduction: Chronic Kidney Disease (CKD) patients undergoing haemodialysis are more prone for hypomagnesemia. A lack of magnesium can hasten the development of atherosclerosis and vascular calcification. The most widely used non invasive marker for assessing atherosclerosis risk is the measurement of Carotid Intima-Media Thickness (CIMT). The role of magnesium in cardiovascular health can be assessed by correlating serum magnesium levels with CIMT.

Aim: To correlate postdialysis serum magnesium levels and atherosclerosis risk as measured by ultrasound-guided CIMT in CKD patients undergoing Maintenance Haemodialysis (MHD).

Materials and Methods: A hospital-based cross-sectional study was conducted at KMCH Institute of Health Sciences and Research, Coimbatore, Tamil Nadu, India from May 2023 to July 2023. The study included 100 CKD patients undergoing MHD. Postdialysis, serum magnesium levels and CIMT were measured. Relevant laboratory investigations and clinical history were taken from the case records. Analysis of variance and Student's t-test were employed for the statistical analysis of the data. The correlation between the parameters was assessed using Pearson's correlation coefficient.

Results: The mean magnesium level was 1.5±0.3 mg/dL, 36% of the study population had hypomagnesemia. The mean right-side and left-side CIMT in the study population were 0.56 mm and 0.6 mm, respectively. There was a negative correlation between CIMT and magnesium (Right CIMT r-value=-0.046, p-value=0.651; Left CIMT r-value=-0.066, p-value=0.512), but it was not statistically significant. CIMT showed a significant negative correlation with serum creatinine (Right CIMT r-value=-0.220, p-value=0.029; Left CIMT r-value=-0.126, p-value=0.216) and serum phosphate (Right CIMT r-value=-0.256, p-value=0.017; Left CIMT r-value=-0.233, p-value=0.030). CIMT showed a significant correlation between with duration of hypertension (Right CIMT r-value=0.299, p-value=0.003; Left CIMT r-value=0.232, p-value=0.020) and dialysis (Right CIMT r-value=0.288, p=0.004; Left CIMT r-value=0.204, p-value=0.041).

Conclusion: There was a negative correlation between CIMT and serum magnesium levels, but it was not statistically significant. Thus, decreased serum magnesium levels may be an additional risk factor, along with disordered homeostasis of calcium, phosphorous, duration of dialysis, diabetes and hypertension, for developing adverse cardiovascular events.

Keywords: Carotid intima media thickness, Estimated glomerular filtration rate, Renal disorder, Renal replacement therapy

INTRODUCTION

The CKD refers to abnormalities in kidney structure or function that have been present for more than three months and have a specific negative impact on health [1]. As a primary cause of death, CKD affects 8 to 16% of people globally [2]. End-Stage Renal Disease (ESRD) is currently a huge burden in India [3]. CKD is one of the most prevalent non communicable illnesses globally, and it has a significant impact on economic burden, mortality and morbidity [4,5]. One factor for CKD is the fast-rising rates of diabetes and hypertension worldwide [6,7]. A Glomerular Filtration Rate (GFR) below 60 mL/min/1.73 m^2 or the presence of albuminuria, indicates renal disease, is considered an indicator for this condition. CKD is further classified based on the estimated GFR (eGFR) [8].

Patients with chronic renal failure experience the buildup of toxins, fluid and electrolytes in their bodies, leading to a condition known as uremic syndrome. This syndrome can be fatal if the toxins are not eliminated through renal replacement therapy [9]. Haemodialysis is one of the three types of renal replacement therapy available, with the other two being peritoneal dialysis and kidney transplantation. Haemodialysis, is the primary and most widely used treatment for patients with kidney insufficiency who are awaiting a kidney transplant. When a patient undergoes haemodialysis treatments three or four times per week, it is called MHD [10].

Magnesium (Mg^{2+}) is the second-most significant and fourth-most abundant intracellular cation in the body [11]. The equilibrium of magnesium is largely maintained by the kidneys. In the typical population, serum magnesium levels should range from 1.4 to 2.6 mg/dL [12]. In patients receiving continuous haemodialysis, the dialysate magnesium concentration is the main variable used to calculate serum Mg levels. In patients with CKD, hypomagnesemia is linked to vascular calcification and higher cardiovascular mortality; thus, increasing the dialysate Mg concentration is very important to provide supplementation [13,14].

In patients with CKD, related morbidity and disability are highly linked to the incidence of atherosclerotic cardiovascular events [15]. Cardiovascular death can occur as a result of heart failure and dangerous arrhythmias, especially in advanced stages of CKD. Additionally, individuals with CKD face a significant risk of experiencing fatal complications related to endothelial dysfunction, activation of profibrotic and proinflammatory states and atherosclerosis, such as myocardial infarction and stroke [16]. Despite efforts to address traditional and non traditional risk factors for cardiovascular disease (CVD), including hypertension, diabetes and dyslipidaemia, the

impact of CKD on cardiovascular risk remains evident in numerous trials involving CKD patients who have not yet started dialysis treatment.

CIMT has been found to be helpful in assessing the risk and prevalence of CVD, according to numerous research [17-19], and it can be measured easily, consistently and non invasively. Although there are few studies [20,21] suggesting the role of magnesium in cardiovascular health, the novelty of the study was that it links the risk of cardiovascular events in patients undergoing haemodialysis based on serum magnesium levels and CIMT. Thus, serum magnesium levels may be estimated routinely in patients after haemodialysis, and magnesium supplementation may be provided.

In this study the aim was to find the correlation between serum magnesium levels and the risk of atherosclerosis as measured by CIMT in haemodialysis patients.

MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted at KMCH Institute of Health Sciences and Research in Coimbatore, Tamil Nadu, India focusing on patients undergoing MHD over three months, from May 2023 to July 2023. The Institutional Human Ethical Committee (IHEC) granted clearance, and the approval number was 07/IHEC/2023.

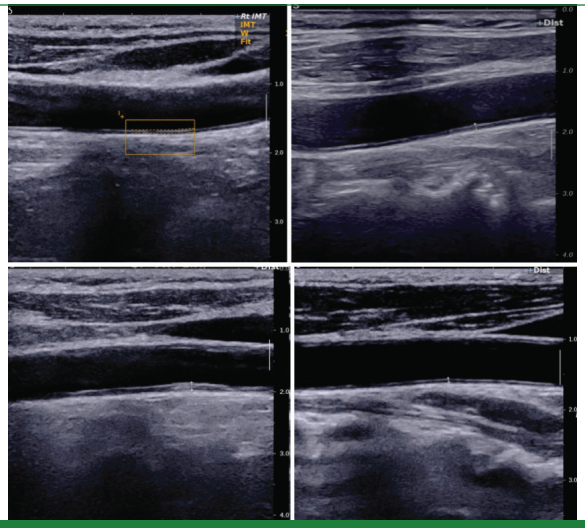
Inclusion criteria: Stage 4 and stage 5 chronic renal failure patients aged 18 years or older, who were undergoing MHD in the Nephrology department and were willing to give consent were included in the study. CKD is staged as stage 4 if GFR value is15-29 mL/min/1.73 m^2, and as stage 5 if the GFR value is <15 mL/min/1.73 m^2 [9].

Exclusion criteria: Patients who were unwilling to provide consent, patients who had done renal transplantation and those receiving magnesium supplementation were excluded from the study.

Sample size calculation: One hundred subjects were included by convenience sampling.

Study Procedure

Written informed consent was obtained from the selected patients. CIMT was measured in the Radiology Department. The medial-adventitial and intimal-luminal contacts of the carotid artery were used to compute the carotid IMT. IMT corresponds to the region between the “double line” of hyperechoic lines. For carotid ultrasonography, a linear-array transducer with a fundamental frequency of at least 7 MHz should be employed. While a depth of focus between 30 and 40 mm is the appropriate depth of focus, people with larger necks or deeper veins may need a deeper focus. In transverse and longitudinal sections, the Common Carotid Artery (CCA) should be scanned in B-mode carotid ultrasonography from its origin to the carotid bifurcation (BIF), Internal Carotid Artery (ICA), and External Carotid Artery [Table/Fig-1] [22].



[Table/Fig-1]: USG images of the CIMT thickness.

Three mL of blood sample was collected immediately after dialysis. The blood samples were collected in a blood collection tube without anticoagulant and promptly transported to the biochemistry laboratory. The collected samples were kept at room temperature for 25-30 minutes to allow clotting, after which the serum was separated through centrifugation at 3000 rpm for 15 minutes. The postdialysis serum concentrations of magnesium (reference range: 1.4-2.6 mg/dL) were analysed in COBAS INTEGRA 400 plus chemistry analyser (Roche Diagnostics Ltd), and the results were recorded. The total magnesium concentration was measured photometrically at 600 nm via the decrease in xylidyl blue absorbance. The other required details of the patients were obtained from the patients’ records maintained at the Department of Nephrology using a preset proforma. This included age, gender, duration of dialysis, history of diabetes, history of hypertension and previously reported blood chemistry parameters: eGFR, serum urea, serum creatinine, serum sodium, serum potassium, serum calcium, and serum phosphorous [Table/Fig-2] [23]. All the collected data were recorded for further statistical analysis.

Parameter	Reference range	Method of estimation
eGFR (mL/min/1.73 m^2)	125	CKD-Epidemiology Collaboration
Serum urea (mg/dL)	15-40	Urease- glutamate dehydrogenase method
Serum creatinine (mg/dL)	0.72 to 1.18 in men 0.55 to 1.02 in women	Jaffe’s alkaline picrate method
Serum sodium (mEq/L)	135-145	Direct Ion selective electrode- Potentiometry
Serum potassium (mEq/L)	3.5-5.5	Direct Ion selective electrode- Potentiometry
Serum calcium (mg/dL)	9-10.6	NM-BAPTA method
Serum phosphorous (mg/dL)	2.8-5.9	Ammonium molybdate method

[Table/Fig-2]: Reference ranges of the blood chemistry parameters [23].

STATISTICAL ANALYSIS

Statistical analysis of the data obtained was done using the Statistical Package for the Social Sciences (SPSS) software version 28.0. The results were analysed with tables and bar charts. Demographic data were analysed with descriptive statistics such as mean±standard deviation (SD) for the continuous variables, while categorical variables were analysed with frequencies and percentages. Analysis of variance (ANOVA) and Student’s t-test were employed for the statistical analysis of the data. The p-value of <0.05 were taken as the significant value. The correlation between the parameters was assessed using Pearson’s correlation coefficient. A 75th percentile values were taken based on the results from large European cohort studies [24].

RESULTS

A total of 100 CKD patients undergoing haemodialysis were included in the study, comprising 84 male patients and 16 female patients. The mean age of the patients was 44.6±14.6 years. Other demographic characteristics are shown in [Table/Fig-3].

A 92% of the study population falls in CKD stage 5 based on eGFR. Among 100 participants, 6% had hypophosphatemia, and 22% had hyperphosphatemia. A 77% of study participants had hypocalcaemia, and 36% of the study population had hypomagnesemia [Table/Fig-4].

Among males, on the right-side, less than 30 years of age, about 9 (64.3%) had CIMT above 0.49 mm. In the age group of 31-40 years, about 16 (69.6%) had CIMT above 0.51 mm. In the age group of 41-50 years, about 10 (55.6%) had CIMT above 0.58 mm, and among those above 50 years of age, 9 (31%) had CIMT more than

0.63 mm [Table/Fig-5]. Among males, on the left-side, <30 years of age, about 9 (64.3%) had CIMT above 0.50 mm. In the age group of 31-40, about 12 (52.2%) had CIMT above 0.58 mm. In the age group of 41-50, about 8 (44.4%) had CIMT above 0.62 mm, and among those above 50 years of age, about 5 (17.2%) had CIMT more than 0.71 mm [Table/Fig-6].

Variables		Frequency (%) or Mean±SD
Age (years)		44.6+14.6
Gender	Male	84%
	Female	16%
Body mass index	Underweight	11%
	Normal	57%
	Overweight	29%
	Obese	3%
Diabetes	Yes	35%
	No	65%
Duration of diabetes (years)		10+8.1
Hypertension	Yes	81%
	No	19%
Duration of hypertension (years)		5.7+5.4
Duration of dialysis (years)		2.2+1.9

[Table/Fig-3]: Distribution of demographic characteristics of study participants.

Clinical parameters	Mean±Std. Deviation
Serum magnesium (mg/dL)	1.5±0.3
	36% had hypomagnesemia
	64% had normal levels of magnesium
Serum creatinine (mg/dL)	8.14±3.4
Estimated Glomerular Filtration Rate (eGFR) (mL/min/1.73 m^2)	8.4±4
	8% in stage 4 CKD
	92% in stage 5 CKD
Serum urea (mg/dL)	84.9±36.7
Serum calcium (mg/dL)	8.4±0.8
	23% had normocalcaemia
	77% had hypocalcaemia
Serum phosphorus (mg/dL)	4.8±1.5
	6% had hypophosphatemia
	22% had hyperphosphatemia
Serum sodium (mmol/L)	137.5±2.9
Serum potassium (mmol/L)	5±0.8
Carotid intima medial thickness-right	0.56±0.08
Carotid intima medial thickness-left	0.6±0.1

[Table/Fig-4]: Distribution of clinical characteristics of study participants.

Age and carotid intima medial thickness value	n (%)
<30 years (n=14)	
<0.48 mm (75th percentile)	5 (35.7)
>0.49 mm	9 (64.3)
31-40 years (n=23)	
<0.50 mm (75th percentile)	7 (30.4)
>0.51 mm	16 (69.6)
41-50 years (n=18)	
<0.57 mm (75th percentile)	8 (44.4)
>0.58 mm	10 (55.6)
>50 years (n=29)	
<0.62 mm (75th percentile)	20 (69.0)
>0.63 mm	9 (31.0)

[Table/Fig-5]: Males, right-side CIMT in the study population.

Age and carotid intima medial thickness value	n (%)
<30 years (n=14)	
<0.49 mm (75th percentile)	5 (35.7)
>0.50 mm	9 (64.3)
31-40 years (n=23)	
<0.57 mm (75th percentile)	11 (47.8)
>0.58 mm	12 (52.2)
41-50 years (n=18)	
<0.61 mm (75th percentile)	10 (55.6)
>0.62 mm	8 (44.4)
>50 years (n=29)	
<0.70 mm (75th percentile)	24 (82.8)
>0.71 mm	5 (17.2)

[Table/Fig-6]: Males, left-side CIMT in the study population.

Among females, in the age group of <30 years, all patients (n=4) had right-side CIMT greater than 0.44 mm. In the age group of 31-40 years, 3 (42.9%) had right-side CIMT less than 0.50 mm. In the age group of 41-50 years, 2 (66.7%) had right-side CIMT of <0.53 mm. In the age group of more than 50 years, one had right-side CIMT of 0.60 mm and 1 had CIMT <0.60 mm [Table/Fig-7]. Among females in the age group of less than 30 years of age all the patients had left-side CIMT of 0.47 mm. In the age group of 31-40 years, 2 (28%) had left-side CIMT of <0.51 mm. In the age group of 41-50 years, all three had left-side CIMT of >0.57 mm, and in the age of >50 years 1 (50%) had left-side CIMT of >0.64 mm [Table/Fig-8].

Age and carotid intima medial thickness value	n (%)
<30 years (n=4)	
>0.44 mm (75th percentile)	4 (100)
31-40 years (n=7)	
<0.50 mm (75th percentile)	3 (42.9)
>0.50 mm	4 (57.1)
41-50 years (n=3)	
<0.53 mm (75th percentile)	2 (66.7)
>0.53 mm	1 (33.3)
>50 years (n=2)	
<0.60 mm (75th percentile)	1 (50)
>0.60 mm	1 (50)

[Table/Fig-7]: Females, right-side CIMT in the study population.

Age and carotid intima medial thickness value	n (%)
<30 years (n=4)	
>0.47 mm (75th percentile)	4 (100)
31-40 years (n=7)	
<0.51 mm (75th percentile)	2 (28)
>0.52 mm	5 (71)
41-50 years (n=3)	
>0.57 mm (75th percentile)	3 (100)
>50 years (n=2)	
<0.64 mm (75th percentile)	1 (50)
>0.64 mm	1 (50)

[Table/Fig-8]: Females, left-side CIMT in the study population.

About 24 patients with hypomagnesemia had high right-side CIMT, and 22 patients with hypomagnesemia had high left-side CIMT, as detailed in [Table/Fig-9,10].

There was a negative correlation between serum magnesium levels and both right and left CIMT; but it is not statistically significant since the p-value >0.05 and the details have been depicted in [Table/Fig-11].

Carotid intima media thickness	Hypomagnesemia	Normal magnesium	Total
Carotid intima medial thickness normal	12	34	46
Carotid intima medial thickness high	24	30	54
Total	36	64	100

[Table/Fig-9]: Serum magnesium and right-side CIMT in the study population.

Carotid intima media thickness	Hypomagnesemia	Normal magnesium	Total
Carotid intima medial thickness normal	14	39	53
Carotid intima medial thickness high	22	25	47
Total	36	64	100

[Table/Fig-10]: Serum magnesium and left-side CIMT in the study population.

Variables	Pearson correlation	p-value
Age	0.128	0.205
Duration of diabetes mellitus	0.133	0.447
Duration of hypertension	0.089	0.430
Duration of dialysis	0.006	0.950
Estimated Glomerular Filtration Rate (eGFR)	-0.021	0.834
Creatinine	0.023	0.819
Urea	0.057	0.585
Calcium (mg/dL)	0.039	0.709
Phosphorus (mg/dL)	-0.012	0.915
Sodium (mEq/L)	-0.095	0.371
Potassium (mEq/L)	0.015	0.885
Right-side carotid intima medial thickness	-0.046	0.651
Left-side carotid intima medial thickness	-0.066	0.512

[Table/Fig-11]: Correlation of serum magnesium with clinical parameters.

The correlation of various analytes, like serum creatinine with duration of diabetes mellitus, duration of hypertension with right and left CIMT, duration of dialysis with right and left CIMT, and serum phosphorus with right and left CIMT, have been done and the details are depicted in [Table/Fig-12].

Correlation	Pearson correlation (r-value)	p-value
Serum creatinine with duration of diabetes mellitus	-0.232	0.020
Duration of hypertension with right carotid intima medial thickness	0.299	0.003
Duration of hypertension with left carotid intima medial thickness	0.232	0.020
Duration of dialysis with right carotid intima medial thickness	0.288	0.004
Duration of dialysis with left carotid intima medial thickness	0.204	0.041
Serum creatinine with right carotid intima medial thickness	-0.220	0.029
Serum creatinine with left carotid intima medial thickness	- 0.126	0.216
Serum phosphorous with right carotid intima medial thickness	-0.256	0.017
Serum phosphorous with left carotid intima medial thickness	-0.233	0.030

[Table/Fig-12]: Correlation of various analytes.

DISCUSSION

The mean duration of diabetes in the study population was 10 years. Diabetes mellitus plays an important role in the development and progression of CKD. The mean duration of hypertension in the study population was 5.7 years. A causal association between systemic hypertension and CKD could not be established, as CKD could also result in the development of hypertension owing to the role of kidneys in maintaining blood pressure. The mean duration of dialysis in the study population was 2.2 years. About 92% of the study population had stage five CKD based on estimated glomerular filtration rate (eGFR). In the present study, about 77% of the population had hypocalcaemia. This decrease in serum calcium level is expected because of the kidneys' role in forming an active form of vitamin D, that in turn plays the key role in maintaining the serum calcium levels. Vitamin D is responsible for the absorption of dietary calcium from the intestines and the reabsorption of calcium from the kidneys. In the present study, about 22% of the population had hyperphosphatemia. Hyperphosphatemia in CKD is due to the decreased GFR, and hence decreased filtration of phosphate, and also by poor dietary restriction of phosphate.

In the present study, 36% of the population had hypomagnesemia, and 64% had normal magnesium levels. According to Ramasamy I et al., 27% of the patients with CKD undergoing MHD had hypomagnesemia [12]. These findings were similar to those of Leenders NHJ et al., where there was a significant decrease in postdialysis serum magnesium levels in the study population [25]. This decrease in postdialysis magnesium level may be because of the decreased dietary intake of magnesium, low concentration of dialysate fluid magnesium, or maybe due to intake of drugs that interfere with magnesium homeostasis [12]. Based on the CCA CIMT values and percentiles from large European cohort studies 75th percentile values were taken [24].

Among males, on the right-side, less than 30 years of age, about n=9 (64.3%) had CIMT above 0.49 mm. In the age group of 31-40 years, about n=16 (69.6%) had CIMT above 0.51 mm. In the age group of 41-50 years, about n=10 (55.6%) had CIMT above 0.58 mm, and those above >50 years of age, n=9 (31%) had CIMT more than 0.63 mm. Among males, on the left-side, less than 30 years of age, about n=10 (71.4%) had CIMT above 0.50 mm. In the age group of 31-40 years, about n=12 (52.2%) had CIMT above 0.58 mm. In the age group of 41-50 , about n=8 (44.4%) had CIMT above 0.62 mm, and those above >50 years of age, about n=5 (17.2%) had CIMT more than 0.71 mm.

Among females, in the age group of less than 30 years of age, all the patients (n=4) had right-side CIMT of >0.44 mm, those in the age group of 31-40 years of age three had right-side CIMT of <0.50 mm, and four has right-side CIMT greater than 0.50 mm, those in the age group of 41-50 years, two had right-side CIMT of <0.53 mm, and one had a CIMT of 0.53 mm. In the age group of more than 50 years, one had right-side CIMT of 0.60 mm, and one had less than 0.60 mm. Among females in the age group of less than 30 years, all patients had left-side CIMT greater than 0.47 mm. In the age group of 31-40 years, one had left-side CIMT of <0.51 mm, and six had >0.52 mm. In the age group of 41-50 years, all three had left-side CIMT of >0.57 mm, those in the age of >50 years all two had left-side CIMT of >0.64 mm.

CIMT has been found to have predictive value in cardiovascular risk assessment [17]. There was an increasing trend of CIMT in patients as their age increased. The mean right-side carotid artery intima-media thickness in the study population was 0.55 mm, and that on the left-side was 0.60 mm. According to El-Ghany SA et al., [26], the mean CIMT in their population was 1.06 mm, which is higher than the mean value observed in present study population. This may be because of the geographical variations and increased phosphate levels (mean=5.2 mg/dL). This increased mean CIMT in the study population of El-Ghany SA et al., may also be explained by the increased prevalence of hypomagnesemia (n=36, 60%) in their population when compared to the current study (36%) [26].

The mean CIMT in the current study was also in contrast with the findings of Alarbagy AR et al., where the CIMT was in the higher range when compared to present study population, even in those

patients with serum magnesium in the normal range [27]. This difference could be explained by the geographical variations.

There was a significant negative correlation between serum creatinine levels and duration of diabetes (r-value=-0.232, p-value=0.020). Additionally, there was a significant correlation between the duration of hypertension and CIMT on both the right and left-sides (right: r-value=0.299, p-value=0.003; left: r-value=0.232, p-value=0.020). This proves the increased cardiovascular risk caused by hypertension. There was a significant correlation between the duration of dialysis and CIMT on both right and left-sides (right: r-value=0.288, p-value=0.004; left: r-value=0.204, p-value=0.041), as haemodialysis is an independent risk factor for adverse cardiovascular events.

There was also a significant negative correlation between right-side CIMT and serum creatinine (r-value=-0.220, p-value=0.029), as CKD is an independent risk factor for adverse cardiovascular events. A significant negative correlation was observed between serum phosphate and CIMT on both the right and left-sides (right: r-value=-0.256, p-value=0.017; left: r-value=-0.233, p-value=0.030), as there will be hyperphosphatemia is common in patients with CKD. There was a negative correlation between right and left CIMT with posthaemodialysis serum magnesium levels, but it was not statistically significant with (right CIMT: r-value=-0.046, p-value=0.651; left CIMT: r-value=-0.066, p-value=0.512). This was also similar to the findings of El-Ghany SA et al., where there was no significant correlation between the two parameters (r-value=0.04, p-value=0.66) [26]. Alarbagy AR et al., also concluded that serum magnesium is not an independent risk factor for atherosclerosis [27].

In contrast, Gulati Y et al., found a significant correlation between serum magnesium and CIMT (Pearson correlation coefficient was -0.677 and -0.704), with CIMT being significant at p-value<0.001 [28]. Thus, in CKD patients, there is disordered homeostasis of calcium, phosphorous, and magnesium, and there will be an accumulation of uremic toxins. The major risk factors for CKD are diabetes mellitus and hypertension, all together finally leading to adverse cardiovascular events.

In patients undergoing haemodialysis, decreased magnesium levels may be an additional risk factor that may hasten vascular calcification, leading to adverse cardiovascular events. Although it was not statistically significant in this study, the negative correlation between CIMT and serum magnesium showed a negative correlation, thus estimation of serum magnesium levels may be routinely done in patients receiving haemodialysis, thus one can identify hypomagnesemia, and correction can be done and that may prevent adverse cardiovascular events.

Limitation(s)

This was a single-centered, hospital-based study, and serum total magnesium was measured instead of ionised magnesium, which is the biologically active form. Multicentric trials could be done to confirm the findings in a larger, more varied population. CIMT alone was used as a marker for predicting adverse cardiovascular events. Along with CIMT, other cardiovascular risk markers could be studied, and correlation of these markers with magnesium could be done and this gives a better insight into the role of magnesium in cardiovascular health.

CONCLUSION(S)

In the present study, there was a significant correlation between the duration of hypertension, dialysis duration, serum creatinine, and serum phosphate levels with CIMT. About 36% of the study population had hypomagnesemia. CIMT and serum magnesium showed a negative correlation, but it was not statistically significant. Although there was no significant correlation between CIMT and magnesium levels, it may be beneficial for the patients if postdialysis serum magnesium levels were estimated routinely and magnesium supplementation provided to prevent adverse cardiovascular events. However, further studies with larger sample size are needed to find the correlation between magnesium levels and cardiovascular risk markers in CKD patients receiving haemodialysis, and also to assess the independent role of magnesium in cardiovascular health.

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