RESEARCH PAPER

Clinical Profile of Chronic Kidney Disease –Mineral and Bone Disorders

Dr. Rajagiri Triveni[1], Koppula Jyothi[2], Dr. Koppula Sirisha[1], Maganti Soumya[3], Konagala Arudra[3], Meka Saranya[3], Lingineni Mani Deepa Chandrika*[3], Avanigadda Niharika[3], Dr. Varun Kumar Bandi[4]

[1]Assistant professor, Department of Pharmacy Practice, KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, Andhra Pradesh, India
[2]Assistant professor, Department of Pharmaceutical Analysis, KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, Andhra Pradesh, India
[3] Pharm D Intern, KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, Andhra Pradesh, India
[4]Professor & HOD, Department of Nephrology, Dr. Pinnamaneni Siddhartha Institute Medical Sciences & Research Foundation, Gannavaram, Andhra Pradesh, India
***Corresponding Author:** Lingineni Mani Deepa Chandrika, Email: linginenimanideepachandrika@gmail.com*

Received: 23rd September, 2026, Revised: 8th October, 2026, Accepted: 20th October, 2026, Published: 5th Nov., 2026

ABSTRACT

Background: Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD) is a major complication of chronic kidney disease, which is characterized by abnormalities in calcium, phosphate metabolism and parathyroid hormone (PTH) metabolism. They are usually related to vascular calcification and higher risk of cardiovascular morbidity.

Materials and Methods: A six-month cross-sectional observational study was carried out in a tertiary care hospital among 60 patients diagnosed with CKD stage ≥ 3. Demographic, clinical, and biochemical parameters were collected along with serum calcium, phosphate, PTH, and creatinine levels to assess vascular calcification radiologically using calcification scoring system.

Results: The majority of patients involved in the study were men of middle age with a rate of 63.3%. The principal conditions present alongside the disease included hypertension (93.3%) and diabetes (58.3%). The most frequently encountered symptoms during the study included bone pain (88.3%) and muscle weakness (95%). Moderate vascular calcification was noted frequently. It has been shown, evaluating serum phosphorus that it was related to elevated levels of PTH ($p < 0.05$); at the same time, increasing age was associated with higher scores of vascular calcifications. However, serum calcium did not have significant dependence ($p > 0.05$).

Conclusion: CKD-MBD has a great prevalence among CKD patients and is strongly associated with clinical manifestations and vascular calcification. In order to minimize complications and achieve good results of treatment, prompt diagnosis and continuous monitoring of mineral metabolism must be performed.

Keywords: Chronic Kidney Disease, Mineral Metabolism, Parathyroid Hormone, Vascular Calcification.

How to cite this article: Triveni R, Jyothi K, Sirisha K, Soumya M, Arudra K, Saranya M, Chandrika LMD, Niharika A, Bandi VK. Clinical Profile of Chronic Kidney Disease–Mineral and Bone Disorders. Int J Drug Deliv Technol. 2026;16(87s): 1382-1389; DOI: 10.25258/ijddt.16.87s.145

INTRODUCTION

Chronic Kidney Disease (CKD) is an irreversible and progressive disorder characterized by gradual loss of kidney function over time. CKD is considered a serious public health crisis in the world because of its increasing prevalence, and also, the associated morbidity, mortality, and economic burden. Diabetes mellitus and high blood pressure continue to be the prime causes of CKD all over the world. The burden of CKD in India is constantly rising due to the rising lifestyle-related diseases, delayed diagnosis, and poor accessibility to health care facilities [1]. As the kidney strength decreases, several metabolic and hormonal abnormalities appear, especially in the metabolism of calcium, phosphorus, vitamin D, and parathyroid hormone (PTH), resulting in a condition termed Chronic Kidney Disease–Mineral and Bone Disorder (CKD-MBD) [2].

The condition termed CKD-MBD affects the entire body through disturbances in disorders of mineral metabolism, in the processes of creating bone as well as bringing minerals to it via the circulatory system. Decrease in glomerular filtration rate (GFR) results in retention of phosphate and failure to activate vitamin D, which leads to hypocalcaemia and secondary hyperparathyroidism [3]. The constant high level of parathyroid hormone (PTH) results in elevation of processes of bone turnover leading to renal osteodystrophy with its symptoms, which include pain in the bones, fractures, deformities, and weakness of the muscles [4].

Besides symptoms related to bone, CKD-MBD is associated with issues connected to calcification of

blood vessels and heart valves leading to the number of cardiovascular problems and increasing risks to die from the condition [5]. Cardiovascular disease is the main cause of death for CKD patients, while disturbances in metabolism concerning calcium and phosphorus play an important role in the process. The calcification of blood vessels is responsible for stiffening of arteries, hypertension, hypertrophy of the left ventricle, and increasing the load on the heart of patients [6].

Numerous studies have shown that some disorders exhibited by individuals with chronic kidney disease include hyperphosphatemia, vitamin D deficiency, elevated parathyroid hormone, and vascular calcifications are quite common among patients with chronic kidney disease, particularly in the advanced stages and in those undergoing dialysis [7]. Few patients, however, show any clinical signs of chronic kidney disease-mineral bone disorder during the initial stages, which results in a postponed diagnosis of their condition [8].

Thus, timely detection of biochemical parameters such as serum calcium, phosphorus, alkaline phosphatase, vitamin D, and PTH enables the prevention of complications and improvement of prognosis [9][10]. Consequently, this research is aimed at studying the clinical characteristics of patients with chronic kidney disease-mineral bone disorder and examining the link between biochemical abnormalities, disturbances in parathyroid hormone secretion, and vascular calcifications in patients suffering from chronic kidney diseases.

METHODS AND MATERIALS

A hospital based observational study was conducted for a period of six months between October 2025 to March 2026 at Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation (Dr. PSIMS & RF), Andhra Pradesh in order to assess the clinical profile of chronic kidney disease–Mineral and Bone Disorder (CKD-MBD) in patients diagnosed with chronic kidney disease. The study required subjects aged over 18 years of age of both sexes and diagnosed with CKD stage >3 of the disease and willing to provide informed consent to take part in the study. Patients already treated with glucocorticoids, bisphosphonates, NSAIDs, having liver diseases, primary parathyroid disorders, having sustained fractures recently, having abnormal vasculature for some other reason, or not willing to give informed consent were eliminated from the study. Ethical clearance was secured from the Institutional Ethics Committee by those responsible for the project, and informed consent was signed by all the subjects. The total number of patients accepted for the study was 60.

Demographic, clinical, co-morbidities, personal, laboratory, and radiological characteristics were collected from patient interviews, treatment cards, and medical record forms through a structured data collection tool. Laboratory tests included serum calcium, serum phosphate, alkaline phosphatase (ALP), creatinine, albumin, parathyroid hormone (PTH), estimated glomerular filtration rate, and haemoglobin (Hb). Radiological changes were evaluated using lumbar and pelvic X-rays to determine the abnormalities associated with CKD-MBD. The data entry and statistical analysis were performed using Microsoft Excel and IBM SPSS version 29. Qualitative measures were compiled in terms of percentages and frequencies while the quantitative measures were presented as mean ± standard deviation. For statistical analysis, chi-square test, independent t test, and ANOVA test were used, and $p < 0.05$ was considered significant.

RESULTS

A total of 60 subjects with CKD stage ≥3 was recruited for participation in the study. The average age of the participants in the study was 47.75±14.02 years. Most patients (30%) belonged to the age group of 40-49 years. Males made up 63.3% of the study population, whereas females made up 36.7% of the sample. The most prevalent comorbidity among participants was hypertension (93.3%), followed by diabetes mellitus (58.3%) and thyroid disorders (21.7%). The history of smoking and alcohol consumption was obtained in 78.3% and 70% of the participants, respectively.

The most frequently reported symptoms were bone pain and muscle weakness. Bone pain was present in 88.3% of the subjects, while muscle weakness was observed in 95% of the subjects. Fractures were found in only 3.3% of patients, whereas skeletal deformities were not observed in any participant (Table1). The mean duration of CKD was 2.08±1.26 years. The average serum calcium level was found to be 8.79±0.96 mg/dL; phosphorus levels were measured to be 5.52±1.85 mg/dL, PTH level was found to be 413.63±255.71 pg/mL and serum creatinine was found to be 8.64±2.33 mg/dL. The mean eGFR was found to be 6.88±4.64 mL/min/1.73m², which indicates advanced renal failure (Table2).

A total of 48 subjects (80%) showed vascular calcification, indicating that 12 individuals were free of calcification (20%). The most prevalent finding was calcification score 2, which was observed in 40% of individuals; other findings included calcification score 1 (25% of subjects), calcification score 0 (20% of subjects), and calcification score 3 (15% of subjects), showing that moderate calcification was present in the majority of individuals evaluated in the study. As for the drugs used to treat the participants in this study, calcium carbonate was by far the most prescribed treatment (41.7%), followed closely by sevelamer (16.7%) and calcium acetate (15%). Of the total participants, 26.7% were not treated for CKD-MBD (Figure1).

Demographic properties of the population were evaluated for two factors, namely the association of different variables and the severity of vascular calcification, where male patients showed higher rates of calcification as well as those with hypertension, diabetes, smokers, and alcohol consumers. The

association of thyroid problems and calcification appeared to be statistically significant (p=0.04), while other variables such as age, gender, hypertension, diabetes, smoking, and alcohol consumption were not statistically important (p>0.05).

Symptoms and vascular calcification analysis indicated that bone pain, weakness of muscles and presence of fractures were more often found in patients with vascular calcification. Nonetheless, associations were not statistically significant (p>0.05) (Table3). Research on laboratory characteristics in patients with vascular calcification and without it showed no statistically significant differences in haemoglobin, creatinine, calcium, phosphorus, PTH, TSH, ALP, eGFR, albumin and kt/v (p>0.05) (Table4).

The relationship between demographic features and the level of calcification demonstrated that significant calcification was mainly observed among patients aged 40-59 years. Age was significantly linked to the level of calcification (p=0.04). Significant calcification was also found among men, people suffering from hypertension and diabetes, smokers and alcohol drinkers, even though the connections were not considered statistically reliable (Table5). The laboratory parameter comparison across calcification scores indicated differences in haemoglobin, serum creatinine, calcium, phosphorus, PTH, ALP, eGFR, albumin as well as kt/v but none of the parameters were statistically significant (p>0.05) (Table6).

An analysis revealed that most of the patients with elevated PTH levels (>300 pg/mL) were aged between 40 and 59 years as well as mostly males. The patients with elevated PTH levels were mostly experiencing bone pain and muscle weakness. The serum phosphorus levels were found to have elevated with increase of PTH levels and phosphorus levels were 4.68±1.61 mg/dL in PTH group <150, 5.01±1.54 mg/dL in PTH between 150 and 300 and 6.07±1.95 mg/dL in PTH group >300 respectively. The difference was statistically significant (p=0.04) (Table7). The calcium, serum creatinine, ALP, eGFR, albumin and kt/v laboratory parameters were not statistically significant (p>0.05) (Table8).

Table 1. Baseline Demographic and Clinical Characteristics

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	<20	1	1.7
	20–29	5	8.3
	30–39	11	18.3
	40–49	18	30.0
	50–59	15	25.0
	60–69	6	10.0
	70–79	4	6.7
	Mean ± SD	**47.75 ± 14.02**	—
Gender	Male	38	63.3
	Female	22	36.7
Hypertension	Yes	56	93.3
	No	4	6.7
Diabetes Mellitus	Yes	35	58.3
	No	25	41.7
Thyroid Disorder	Yes	13	21.7
	No	47	78.3
Alcohol Consumption	Yes	42	70.0
	No	18	30.0
Smoking	Yes	47	78.3
	No	13	21.7
Bone Pain	Yes	53	88.3
	No	7	11.7
Muscle Weakness	Yes	57	95.0
	No	3	5.0
Fracture History	Yes	2	3.3
	No	58	96.7
Skeletal Deformities	Yes	0	0
	No	60	100.0

Table 2. Baseline Laboratory Parameters

Variables	Minimum	Maximum	Mean± SD
CKD Duration (Years)	0.5	6	2.08±1.26
Cap Product	19.98	88.45	48.06±15.19
Corr Calcium	0	12.35	9.12±1.85
Hb	4.8	15	8.22±1.78
Sr creatinine	1.5	13.7	8.64±2.33
Calcium	5.9	10.8	8.79±0.96
Phosphorous	2.2	10.53	5.52±1.85
PTH	85.39	1231.38	413.63±255.71
TSH	0.20	8.66	3.01±1.96
ALP	50	317	117.83±51.86
e-GFR	3.08	39	6.88±4.64
Albumin	2.7	7.6	3.87±0.68
kt/v	0.64	1.9	1.11±0.27

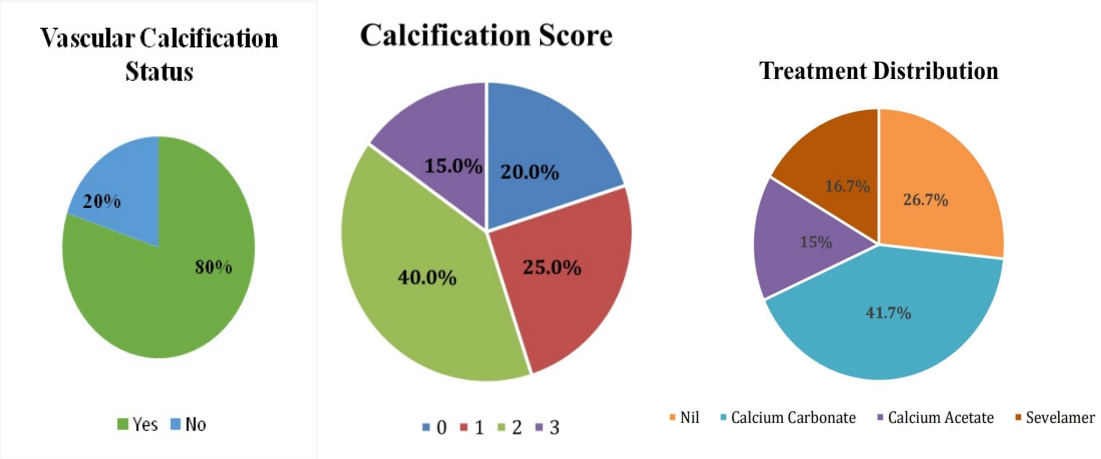


Figure 1. Graphical representation of vascular calcification status, calcification score, and treatment distribution in patients with CKD-MBD

Table 3: Association with vascular calcification

Variables		Vascular Calcification				Total		Fishers Exact Value	p Value
		0		1					
		N	%	N	%	N	%		
Age	<20	1	8.3	0	0	1	1.7	5.12	0.5
	20-29	1	8.3	4	8.3	5	8.3		
	30-39	1	8.3	10	20.8	11	18.3		
	40-49	4	33.3	14	29.2	18	30.0		
	50-59	4	33.3	11	22.9	15	25.0		
	60-69	1	8.3	5	10.4	6	10.0		
	70-79	0	0	4	8.3	4	6.7		
Gender	Female	5	41.7	17	35.4	22	36.7	0.16	0.4
	Male	7	58.3	31	64.6	38	63.3		
HTN	Yes	12	100.0	44	91.7	56	93.3	1.07	0.3
	No	0	0	4	8.3	4	6.7		
DM	Yes	6	50.0	29	60.4	35	58.3	0.43	0.5
	No	6	50.0	19	39.6	25	41.7		
Thyroid	Yes	0	0	13	27.1	13	21.7	4.15	**0.04***
	No	12	100.0	35	72.9	47	78.3		
Alcohol	Yes	9	75.0	33	68.8	42	70.0	0.18	1
	No	3	25.0	15	31.3	18	30.0		
Smoking	Yes	10	83.3	37	77.1	47	78.3	0.22	1

	No	2	16.7	11	22.9	13	21.7		
Bone Pain	Yes	11	91.7	42	87.5	53	88.3	0.16	1
	No	1	8.3	6	12.5	7	11.7		
Muscle Weakness	Yes	12	100.0	45	93.8	57	95.0	0.79	1
	No	0	0	3	6.3	3	5.0		
Fracture History	Yes	0	0	2	4.2	2	3.3	0.52	1
	No	12	100.0	46	95.8	58	96.7		
Skeletal Deformities	Yes	0	0	0	0	0	0	-	-
	No	12	100.0	48	100.0	60	100.0		

Table 4: Comparison of Laboratory Parameters and Vascular Calcification

Variables	Vascular Calcification		t Value	p Value
	0	1		
Hb	8.42±2.42	8.17±1.61	0.3	0.7
Sr creatinine	8.38±2.01	8.7±2.41	-0.47	0.6
Calcium	8.97±0.93	8.75±0.97	0.71	0.4
Phosphorous	5.66±1.62	5.49±1.92	0.3	0.7
PTH	426.36±230.92	410.44±263.72	0.21	0.8
TSH	2.37±1.51	3.17±2.04	-1.51	0.1
ALP	124.15±45.21	116.25±53.72	0.52	0.6
e-GFR	6.82±2.47	6.89±5.06	-0.07	0.9
Albumin	4.22±1.11	3.78±0.51	1.35	0.2
k t/v	1.07±0.22	1.12±0.28	-0.72	0.5

Table 5: Association with calcification score

Variables		Calcification Score								Total		Fishers Exact Value	P Value
		0		1		2		3					
		N	%	N	%	N	%	N	%	N	%		
Age	<20	1	8.3	0	0	0	0	0	0	1	1.7	24.81	**0.04***
	20-29	1	8.3	2	13.3	2	8.3	0	0	5	8.3		
	30-39	1	8.3	6	40.0	4	16.7	0	0	11	18.3		
	40-49	4	33.3	1	6.7	10	41.7	3	33.3	18	30.0		
	50-59	4	33.3	3	20.0	6	25.0	2	22.2	15	25.0		
	60-69	1	8.3	0	0	2	8.3	3	33.3	6	10.0		
	70-79	0	0	3	20.0	0	0	1	11.1	4	6.7		
Gender	Female	5	41.7	6	40.0	7	29.2	4	44.4	22	36.7		
	Male	7	58.3	9	60.0	17	70.8	5	55.6	38	63.3		
HTN	Yes	12	100.0	14	93.3	21	87.5	9	100.0	56	93.3	1.89	0.7
	No	0	0	1	6.7	3	12.5	0	0	4	6.7		
DM	Yes	6	50.0	8	53.3	15	62.5	6	66.7	35	58.3	1.01	0.8
	No	6	50.0	7	46.7	9	37.5	3	33.3	25	41.7		
Thyroid	Yes	0	0	4	26.7	8	33.3	1	11.1	13	21.7	6.03	0.09
	No	12	100.0	11	73.3	16	66.7	8	88.9	47	78.3		
Alcohol	Yes	9	75.0	10	66.7	17	70.8	6	66.7	42	70.0	0.4	0.8
	No	3	25.0	5	33.3	7	29.2	3	33.3	18	30.0		
Smoking	Yes	10	83.3	9	60.0	21	87.5	7	77.8	47	78.3	4.07	0.2
	No	2	16.7	6	40.0	3	12.5	2	22.2	13	21.7		
Bone Pain	Yes	11	91.7	14	93.3	19	79.2	9	100.0	53	88.3	2.67	0.4
	No	1	8.3	1	6.7	5	20.8	0	0	7	11.7		
Muscle Weakness	Yes	12	100.0	15	100.0	21	87.5	9	100.0	57	95.0	2.81	0.3
	No	0	0	0	0	3	12.5	0	0	3	5.0		
Fracture Histo ry	Yes	0	0	1	6.7	0	0	1	11.1	2	3.3	3.47	0.2
	No	12	100.0	14	93.3	24	100.0	8	88.9	58	96.7		

Skeletal Deformities	Yes	0	0	0	0	0	0	0	0	0	0	-	-
	No	12	100.0	15	100.0	24	100.0	9	100.0	60	100.0		

Table 6: Comparison of Laboratory Parameters and Calcification Score

Variables	Calcification Score				F Value	p Value
	0	1	2	3		
Hb	8.42±2.42	8.81±1.14	8.03±1.85	7.51±1.33	1.19	0.3
Sr creatinine	8.38±2.01	8.22±2.88	9.33±2.07	7.82±2.2	1.31	0.2
Calcium	8.97±0.93	9.09±1	8.56±0.84	8.71±1.19	1.1	0.3
Phosphorous	5.66±1.62	4.87±1.72	6.03±2.09	5.08±1.46	1.47	0.2
PTH	426.36±230.92	390.44±262.25	413.91±232.99	413.56±361.56	0.068	0.9
TSH	2.37±1.51	2.91±1.55	3.53±2.47	2.63±1.35	1.11	0.3
ALP	124.15±45.21	139.53±76.86	99.54±29.27	122±47.52	2.05	0.1
e-GFR	6.82±2.47	8.62±8.6	5.97±1.74	6.51±2.02	1.04	0.4
Albumin	4.22±1.11	3.68±0.56	3.73±0.46	4.09±0.46	2.27	0.09
kt/v	1.07±0.22	1.1±0.31	1.13±0.28	1.15±0.23	0.18	0.9

Table 7: Association with PTH categories

Variables		PTH						Total		Fishers Exact Value	p Value
		<150		150-300		>300					
		N	%	N	%			N	%		
Age	<20	0	0	0	0	1	3.1	1	1.7	8.73	0.7
	20-29	1	10.0	3	16.7	1	3.1	5	8.3		
	30-39	4	40.0	3	16.7	4	12.5	11	18.3		
	40-49	2	20.0	5	27.8	11	34.4	18	30.0		
	50-59	2	20.0	5	27.8	8	25.0	15	25.0		
	60-69	1	10.0	1	5.6	4	12.5	6	10.0		
	70-79	0	0	1	5.6	3	9.4	4	6.7		
Gender	Female	3	30.0	7	38.9	12	37.5	22	36.7	0.28	0.9
	Male	7	70.0	11	61.1	20	62.5	38	63.3		
HTN	Yes	10	100.0	18	100.0	28	87.5	56	93.3	2.53	0.3
	No	0	0	0	0	4	12.5	4	6.7		
DM	Yes	7	70.0	12	66.7	16	50.0	35	58.3	1.9	0.4
	No	3	30.0	6	33.3	16	50.0	25	41.7		
Thyroid	Yes	1	10.0	4	22.2	8	25.0	13	21.7	0.56	0.6
	No	9	90.0	14	77.8	24	75.0	47	78.3		
Alcohol	Yes	7	70.0	11	61.1	24	75.0	42	70.0	1.16	0.5
	No	3	30.0	7	38.9	8	25.0	18	30.0		
Smoking	Yes	8	80.0	13	72.2	26	81.3	47	78.3	0.69	0.8
	No	2	20.0	5	27.8	6	18.8	13	21.7		
Bone Pain	Yes	9	90.0	16	88.9	28	87.5	53	88.3	0.2	1
	No	1	10.0	2	11.1	4	12.5	7	11.7		
Muscle Weakness	Yes	10	100.0	16	88.9	31	96.9	57	95.0	1.74	0.2
	No	0	0	2	11.1	1	3.1	3	5.0		
Fracture History	Yes	0	0	1	5.6	1	3.1	2	3.3	0.87	1
	No	10	100.0	17	94.4	31	96.9	58	96.7		
Skeletal Deformities	Yes	0	0	0	0	0	0	0	0	-	-
	No	10	100.0	18	100.0	32	100.0	60	100.0		

Table 8: Comparison of Laboratory Parameters and PTH

Variables	PTH			F Value	p Value
	<150	150-300	>300		
Hb	8.71±2.76	8.47±1.34	7.93±1.62	0.96	0.4
Sr creatinine	8.22±2.4	8.93±1.95	8.6±2.53	0.31	0.7
Calcium	9.33±1.06	8.71±0.95	8.67±0.91	1.92	0.1
Phosphorous	4.68±1.61	5.01±1.54	6.07±1.95	3.39	0.04*
TSH	2.16±2.45	2.76±1.69	3.41±1.89	1.79	0.1
ALP	102.98±42.35	117.72±42.19	122.53±59.4	0.53	0.6
e-GFR	7.3±2.66	6.16±1.97	7.15±6.04	0.3	0.7
Albumin	3.85±0.59	3.83±0.53	3.89±0.79	0.05	0.9
k t/v	1.18±0.27	1.09±0.19	1.1±0.3	0.34	0.7

DISCUSSION

The aim of the current study was to determine the clinical characteristics of Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD) in relation to vascular calcification, biochemical parameters, and Parathyroid Hormone (PTH) levels in patients with Chronic Kidney Disease (CKD). The average age of the patients was 47.75 ±14.02, with a major portion of the study population in the middle-aged category. This shows that CKD-MBD is common among this age group and also among older people. Similar results have been reported by Vikrant and Parashar (2011) [11] in their study where they established that the prevalence of mineral and bone disorders linked to CKD was higher among old and middle-aged populations.

In the present investigation, the higher prevalence of CKD-MBD among male subjects than female subjects (63.3%) were in accordance with the results of Ghosh et al. (2008) [12]they also found that males were more affected than females. This could be due to the fact that males have more proclivity towards risk factors such as smoking and drinking and are thus more prone to CKD. The study found that hypertension and diabetes mellitus are the most frequently encountered comorbid conditions. Sethi et al. (2018) [13] also found that diabetic nephropathy and hypertensive are among the principal causes of CKD and CKD-MBD. Muscle weakness and bone pain were the leading manifestations as seen in the study, which corroborates with the earlier observation of Sethi et al. (2018) who found proximal muscle weakness and bone pain to be common signs in CKD-MBD patients.

The study shows increased average PTH levels indicating that secondary hyperparathyroidism is more common among CKD patients. Similar observations were made by Valson et al. (2014) [14] where they found a higher number of CKD patients suffering from hyperparathyroidism. These findings help in understanding the mechanism of disturbed metabolism of calcium and phosphorus in the pathophysiology of CKD-MBD. Most of the patients in this study were found to have vascular calcification, which shows increased cardiovascular risk among CKD patients. Identical observations were made by Ghosh et al. (2008) who found a high incidence of vascular and valvular calcification in such patients.

It was found that there was a significant relationship between serum phosphorus and PTH levels (p=0.04), which means that phosphate retention plays a role in secondary hyperparathyroidism. Similar results were achieved by Vikrant and Parashar (2011), who also showed a positive relationship between phosphorus and PTH. Age also shows a significant association with calcification score, i.e. the older the age, the more advanced the vascular calcification, which confirms the findings of Valson et al. (2014). Nevertheless, it is important to understand that most biochemical indicators have no significant correlation with either vascular calcification or the score of calcifications.They are similar to the findings by Ghosh et al. (2008) and Dama et al. (2023) [15] which means that CKD-MBD is a disorder that is multifactorial in nature with not only metabolic changes but also complex hormonal and inflammatory mechanisms rather than only abnormalities in laboratory tests.

To summarize, one can assume that the findings of the current research confirm the frequent occurrence of CKD-MBD among the patients with chronic kidney disease and highlighting the significance of timely diagnosis and management of cases to prevent skeletal and cardiac problems.

CONCLUSION

In conclusion, Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD) is a prevalent complication of CKD Patients and is observed more frequently in middle-aged males who have comorbid conditions such as hypertension and diabetes. Bone pain and muscle weakness were the most common and frequent clinical symptoms. Some biochemical changes were observed including calcium, phosphorus, and PTH. The prevalence of vascular calcification was also high suggesting high cardiovascular risk. Phosphorus was found to be significantly related with PTH suggesting its role in disease progression. Overall, the study highlights the importance of early detection and treatment of CKD-MBD to avoid any complications.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the support of their institution and all those who contributed to the successful completion of this work.

FINANCIAL SUPPORT AND SPONSORSHIP

No funding is received

CONFLICT OF INTEREST

Nil

REFERENCES

1. Khattar A, Rao N K, Prabhu R, Pokhrel Br, Gurung S, Varghese Gm, Et Al. Clinical Profile of Mineral Bone Disorders (Renal Osteodystrophy) In Chronic Kidney Disease Patients. Asian J Pharm Clin Res. 2021 Jul. 7;14(7):107-10.
2. Fathima R, Rao CU. Study of the Prevalence and Severity of Disordered Mineral Metabolism in Patients with Chronic Kidney Disease Stage-5 on Hemodialysis. Journal of Contemporary Medicine and Dentistry. 2021;9(2):8-12.
3. M. Edwin Fernando, Ishwarya Annamalai, S A K Noor Mohammed, Thirumavalavan S, Chandramohan K, N D Srinivasa Prasad. Mineral Bone Disorders in Native Chronic Kidney Disease Patients Â€ “A Cohort Study from A Tertiary Centre in South India. Med. res. chronicles. 2018 Apr. 30;5(2):162-71.
4. Butt B, Ejaz T, Sabir S, Khan G. Patterns of chronic kidney disease–mineral bone disease and its relationship with socio-demographic factors among the patients of chronic kidney disease undergoing hemodialysis. Pakistan Armed Forces Medical Journal. 2021 Jan 1;71.
5. Etta PK, Sharma RK, Gupta A. Study of chronic kidney disease-mineral bone disorders in newly detected advanced renal failure patients: A Hospital-based cross-sectional study. Saudi J Kidney Dis Transpl. 2017 Jul-Aug;28(4):874-885.
6. Sheikh RY, Bhat NA, Bandyopadhay A, Chowdhury AR. Spectrum of mineral bone disorder in patients with CKD stage 3-5 from eastern India. JMS SKIMS. 2019 Dec 3;22(3):16-20.
7. Aggarwal HK, Jain D, Yadav S, Kaverappa V. Bone mineral density in patients with predialysis chronic kidney disease. Ren Fail. 2013 Sep;35(8):1105-11.
8. Abdu A, Abdu A, Arogundade FA. Prevalence and pattern of chronic kidney disease-mineral bone disorders among hemodialysis patients in kano, northwest nigeria. Annals of African Medicine. 2019 Oct 1;18(4):191-5.
9. Pavan M, Ranganath R, Chaudhari AP, Upadhayaya KL, Mehta HJ. Practice pattern of chronic kidney disease-mineral and bone disorder (CKD-MBD) in hemodialysis patients in a tertiary care centre in India. Diálisis y Trasplante. 2012 Oct 1;33(4):110-4.
10. Levin A, Bakris GL, Molitch M, Smulders M, Tian J, Williams LA, Andress DL. Prevalence of abnormal serum vitamin D, PTH, calcium, and phosphorus in patients with chronic kidney disease: results of the study to evaluate early kidney disease. Kidney international. 2007 Jan 1;71(1):31-8.
11. Vikrant S, Parashar A. Prevalence and severity of disordered mineral metabolism in patients with chronic kidney disease: A study from a tertiary care hospital in India. Indian journal of endocrinology and metabolism. 2016 Jul 1;20(4):460-7.
12. Ghosh B, Brojen T, Banerjee S, Singh N, Singh S, Sharma OP, Prakash J. The high prevalence of chronic kidney disease-mineral bone disorders: A hospital-based cross-sectional study. Indian J Nephrol. 2012 Jul;22(4):285-91.
13. Sethi S, Sethi N, Sandhu JS, Makkar V, Kaur S, Sohal PM, Mehta S. Changing Spectrum of Mineral Bone Disorder in Chronic kidney disease stage 3 to 5 D and Its Associated Factors, A Prospective Cross-Sectional Study from Tertiary Care Hospital in Northern India. Iranian journal of kidney diseases. 2021 May 1;15(3):199.
14. Valson AT, Sundaram M, David VG, Deborah MN, Varughese S, Basu G, Mohapatra A, Alexander S, Jose J, Roshan J, Simon B, Rebekah G, Tamilarasi V, Jacob CK. Profile of incident chronic kidney disease related-mineral bone disorders in chronic kidney disease Stage 4 and 5: A hospital based cross-sectional survey. Indian J Nephrol. 2014 Mar;24(2):97-107.
15. Darma B, Santoso D, Tjempakasari A. Profile and Phenotypes of Chronic Kidney Disease-Mineral and Bone Disorders in Chronic Haemodialysis Patients. kidney. 2024; 6:7.