

RENAL OSTEODYSTROPHY IN CHRONIC KIDNEY DISEASE PATIENT

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ABSTRACT

BACKGROUND

Based on extensive research, ROD is a condition that impacts the bones and arises in individuals with renal disease. Various studies have found that this condition is identified by a unique range of clinical, biochemical and histologic abnormalities. Therefore, we have decided to comprehensively investigate the clinical features and prevalence of ROD in CKD patients as a vital component of our study.

MATERIALS & METHOD

In total, 75 patients who had been previously identified as having CKD took part in the research study. After receiving approval from the ethics committee, comprehensive clinical, laboratory, biochemical investigations & X-ray investigation were carried out on all patients over the course of 21 months.

RESULT

In our study, we found that OP shows the highest presence at 54.7%. All other findings were low, like SR. 9.3%, fracture 5.3%, ST-C, and OS show equal percentages (2.7%), and the least was SCS (13%). OP was mainly seen in patients with low calcium levels. Soft tissue calcification was associated with patients having a high calcium-phosphorous product level and was seen in both patients with soft tissue calcification. PF were seen in 4, i.e., 5.3% of the patients.

CONCLUSION

We conclude that the key X-ray finding in the study was the presence of OP, characterized by reduced bone density and SR of the phalanges. Other findings include soft tissue calcification, SCS, and PF.

KEYWORDS

X-ray, ROD, CKD, clinical, biochemical, histologic abnormalities.

INTRODUCTION

Several studies have found that “all biochemical problems and skeletal symptoms in people with chronic kidney disease or end-stage renal disease are part of renal osteodystrophy (ROD)”.¹ Other research has also shown that “this condition causes big changes in the levels of calcium, phosphorous, PTH, and vitamin D in the blood, as well as effects on bone turnover, mineralization, and calcifications outside of the bones”.² Furthermore, studies have shown that “it has been suggested that a GFR of less than 60 mL/min/1.73 m² is when these abnormalities become most apparent”.^{2,3} Additionally, various studies have concluded that “every year, a significant number of people around the world are diagnosed with chronic kidney disease (CKD), affects 5-10% of population with expected incidence being 5-8% every year”.⁴ . Studies have also shown that people with CKD face a range of negative consequences, including kidney function loss, cardiovascular disease, and premature death.⁴ Furthermore, studies have also proved that these outcomes contribute to higher rates of illness, death, hospitalizations, and healthcare usage.⁴ In addition to this, studies concluded that diabetes and hypertension are believed to be the underlying causes of approximately 40% and 25% of CKD cases, respectively.⁴ Thus, studies revealed that the incidence of both conditions has been increasing since 1988, coinciding with the rise in the prevalence of CKD Stages 2–5.⁴ Based on these studies, researchers have come to the conclusion that “getting worse CKD is linked to a number of problems with mineral and bone metabolism”.⁵ Thus, in our study we have decided to evaluate & assess the clinical features & incidence of ROD in CKD patients.

MATERIALS & METHOD

We have conducted an observational type of study in the department of general medicine at Sri Aurobindo Medical College and Post Graduate Institute, Indore (Madhya Pradesh), for 21 months, starting in December 2019 and ending in September 2021, after approval from the ethical committee, with a total of 75 patients. Both IPD and OPD patients were taken into the study. A pre-structure preforma was used to collect baseline data. Detailed history of clinical , laboratory, biochemical examination & X-ray investigation was done for all patients .

Inclusion Criteria

1. Cases who all were diagnosed with CKD on clinical ,biochemical &USG parametera.
2. Both male & female were included
3. Clinical feature of ROD like pain over upper & lower extremities, backache, clavicle loin etc, bone deformties, restriction of mobility of joint , small joint, spine and abnormalities in bone growth & development.

Exclusion Criteria

1. Case of AKI
2. H/o bone injuries , fracture.
3. H/o other con-cominant bone disease like tumor, bony dysplasia, TB, hypo/hyperthyroidism.
4. Patient known to be taking drugs like steroid, calcium supplement & phosphate binder.

STATISTICAL ANALYSIS

We have “coded & entered data into microsoft excel 2010 using excel 2010 & SPSS 20.0 for windows”. The categorical or dichotomous variables were expressed as absolute values & percentage & was compared with Pearson test.

RESULT

Age Group	Frequency	Percent
18-25 Years	0	0.0
26-35 Years	6	8.0
36-45 Years	19	25.3
46-55 Years	16	21.3
56-65 Years	31	41.3
>=66 Years	3	4.0
Total	75	100.0

Table 1: Age Group

In our study, we found that the distribution of respondents was based on their age group. The highest percentage of respondents, i.e., 41.3%, belonged to the 56-65 age group, followed by 25.3% of respondents who were of the age range of 36-45 years. Nearly 21% of respondents were between the ages of 36 and 45, 8% were between the ages of 26 and 35, and 4% were 66 years or older (Table 1).

Sex	Frequency	Percent
Female	26	34.7
Male	49	65.3
Total	75	100.0

Table 2: Sex Group

In our study, we found that the distribution of respondents was based on their sex. A majority of respondents, i.e., 65.3%, were male children, while 34.7% were female (Table 2).

PTH Status	Frequency	Percent
Abnormal	52	69.3
Normal	23	30.7
Total	75	100.0
Table 3: PTH status.		

In our study, we found that the distribution of respondents was based on their PTH status. PTH levels above 65 pg/mL were considered abnormal. A majority of respondents, i.e., 69.3%, had abnormal PTH while 30.7% had normal PTH (Table 3).

CKD stages	Frequency	Percent
3	13	17.3
4	18	24.0
5A	16	21.3
5B	28	37.3
Total	75	100.0
Table 4: CKD stage		

In our study, we found that the distribution of respondents was based on their CKD stages. The highest percentage of respondents, i.e., 37.3%, belonged to CKD stage 5B (stage 5 patients on hemolysis), followed by 24% of respondents who were on the 4th stage of CKD, nearly 21% were on the 5A stage, and the least, i.e., 17.3%, belonged to the 3rd stage. (Table 4).

X ray Finding	Frequency	Percent
Abnormal	48	64.0
Normal	27	36.0
Total	75	100.0
Table 5: X-ray finding		

In our study, we found that the distribution of respondents was based on their X-ray findings. A majority of respondents, i.e., 64%, had abnormal findings, while 36% had normal X-ray findings (Table 5).

Calcium Level	Frequency	Percent
Abnormal	41	54.7
Normal	34	45.3
Total	75	100.0
Table 6 : Calcium Level		

In our study, we found that the distribution of respondents was based on their calcium level. A normal calcium level was considered to be between 8 and 11 mg/dl. The majority of respondents, 54.7%, had Abnormal calcium levels, while 45.3% had Normal calcium levels (Table 6).

Po4 Status	Frequency	Percent
Abnormal	52	69.3
Normal	23	30.7
Total	75	100.0

Table 7: Po4 status

In our study, we found that the distribution of respondents was based on their Po4 status. Normal Po4 was considered to be between 2.5 and 4.6 mg/dl. A majority of respondents, i.e., 69.3%, were abnormal, while 30.7% had normal PO4 status (Table 7).

Ca*Po4 Status	Frequency	Percent
Abnormal	22	29.3
Normal	53	70.7
Total	75	100.0

Table 8: Ca*Po4 Status

In our study, we found that the distribution of respondents was based on their Ca*Po4 status. A majority of respondents, i.e., 70.7%, had an abnormal Ca*Po4 status, while 29.3% had a normal Ca*Po4 status. Normal calcium-phosphorous products are taken at <55 mg/dl (Table 8).

X ray Finding	Frequency	Percent (N=75)
Osteopenia(OP)	41	54.7%
Subperiosteal resorption(SR)	7	9.3%
Pathological Fracture(PF)	4	5.3%
Soft tissue calcification(ST-C)	2	2.7%
Subchondral sclerosis(SCS)	1	1.3%
Osteosclerosis(OS)	2	2.7%

Table 9: Presence of different X-ray finding

In our study, we found the OP shows the highest presence at 54.7%. All other findings were low, like SR. 9.3%, fracture 5.3%, ST-C and OS show equal percentages (2.7% and the least

was SCS (13%). OP was mainly seen in patients with low calcium levels. Soft tissue calcification was associated with patients having a high calcium-phosphorous product level and was seen in both patients with soft tissue calcification. PF were seen in 4, i.e., 5.3% of the patients (Table 9).

DISCUSSION

According to the findings of recent studies, “people who have CKD have significantly raised rates of morbidity, mortality, hospitalizations, and overall healthcare utilization”.⁵ Studies have also proved that, “this is due to the adverse effects of the condition, which include a slow but steady reduction in kidney function, cardiovascular disease, and death at an earlier age”.⁵ In addition, research has shown that “when kidney function declines, there is a progressive breakdown in mineral balance, results in aberrant levels of phosphorus and calcium, as well as variations in hormones such as parathyroid hormone (PTH) and vitamin D3”.⁵ Studies have also revealed that “there is increasing evidence suggesting that these problems in mineral and bone metabolism are related to an increased risk for cardiovascular calcification, morbidity, and mortality”.⁶

Our study analyzed a group of 75 patients diagnosed with CKD, spanning from 26 to 70 years of age. The age group between 56 and 65 years old had the highest proportion, accounting for 41.3% of the total. It was followed by the 36- to 45-year-old group, which made up 25.3% of the population, and the 46- to 55-year-old group, which accounted for 21.3%. “The findings of our study align with the research conducted by McClellan et al.,⁷ Agarwal S. K. et al.,⁸ and Memos et al.,⁹ concluded that renal bone disease was prevalent among an elderly population with a mean age of 49.2 + 11.2 years”. In addition, the proportion of men in our study was 65.3%, while the proportion of females was 34.7%, respectively. As a result, the majority of CKD patients in our study were men. “The results of our study were on par with those found in studies conducted by Agarwal et al.,⁸ and Nissenon et al.,¹⁰.” Additionally, we found that a PTH level of greater than 65 pg/mL was deemed abnormal in our study. The greatest amount of PTH that was found was 795.3 pg/ml, and out of 75 patients, 52 (69.3%) instances had PTH levels that were higher than 65 pg/ml. The remaining 23 patients had PTH levels that were within the normal range. A significant rise in PTH levels was seen in CKD, which is consistent with the results of the study that Block et al.,¹¹ conducted. High PTH levels were also shown to have a significant correlation with death from all causes by these researchers. They came to the conclusion that an increased level of blood PTH may be connected with an increased risk of passing away due to cardiac reasons. Studies conducted by Amann K. and colleagues¹²

further showed that parathyroid hormone may operate as a permissive factor that encourages the activation of cardiac fibroblasts and inter-myocardiocytic fibrosis. Furthermore, it was found that out of the total number of patients, 41 individuals (54.6%) had OP, while only 7 patients (9.3%) showed X-rays indicating SR. Surprisingly, this was discovered even though 41 patients had OP. SR is visible in the radial aspect of the hand's terminal phalanges. PF were observed in approximately four patients (5.5%). In two patients, we observed additional abnormalities, including OS and ST-C. These findings were present in approximately 2.67 percent of the total patient population. There was only one patient who experienced subchondral sclerosis, which accounted for 1.3% of all patients. Furthermore, a significant number of patients who showed irregularities on their X-rays also displayed elevated PTH levels and decreased calcium levels. Patients with soft tissue calcification exhibited significantly elevated calcium levels. In a study conducted by Rizvi and colleagues,¹³ they discovered osteopenia, or reduced bone density, in 55.22% of the cases. These findings align with previous research. According to a study conducted by Thimmappa and colleagues,¹⁴ "SR was observed in 6% of the cases examined".

LIMITATION OF THE STUDY

We conducted our study during the COVID-19 period, so our results can vary for calcium and protein, as at that time people were mainly taking multivitamins for immunity boosting. Furthermore, in our study, we have not seen the histomorphology parameter to diagnose disease, which is an important parameter for an exact diagnosis, and due to economic constraints, many investigations were not done, which was indicated.

CONCLUSION

Our research findings indicate that a significant proportion of individuals diagnosed with ROD fell within the age range of 55 to 65. There was a greater number of males in comparison to females, with a M to F ratio of 1.8 to 1. Most patients diagnosed with ROD were categorized as being in Stage 5. Out of the 44 patients with stage 5 CKD, a significant number of 37 individuals showed bone alterations, making up 77.1% of the sample. On the other hand, bone changes were observed in only 14.6% of patients with stage 4 CKD and 8.3% of patients with stage 3 CKD. The main X-ray finding in the study was the presence of OP, which is characterized by a decrease in bone density along with SR of the phalanges. Other findings include a PF, SCS and ST-C.

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