



SPECTRUM OF RENAL OSTEODYSTROPHY IN ADVANCED RENAL FAILURE PATIENTS- SINGLE CENTRE TERTIARY CARE STUDY

Nephrology

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ABSTRACT

Aim: To study the spectrum of renal osteodystrophy in patients with advanced renal failure in a tertiary hospital

Objective: To study the cardiovascular outcomes and mortality in patients with renal osteodystrophy with one year follow up.

Methods: A prospective, observational study done at tertiary centre in South India over 1 year in CKD 5 ND and CKD 5D patients.

Results: 112 patients were recruited of which 68% were CKD 5D and 32% were CKD stage 5 ND. Prevalence of Renal osteodystrophy in our study was 67%, with prevalence among CKD 5 ND 58%, and CKD 5D patients being 71%. Adynamic bone disease along with osteomalacia being the common forms of renal osteodystrophy, each seen in 20.5% of patients. Among patients with Renal osteodystrophy, Systolic dysfunction was seen in 23% of patients, Diastolic dysfunction in 31% of patients and Both systolic and diastolic dysfunction in 15% of patients. Mortality was seen in 9 patients (8%).

Conclusion: A significant association was seen between Diabetes and Adynamic bone Disease. Renal osteodystrophy did not show any significant association with mortality. Systolic dysfunction and Hemodialysis had significant association with mortality.

KEYWORDS

Renal osteodystrophy (ROD), iPTH(Intact Parathormone) ,Adynamic bone disease, Osteitis fibrosa cystica , Osteomalacia , Mixed uremic osteodystrophy

INTRODUCTION

Renal osteodystrophy is a set of metabolic bone disorders that occurs in patients with chronic kidney disease¹. The incidence of ROD in patients with advanced renal failure treated with maintenance hemodialysis (HD) is 90 to 100%². In healthy individuals, serum concentrations of phosphorus (P) and calcium (Ca) are being maintained through the interaction of two hormones: parathyroid hormone (PTH) and 1,25-(OH)₂D (calcitriol). The kidneys play a critical role in maintaining normal serum Ca and P concentration; thus, derangements in mineral metabolism are common in patients with chronic kidney disease (CKD). ROD is defined as the measure of the skeletal component of chronic kidney disease- mineral bone disorder (CKD-MBD)³. It starts early during the loss of kidney function from CKD stage 2⁴ and seen in virtually all chronic end-stage kidney disease patients on dialysis (CKD-5D). The disturbances in mineral and bone metabolism are a significant cause of morbidity and have been associated with increased cardiovascular mortality^{5,6,7,8}. Bone disease in CKD is associated with an increased risk of fractures and death⁹. The most accurate diagnostic test for detecting ROD in CKD patients is the bone biopsy, but it is invasive and requires trained personnel for its interpretation, thus hampering its use in clinical practice¹⁰. Together with the measurements of serum calcium, phosphorus, and alkaline phosphatase levels, intact PTH (iPTH) and 25(OH)vitD3 is used to evaluate, diagnose, and guide the treatment of renal osteodystrophy.

Classically, bone disease in CKD has been classified into four major categories, i.e., Osteitis fibrosa cystica (high turnover), Adynamic bone disease (low turnover bone disease), Osteomalacia, and Mixed uremic osteodystrophy¹¹. Management of Renal osteodystrophy includes correction of biochemical abnormalities resulting in bone disease, i.e., calcium, phosphorus, Vitamin-D, and PTH. Management and outcome of ROD varies with each pattern of renal osteodystrophy.

Studies on renal osteodystrophy in CKD stage 5 patients are less, especially in the Indian subcontinent. The purpose of this study is to study the spectrum of renal osteodystrophy in patients with advanced renal failure and to know their cardiovascular outcomes and mortality during this study period.

MATERIALS AND METHODS:

A prospective observational study carried out at the Andhra medical college, Visakhapatnam in patients with advanced renal failure (CKD 5 ND & CKD 5 D less than 6 months duration) for period of 1 year. Serum calcium, albumin, phosphate, alkaline phosphatase, 25(OH) vit D and iPTH were measured. Type of ROD is determined and treated according to KDIGO guidelines. These patients were subjected to ECG, CXR and 2D Echo.

STATISTICAL ANALYSIS:

Appropriate statistical tests (Mean, S.D, Median t-test for quantitative/continuous variables and proportions, Chi-square/Fisher exact test for qualitative variables) were conducted using SPSS Statistics 17.

RESULTS

Total of 112 patients included in this study. Mean age of males being 51.72+/-11.875, whereas females being 49.74+/- 13.46. Overall mean age was 51.31+/-12.18.

1.MEAN AGE DISTRIBUTION AMONG GENDER

Sex	N	Mean	Std. Deviation
Male	89	51.72	11.875
Female	23	49.74	13.464

Most common symptom being bone pains(arthralgia) seen in 85 patients. Myalgia as a symptom is seen in 75 patients. Muscle weakness is seen in 14 patients. Bone deformities are seen in only 2 patients as a symptom. Hypertension is seen in 104 patients (93%), Diabetes in 25 patients (22.3%). All the patients who had diabetes also had hypertension.

2.SYMPTOMS OF RENAL OSTEODYSTROPHY

Symptoms	Frequency	Percent
Bone pains	85	75.9%
Muscle weakness	14	12.5%
Myalgia	75	67%
Deformities	2	1.8%
Total patients	112	100%

Most common etiology of CKD in our study being Chronic interstitial nephritis (CIN), seen in 62 patients (55.4%). Diabetic kidney disease is the next common cause being seen in 23 patients (20.5%). Chronic glomerulonephritis is seen in 10 patients. Hypertensive nephropathy in 5 patients, Renal artery stenosis in 1 patient. Etiology is unknown in 10 patients.

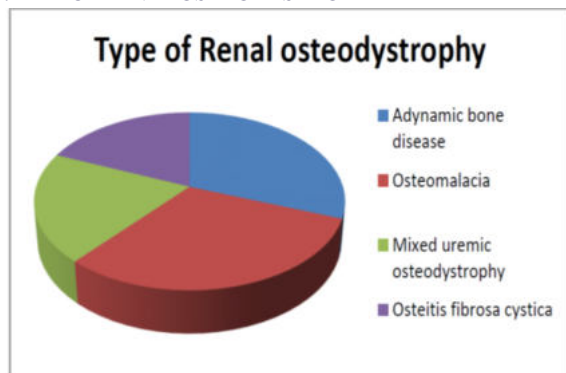
3. CKD ETIOLOGY

CKD etiology	Frequency	Percent
ADPKD	1	0.9
CGN	10	8.9
CIN	62	55.4
Diabetic Kidney Disease	23	20.5
Hypertensive Nephropathy	5	4.5
Renal Artery Stenosis	1	0.9
Unknown	10	8.9
Total	112	100

94 patients had either Vitamin D deficiency or insufficiency, corresponding to 84% of the patients. Out of these patients, 42 had Vitamin D deficiency (37.5%) and 52 had Vitamin D insufficiency (46.5%).

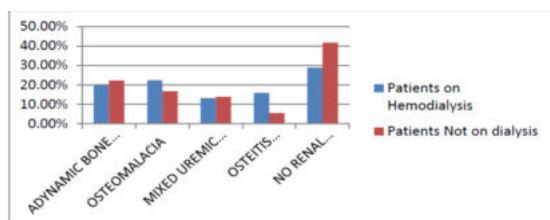
76 out of 112 were on Hemodialysis whereas 36 patients were CKD stage 5 not on dialysis, corresponding to 67.9% and 32.1% respectively. Prevalence of renal osteodystrophy in our study is 67%, with 75 out of 112 patients having renal osteodystrophy. Out of 75 patients who had renal osteodystrophy, 23 patients had Adynamic bone disease (30.67%), 23 had Osteomalacia (30.67%), 15 patients had Mixed uremic osteodystrophy (20%) and 14 had Osteitis fibrosa cystica (18.67%).

4. TYPE OF RENAL OSTEODYSTROPHY



Commonest pattern of Renal osteodystrophy seen in patients on hemodialysis was Osteomalacia in 22.4% of the patients, whereas in CKD 5 not on dialysis, most common pattern was Adynamic bone disease in our study.

5. TYPE OF RENAL OSTEODYSTROPHY AND TYPE OF RRT



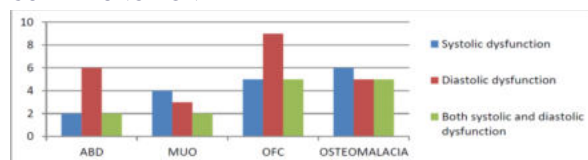
Out of 25 patients who had Diabetes, 12 patients had Adynamic bone disease. Association between presence of Diabetes and Adynamic bone disease was found to be significant in our study with p value of 0.0003 ($p < 0.05$).

6. ASSOCIATION OF DIABETES WITH ADYNAMIC BONE DISEASE

		ADYNAMIC BONE DISEASE		P value
		PRESENT	ABSENT	
DIABETES	PRESENT	12	13	0.0003
	ABSENT	11	76	

Out of 75 patients who had Renal osteodystrophy, 17 had systolic dysfunction, corresponding to 23% of patients, 23 had diastolic dysfunction (31%) and 11 patients had both systolic and diastolic dysfunction (15%).

7. TYPE OF RENAL OSTEODYSTROPHY AND CARDIOVASCULAR FUNCTION



Presence or absence of renal osteodystrophy and cardiovascular outcomes in the form of systolic dysfunction and diastolic dysfunction did not show any statistical significance (p value > 0.05).

At the end of one year follow up, based on biochemical parameters, 42 patients did not have renal osteodystrophy (45.7%) and 50 patients had renal osteodystrophy (54.3%). Out of 50 patients, 35 had Adynamic bone disease (70%) and 15 had Osteitis fibrosa cystica (30%).

Systolic dysfunction was seen in 52% patients and diastolic dysfunction was seen in 51% of patients at the end of follow up. Both systolic and diastolic dysfunction was seen in 40% of patients. Among patients with Renal osteodystrophy, systolic dysfunction was seen in 60% of patients, diastolic dysfunction seen in 60% of patients and Both systolic and diastolic dysfunction was seen in 54% of patients. More no. of patients with Renal osteodystrophy had both systolic and diastolic dysfunction at the end of 1 year compared to patients without Renal osteodystrophy with p value of 0.003.

Out of 112 patients, 9 patients expired by the end of one year follow up (8%). Out of 75 patients who had Renal osteodystrophy, 4 patients expired over a period of 1 year follow up (5.3%). 5 patients out of 37 patients who did not have renal osteodystrophy expired by the end of 1 year follow up (13.5%).

8. RENAL OSTEODYSTROPHY AND MORTALITY WITH P VALUE

Patients with renal osteodystrophy	75	4	5.3%	0.430
Patients without renal osteodystrophy	37	5	13.5%	
Total	112	9	8%	

Presence of Renal osteodystrophy did not show any significant association with mortality ($p > 0.05$).

9. HEMODIALYSIS AND MORTALITY

Type Of RRT	Hemodialysis	76	9	0.032
	Not on dialysis	36	0	

10. SYSTOLIC DYSFUNCTION AND MORTALITY

L V Systolic Function	Good	82	3	0.01
	Systolic dysfunction	30	6	

In our study, type of Renal replacement therapy, i.e., Hemodialysis and Systolic dysfunction have shown to be significant factors for mortality with p value < 0.05 .

Limitations of the study:

- Bone biopsy was not performed to confirm the diagnosis of type of renal osteodystrophy.
- Radiological imaging was not used in the diagnosis of Renal osteodystrophy.
- Status of vascular calcification is not being assessed in this study.
- Follow up is for short duration of 1 year.

CONCLUSIONS:

- The prevalence of Renal osteodystrophy in our study was 67%, prevalence among CKD 5 Not on dialysis was 58%, whereas among CKD 5 on Hemodialysis patients was 71%.

- Adynamic bone disease along with osteomalacia being the common forms of renal osteodystrophy, each seen in 20.5% of patients.
- Commonest pattern of Renal osteodystrophy seen in patients on hemodialysis was Osteomalacia whereas most common pattern seen in CKD 5 not on dialysis was Adynamic bone disease.
- Significant association between Diabetes and Adynamic bone disease in our study ($p=0.0003$).
- Renal osteodystrophy did not show any significant association with systolic or diastolic dysfunction in our study.
- Renal osteodystrophy did not show any significant association with mortality in our study.
- Systolic dysfunction and Hemodialysis had significant association with mortality in our study.

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