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Research Article

Clinicoechocardiographic Study of Cardiac Abnormalities in Chronic Kidney Disease

Neelakandan Ramya , K.R.Meera*

Department of General Medicine, Aarupadai Veedu Medical College and Hospital, Puducherry

***Corresponding author: K.R.Meera**

E-mail: krmeeramallan@yahoo.co.in

Abstract:

Background: At every stage of chronic kidney disease, cardiovascular disease leads as the predominant cause of morbidity and mortality. There is a 10 – 200 fold increased risk for cardiovascular disease in patients with CKD in comparison to general population.

Aim: To study the various cardiac abnormalities in chronic kidney disease and correlate clinical presentation with echocardiographic findings.

Materials and Methods: This cross sectional study was conducted in Aarupadai Veedu Medical College and Hospital, Puducherry from February 2017 to july 2017. All adult chronic kidney disease patients of both sexes were included in the study after obtaining informed consent. A detailed history taking and a thorough physical examination was performed followed by investigations including echocardiography. Cardiac abnormalities were studied and these were correlated to echocardiographic findings. SPSS software was used for statistical purposes.

Results: A total of 50 cases of chronic kidney disease were included in the study. 33 patients were males and 17 patients were female. Mean age of patients studied was 55.16 ± 10.71. Hypertension was found in 41 of 50 patients. Of these, 27 patients had concentric left ventricular hypertrophy. 20 of 50 patients had coronary artery disease . Ischemic dilated cardiomyopathy was observed in 12 of these 20 patients. 22 of 50 patients were having heart failure. Pericardial effusion was seen in 16 patients. Atrial fibrillation was present in 6 of 50 patients.

CONCLUSION: Cardiac abnormalities are common in chronic kidney disease. Hypertensive heart disease is the commonest clinical manifestation in patients with chronic kidney disease. Heart failure, coronary artery disease and pericardial effusion are other common manifestations. Concentric left ventricular hypertyrophy and Ischemic dilated cardiomyopathy are associated with declining glomerular filtration rate.

Keywords: Chronic kidney disease , Hypertension, Coronary artery disease, Dilated cardiomyopathy .

Abbreviations: Chronic kidney disease(CKD), Hypertension(HTN), Coronary artery disease(CAD), Left ventricular hypertrophy(LVH) , Dilated cardiomyopathy (DCM).

INTRODUCTION

Cardiovascular disease(CVD) occurs more frequently and prematurely in patients with chronic kidney disease(CKD) and it affects patients at any stage of the CKD. CKD patients in their early stages are more prone to die of cardiovascular complications rather than progressing to end stage renal disease. CKD is now considered as a risk factor equivalent for development of coronary artery disease(CAD).[1] The spectrum of cardiovascular manifestations in CKD include coronary artery disease, cardiac failure, Peripheral vascular disease, cardiac arrhythmias and sudden cardiac death. Among these, CAD serves as the predominant cause of morbidity and mortality.[1,2] The prevalence of occult coronary artery disease is very high in CKD patients.[3] Cardiovascular events predominates as the leading cause of death in patients with CKD and it affects even the earliest clinically silent stages.[4] Hence we in our study analysed the cardiac abnormalities in patients with CKD and correlated clinical presentation with echocardiographic findings.

MATERIALS AND METHODS

This is a cross sectional study conducted at Department of General Medicine, Aarupadai Veedu Medical College and Hospital, Puducherry from February 2017 to july 2017. All adult patients diagnosed with CKD of both sexes were included in the study after getting informed consent. Those patients who were diagnosed with acute renal failure and those not willing for informed consent were excluded. A detailed history with special reference to cardiovascular symptoms were taken. A thorough clinical

examination was also done in all patients. Complete blood count, renal function tests, electrocardiography and ultrasonogram of abdomen and pelvis were performed in all patients. Echocardiographic study of the heart to assess cardiac status like left ventricular ejection fraction, Chamber sizes, regional wall motion abnormality, valve function and pericardial effusion was done. All findings and investigations were written and documented in pre prepared proforma. For statistical analysis SPSS 20.0.0 software was used.

RESULTS

The mean age of patients in the study was 55.16±10.71. With respect to age 16 of 50 patients were in the age group above 60 years.

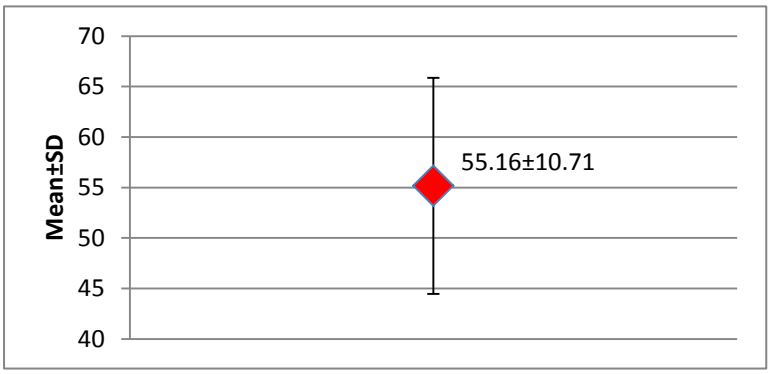

Fig1: Mean age of patients

Age group	Number of patients
31 – 40 years	5 (10%)
41 – 50 years	15 (30%)
51 – 60 years	14 (28%)
>60 years	16 (32%)

Table 1: Distribution of patients with respect age

Of 50 patients 33 were males and 17 were females.

With respect to CKD stage , 20 patients were in CKD stage 5, 7 patients in CKD stage 4 , 14 patients in CKD stage 3, 6 patients in CKD stage 2, 2 patients in stage 1 and 1 patient in CKD stage 0.

Age group (years)	CKD STAGE (MALES)					
	5	4	3	2	1	0
31– 40	2 (4%)	1(2%)	0(0%)	1(2%)	0(0%)	0(0%)
41 - 50	5(10%)	0(0%)	1(2%)	0(0%)	0(0%)	0(0%)
51– 60	1(2%)	1(2%)	3(6%)	1(2%)	1(2%)	1(2%)
>60	5(10%)	3(6%)	7(14%)	0(0%)	0(0%)	0(0%)

Table 2: Distribution of male patients with respect to CKD Stage

Age group (years)	CKD STAGE (FEMALES)					
	5	4	3	2	1	0
31– 40	1(2%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
41 – 50	3(6%)	1(2%)	1(2%)	3(6%)	1(2%)	0(0%)
51– 60	3(6%)	1(2%)	2(4%)	0(0%)	0(0%)	0(0%)
>60	0(0%)	0(0%)	0(0%)	1(2%)	0(0%)	0(0%)

Table 3: Distribution of female patients with respect to CKD Stage

41 of 50 (82%) of patients had hypertension(HTN). Of them 19 patients (46.3%) were in CKD stage 5 followed by 8 patients (19.5 %) patients each in CKD stages 3 and 4 only 2 patients (4.8 %) in early CKD stages 0 to 2.

N=41

Sl. No	Stages of CKD	Frequency	Percentage
1	5	19	46.3%
2	4	8	19.5%
3	3	8	19.5%
4	2	4	9.7%
5	1	1	2.4%
6	0	1	2.4%

Table No. 4 Number of patients with HTN according to CKD Stage

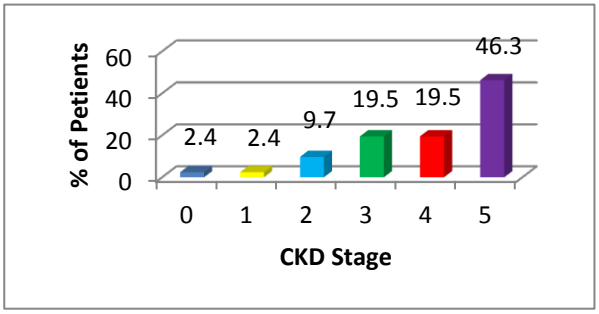

Fig. 2 Number of patients with HTN according to CKD Stage

27 of 41 (65%) of patients with HTN had left ventricular hypertrophy(LVH). On correlating LVH with clinical stage of CKD, 13 (48.1%) patients with LVH were in stage 5 and 10 (37%) patients with LVH were in CKD stage 3. Only two patients were in early CKD stages 0 to 2.

N=27

Sl. No	Stages of CKD	Frequency	Percentage
1	5	13	48.1%
2	4	2	7.4%
3	3	10	37%
4	2	1	3.7%
5	1	1	3.7%
6	0	0	0%

Table No. 5 Number of patients with LVH according to CKD Stage

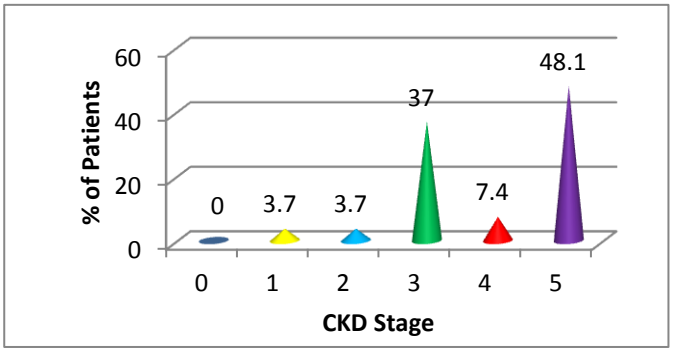

Fig. 3 Number of patients with LVH according to CKD Stage

CAD was present in 20 of 50 (40%) patients. Of them 9 patients were in CKD stage 5 and 5 patients each in CKD stages 3 and 4.

N=20

Sl. No	Stages of CKD	Frequency	Percentage
1	5	9	45%
2	4	5	25%
3	3	5	25%
4	2	1	5%
5	1	0	0%
6	0	0	0%

Table No. 6 Number of patients with CAD according to CKD Stage

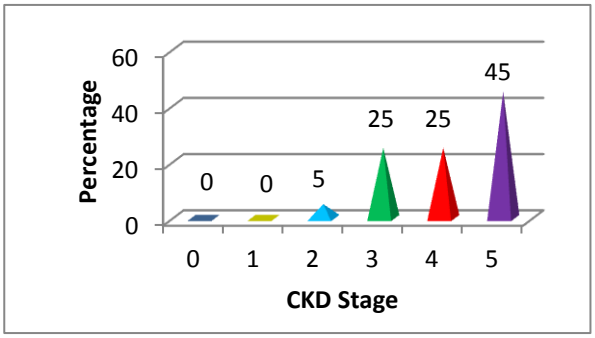

Fig. 4 Number of patients with CAD according to CKD Stage

Echocardiographically 18 of these 20 (90%) patients with CAD had depressed ejection fraction. Only 2 patients had preserved ejection fraction. On studying patients with Dilated cardiomyopathy(DCM) according to clinical stage of CKD it was observed that 7 (58.3%) of patients with DCM were in CKD stage 5 followed by 3 patients in stage 4 and 1 patient each in CKD stages 3 and 2.

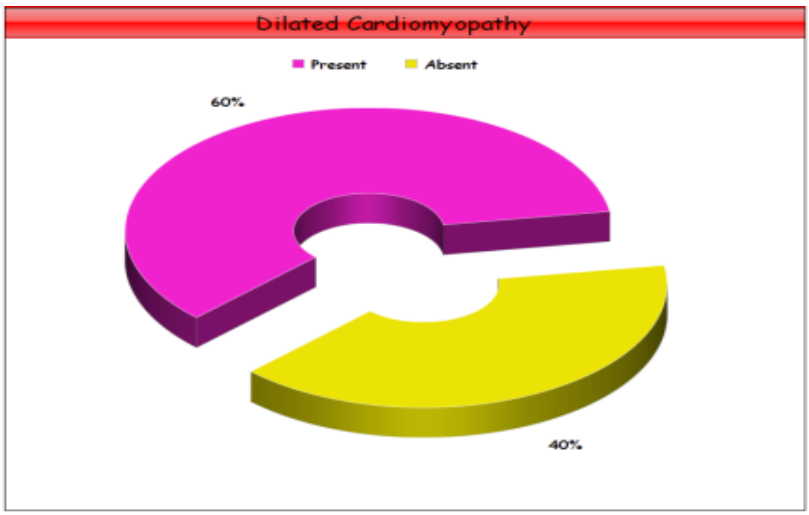

Fig. 5 Number of CAD patients with DCM

N=12

Sl. No	Stages of CKD	Frequency	Percentage
1	5	7	58.3%
2	4	3	25%
3	3	1	8.3%
4	2	1	8.3%
5	1	0	0%
6	0	0	0%

Table No. 7 Number of patients with DCM according to CKD Stage

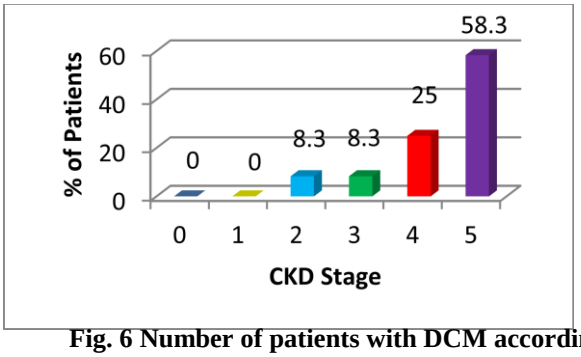

Fig. 6 Number of patients with DCM according to CKD Stage

Heart failure was observed in 22 of 50 (44%) of patients in the study group. 14 of these 22 patients (63.6%) with heart failure were in CKD stage 5 followed by 5 patients in CKD stage 4, 2 patients in stage 3 and only 1 patient in stage 2. Of these patients with heart failure majority 17 (77.2 %) patients had CAD. 5(22.7%) patients had severe anaemia without CAD. Severe anaemia was cofound in 7 of CAD patients in heart failure.

N=22

Sl. No	Stages of CKD	Frequency	Percentage
1	5	14	63.6%
2	4	5	22.7%
3	3	2	9%
4	2	1	4.5%
5	1	0	0%
6	0	0	0%

Table No. 8 Number of patients with Heart Failure according to CKD Stage

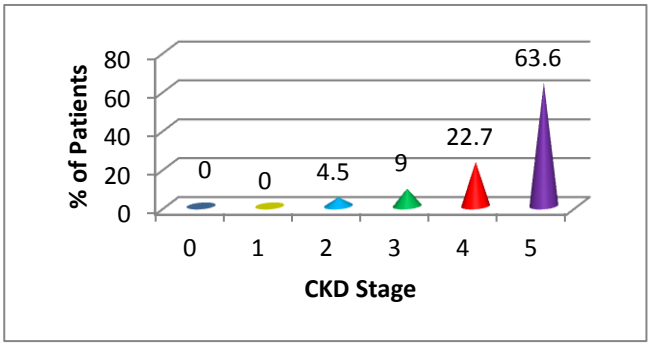

Fig. 7 Number of patients with Heart Failure according to CKD Stage

On correlating CKD stage with echocardiographic finding of LV dysfunction, all 20 patients in CKD stage 5 had EF <50%.

Stages of CKD	LV Dysfunction			
	Severe LV Dysfunction	Moderate LV Dysfunction	Mild LV Dysfunction	No LV Dysfunction
5	3 (6%)	5 (10%)	12 (24%)	0 (%)
4	1 (2%)	1 (2%)	3 (6%)	1 (2%)
3	0 (0%)	1 (2%)	5 (10%)	9 (18%)
2	1 (2%)	0 (0%)	0 (0%)	5 (10%)
1	0 (0%)	0 (0%)	0 (0%)	2 (4%)
0	0 (0%)	0 (0%)	0 (0%)	1 (2%)

Table 9: Number of patients with LV dysfunction according to CKD stage

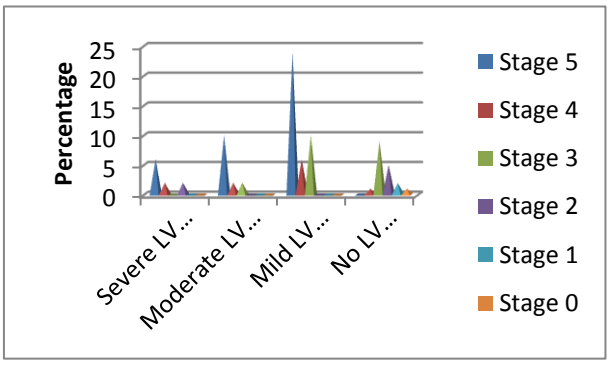

Fig 8: Number of patients with LV dysfunction according to CKD stage

16 patients in the study had pericardial effusion. Of them 9 (56.3%) patients were in CKD stage 5, 4 patients in CKD stage 4 and 3 patients in CKD stage 3.

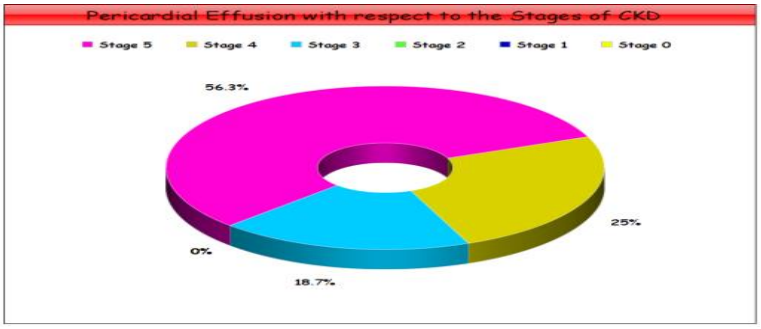

Fig. 9 Number of patients with pericardial effusion according to CKD stage

Atrial Fibrillation was seen in six patients. Of them two patients were in stage 5, two patients in stage 4 and one patient in stage 3 of CKD.

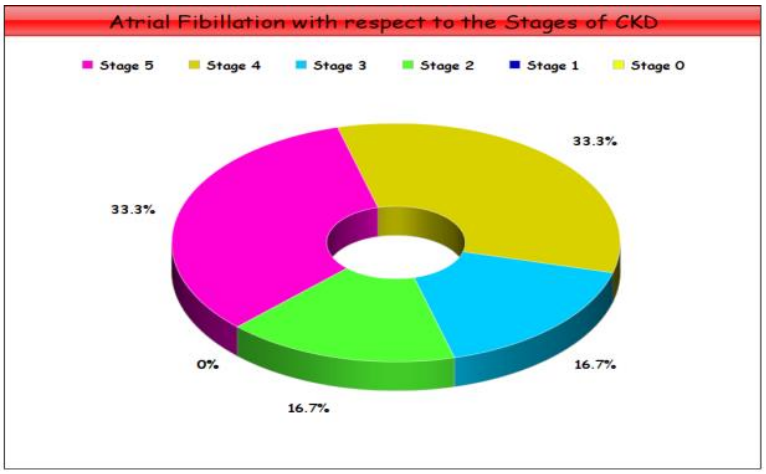

Fig. 10 Number of patients with Atrial Fibrillation according to CKD stage

DISCUSSION

CKD patients are at increased risk for cardiovascular complications.[1] Adverse cardiovascular events serves as the predominant cause of morbidity and mortality in CKD.[4] From studies so far, it is a well proven fact that hypertension is an independent risk factor for cardiovascular morbidity and mortality.[5]There exist a close interrelationship between HTN and decline in kidney function. Blood pressure elevates steadily with failing renal function and persistent elevations in blood pressure in turn further declines the kidney function and fastens the process of kidney damage.[6] In national survey by US Renal Data System in 2010, it was estimated that there is an increase in prevalence of HTN with advancing stage of CKD as they observed that 84.1 % of patients with HTN were in CKD stages 4 and 5.[7] In our study, HTN was the most common manifestation found. We observed that there is an increase in prevalence of HTN with progressive decline in kidney function . HTN was increasingly found in later stages of CKD as 58.5 % of patients with HTN in our study were in CKD stage 4 and 5 .This observation is similar to US Renal Data System 2010 data where 84.1% of patients with HTN were in CKD stages 4 and 5. Left ventricular hypertrophy(LVH) is more prevalent in hypertensive patients with CKD in comparison to hypertensive patients without CKD.[8] In our study 27 patients with HTN had LVH. There is a strong risk of adverse cardiovascular events in patients with severe and persistent LVH.[9] It was also reported that this risk decreases with regression in LV size.[10]Levin et al in their study on 175 predialysis patients observed that presence of LVH increases with declining GFR.[11] In this present study of ours a similar observation was made as it was found that 51.8 % of patients with LVH were in stage 5 of CKD followed by 44.4 % of patients in CKD stages 3 and 4 and only 3% in early CKD stages 0 to 2.

Studies so far has shown that CKD is an independent risk factor for the development of coronary artery disease.[12] CAD by itself is an independent risk factor that can predict the progression of chronic renal disease. [13]As CAD and CKD perpetuate progression of one another, both of them together were mentioned in one of the studies as janus face. Janus was an ancient roman god who was considered having two faces – one that can look retrospectively to the past and one that can look forward to the future.[14] 2012 USRDS data estimated that 40 – 50 % of deaths in dialysis patients is due to CAD. [15] In our study CAD was present in 40% of patients. Prevalance of CAD was more seen with later stages of CKD. 95% of patients with CAD were in CKD stages 3 to 5. Only 5% of patients in early CKD stages (0 to 2) were seen having CAD. Echocardiographically dilated cardiomyopathy(DCM) was present in 60% of these patients with CAD. DCM was present more with later stages of CKD. 58.3% of patients with DCM were in CKD stage 5. 90% of patients with CAD had a reduction in ejection fraction and in only 10% patients ejection fraction was preserved.

Heart failure is another most common complication in CKD and its prevalence increases with declining GFR.[16] Heart failure at initiation of dialysis is an independent predictor of short term mortality in these patients.[17] Trespalacious et al reported that 80% of ESRD patients diagnosed having heart failure are likely to die in three years.[18]In our study 44% of patients had heart failure. Of them 86.3% of patients were in CKD stages 4 and 5. An increasing prevalence of heart failure with advancing stages of CKD was observed. Echocardiographically LV dysfunction was observed more with later stages of CKD. All patients in CKD stage 5 in our study had LV dysfunction. Patients without LV dysfunction were mainly observed in from CKD stages 0 to 3.

Other complication of CKD is pericardial disease. Pericarditis is usually seen in advanced uremia and it may or may not be

associated with pericardial effusion.[19]In our study all patients with clinical, electrocardiographic and chest X ray features suggestive of pericardial effusion were confirmed with echocardiography apart from asymptomatic patients with pericardial effusion detected on detailed ECHO as a part of study. We observed that 32% of patients in the study had pericardial effusion. 56.25 % of patients with pericardial effusion were in CKD stage 5 and 43.75 % of patients in CKD stages 3 and 4. Pericardial effusion was not observed in early stages (0 to 2) of CKD in our study. CKD patients have a high risk of developing various cardiac arrhythmias. USRDS 2008 annual data estimated that sudden cardiac death accounts for 25% of mortality in patients with comorbidities on hemodialysis.[20]Vanquez et al reported a 3 out of 5 prevalence of atrial fibrillation(AF) in patients on dialysis. They also stated that presence of AF is associated with a 5 year mortality risk of 80%.[21] In our study 6 out of 50 patients had AF. All of them were in chronic renal failure (CKD stages 3 to 5).

LIMITATIONS OF THE STUDY

One of the limitation of our study is a small sample size of patients studied (50 patients). Secondly, Coronary angiogram in asymptomatic patients to discover occult CAD ideally would give a better data on prevalence of CAD in our patients studied.

CONCLUSION

Cardiac abnormalities are common in patients with chronic kidney disease. Hypertensive heart disease is the most common clinical manifestation of chronic kidney disease. Heart failure and coronary artery disease are other common cardiac abnormalities found in patients with chronic kidney disease. Atrial fibrillation is observed in advanced stages of CKD. Echocardiographically left ventricular hypertrophy and Ischemic dilated cardiomyopathy are increasingly associated with declining renal function. Pericardial effusion is a frequent complication in CKD. Hence all chronic kidney disease patients needs a thorough clinical evaluation for cardiac manifestations and echocardiographic assessment to look for cardiac abnormalities.

Institutional Ethical Committee Approval: Obtained.

Conflicts Of Interest

Nil

Financial Support

Nil

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