

**Echocardiographic changes in patients with chronic kidney disease - An observational study in rural tertiary care hospital**

<sup>1</sup>Inbanathan J, Professor and Head of Department, Dept of General Medicine, AIMS BG Nagara, Mandya, Karnataka.

<sup>2</sup>Vinod Angadi, Junior Resident, Dept of General Medicine, AIMS BG Nagara, Mandya, Karnataka.

<sup>2</sup>Vinay Kumar K R, Junior Resident, Dept of General Medicine, AIMS BG Nagara, Mandya, Karnataka.

<sup>3</sup>Anand L, Assistant Professor, Dept of General Medicine, AIMS BG Nagara, Mandya, Karnataka.

**Corresponding Author:** Vinod Angadi, Junior Resident, Dept of General Medicine, AIMS BG Nagara, Mandya, Karnataka.

**Citation this Article:** Inbanathan J, Vinod Angadi, Vinay Kumar K R, Anand L, “Echocardiographic changes in patients with chronic kidney disease - An observational study in rural tertiary care hospital”, IJMSIR- January - 2023, Vol – 8, Issue - 1, P. No. 155 – 161.

**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

**Abstract**

**Background:** Chronic kidney disease contains a spectrum of different patho physio logical processes associated with deranged kidney function and progressive decline in glomerular filtration rate. Presence of CKD or associated multiple risk factors is found to be directly proportional to development of cardiovascular diseases, thus leading to increased morbidity, mortality and rate of hospitalization. ECG and echo cardio graphic changes are common in CKD patients. In this study, echocardiography changes of CKD patients attending Medicine Department of a rural tertiary care teaching hospital is analyzed.

**Aims:** To analyze the echo cardio graphy changes in chronic kidney disease patients.

**Materials and methods:** Cross-sectional study, carried out at rural tertiary care teaching hospital on 80 patients attending to the outpatient and in-patient clinics with CKD status, during the period from November 2021 to July 2022 in the department of General medicine,

Adichunchunagiri Institute of Medical Sciences, BG Nagara, Mandya, Karnataka India.

**Statistical Analysis:** Data were analyzed using SPSS version 23.0 and Microsoft office. All characteristics were summarized descriptively. The results were considered to be statistically significant with p-value < 0.05.

**Results:** A total number of 80 subjects were included in this study, of which 42 were on maintenance hemo dialysis and 38 were on medical management. The mean age of study population was  $44.9 \pm 11.8$  years. Male/female ratio was 52/28 i.e., this study had male predominance. There were 72% anemic and 38% hyper tensive patients. Left Ventricular Hyper trophy was noted in 46.8%, in which around 50% of them had mild LVH. Left Ventricular Diastolic Dysfunction was diagnosed in 64%, while pulmonary arterial hyper tension was detected in 53% of cases.

**Conclusion:** Patients with chronic kidney disease have high frequency of abnormal echocardiography findings.

All hospitalized CKD patients should undergo ECG and echo cardiography screening to treat and prevent cardiovascular complications.

**Keywords:** chronic kidney disease, echo cardiography, hemodialysis

### **Introduction**

Chronic kidney disease contains a spectrum of different pathophysiological processes associated with deranged kidney function and progressive decline in glomerular filtration rate. Presence of CKD or associated multiple risk factors is found to be directly proportional to development of cardiovascular diseases, thus leading to increased morbidity, mortality and rate of hospitalization. The age-adjusted cardiovascular complications and mortality is about 30 times higher in end-stage renal disease than in general population. Pre-transplant cardiovascular disease is also a risk factor for post-transplant cardiovascular disease. Most patients with chronic kidney disease succumb to cardiovascular disease before even reaching stage 5 CKD. Between 30-45% of the patients who do reach stage 5 CKD have advanced cardiovascular complications. Thus, the focus of the patient care in earlier CKD stages should be directed to prevention of cardiovascular complications.

### **Materials and methods**

#### **Study place**

Patients with chronic kidney disease attending to the outpatient and in-patient clinics at the department of General Medicine AIMS, BG Nagara, Mandya, Karnataka India.

#### **Study period**

Study was carried out during the period from November 2021 to July 2022

**Study type:** Cross-sectional study

#### **Source of data/Sampling method**

Patients with chronic kidney disease attending to the outpatient and in-patient clinics during the period from

November 2021 to July 2022 at the department of General Medicine AIMS, BG Nagara, Mandya, Karnataka India. Based on convenient sampling, 80 patients were selected with following inclusion and exclusion criteria.

#### **Sample size**

A total of 80 patients were selected for the study after applying inclusion and exclusion criteria.

#### **Inclusion criteria**

1. Patients willing to give informed consent
2. Patients above 18 years of age
3. Patients with different stages of chronic kidney disease irrespective of underlying etiology

#### **Exclusion criteria**

1. Patients not willing to give informed consent
2. Patients who are known case of
3. Ischemic Heart Disease
4. Chronic Obstructive Pulmonary Disease
5. Chronic Liver Disease
6. HIV
7. Hypo/hyperthyroidism
8. Connective tissue disorder

#### **Following were the investigations done for subjects**

- Complete blood count
- Renal function test
- Serum Electrolytes
- Serum calcium, serum phosphorus
- ECG
- Echocardiography
- And other relevant investigations

#### **Data collection**

Detailed present, past, personal and family history noted and clinical examination done specially looking for any signs of anemia, ischemic heart disease and other cardiovascular disorders. All these findings were properly entered in proforma. Normal reference range for

renal function test has been considered as serum urea (15 - 50 mg/dl), serum creatinine (0.4 - 1.4 mg/dl)

**Statistical analysis**

All the characteristics were summarized descriptively. For continuous variables, the summary statistics of mean, Standard Deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square/ Freeman - Halton Fisher exact test was employed to determine the significance of differences between groups for categorical data. Statistically significant tests - unpaired t test, ANOVA and F test were utilized according to variables and equality of variance was tested. If the p value < 0.05, then results were considered to be statistically significant. Data were analyzed using SPSS version 23.0 and Microsoft office.

**Results**

Total number of cases was 80.

Table 1: Distribution of subjects according to gender

Sex	N	%
Male	52	65
Female	28	35
Total	80	100.0

It was observed that majority of patients were males (65%) and females were (35%)

Figure 1: Distribution of cases according to gender

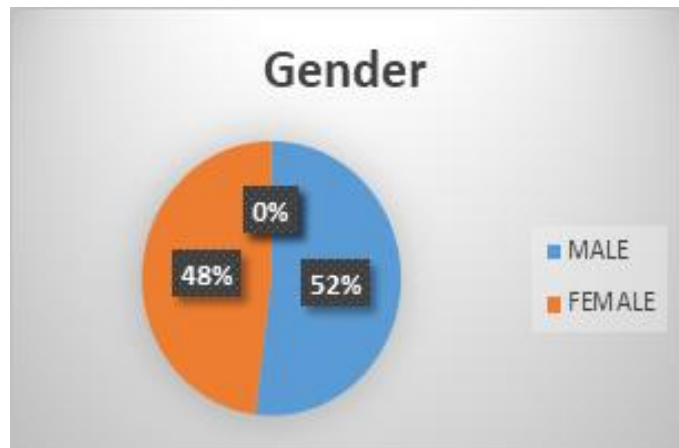
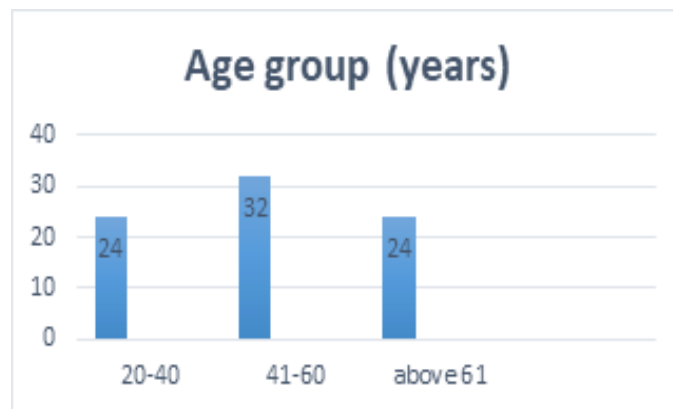


Table 2: Distribution of subjects based on age

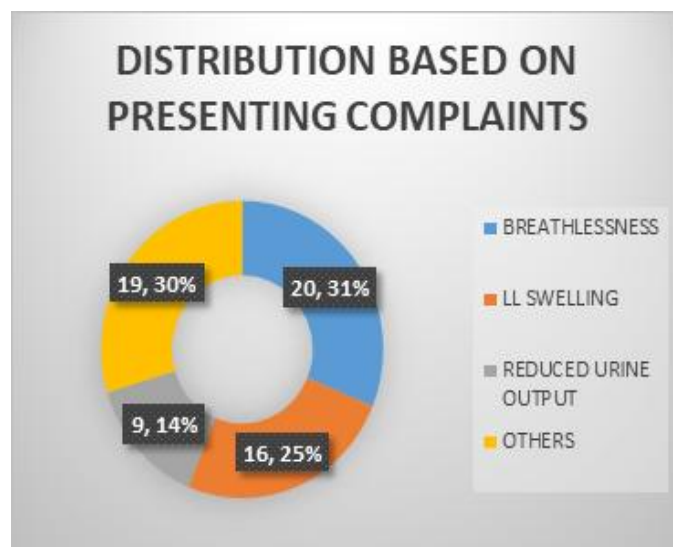
Age Group (years)	N	%
20-40	24	29
41-60	32	40
Above 61	24	29
Total	80	100

Figure 2: Distribution of subjects based on age



The mean age of study population was 44.9 ± 11.8 years. Majority of patients were in the age group of 41-60 years.

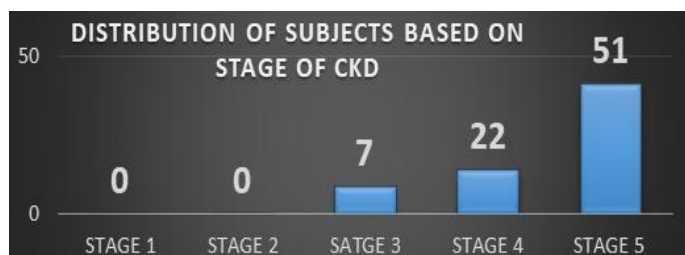
Figure 3: Distribution based on presenting complaints



Majority of the patients presented with volume overload status complaining breathlessness (31%), lower limb swelling (25%). Around 14% Of CKD patients gave history of reduced urine output.

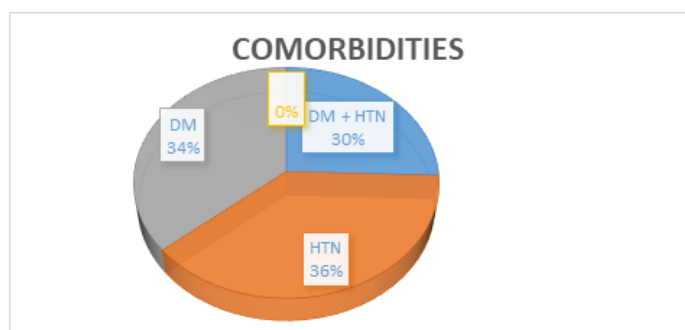
Most of them also had generalized fatigue, body ache and pruritis in common (30%).

Figure 4: Distribution of subjects based on stage of CKD



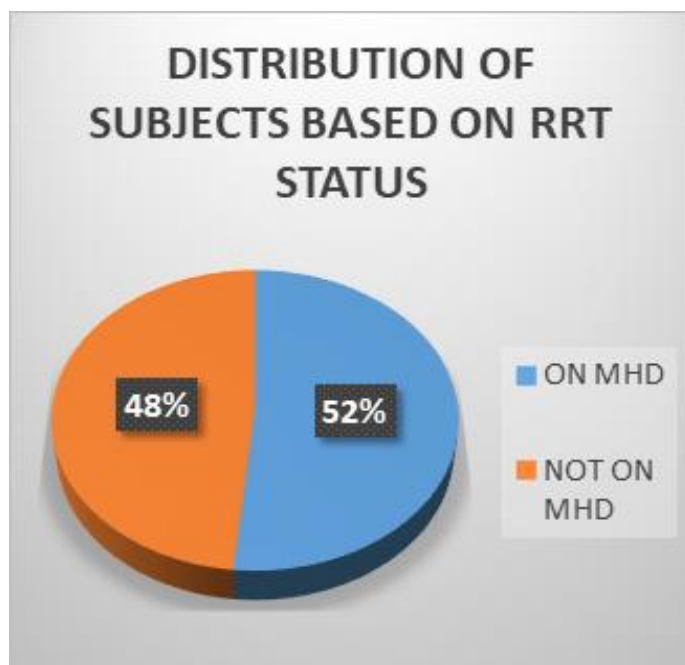
A total of 64% of cases were of end stage renal disease while 27.5% of them were in stage 4 and 8.75% in stage 3 who were on medical management and regular follow up.

Figure 5: Comorbidities



Out of 80 patients, 36% had hypertension alone, 34% had diabetes alone and 30% had both hypertension and diabetes.

Figure 6: Distribution of subjects based on RRT status



In our study 52% of patients were on regular hemo dialysis twice or thrice a week based on volume status and dry body weight, where as 48% of them were on medical management.

Table 3: Various biochemical parameters in patients with CKD

Parameter	N	%
Anemia	68	85
Hyperkalemia	18	22.5
Hypocalcemia	62	77.5
Hyperphosphatemia	32	40

Majority of CKD patients had anemia (85%). On evaluation most of them had normocytic normochromic anemia (64%) who required erythropoietin analogues for treatment and few of them had microcytic hypochromic anemia (32%), they required iron supplements for correction of anemia. Very few of them had dimorphic anemia (4%) who required both iron and vitamin supplements. Around 77.5% of them had calcium deficiency and 40% of them showed hyperphosphatemia. Hyperkalemia was noted in 22.5% of cases.

Table 4: Distribution of study cases as per ECG findings

ECG	N	%
Normal sinus rhythm	32	40
Sinus tachycardia	26	32.5
Left ventricular hypertrophy	24	30
Pulmonary artery hypertension	16	20
Poor progression of r wave	8	10
Low voltage complex	5	6.25
Arrhythmias	10	12.5

Most common ECG finding were sinus tachycardia (32.5%) and left ventricular hypertrophy (30%). 12.5% of cases had arrhythmias where as 20% had pulmonary artery hypertension.

Table 5: Echocardiographic changes in CKD

LVH	N	%
Mild	24	50
Moderate	20	43
Severe	4	7

Figure 7: Left ventricular hypertrophy

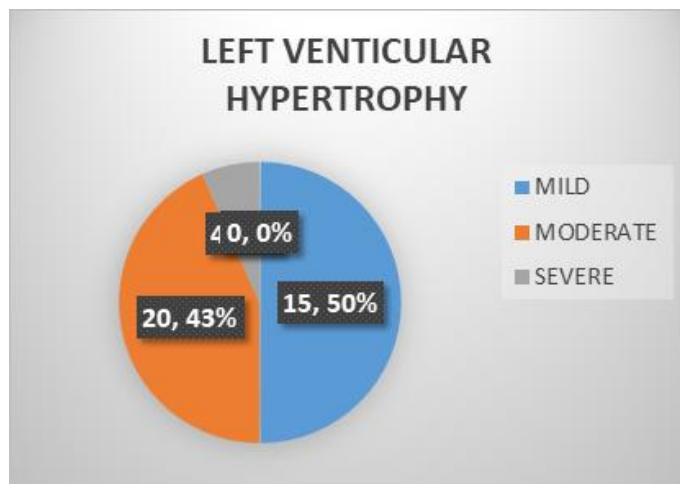


Table 6: Pulmonary artery hypertension

Pah	N	%
Mild	28	35
Moderate	26	32
Severe	26	32

Figure 8: Pulmonary artery hypertension

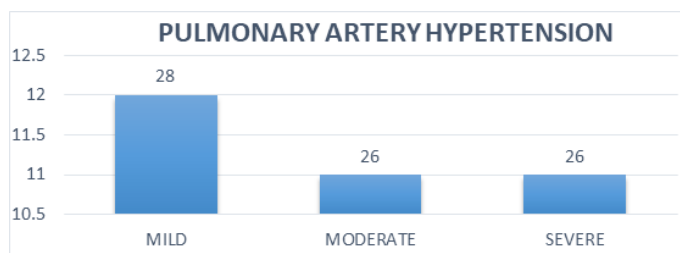


Table 7: Left ventricular diastolic dysfunction

Lvdd	N	%
Grade 1	48	60
Grade 2	30	36
Grade 3	2	2

In our study 64% of cases had LVDD, out of which majority had grade 1 LVDD and 30% had moderate LVDD.

Table 8: Pericardial effusion

	N	%
Trace	8	10
Mild	12	67
Moderate	4	2
Gross	0	0

18% of cases showed pericardial effusion, out of which majority (67%) had mild pericardial fluid collection. None of the cases had gross pericardial effusion.

Table 9: Systolic dysfunction

	N	%
Mild	14	18
Moderate	9	10
Severe	1	1

Systolic dysfunction was noted in around 23% of cases, majority (18%) had mild systolic dysfunction

Table 10: Other major echo findings

	N	%
Hypertensive heart disease	17	21
Ischemic heart disease	7	9
Dilated cardiomyopathy	10	12

Around 21% showed hypertensive heart disease, 12% had dilated cardiomyopathy and 9% of cases showed ischemic heart disease changes.

### CROSS REFERENCES

Study	Goorna war et al	Shivendra et al	Tarun rao et al	Mehta k s et al	H suresh et al	our study
LVH	36%	48%				46.8%
LVDD		51%	55.2%			64%
PAH				60.5%	43.5%	53%
Pericardial effusion	6%	6%				18%
Systolic dysfunction		28%	47.8%			23%
IHD	16%	8.5%				9%
DCM	4%					12%

## Conclusion

Electrocardiography and echocardiography are the non-invasive tools which can be used to identify cardiovascular disease early in the course of CKD. Present study observed high prevalence of ECG and 2-D echo abnormalities in CKD patients. Left ventricular diastolic dysfunction and hypertrophy were the most commonly detected abnormality while pulmonary arterial hypertension was present in about 50% of the cases.

In view of the above findings, present study recommends periodic electrocardiographic and echocardiographic examination for diagnosis and early treatment of cardiac abnormalities in patients with CKD at regular intervals.

## References

1. Luft FC. Baa, Baa, black sheep, are your kidneys full? J Physiol [Internet]. 2003;549-55.
2. Bucher L, Lewis SL, Dirkson SR, Harding MM, Heitkemper Margaret M. Medical-Surgical Nursing: Assessment and Management of Clinical Problems. 2007. 376-390.
3. Mani M.K Prevention of chronic renal failure at the community level. Kidney International 2003; 63: 586-9.
4. Agarwal SK, Srivastava RK, Chronic Kidney Disease in India – Challenges and Solutions, Nephron Clin Pract, 2009, 111, 197-203.
5. Prabakar MR, Chandrasekaran V, Soundarajan P, Renal Data from the Asia-Africa, Saudi Journal of Kidney Diseases and Transplantation, 2008, 19, 847-53.
6. Pisoni R, Aros C, Ruggenti P, Remuzzi G, Mechani SMS of progression of chronic renal disease. Saudi J Kidney Dis Transpl. 2002 Jul-Sep; 13 (3) :250-6.
7. Remuzzi G, Bertani T. Pathophysiology of progressive nephropathies. N Engl J Med. 1998 Nov 12; 339 (20):1448-56.
8. El-Nahas AM. Plasticity of kidney cells: role in kidney remodeling and scarring. Kidney Int. 2003 Nov; 64 (5):1553- 63.
9. Sarnak MJ, Levey AS, Schoolwerth AC, Coresh J, Culeton B, Hamm LL, et al. Kidney disease as a risk factor for development of cardiovascular disease: A statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. Circulation. 2003 Oct 28; 108 (17): 2154-69.
10. Moe S, Drucke T, Cunningham. Definition, Evaluation and Classification of renal osteodystrophy a Positive statement from kidney disease; Improving Global Outcome (KDIGO). Kidney Int. 2006;69:1945-53
11. . Shivendra S, Doley PK, Pragya P, Sivasankar M, Singh VP, et al. Echocardiographic Changes in Patients with ESRD on Maintenance Hemodialysis-A Single Centre Study. J Cardiovasc Dis Diagn. 2014;2:165-9.
12. Ahmed HA, Yassein YS, Zaki SA, Al Qersh AM, Fahim FS. Study of echocardiographic changes Among adult patients on maintenance hemodialysis. Menoufia Med J 2016;29:44-51
13. Dhamija JP, Saxena N, Saxena S. Evaluation of 2-D echo findings in chronic kidney disease.
14. Case study of 35 end stage renal disease patients. IAIM, 2016; 3(9): 61-65.
15. Sachdeva S, Khurana T, Kaur S, Kamalpreet, Aggarwal R, Kaur A, Singh B. ECG and ECHO Changes in CKD. Ann. Int. Med. Den. Res. 2017; 3(5):ME10-ME14.
16. Reddy S. Assessment of ECG and Echo Findings among With Chronic Kidney Disease Patients. Sch. J. App. Med. Sci., 2017; 5(9A):3475-3480.
17. Ramegowda RB, Samdeshi AL, Khanvilkar Y. A study of Echo cardio graphic changes in patients With Chronic Kidney disease in a tertiary care centre in South

Karnataka. JMSCR. 2018.

18. Motiyani P, Jagat RS, Barde R, Dubey TN, Meena RS. Cardiac status in CKD patients on Maintenance hemodialysis to detect cardiovascular disease: importance of M mode Echocardiography. *IJMR*. 2019; 4(2):130-134.

19. Islam T, Datta A, Tripura K. A cross sectional study on cardiovascular comorbidities in patients of Chronic kidney disease attending Tripura Medical College & Dr. B. R. Ambedkar memorial teaching Hospital. *J. Evid. Based Med. Healthc*. 2019; 6(35), 2387-2392.

20. Centre for Disease Control and Prevention (CDC). National Chronic Kidney Disease Fact Sheet 2014. CDC, Atlanta, United States of America; 2014. Available from: [http://www.cdc.gov/diabetes/pubs/pdf/kidney\\_factsheet.pdf](http://www.cdc.gov/diabetes/pubs/pdf/kidney_factsheet.pdf).

21. Kaliya M, Rathod M, Gohel A, Tanna A, Mehta M. A study of biochemical profile of chronic renal Failure patients in tertiary care hospital: a cross sectional study. *International Journal of Scientific Reports*. 2015 Dec 19;1(8):303-6.

22. Bostom A, Brosnan JT, Hall B, Nadeau MR, Selhub J. Net uptake of plasma homocysteine by the rat Kidney in vivo. *Atherosclerosis*. 1995;116(1):59-62.

23. Guttormsen AB, Ueland PM, Svarstad E, Refsum H. Kinetic basis of hyperhomocysteinemia in Patients with chronic renal failure. *Kidney international*. 1997 ;52 (2): 495-502.

24. Bostom AG, Kronenberg F, Jacques PF, Kuen E, Ritz E, Konig P, et al. Proteinuria and plasma total Homocysteine levels in chronic renal disease patients with a normal range serum creatinine: critical Impact of true glomerular filtration rate. *Atherosclerosis*. 2001; 159 (1): 219-23

25. Kalantar-Zadeh K, Block G, Humphreys MH, Kopple JD. Reverse epidemiology of cardiovascular Risk

factors in maintenance dialysis patients. *Kidney international*. 2003;63(3):793-808.

26. Kalantar-Zadeh K, Block G, Humphreys MH, Kopple JD. Reverse epidemiology of cardiovascular Risk factors in maintenance dialysis patients. *Kidney international*. 6 3(3):793-808.