



STUDY OF ECHOCARDIOGRAPHIC PATHOLOGY IN PATIENTS WITH CHRONIC KIDNEY DISEASE IN RURAL NORTH INDIA

General Medicine

Dr. S. Manoj kumar	Postgraduate Junior Resident, Department of General Medicine, Mayo institute of Medical sciences, Barabanki, Uttar Pradesh, India.
Dr. Kavuri Vigna Suma Lohith	Postgraduate Junior Resident, Department of General Medicine, Mayo institute of Medical sciences, Barabanki, Uttar Pradesh, India.
Dr. Nitin Srivastava*	Assistant Professor, Department of General Medicine, Mayo institute of Medical sciences, Barabanki, Uttar Pradesh, India. *Corresponding Author
Dr. (Col) Anil Kumar Pawah	Professor, Department of General Medicine, Mayo institute of Medical sciences, Barabanki, Uttar Pradesh, India.

ABSTRACT

Background: Cardiovascular disease (CVD) is leading cause for increase of patients with Chronic Kidney Disease (CKD). This increased risk of CVD may begin during early stage of CKD much before the onset of kidney injury. Apart from cardiovascular disease, Diabetes, and Hypertension is also a cause and effect of CKD. **Objectives:** To evaluate and analyze echocardiographic changes in patients with CKD and to determine the quality of life of people by knowing the prevalence of Echocardiographic changes in chronic kidney disease patients. **Methods:** A total of 60 CKD patients admitted to the Mayo Institute of Medical Science, Barabanki from January 2022 to December 2022, were included in this study. The patients were evaluated as per the history, physical examination, systemic examination, Serum Creatinine, Blood Urea, Urine Routine, Electrocardiograph (ECG) and Echocardiography. **Results:** In the present study echocardiographically determined cardiovascular abnormalities were observed in 80% of patients. Left Ventricular Hypertrophy (LVH) in 50% patients. LVH and Ischemic Heart Disease in 20%, Ischemic heart disease (IHD) 9%, Pericardial effusion in 5.0%, dilated cardiomyopathy in 10%, Septal hypertrophy in 2.0% is observed. **Conclusion:** LVH is the most common morphological abnormality observed. In our center, we were able to diagnose that IHD patients by echocardiogram and referred them for coronary artery intervention promptly and we could screen CKD patients before undergoing renal transplant to detect and correct Coronary Artery Disease (CAD) and an echo is a tool to detect Pericardial Effusion and to advise pericardiocentesis and adequate dialysis.

KEYWORDS

Echocardiography, Diabetes, Coronary Artery Disease, Chronic Kidney Disease, Left Ventricular Hypertrophy, Ischemic Heart disease

INTRODUCTION

The Kidneys play a vital role in fluid, electrolyte and acid-base homeostasis in humans. Chronic kidney disease (CKD) encompasses a spectrum of different pathophysiologic processes associated with abnormal kidney function and a progressive decline in glomerular filtration rate (GFR)^[1].

CKD is defined as Kidney damage for more than 3 months by structural or functional abnormalities of kidney, with or without decreased GFR, manifest by either; pathological abnormalities or markers of kidney damage, including abnormalities in composition of the blood or urine, or abnormalities in imaging tests. Cardiovascular disease (CVD) is a leading cause of morbidity and mortality in patients of CKD.

Most of the patients with CKD succumb to CVD before reaching end stage CKD. Thus focus of patient care in earlier CKD stages should be directed to the prevention of cardiovascular complications^[1,2].

A strong union exists between CKD and CVD, with an increase in CVD observed with declining GFR. Indeed, CVD is the main cause of morbidity and mortality in CKD patients^[3].

Echocardiographic abnormalities are very common in patients suffering from end-stage renal disease (ESRD), determining the echocardiographic abnormalities in these patients can help in the prevention of mortality, so periodic echocardiographic examination for early diagnosis and treatment of cardiac abnormalities is highly advised^[4].

Cardiac structural and functional changes detected by echo cardiography are common in patients with CKD undergoing hemodialysis, and have been recognized as key outcome predictors. The cardiovascular mortality in these individuals is 10 to 20 fold more frequent than in the general population^[5].

In the present study, an attempt has been made to study various structural and functional cardiovascular changes in CKD with help of 2D echocardiography and to correlate it with clinical findings and other investigations

MATERIALS AND METHODS

All patients admitted to Mayo Institute of Medical sciences, Barabanki, UP with CKD in the Department of General Medicine and Hemodialysis unit from 1st January 2022 - 31st December 2022

The history and general physical findings on examination with special emphasis on cardiovascular findings and investigations were entered in the proforma.

Sr. Creatinine was estimated by using Mod. Jaffes Kinetic Method.

Principle:

Picric acid in an alkaline medium reacts with creatinine to form an orange-colored complex with the alkaline picrate. The intensity of the color formed during the fixed time is directly proportional to the amount of creatinine present in the sample.

Creatinine + Alkaline Phosphate Orange Colored Complex.

Reference values:

Serum creatinine

Males : 0.6-1.2 mg%

Females: 0.5-1.1 mg%

Sample Material: Serum Creatinine is stable in serum for 1 day at 2-8 degree Celsius.

Procedure:

Wavelength/filter: 520nm, Reaction: Fixed Time Kin, Incubation, Temp.: 30 degree Celsius/37 degree Celsius, Delay Time: 30 sec, Read Time: 60 sec, No. of readings: 2, Interval: 60 sec, Sample Vol.: 0.10 ml, Reagent Vol.: 1 ml, Units: mg/ dl.

2D Echocardiography:

2D echocardiography was done by using Wipro GE, VividS5 echocardiography machine with a probe of 3 Mega hertz. Left lateral position was used while doing echocardiographic evaluation of CKD patients.

All the patients underwent detailed echocardiographic examination by

following views:

1. Left parasternal long axis.
2. Left parasternal short axis.
3. Apical- 4 chambers, 5 chambers (for aortic valve flow), 2 chambers & 3 chambers.
4. M mode

GFR estimation: Was done using

1. Cockcroft Gault equation ,

$GFR = (140 - \text{Age} \times \text{body weight in kg}) / 72 \times \text{PCr (mg/dl)}$ (Multiply by 0.85 in females)

2. MDRD formula

$186 \times [\text{serum creatinine (mg/dl)}]^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ if female})$

Table 1. Staging of CKD

Stages of CKD	GFR ml/min per 1.73 m2
0	>90a
1	≥90b
2	60-89
3	30-59
4	15-29
5	< 15

- a. With risk factors for CKD
- b. With demonstrated Kidney damage

Selection Criteria:

1. Azotemia for ≥ 3 months
2. Symptoms and signs of uremia
3. Presence of broad Casts in urinary sediment

Study Type: Observational study

Inclusion criteria

Patients with chronic kidney diseases admitted under General Medicine department and Hemodialysis unit excluding

Exclusion criteria

1. Documented ischemic heart disease
2. Valvular heart disease.
3. Documented Congenital heart disease
4. Patients with acute kidney injury
5. Patients who are Hepatitis B Surface antigen (HBsAg) Positive, Human Immuno-deficiency Virus (HIV) positive and Hepatitis C Viral (HCV) antibody positive
6. Patients in whom Renal Biopsy is required for diagnosis

RESULTS

In the present study, cardiovascular involvement was studied in 60 patients of CKD during period of 1st of January 2022 to 31st of December 2022 in the Department of General Medicine and hemodialysis unit. The observations made were as follows:

The age of the patients in the present study ranged from 18 years to 80 years. The mean age was 46.58 ± 13.3 years with male: female ratio 1.50:1.

Table 2. Distribution of study subjects based on age & gender

Age in years	Gender		Total
	Male	Female	
≤ 20	2 (3.3%)	1 (1.6%)	3 (5%)
21-40	10 (16.6%)	5 (8.3%)	15 (25%)
41-60	18 (30.0%)	12 (20.0%)	30 (50%)
≥ 61	6 (10%)	6 (10%)	12 (20%)
Total	36 (60%)	24(40%)	60 (100%)

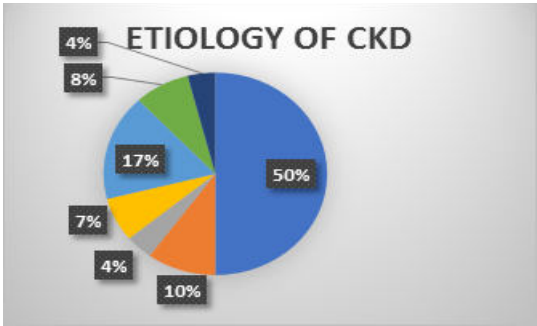
Etiology of chronic kidney disease:

The most common association of CKD in present study includes cardiovascular disease i.e. 30(50%) patients. Other causes of chronic kidney disease observed in the present study were diabetes mellitus (10%), Obstructive uropathy (4%), Chronic Glomerulo nephritis (7%), Hypertension & Diabetes combined (17%), Analgesic Nephropathy(8%), Obstructive uropathy & Diabetes combined (4%).

Table 3. Distribution of patients based on dialysis

Type of management	Number	Percent
Dialysis		
On Dialysis	54	90.00%

Not on Dialysis	6	10.00%
Total	60	100.00%



Echocardiographic manifestations:

Out of 60 cases of CKD studied by echocardiography, 48(80%) patients showed presence of echocardiographic manifestations. Most of them 18 (30%) showed LVH alone, combined LVH and IHD (Valvular abnormalities and any Hypokinesia) were 12(20%), while 12 (20%) patients did not reveal any echocardiographic manifestation.

Other echocardiographic manifestations like IHD alone 9(15%), Dilated Cardiomyopathy 6(10%) and Pericardial Effusion 3(5%).

Table 4. Distribution of study subjects based on Echo interference

	Frequency	Percent
Normal	12	20.0
LVH	18	30.0
IHD	9	15.0
LVH and IHD	12	20.0
Dilated cardiomyopathy	6	10.0
Pericardial Effusion	3	5.0
Total	60	100.0

The lowest ejection fraction observed in this study was 15 % and highest ejection fraction observed in this study was 55 %. Maximum number of patients i.e. 36(60%) had ejection fraction between 41% to 50%.

Table 5: Distribution of study subjects based on Left Ventricular Ejection Fraction (LVEF)

LVEF %	Frequency	Percent
≤ 30.0	3	5.0
31.0 - 40.0	9	15.0
41.0 - 50.0	36	60.0
51.0+	12	20.0
Total	60	100.0

DISCUSSION

Chronic kidney disease causes multisystem involvement. Cardiovascular disease coexists with CKD. Echocardiography can detect cardiac changes in the early stages. Echocardiography is simple, safe, and sensitive method to detect small pericardial effusion, helping to analyze the cause of chest pain and cardiomegaly and thus guide anticoagulant therapy in patients who are on hemodialysis. Early detection and treatment of major cardiac complications in patients with chronic renal failure may change the outcome.

The present study was conducted in the Department of General Medicine from January 2022 to Dec 2022. This study consisted of 60 patients of chronic renal failure.

The age of the patients in this study ranged from 18 years to 80 years with the mean age being 46.58±13.3 years. The majority of patients (50%) belonged to the age group of 41 years to 60 years.

The age group of patients is comparable to studies of Shivendra et al^[6] - 21 to 70 years.

In the present study, 36(60%) patients were males and 24(40%) patients were females. Male to female ratio is 1.50:1.

The study of Foley et al^[8] who found the male to female ratio as 2:1 and study of Ladda et al^[2] found that Male to female ratio was 3:1. The study of Goornavar SM et al^[21] found that Male to Female ratio 1.08:1. The

gender of the patients was compared with Owen et al^[7] who found it to be 2:1. Male gender was more in all studies except in the study of D' Cruz et al^[9] who had male to female ratio as 2:3

The commonest etiology of chronic kidney disease (50%) was hypertension. Other studies also showed a similar trend. Lewis et al^[10] who observed 46% incidence of hypertension, 60 % incidence by Jkaheimo et al^[11], 24% incidence by Greaves et al^[12] 30% incidence by Levin et al^[13]. While, in contrast with our study, Gupta et al^[14] and Owen et al^[9] reported chronic glomerulonephritis as most common etiology in 50% & 65% cases respectively.

Other causes of chronic kidney disease observed in the present study were diabetes mellitus (10%), Obstructive uropathy (4%), Chronic Glomerulo nephritis (7%), Hypertension & Diabetes combined (17%), Analgesic Nephropathy (8%), Obstructive uropathy & Diabetes combined (4%).

Maximum number of patients i.e. 48(80%) belonged to stage 5 CKD while 12(20%) belong to stage 4. No cases were found to be in stage 1,2 and 3.

Out of 60 patients studied 6 (10%) patients were on conservative line of management without dialysis and 54 (90%) patients were on dialysis.

Percentage of dialysed and non-dialysed patients in the present study is comparable with the study of Greaves et al (1994)^[12] who reported 30% patients on conservative treatment and 70% patients on dialysis treatment.

Pericardial effusion was reported in 3 (5%) patients which is consistent with a study by Barrionuevo JDA et al (2010)^[15] where they found 6.5% patients with pericardial effusion. Laddha M et al (2014)^[2] reported an incidence of pericardial effusion of 14.3%. Shvendra et al reported an incidence of 17.14%. While Menon et al (1998)^[16] who reported 32% incidence and Achari et al (1989)^[17] who reported 50% incidence of pericardial effusion in chronic renal failure patients.

In the present study ischemic heart disease was documented in 21(35%) patients echo, in contrast to Parfrey et al^[18], who reported 20% incidence of ischemic heart disease in chronic renal failure patients and 25 % in the study of Greaves et al^[12].

Etiology of myocardial ischemia in chronic renal failure is unclear but atherosclerosis, left ventricular hypertrophy and anemia are proposed causes.

Left ventricular hypertrophy was reported in 30(50%) patients. It is consistent with the study of Menon et al who reported 40 % incidence and Raut et al^[19], who reported 30 % incidence.

Out of 60 patients studied only 12(20%) patients had left ventricular hypertrophy on electrocardiogram and 48 (80%) patients had no evidence of LVH on electrocardiogram. By echo we had 30(50%) had evidence of LVH. Thus echo cardiogram is superior to electrocardiogram in detecting LVH.

The lowest ejection fraction observed in this study was 15 % and highest ejection fraction observed in this study was 55 %.

In the present study no statistically significant correlation was observed between left ventricular hypertrophy and either hemoglobin level or duration of the chronic kidney disease or Serum creatinine levels. There was significant association 18 (30%) between LVH and presence of hypertension.

Cause of left ventricular hypertrophy in chronic kidney disease remains unclear but is usually associated with modifiable factors. i.e. systemic hypertension, uremia, anemia.

CONCLUSION

In the present study, Patient's age ranged from 18 years to 80 years with mean age was 46.58 ± 13.3 years. Hypertension was commonest etiology (50%), Other etiologies were diabetes (10%), obstructive uropathy (4%), CGN (7%), HTN with DM (17%), AN (8%), DM with OBS (4%). Duration of CKD as well as adequacy of dialysis were significantly associated with presence of pericardial effusion. There

was a significant association between the duration of CKD and left ventricular hypertrophy. A maximum number of patients i.e. 48 (80%) belonged to stage 5 CKD while 12(20%) belonged to stage 4 CKD. No cases were found to be in Stages 1, 2 & 3. LVH was present in 20% patients on electrocardiogram in contrast to 50% patients showing LVH on echocardiogram. Echocardiography is a sensitive investigation to study morphology and functional abnormality of heart in chronic kidney disease. In our centre, we were able to diagnose IHD patients by Echocardiogram and refer them for coronary artery intervention promptly. All patients undergoing renal transplant are screened by Echo to detect and correct CAD. Echo is a tool to detect moderate and massive PE and to advice pericardiocentesis and adequate dialysis. Hence, we advice periodic Echo once in 3-6 months as and when necessary in our center.

REFERENCES

1. Bargman JM, Skorecki K. Chronic Kidney disease. In; Longa DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscal J, editors. *Harrison's principles of Internal medicine*, 18th ed New York: McGrawhill. 2012 p. 2308-21.
2. Laddha M, Sachdeva V, Diggikar PM, Satpathy PK, Kakrani AL. Echocardiographic Assessment of Cardiac Dysfunction in Patients of End Stage Renal Disease on Haemodialysis. *JAPI* 2014 Jan ;62:28-32.
3. Lesaffre F, Wynckel A, Nazezyrollas P, Rieu P, Metz D. Echocardiography to predict adverse cardiac and vascular events in patients with severe chronic kidney disease (stage 4): A prospective study. *Archives of Cardiovascular Disease* 2013; 106: 220-7.
4. Ostovan MA, Maglum Z, Raisijalali GH, Roozbeh J, M Sogheb M. Spectrum of Echocardiographic abnormalities in end stage renal disease patients undergoing hemodialysis. *Iranian Red Crescent Medical Journal* 2008; 10(2): 115-35.
5. Barberato SH, Pecoits - Filho R. Echocardiographic Alteration in Patients with Chronic Kidney Failure Undergoing Hemodialysis. *Arq Bras Cardiol* 2010; 94(1):1317.
6. Shivendra I S, Doley PK, Pragya P, Sivasankar M, Singh VP and Neelam S. Echocardiographic Changes in Patients with ESRD on Maintenance Hemodialysis-A Single Centre Study. *J Cardiovasc Dis Diagn* 2014; 2:4.
7. Owen WF, Madore F, Brenner BM. An observational study of cardiovascular characteristics of long term end-stage renal disease survivors. *American Journal of Kidney Diseases*. 1996; 28: 931-36.
8. Foley RN, Parfrey PS, Hurott JD, Kent GM, Martin CJ, Murray DC et al. Clinical and echocardiographic disease in patients starting end stage renal disease therapy. *Kidney Int*. 1995; 47: 186-92.
9. D'Cruz IA, Bhatta GR, Cohen HC, Glicka. Echocardiographic detection of cardiac involvement in patients with chronic renal failure. *Arch Intern Med*. 1978; 138: 720-4.
10. Lewis BS, Milne FJ, Goldberg B. Left ventricular functions in chronic renal failure. *British Heart Journal* 1976; 33: 1229-39.
11. Jkaheimo M, Huttunen K, Takkunen J. Cardiac effects of chronic renal failure and haemodialysis treatment - Hypertensive versus normotensive patients. *British Heart Journal* 1981; 45:710-16.
12. Grea
13. ves SC, Gamble GD, Collins JF, Whalley GA, Sharpe DN. Determinants of left ventricular hypertrophy and systolic dysfunction in chronic renal failure. *American Journal of Kidney disease*. 1994; 24: 768-76.
14. Levin A, Singer J, Thompson C, Ross H, Lewis RN. Prevalent left ventricular hypertrophy in pre-dialysis population. Identifying opportunities for intervention. *American Journal of Kidney Diseases*. 1996; 27: 347-54.
15. Gupta S, Dev V, Kumar V, Dash SC. Left ventricular diastolic function in end-stage renal disease and the impact of haemodialysis. *The American Journal of Cardiology*. 1993; 71: 1427-30.
16. Barrionuevo AJD, MF, Vargas-Machuca G, Pulido FG, Sacaluga LG, Govantes MAG, and Martinez-Martinez A. Transthoracic Echocardiographic Findings in Patients With Chronic Kidney Disease Awaiting Kidney Transplantation. *Transplantation Proceedings*, 2010;42:3123-5
17. Menon AS, Kumar B, Rao KS, Kalara SP. Cardiac changes in chronic renal failure. *JAPI*. 1998; 46(1): 102.
18. Achari V, Thakur AK. Echocardiographic detection of cardiac involvement in chronic renal failure. *JAPI*. 1989; 37(7): 434-36.
19. Parfrey PS. Cardiac and cerebrovascular disease in chronic uraemia. *American Journal of Kidney Diseases*. 1993; 21: 77-80.
20. Raut SG, Siar MA, Tankhiwale SR. Cardiac involvement in chronic renal failure a study by echocardiography. *JAPI*. 1998; 46(1): 101.
21. Goornavar et al. A study of echocardiographic changes in patients with chronic kidney disease, *medica innovativa* 1-5.