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Original Research Article

Prevalence of Echocardiographic Changes in Patients with Chronic Kidney Disease: A Hospital Based Observational Study

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Abstract:

Background: The primary cause of morbidity and death for those with Chronic Kidney Disease (CKD) is cardiovascular disease (CVD). Long before renal failure sets in, during the early stages of CKD, there may be an elevated risk of CVD. When CVD mortality in the dialysis population is compared to the general population, it clearly illustrates the significant burden of CVD. Aims of this study to identify the Echocardiographic changes in patients with CKD and know the prevalence of each Echocardiographic change in CKD.

Methods: This study comprised 50 patients with chronic kidney disease (CKD) who were admitted between April 2023 and September 2023 to the general medicine department of the ICARE Institute of Medical Sciences and the Dr. Bidhan Chandra Roy Hospital in Haldia, West Bengal. The patients were assessed using the following methods: electrocardiography (ECG), blood urea, serum creatinine, general physical examination, systemic examination, and echocardiography.

Results: In the present study, 86% of patients had cardiovascular abnormalities identified by echocardiography. 36% of patients had left ventricular hypertrophy (LVH). 16% of cases are Ischemic heart disease (IHD), 22% are LVH and Ischemic heart disease, 4.0% are dilated cardiomyopathy, 6.0% are pericardial effusion, and 2.0% are septal hyperthrophy.

Conclusion: The most frequent morphological anomaly found is LVH. We could screen CKD patients before they underwent renal transplantation to detect and correct Coronary Artery Disease (CAD), and echo is a tool to detect moderate and massive Pericardial Effusion. In our center, we were able to diagnose IHD patients by echocardiogram and refer them for coronary artery intervention promptly. and to recommend appropriate dialysis and pericardiocenteties.

Keywords: Echocardiography, Chronic Kidney Disease, Left Ventricular Hypertrophy, Ischemic Heart disease.

Introduction

A range of distinct pathophysiologic processes linked to aberrant kidney function and a persistent decrease in glomerular filtration rate (GFR) are collectively referred to as chronic kidney disease (CKD)[1].

Chronic kidney disease (CKD) is defined as kidney damage caused by structural or functional abnormalities of the kidney that last longer than three months. This can occur with or without decreased GFR and can be indicated by pathological abnormalities or markers of kidney damage, such as abnormalities in the blood or urine composition or abnormalities in imaging tests. In patients with chronic kidney disease (CKD), cardiovascular disease (CVD) is a major cause of death and morbidity. Before they reach end stage CKD, the majority of CKD patients pass away from CVD. Therefore, the objective of patient management during the early phases of CKD should be to prevent cardiovascular complications[1,2].

There is a clear correlation between CKD and CVD, with a rise in CVD seen as GFR declines. It is true that the primary cause of morbidity and death among CKD patients is CVD[3].

Patients with end-stage renal disease (ESRD) frequently experience echocardiographic abnormalities. Understanding the range of these abnormalities in these patients can help prevent mortality, so periodic echocardiographic examination is strongly advised for the diagnosis and treatment of cardiac abnormalities[4].

Echocardiography-detected alterations in heart shape and function are frequently observed in he-

modialysis patients with chronic kidney disease (CKD) and have been identified as important determinants of prognosis. These people have cardiovascular deaths 10–20 times more frequently than the overall population[5]. With the help of 2D echocardiography, several cardiovascular alterations in CKD have been studied in the present study in an effort to correlate the results with clinical observations and other investigations.

Materials and Methods

This hospital based observational study was conducted at the hemodialysis unit and medicine department of the ICARE Institute of Medical Sciences and Dr. Bidhan Chandra Roy Hospital in Haldia, West Bengal. All CKD patients hospitalized between April 2023 and September 2023 with Azotemia for ≥ 3 months, symptoms and signs of uremia and Presence of broad Casts in urinary sediment. Patients who are documented ischemic heart disease, valvular heart disease, congenital heart disease, chronic alcoholism, acute kidney injury, Hepatitis B Surface antigen (HBsAg) Positive, Human Immuno-dificiency Virus (HIV) positive, Hepatitis C Viral (HCV) antibody positive and Renal Biopsy is required for diagnosis were excluded in this study.

The proforma contained the history, physical examination results, with a focus on cardiovascular findings, and results of any investigations.

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

Principle

Picric acid in an alkaline medium reacts with creatinine to form an orange coloured complex with the alkaline picrate. Intensity of the colour 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: 0.5-1.1mg%

Sample Material: Serum Creatinine is stable in serum for 1 day at 2-8^{0}C.

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. 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 Cockcroft Gault equation,

GFR = (140-Age × body weight in kg)

72 × PCr (mg/dl)

(Multiply by 0.85 in females)

Staging of CKD was done as per GFR[1]

Table 1: Staging of CKD

Stage of CKD	GFR ml/min per 1.73 m^2
0	>90[a]
1	90[b]
2	60-89
3	30-59
4	15-29
5	<15

[a.]With risk factors for CKD
[b.]With demonstrated Kidney damage

Results

The age of the patients in the present study ranged from 18 years to 80 years. The mean age was 47.58±15.3 years with male: female ratio 1.08:1.

Table 2: Distribution of study subjects based on age and gender

Age in years	Gender		Total
	Male	Female	
≤20	1(3.8%)	1(4.2%)	2(4.0%)
21-40	8(30.8%)	7(29.2%)	15(30.0%)
41-60	12(46.2%)	10(41.7%)	22(44.0%)
≥61	5(19.2%)	6(25.0%)	11(22.0%)
Total	26(100%)	24(100%)	50(100%)

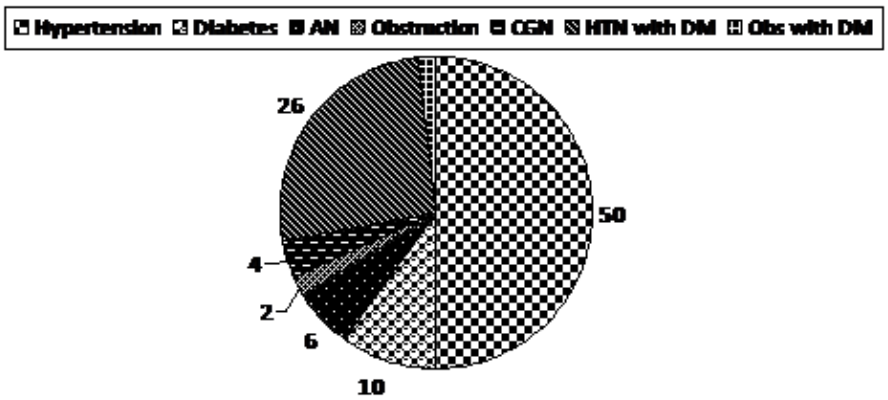

Figure 1: Distribution of study subjects according to etiology

AN – Analgesic Nephropathy, CGN – Chronic Glomerulonephritis Obs – Obstetrics

Table 3: Distribution of patients based on dialysis

Type of management		
Dialysis	**Number**	**Percent (%)**
On Dialysis	46	92.00%
Nont on Dialysis	4	8.00%
Total	50	100.00%

Echocardiographic manifestations: 43 (86%) of the 50 CKD patients whose echocardiograms were examined had echocardiographic symptoms. Of them, the majority—18 (36%)—showed LVH alone; 11 (22%) showed both LVH and IHD; and 7 (14%) showed no echocardiographic manifestations at all. Additional echocardiographic symptoms include IHD alone (16%), Septal Hypertrophy (2%), Pericardial Effusion (6%), and Dilated Cardiomyopathy (4%).

Table 4: Distribution of study subjects based on Echo interference

	Frequency	Percent (%)
Normal	7	14.0%
LVH	18	36.0%
IHD	8	16.0%
LVH and IHD	11	22.0%
Dilated cardiomyopathy	2	4.0%
Pericardial Effusion	3	6.0%
Septal hypertrophy	1	2.0%
Total	50	100.0%

The lowest ejection fraction observed in this study was 30 % and highest ejection fraction observed in this study was 55 %. Maximum number of patients i.e. 34(68%) 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	2	4.0%
31.0-40.0	7	14.0%
41.0-50.0	34	68.0%
51.0+	7	14.0%
Total	50	100.0%

Discussion

Multisystem involvement results from chronic renal disease. Early detection of heart abnormalities is possible with echocardiography. In order to help patients receiving hemodialysis understand the reason of their chest pain and cardiomegaly and to direct their anticoagulant medication, echocardiography is a safe, straightforward, and sensitive technique for detecting minor pericardial effusions. Patients with chronic renal failure may have a different result if significant cardiac problems are identified early and treated.

Age of the patients in this study ranged from 18 years to 80 years with mean age being 47.58±15.3 years.

Majority of patients (44%) belonged to age group of 41 years to 60 years.

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

In the present study, 26(52%) patients ware males and 24(48%) patients were females. Male to female ratio being 1.08:1.

The patients' genders were similar to those of Owen et al. [7], Foley et al. [8], Ladda et al. [2], and other studies. Owen et al. found the male to female ratio to be 2:1. In every study, the male gender predominated, with the exception of D' Cruz et al. [9] study, which reported a male to female ratio of 2:3. Hypertension was the most common etiology of chronic renal disease (50%). Similar trends were also observed in other research. 46% of hypertension cases were reported by Lewis et al. [10], 60% by Jkaheimo et al. [11], 24% by Greaves et al. [12], and 30% 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. The present study identified diabetes mellitus (10%), obstructive uropathy (2%), chronic glomerulo nephritis (4%), hypertension and diabetes combined (26%), and obstructive uropathy and diabetes combined (2%), as additional causes of chronic kidney disease.

45 patients, or 90% of the total, were in stage 5 of CKD, while 5 patients, or 10%, were in stage 4. No cases in stages 1, 2, or 3 were found.

Of the 50 patients analyzed, 4 (8%) were receiving conservative care without dialysis, and 46 (92%) were receiving the treatment.

The current study's percentage of dialyzed and non-dialyzed patients is similar to that of Greaves et al. [12], who found that 30% of patients had conservative treatment and 70% received dialysis.

Three patients (6%) had pericardial effusion, which is in line with research by Barrionuevo JDA et al. [15] that identified 6.5% of patients to have pericardial effusion. According to Laddha M et al. [2], 14.3% of cases of pericardial effusion were recorded. A 17.14% incidence was observed by Shvendra et al. In contrast, Menon et al.[16] observed a 32% incidence of pericardial effusion in patients with chronic renal failure, whereas Achari et al.[17] reported a 50% incidence.

Compared to Parfrey et al. [18], who reported a 20% incidence of ischemic heart disease in patients with chronic renal failure, and Greaves et al. [12], who reported a 25% incidence, ischemic heart disease was documented in 8 (or 16%) of the patients in the current study.

Although the exact etiology of myocardial ischaemia in chronic renal failure is unknown, theories include anemia, atherosclerosis, and left ventricular hypertrophy.

In 18 (36%) of the patients, left ventricular hypertrophy was found. It is in line with studies by Raut et al. [19], which indicated 30% incidence, and Menon et al. [40% incidence].

Of the fifty patients under investigation, only fifteen (30%) showed ECG evidence of left ventricular hypertrophy, while thirty-five (70%), showed no evidence of LVH. By echo, 18 people, or 36%, showed signs of LVH. For this reason, echo cardiograms are better than ECGs at identifying LVH.

Within the present study, no statistically significant association was found between left ventricular hypertrophy and serum creatinine levels, hemoglobin levels, or the length of the chronic renal illness. There was a substantial correlation between the occurrence of hypertension and LVH18 (36%).

Although the exact cause of left ventricular hypertrophy in chronic renal disease is unknown, modifiable factors are typically linked to it. such include uremia, anemia, and systemic hypertension.

Conclusion

The patients in this study ranged in age from 18 to 80 years old, with a mean age of 47.58 ± 15.3 years. The most common cause (50%) was hypertension. Obstructive uropathy (2%), diabetes (10%), CGN (4%), HTN with DM (26%), AN (6%), and DM with OBS (2%), were the other etiologies. Pericardial effusion was significantly correlated with both the length of CKD and the quality of dialysis. There was a strong correlation between left ventricular hypertrophy and the length of CKD. There were a maximum of 45 patients (90%) who were classified as having stage 5 CKD and 5 patients (10%) as having stage 4 CKD. No cases in Stages 1, 2, or 3 were discovered. Compared to 58% of patients who showed LVH on an echocardiography, only 30% of patients had LVH on an electrocardiogram.

Echocardiography is a sensitive test used to examine the anatomy and dysfunction of the heart in chronic renal failure.

With the use of an echocardiography, our center was able to quickly diagnose IHD patients and recommend them for coronary artery intervention. Echo performs screenings on all patients receiving renal transplants in order to identify and treat CAD. Echo is a method used to identify major and moderate PE and to recommend appropriate dialysis and pericardiocentesis. As a result, in our center, we advise periodic Echo once every three to six months as needed.

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; 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, Nazeyrollas 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 Echocardigraphic 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 Alternation in Patients with Chronic Kidney Failure Undergoing Hemodialysis. Arq Bras Cardiol. 2010; 94(1):131-7.
6. Shivendra1 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. Huroett 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. Greaves 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.
13. 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.
14. 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.
15. Barrionuevo AJD, MF, Vargas-Machuca G, Pulido FG, Sacaluga LG, Govantes MAG, and Martínez-Martínez A. Transthoracic Echocardiographic Findings in Patients with Chronic Kidney Disease Awaiting Kidney Transplantation. Transplantation Proceedings, 2010; 42: 3123-5.
16. Menon AS, Kumar B, Rao KS, Kalara SP. Cardiac changes in chronic renal failure. JAP1.1998; 46(1): 102.
17. Achari V, Thakur AK. Echocardiographic detection of cardiac involvement in chronic renal failure. JAPI. 1989; 37(7): 434-36.
18. Parfrey PS: Cardiac and cerebrovascular disease in chronic uraemia. American Journal of Kidney Diseases. 1993; 21:77-80.
19. Raut SG, Siar MA, Tankhiwale SR. Cardiac involvement in chronic renal failure a study by echocardiography. JAPI.1998; 46(1):101.