



A study of Electrocardiographic and Echocardiographic changes in patients with chronic kidney disease

Authors

Dr Prashant Pathak, Dr MP Singh (Professor), Dr PK Agrawal (Prof .HOD), Dr Sachin

Abstract

Introduction: *In health, the volume and composition of body fluids vary within narrow limits, which the kidneys largely maintain. Additionally, they perform a variety of metabolic and endocrine functions. Failure of renal function ultimately results in changes to the interior milieu, which affects every organ system in the body. Chronic Kidney Disease is a clinical syndrome caused by persistent renal dysfunction that results in excretory, metabolic, and synthetic failure, resulting in the accumulation of non-protein nitrogenous substances. Once the cause of CKD is determined, additional evaluation is used to maintain or restore glomerular filtration rate. Due to the high rate of cardiovascular complications in CKD, it is critical to evaluate cardiovascular risk factors.*

Aim of the Study: *Our study aim is to identify Electrocardiographic and Echocardiography changes in patients with chronic kidney disease.*

Materials and Methods: *The study was conducted in patients with CKD admitted in Katihar Medical College and Hospital, Katihar. This study is cross sectional study.*

Discussion: *Chronic renal failure is a group of signs and symptoms referred to as uraemia. It can manifest with symptoms consistent with involvement of any organ in the body.*

Conclusion: *41–50-year males were the most common affected people in our study group. Each patient was anaemic. Diabetes was the most frequently encountered ethology. LVH was the most frequently observed ECG abnormality. All patients had echocardiographic detection of cardiac changes. Echocardiography is a priceless tool for detecting early cardiac abnormalities in chronic kidney disease. Thus, echocardiography should be a routine part of the evaluation process for renal transplantation. Cardiac changes were more prevalent in patients with advanced chronic renal failure, indicating a positive correlation between cardiac changes and the severity of chronic renal failure.*

Keyword: *Chronic Kidney Disease, Electrocardiographic, Echocardiographic, constellation.*

Introduction

Chronic Kidney Disease is a clinical syndrome caused by persistent renal dysfunction that results in excretory, metabolic, and synthetic failure, resulting in the accumulation of non-protein nitrogenous substances. Once the cause of CKD is

determined, additional evaluation is used to maintain or restore glomerular filtration rate. Due to the high rate of cardiovascular complications in CKD, it is critical to evaluate cardiovascular risk factors.

On renal ultrasonography, the presence of small kidneys (i.e., small in relation to body size) is a reliable indicator of chronic kidney disease. Renal biopsy is the gold standard for distinguishing acute from chronic kidney disease. Easy fatigability, dyspnoea, pedal oedema, syncope, and angina are the most frequently encountered cardiovascular symptoms in patients with advanced renal failure. Cardiovascular structural and functional evaluations are performed using X-rays, electrocardiography, and echocardiography. Cardiovascular disease accounts for approximately 50% of all deaths in patients with chronic kidney disease. Left Ventricular dysfunction is estimated to occur in approximately 65% of these patients. With renal replacement therapy, all patients with mild to moderate Left Ventricular systolic dysfunction had their heart function normalised.

Aims and Objectives

Our study aim is to identify Electrocardiographic and Echocardiography changes in patients with chronic kidney disease.

Material and Methods

This study is cross sectional study.

The following criteria were used in the selection of cases.

- 1) Patients with GFR of 30-59 ml/min and/or
- 2) On abdominal ultrasound, patients with bilateral contracted kidneys and poor cortical medullary differentiation.
- 3) Patients with established chronic kidney disease, regardless of the aetiology.
- 4) Patients with known valvular heart disease, coronary artery disease, or systemic hypertension on regular medication were excluded, as were those with impaired pulmonary function.

All patients underwent a detailed history of illness, with a particular emphasis on cardiovascular symptoms, and a comprehensive clinical examination. Blood biochemical analyses, electrocardiograms, abdominal ultrasonography, and a complete hemogram were conducted. To minimise observer variation, all patients underwent echocardiography by a single echocardiographer.

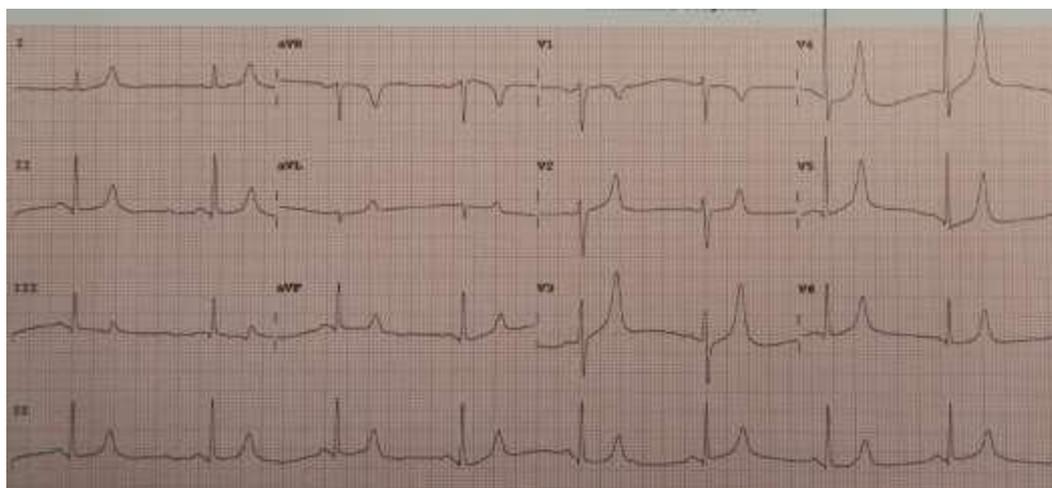


Fig-1: ECG changes of hyperkalemia in a patient with CKD

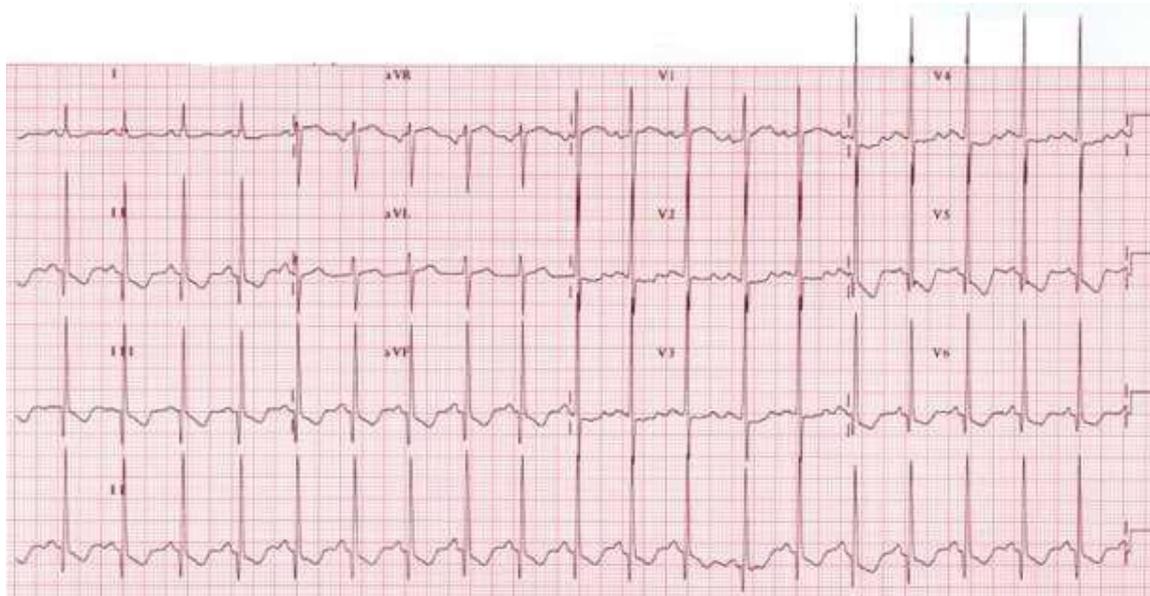


Fig-2: ECG showing left ventricular hypertrophy in a patient with CKD

Results

Table 1 Demographic Profile

Age (in years)			
	Male	Female	P. value
Mean ± SD	51.92±16.43	48.96±13.16	0.548
Duration of DS in months			
Mean ± SD	15.16±10.51	16.87±12.56	0.632
Pulse Rate, Systolic and Diastolic Blood Pressure			
	Mean ± SD	't' Test	P. value
HR	85.94±4.36	139.128	<0.001
SBP	162.72±27.25	42.212	<0.001
DBP	99.60±18.29	38.056	<0.001

Table 2 ECG Changes

Sl. No.	Finding	No. of patients	Percentage
1	LVH	32	64%
2	LVC	8	16%
3	St-T changes	14	28%
4	LBBB	1	2%
5	VPC	11	22%
6	Ischemic	20	40%

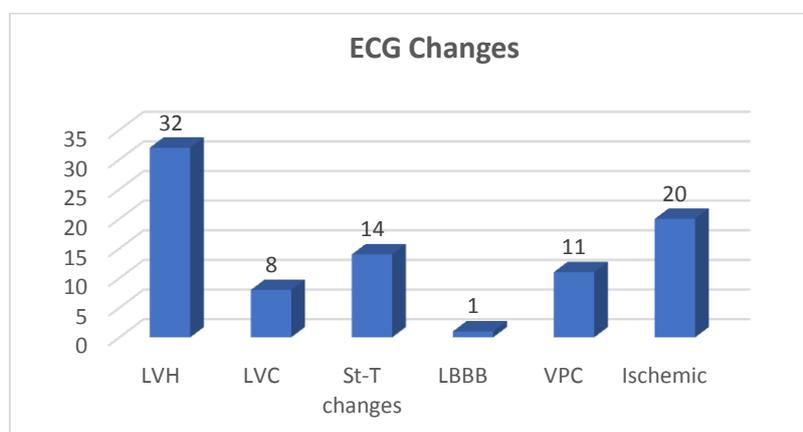


Table 3 Chamber Dilatation

Finding	No. of cases	Percentage
Dilated LV	11	22%
Concentric LVH	24	48%
All chambers dilated	8	16%
Dilated LA	7	14%

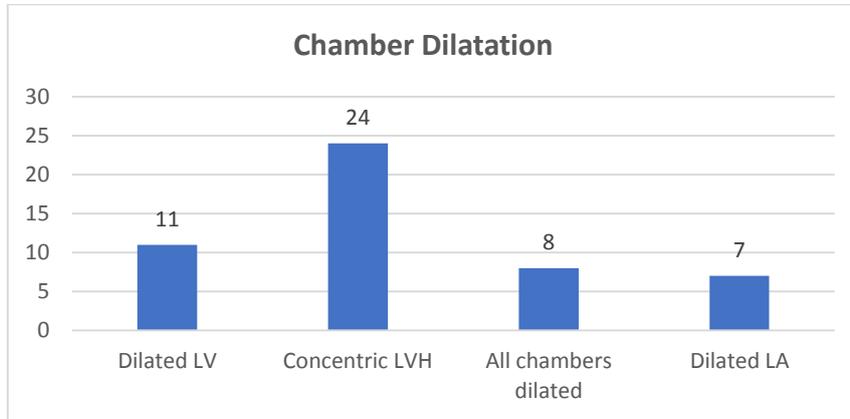


Table 4 Grading

Grading	Mitral Regurgitation	Aortic Regurgitation	Tricuspid Regurgitation
Trivial	4	3	1
Mild	6	3	2
Moderate	1	-	-

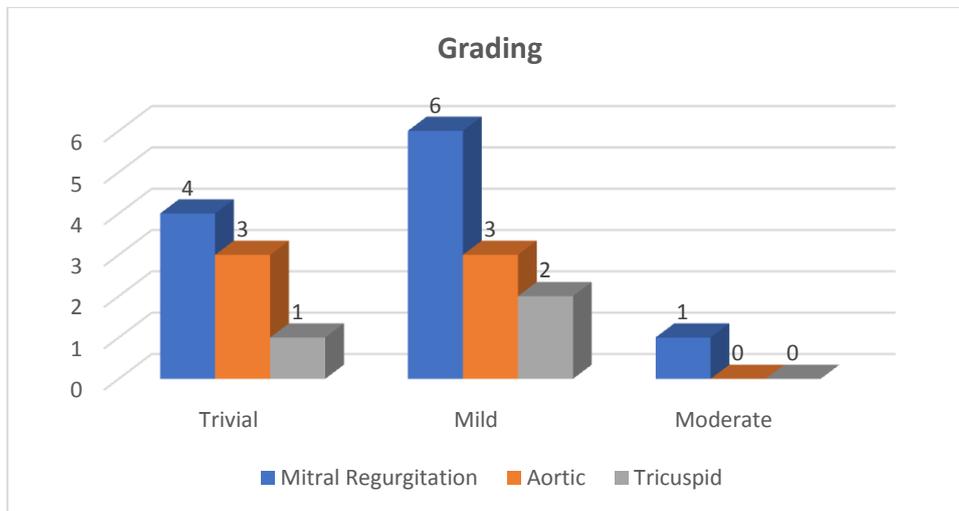
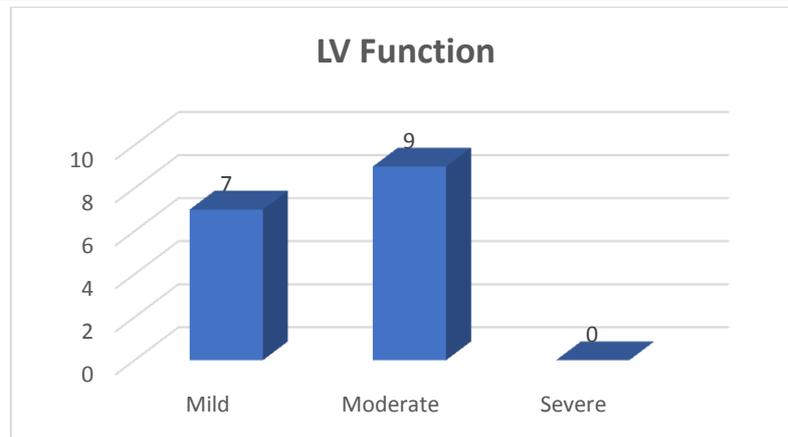


Table 8 LV Function

Grading	No. of cases	Percentage
Mild	7	14%
Moderate	9	18%
Severe	-	



Discussion

Chronic renal failure is a group of signs and symptoms referred to as uraemia. It can manifest with symptoms consistent with involvement of any organ in the body. The current study focuses on cardiac involvement in chronic kidney disease. In 64% of cases, electrocardiograms revealed evidence of LVH with or without strain pattern. In 16% of cases, low voltage complexes are present. In 22% of cases, there are isolated ventricular premature complexes. In 28% of cases, there are no specific ST – T changes. The electrocardiogram will reveal the presence of left ventricular hypertrophy and previous ischemic events. It is a sensitive indicator of hyperkalaemia's cardiac effects. Echocardiography is required for a more precise assessment of LV function and hypertrophy. In the case of cardiac arrhythmias, their episodic nature complicates their identification and characterization. 24 hour Holter monitoring and serial 12-lead ECGs are ideal for detecting ECG changes and cardiac arrhythmias in patients with chronic kidney disease. Sustaining supraventricular tachyarrhythmias is uncommon, but ventricular premature complexes and ventricular tachycardia are common. In all cases, echo revealed cardiac abnormalities.

Chamber Dilatation

- 22% of patients showed dilated LVH.
- 48% of patients showed concentric LVH.

- In our study patients who have had long standing H/O Hypertension, show concentric LVH.
- The only major determinant of LVH in our study was the blood pressure burden.
- It correlates with the Hartnett et al study on impact of hypertension on cardiomyopathy, morbidity, mortality in ESRD.
- The concentric LVH includes Intra ventricular septal thickness in End Diastole. anaemia is an important determinant of End Diastolic Diameter.
- In our study the average Haemoglobin level was relatively 6 -7 gm%.LA enlargement was not a frequent finding in our study. It is thought to be due to diastolic dysfunction due to LVH.

Valves

- Aortosclerosis and Calcification of the Posterior Mitral Annulus are found in 22% of patients in our study group.
- Age, duration, and hyperparathyroidism have been cited as prime determinants of valvular calcification.
- Myocardial fibrosis and cardiac calcification have been reported due to metastatic calcification.

LV Function

- Systolic dysfunction - 30.5% of cases
- Diastolic dysfunction - 54% of cases

- According to Kramer et al¹² factors contributing to development of CCF in patient with CKD are
 1. Volume overload
 2. Valvular heart disease
 3. Negative inotropic effects of Calcium
 4. Cardiac arrhythmias
 5. Pressure overload
 6. Myocardial damage
 7. Anaemia.
- In our study, patients with moderate LV dysfunction showed features of volume overload, anaemia and long-standing history.
- All our patients revealed type I relaxation abnormality of diastolic dysfunction.

LV Contraction

- Global LV Hypokinesia reflects Dilated Cardiomyopathy.

Pericardial Effusion

- 24% of cases have pericardial effusion.
- Haemorrhagic pericardial effusion is a well-recognized complication of uraemia.
- Indeed, it can result in pericardial tamponade, a potentially fatal condition. Pericardial disease is a life-threatening condition that requires prompt dialysis.

Conclusion

- 1) 41–50-year males were the most common affected people in our study group.
- 2) All patients were anaemic.
- 3) The most common ethology was Diabetes.
- 4) LVH was the most common ECG finding noted.
- 5) Echo detection of cardiac changes was present in all patients.
- 6) Echocardiography is a priceless tool for detecting early cardiac abnormalities in chronic kidney disease. Thus, echocardiography should be a routine part

of the evaluation process for renal transplantation.

- 7) Cardiovascular changes were more prevalent in those with advanced chronic renal failure, indicating a positive correlation between cardiac changes and the severity of chronic renal failure..
- 8) Concentric LVH was the most frequently detected abnormality on echo cardiography.

Diastolic dysfunction occurred in 54% of cases, while systolic dysfunction occurred in 30.5 percent of cases.

References

1. O'Neill WC: Sonographic evaluation of renal failure. Review. Am J Kidney Dis 35:1021-1038, 2000.
2. Oxford Textbook of medicine- fourth edition- 2003
3. K/DOQI Clinical Practice Guidelines for Chronic Kidney Disease: Evaluation, classification, and stratification. Kidney Disease Outcome Quality Initiative. Am J Kidney Dis 2002 39: S1-S246, 2002.
4. London GM, Pannier B, Guerin AP, et al: Cardiac hypertrophy, aortic compliance, peripheral resistance, and wave reflection in end-stage renal disease: Comparative effects of ACE inhibition and calcium channel blockade. Circulation 90:2786-2796, 1994.
5. Mazzaferro S, Coen G, Bandini S, et al: Role of ageing, chronic renal failure and dialysis in the calcification of the mitral annulus. Abstract. Nephrol Dial Transplant 8:335-340, 1993.
6. London GM, Pannier B Marchais SJ, Guerin AP: Calcification of the aortic valve in the dialyzed patient. J Am Soc Nephrol 11:778-783,2000.
7. Otto CM. Lind BK. Kitzman DW, et al: Association of aortic-valve sclerosis with cardiovascular mortality and morbidity in

- the elderly. *N Engl J Med* 341:142-147, 1999.
8. Levin A, Singer J, Thompson CR, et al: Prevalent left ventricular hypertrophy in the pre dialysis population: Identifying opportunities for intervention. *Am J Kidney Dis* 27:347-354, 1996.
 9. Barrett BJ, Parfrey PS, Morgan J, et al: Prediction of early death in end stage renal disease patients starting dialysis. *Am J Kidney Dis* 29:214-222, 1997.
 10. Levin A, Thompson CR, Ethier J, et al: Left ventricular mass index increase in early renal disease: Impact of decline in hemoglobin. *Am J Kidney Dis* 34:125-134, 1999.
 11. Foley RN, Parfrey PS, Harnett JD, et al: Impact of hypertension on cardiomyopathy, morbidity and mortality in end-stage renal disease. *Kidney Int* 49:1379-1385, 1996.
 12. Levin A: Anemia and left ventricular hypertrophy in chronic kidney disease populations: A review of the current state of knowledge. *Kidney IntSuppl* (80):35-38, 2002.
 13. Levin A: The role of anemia in the genesis of cardiac abnormalities in patients with chronic kidney disease. *Nephrol Dial Transplant* 17:207-210, 2002.
 14. Levin A, Thompson CR, Ethier J, et al: Left ventricular mass index increase in early renal disease. Impact of decline in hemoglobin. *Am J Kidney Dis* 34:125-134, 1999.
 15. Levin A: Anemia in the patient with renal insufficiency: Documenting the impact and reviewing treatment strategies. *Nephrol Dial Transplant* 14:292-295, 1999.