ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Cross-Sectional Study On Electrocardiographic Changes In Chronic Kidney Disease Patients In A Tertiary Care Hospital, Bangalore, Karnataka, India.

Meenakshi R[1]*, Keshava H K[2], Chandrashekar HR[3], and Diksha M Gowda[4].

[1]Post Graduate, Department of General Medicine, Kempegowda Institute of Medical sciences, Bangalore, Karnataka, India.
[2]Professor, Department of General Medicine, Kempegowda Institute of Medical sciences, Bangalore, Karnataka, India.
[3]Associate Professor, Department of General Medicine, Kempegowda Institute of Medical sciences, Bangalore, Karnataka, India.
[4]Intern (MBBS), Kempegowda Institute of Medical sciences, Bangalore, Karnataka, India.

ABSTRACT

People with CKD are five to ten times more likely to die prematurely than they are to progress to end stage kidney disease. Cardiovascular disease is a major cause of mortality and morbidity among patients with CKD. More than 50 percent of patients with CKD die due to cardiovascular complications. In addition to the traditional risk factors such as coronary disease, diabetes, and left ventricular hypertrophy, patients with ESRD have an increased risk of mortality due to electrolyte disturbances, acid-base balance, and plasma volume shifts that occur during haemodialysis. The objective of present study is to study the Electrocardiographic changes in patients with Chronic Kidney Disease. In this study, 70 patients with CKD were included to study the Electrocardiographic changes in patients with Chronic Kidney Disease. 47% of the study participants belonged to the age group between 51-60 years of age. The mean age of the study participants was found to be 54.11±8.46 years. Majority of the study participants had diabetes (86%) and hypertension (61%). 64%) of the study participants had stage 3 CKD. 23% of the study participants had Left Ventricular Hypertrophy with 16% of study participants having ischemic changes in ECG. When ECG changes were associated with Stages of CKD, association was found to be statistically significant between Left Ventricular Hypertrophy as well as ischemic changes in CKD patients and Stages of CKD of the study participants. Echocardiography provides a simple, non-invasive investigation that can identify even asymptomatic patients at an earlier stage of CKD. So, earlier screening of CKD patients is recommended. The changes in ECG of patients with CKD can aid in detection of CVD and should be carried out in all patients with CKD which may positively impact the care of the CKD population by permitting improved targeting of cardiovascular risk reduction strategies. ECG abnormalities reflect the electrophysiological health of the myocardium and may reflect a combination of deregulations in ionic currents, metabolic changes, alterations in serum electrolytes, and secondary effects of medications. Future studies are recommended to add additional cardiac work-up such as stress testing or cardiac/coronary computed tomography scanning to ECG.

Keywords: ECG changes; chronic kidney disease; cardiovascular disease; LVH.

https://doi.org/10.33887/rjpbcs/2023.14.3.12

Corresponding author

ISSN: 0975-8585

INTRODUCTION

The definition and classification of chronic kidney disease (CKD) have evolved over time, but current international guidelines define this condition as decreased kidney function shown by glomerular filtration rate (GFR) of less than 60 mL/min per 1·73 m^2, or markers of kidney damage, or both, of at least 3 months duration, regardless of the underlying cause. Many people are asymptomatic or have non-specific symptoms such as lethargy, itch, or loss of appetite. People with CKD are five to ten times more likely to die prematurely than they are to progress to end stage kidney disease [1]. Cardiovascular disease is a major cause of mortality and morbidity among patients with CKD. More than 50 percent of patients with CKD die due to cardiovascular complications [2]. Longitudinal studies have established that cardiovascular events occur more frequently than renal events in CKD and mortality rates are in fact higher than the rates of reaching end-stage renal disease (ESRD) [63 Among patients with end-stage renal disease (ESRD) undergoing hemodialysis (HD), prolonged QTC was associated with higher mortality [3-5]. In addition to the traditional risk factors such as coronary disease, diabetes, and left ventricular hypertrophy, patients with ESRD have an increased risk of mortality due to electrolyte disturbances, acid-base balance, and plasma volume shifts that occur during hemodialysis [6]. An early detection and appropriate intervention of these patients will possibly help prevent progression of renal disease, cardiovascular complications and thereby improve the survival rates. In view of this, the present study was undertaken.

Objective Of The Study

The objective of present study is to study the Electrocardiographic changes in patients with Chronic Kidney Disease

METHODOLOGY

Study Design

Cross-sectional study

Study Duration

18 months (December 2020 to May 2022)

Study Area

Kempegowda Institute of Medical Science, Bangalore.

Study Participants

CKD patients attending the Medicine OPD/IPD of KIMS Hospital, Bangalore.

Inclusion Criteria

Age above 18 years.

Exclusion Criteria

- Patients on Haemodialysis.
- Patients on drugs interacting with serum magnesium levels like Lithium, Antacids, Laxatives and Diuretics
- Patients who have underwent recent surgical procedures or trauma
- Patients with Malignancy
- Patients with endocrine disorders like Addison's Disease, Thyroid Disorders, Chronic Alcoholism

Estimation Of Sample Size

On the basis of statistics obtained from Department of Medicine, Kempegowda Institute of Medical Science, an average of 4 cases per month fitting the criteria of the study with study duration of 18 months,

we can expect to have N=72. Based on this population size, using YAMANE equation, for a known population size, sample size (n) equal to

$$n = N/1+Ne2$$

n=sample size, N=population size, e= margin of error (for 95% CI, margin error =0.05)

$$n=72/1+72*0.05*0.05 = 72/1.18 = 61.01$$

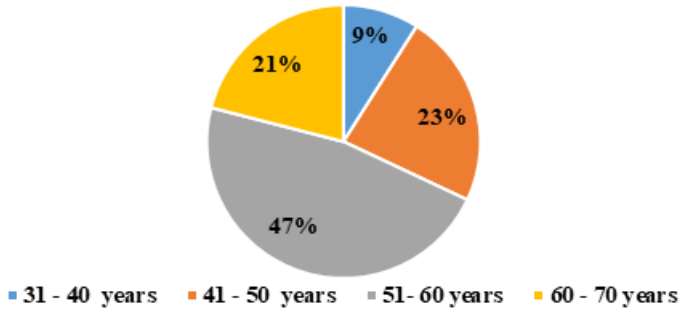
Therefore, after approximating, the sample size of the study participants was fixed at 70.

RESULTS

Table 1: Distribution of the study participants according to their age group

Age	Frequency N	Percentage %
31 - 40 years	6	9
41 - 50 years	16	23
51- 60 years	33	47
60 - 70 years	15	21
MEAN ± SD	54.11±8.46 years	

Figure 1: Distribution of the study participants according to their age group



Majority of the study participants belonged to the age group between 51-60 years (47%) of age. The mean age of the study participants was found to be 54.11±8.46 years.

Table 2: Distribution of the study participants according to their comorbidity profile

Comorbidity profile		Frequency N	Percentage %
Diabetes	Yes	60	86
	No	10	14
Hypertension	Yes	43	61
	No	27	39
Renal disease	Yes	2	3
	No	68	97

Majority of the study participants had diabetes (86%) and hypertension (61%). 3% of the study participants had previous history of renal disease.

Table 3: Distribution of the study participants according to the stages of CKD:

Stages of CKD	Frequency N	Percentage %
2	4	6
3	45	64
4	21	30

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Majority of the study participants had stage 3 CKD (64%) with stage 4 CKD contributing to 30% of the study participants.

Figure 2: Distribution of the study participants according to the stages of CKD

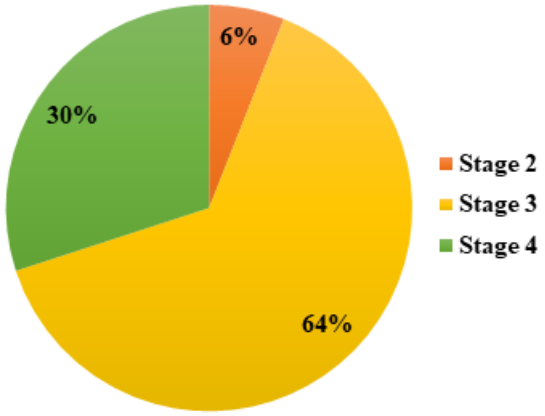

Table 4: Distribution of the study participants according to their ECG changes

ECG changes	Frequency N	Percentage %
NORMAL-ECG	16	23
LVH	16	23
CONDUCTION BLOCK	7	10
ARRYTHMIA	6	8
ISCHEMIC CHANGES	11	16
LOW VOLTAGE COMPLEXES	5	7
HYPERKALAEMIC CHANGES	9	13

23% of the study participants had Left Ventricular Hypertrophy with 16% of study participants having ischemic changes in ECG. 13% of the study participants had hyperkalaemia changes and 10% of the study participants had conduction block. 23% of the study participants had normal ECG changes.

Figure 3: Distribution of the study participants according to their ECG changes

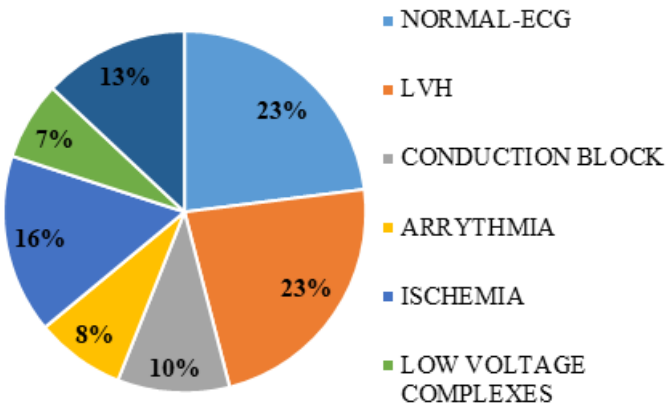

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Table 5: Association of ECG changes with stages of CKD

ECG CHANGES		STAGES OF CKD			P value
		2	3	4	
LVH	YES	0	10	6	**0.000**
	NO	4	35	15	
CONDUCTION BLOCK	YES	1	1	5	0.571
	NO	3	44	16	
ARRYTHMIA	YES	1	1	4	0.354
	NO	3	44	17	
ISCHEMIC CHANGES	YES	0	3	8	**0.024**
	NO	4	42	13	
LOW VOLTAGE COMPLEXES	YES	2	1	2	0.682
	NO	2	44	19	
HYPERKALEMIC CHANGES	YES	2	3	4	0.380
	NO	2	42	17	

In the present study, When ECG changes were associated with Stages of CKD, association was found to be statistically significant between Left Ventricular Hypertrophy changes in CKD patients and Stages of CKD of the study participants. The association was found to be statistically significant between Ischemic changes in CKD patients and Stages of CKD of the study participants.

DISCUSSION

This study included 70 CKD patients attending the Medicine OPD/IPD of KIMS Hospital, Bangalore to study the ECG changes in CKD.

In the present study, 47% of the study participants belonged to the age group between 51-60 years of age. The mean age of the study participants was found to be 54.11±8.46 years. Based on a study done by Heo NJ et al [7], the Mean age of the patients was 73.2 ± 6 years, which is higher than the current study.

In the present study, Majority of the study participants had diabetes (86%) and hypertension (61%). 64%) of the study participants had stage 3 CKD. In a study done by Ajam F et al [8], 70% and 57 % of patients had associated hypertension and diabetes respectively which is similar to the present study. In India, diabetes and hypertension are responsible for at least nearly 50% of all cases of CRF [9].

In the present study, 23% of the study participants had Left Ventricular Hypertrophy with 16% of study participants having ischemic changes in ECG. When ECG changes were associated with Stages of CKD, association was found to be statistically significant between Left Ventricular Hypertrophy as well as ischemic changes in CKD patients and Stages of CKD of the study participants. In the study done by Shafi S et al [10], 22% of the study participants had normal ECG changes with 40.8%, 23.2% 20% and 27.2% of the study participants having Left ventricular hypertrophy, conduction block, Arrythmia and Ischemic changes respectively. Hyperkalemic changes were seen in 23.4% of the study participants. In the study done by Soman SS et al [11], 32%, 15% and 5% of the study participants had ischemic changes, conduction abnormalities and arrhythmias respectively.

ECG abnormalities are common in CKD patients. LVH is the most common electrocardiographic abnormality. Left ventricular hypertrophy (LVH) represents a key feature to provide an accurate picture of systolic-diastolic left heart involvement in CKD patients. Cardiovascular involvement is present in about 80% of prevalent hemodialysis patients. It can be defined as the final result of several pathophysiological pathways leading to cell thickening and concentric LV remodeling. Activation of the renin-angiotensin system, inhibition of nitric oxide synthesis, intravascular volume expansion, secondary anemia, and the presence of arterovenous fistulas can be accountable both for myocardial cell lengthening and eccentric or asymmetric LV development up to LV fibrosis [12].

CONCLUSION

Echocardiography provides a simple, non-invasive investigation that can identify even asymptomatic patients at an earlier stage of CKD. So, earlier screening of CKD patients is recommended. The changes in ECG of patients with CKD can aid in detection of CVD and should be carried out in all patients with CKD which may positively impact the care of the CKD population by permitting improved targeting of cardiovascular risk reduction strategies. ECG abnormalities reflect the electrophysiological health of the myocardium and may reflect a combination of deregulations in ionic currents, metabolic changes, alterations in serum electrolytes, and secondary effects of medications. Future studies are recommended to add additional cardiac work-up such as stress testing or cardiac/coronary computed tomography scanning to ECG.

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