Original Research Article

To Study the Importance of Electrocardiographic and Echocardiographic Findings in Patient of Chronic Kidney Disease with Special Reference to Lipid Profile

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Abstract

Introduction: Dyslipidemia is one of the most common complications of chronic renal failure (CRF) reflected even in the early stages of CRF and usually parallels the deterioration in renal function. As a consequence, dyslipidemia as a risk factor in CKD progression should be explored and documented more. dyslipidemia in CKD patients may actively participate in the progression of cardiovascular disease (CVD) and in the deterioration of kidney function. In the general population, dyslipidemia is a known risk factor for CVD but the relationship of dyslipidemia as a risk factor in CKD progression should be explored and documented more. One of the most important pathophysiological mechanisms for CVD in patients with CKD is the widespread and possibly accelerated formation of atherosclerotic plaques due to hyperlipidemia, uremic toxins, inflammation, oxidative stress, and endothelial dysfunction. Recent studies showed that the level of oxidized low-density lipoprotein (LDL) cholesterol increases and high density lipoprotein (HDL) cholesterol dysfunction occurs as kidney function declines and inflammation becomes more pronounced. **Aim & Objective:** To study the pattern of involvement of cardiovascular system in CKD patients. Correlation of ECG and ECHO findings in hemodialysis and nonhemodialysis patients. To compare the lipid profile in chronic kidney disease patients with and without hemodialysis. **Methodology:** A detailed clinical history and physical examination will be done and findings will be recorded. All the patients in the study will be subjected to biochemical tests like, CBC, renal function tests, and ultrasonographic examination of abdomen to confirm the presence of end stage renal disease and to assess echocardiographic findings of heart. Patients attending the I.P.D. of General Medicine Subjects meeting the inclusion criteria shall be selected. Haemodialysis Patients Nonhaemodialysis Patients ECG, Lipid profile. **Results:** Among CKD patients with hemodialysis, most common ECG abnormality was LVH (n=38), followed by ST changes (n=26), 18 patients had QTc prolongation and P-mitrale or p- pulmonale and 8 patients had tall T wave. Out of 46 hypertension patients of CKD patients without hemodialysis, 24 had LVH in ECG while out of 71 hypertension patients of CKD patients with hemodialysis, 28 patients had LVH in ECG. This correlation between hypertension and LVH in CKD patients with and without hemodialysis came out to be statistically insignificant with chi square value 0.058 (with yates correction) and p value 0.81. **Conclusion:** CKD patients should undergo baseline and regular electrocardiography to screen for cardiovascular diseased as the earliest so that early intervention can be done. Echocardiography is better the electrocardiography in detecting LVH because LVH was detected in 46.3% CKD patients via echo while LVH was detected in 41.2% CKD patients via ECG. ECG showcases the heart's electrical system, whereas ECHO showcases the heart's mechanical system for further investigation and planning of the respective patient's treatment.

Keywords: dyslipidemia,renal

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Introduction

Chronic kidney disease (CKD) encompasses a spectrum of pathophysiologic processes associated with abnormal kidney function, often with a progressive decline in glomerular filtration rate (GFR).Patients with chronic kidney disease have a tremendous burden of cardiovascular disease and patient with end stage renal disease are at the greatest risk for cardiovascular events and death. CKD has a strong association with increased rates of hospitalization, morbidity and mortality.[1] The Global Burden of Disease study 2015 ranked chronic kidney disease as 17th among the cause of deaths globally (Age-standardized annual death rate of 19.2 deaths per 100,000 population[2,3]. In patients with chronic kidney disease and end stage renal disease, abnormalities in left ventricular (LV) structure and function are important subclinical measures that have been associated with adverse clinical outcomes. Also, sudden cardiac death has been accounted for approximately 60% of cardiac-related deaths in patients undergoing dialysis. Chronic renal failure affects almost every system of the body and results in various functional and structural

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abnormalities. Among the cardiovascular system with risk factors of atherosclerosis having large proportion of increased morbidity and mortality. The traditional risk factors for cardiovascular diseases such as hypertension, dyslipidemia, diabetes and obesity are highly prevalent in Chronic Kidney Disease populations.

Echocardiography is a gold standard diagnostic modality for the determination of cardiac structural and functional abnormalities. Abnormal LV geometry, reduction in inter ventricular septum strength, and changes in LV mass index are important parameters that are affected by CKD in patients with preserved EF [4]. Left ventricular hypertrophy (LVH) is one of the common structural cardiac defects in CKD patients. LVH significantly increases the risk of cardiac ischemia, heart failure, and is a strong predictor of mortality in CKD patients[5]. LV dysfunction is an initial precursor of CVD and leads to LVH in the follow-up period [6]. Furthermore, cardiomyopathy among hemodialysis (HD) is due to the presence of coronary artery obstruction, reduction in coronary reserves, and left ventricular physiological-structural abnormalities secondary volume and pressure overload [7]. When efforts to reduced left cardiac preload are not made, adaptation in left ventricular is activated, which leads to a decrease in capillary density, diastolic dysfunction, and disturbances in intraventricular conduction, dilatation, and more compensatory hypertrophy [8]. These phenomena increase vulnerability to increase electrical excitability, leading to sudden cardiac death among these patients [9]. Therefore, the evaluation of echocardiographic parameters in patients of CKD can help to determine the risk and prognosis of CVD in patients of CKD [10].

Dyslipidemia is one of the most common complications of chronic renal failure (CRF) reflected even in the early stages of CRF and usually parallels the deterioration in renal function. As a consequence, dyslipidemia as a risk factor in CKD progression should be explored and documented more. dyslipidemia in CKD patients may actively participate in the progression of cardiovascular disease (CVD) and in the deterioration of kidney function [11]. In the general population, dyslipidemia is a known risk factor for CVD but the relationship of dyslipidemia as a risk factor in CKD progression should be explored and documented more. One of the most important pathophysiological mechanisms for CVD in patients with CKD is the widespread and possibly accelerated formation of atherosclerotic plaques due to hyperlipidemia, uremic toxins, inflammation, oxidative stress, and endothelial dysfunction [12,13]. Recent studies showed that the level of oxidized low-density lipoprotein (LDL) cholesterol increases and high density lipoprotein (HDL) cholesterol dysfunction occurs as kidney function declines and inflammation becomes more pronounced [12,14].

Aims and Objectives

- To study the pattern of involvement of cardiovascular system in CKD patients.
- Correlation of ECG and ECHO findings in hemodialysis and nonhemodialysis patients.
- To compare the lipid profile in chronic kidney disease patients with and without hemodialysis.

Material and Methods

Study Place: JAH & KRH and Department of Medicine

Duration of study: January 2021 to August 2022

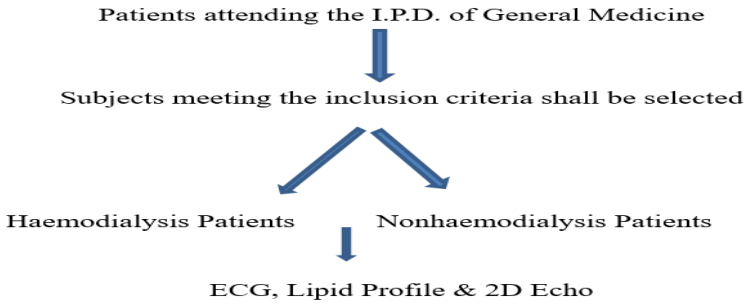
Study design: This is a cross sectional observational study included I.P.D. patients diagnosed as chronic kidney disease based on a combination of history, clinical findings, impaired renal function tests, and abdominal ultrasound.

Sample size: The study comprised 136 patient submitted in Department of Medicine, J.A. Group of Hospitals.

In all cases written informed consent was obtained from each subject.

A detailed clinical history and physical examination was done and findings will be recorded. All the patients in the study was subjected to biochemical tests like, CBC, renal function tests, lipid profile and ultrasonographic examination of abdomen to confirm the presence of end stage renal disease and to assess echocardiographic findings of heart.

Methodology



Inclusion criteria:

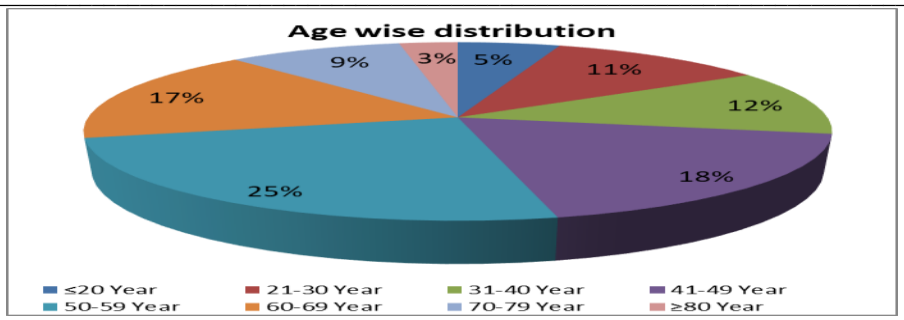
- All confirmed cases of CKD of age group more than 18 yrs.

Exclusion criteria:

- Age <18 years.
- Patients with Renal carcinomas.
- Known cases of IHD.
- Patients who refused to give informed written consent.

Analysis

Observation and Results



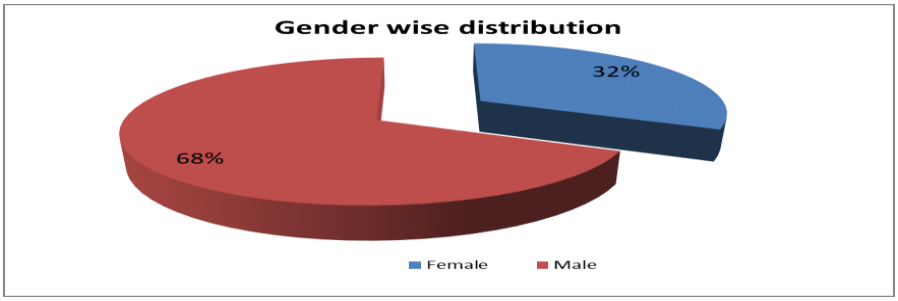


Table 1: ECG and ECHO

			Frequency	Percent
ECG	LA OR RA Abnormality	No	111	81.6
		Yes	25	18.4
	LVH	No	80	58.8
		Yes	56	41.2
	ST Changes	No	102	75.0
		Yes	34	25.0
	Tall T Wave	No	124	91.2
		Yes	12	8.8
	Prolong QTC	No	113	83.1
		Yes	23	16.9
ECHO	LVH	No	73	53.7
		Yes	63	46.3
	DDF	No	78	57.4
		Yes	58	42.6
	LV Systolic Dysfunction	No	96	70.6
		Yes	40	29.4
	Dilated Chambers	No	100	73.5
		Yes	36	26.5

Table 2: Investigation

		Frequency	Percent
Hb	Below Normal	136	100
	Normal	0	0
Serum Urea	< 20 Mg%	0	0
	20 - 45 Mg%	0	0
	> 45mg%	136	100
Total Cholesterol	< 150 mg/dl	24	17.6
	> 250 mg/dl	44	32
Triglyceride	< 60 mg/dl	02	1.4
	> 150 mg/dl	89	65.4
HDL	> 60 mg/dl	00	0
	< 35 mg/dl	108	79.4
LDL	> 130 mg/dl	85	62.5
	< 130 mg/dl	50	36.8
VLDL	< 12 mg/dl	02	1.4
	> 30 mg/dl	76	55.9

Table 3: Association between Haemodialysis and Non haemodialysis and ECG/ECHO Of Study Participants

ECG/ECHO			Haemodialysis		Total	P Value
			No	Yes		
ECG	La Or Ra Abnormality	No	47	64	111	0.258
		Yes	7	18	25	
	LVH	No	36	44	80	0.156
		Yes	18	38	56	
	St Changes	No	46	56	102	0.028
		Yes	8	26	34	
	Tall T Wave	No	50	74	124	0.763
		Yes	4	8	12	
	Prolong QTC	No	49	64	113	0.063
		Yes	5	18	23	
ECHO	LVH	No	35	38	73	0.037
		Yes	19	44	63	
	DDDF	No	39	39	78	0.005
		Yes	15	43	58	
	LV Systolic Dysfunction	No	43	53	96	0.083
		Yes	11	29	40	
	Dilated Chambers	No	45	55	100	0.047
		Yes	9	27	36	

Table 4: Association between Haemodialysis and Non-haemodialysis and Laboratory findings of Study Participants

Laboratory		Haemodialysis		Total	P Value
		No	Yes		
Total Cholesterol	< 150 mg/dl	10	14	24	0.250
	> 250 mg/dl	12	31	43	
Triglyceride	< 60 mg/dl	0	2	02	NA
	> 150 mg/dl	38	51	89	
HDL	> 60 mg/dl	00	0	00	NA
	< 35 mg/dl	44	64	108	
LDL	< 130 mg/dl	19	66	85	0.00001
	> 130 mg/dl	34	16	50	
VLDL	< 12 mg/dl	01	01	02	0.734
	> 30 mg/dl	29	47	76	

Discussion

Out of 136 CKD patients admitted in renal ward of medicine department of G. R. Medical college and JAH group of hospitals Gwalior. Out of 136 CKD patients, 82 patients were on maintenance haemodialysis and 54 patients were non haemodialysis.

Chronic kidney disease is increasing at an alarming rate worldwide and so its mortality and morbidity, which makes it an important public health problem. The mortality and morbidity with CKD, which is predominantly cardiovascular, is up to 5.4 times higher when compared with general population with estimated GFR within normal range. There is in fact a close relationship between dyslipidemia and cardiovascular disease.The result of this study on the lipid profile in patients with chronic kidney disease showed that there are significant alterations in the lipid profile in both groups.

ECG and ECHO findings were also taken into consideration and following are the observations in our study.

In our study, 136 patients, mean age was 48.95+ 16.63 years. Maximum patients belonged to age group 50 - 59 years (n=34), Mean age in our study was comparable to Ajankar et al[15] (45.92±10.14 years), Manjusha Yadla et al[16] (44.7±12.3 years), K Rajnikumari et al[17] (45.28 years).

Slight higher mean age were seen in study of Bignotto et al[18] i.e. 58.5±14.7 years and Sachdeva et al[19] i.e. 58.62±13.7 years.

In the studied population, 93 were males and 43 were females.

Male female ratio is 2:1 which was comparable to following studies:

Rajni kumari et al[17] – Male female ratio - 2:1

Kokkat et al[20] - Male female ratio - 2:1

Sachdeva et al[19] - Male female ratio - 3:1

Magar S et al[21] – Male female ratio 1.5:1

Sign And Symptoms

In our study, most common clinical sign was pallor (75.7%) and most common clinical symptom was anorexia (84.6%) followed by oliguria (82.4%) and swelling of legs (59.6%), facial puffiness (59.6) and breathlessness were found in 51.5% respectively. Similar findings were observed by Prasad RYS et al.[22]

The mean hemoglobin in our study was 7.76 ± 2.05 g/dl slightly lower in CKD patients on dialysis as compared to CKD patients not in hemodialysis.

Co-morbidities

Among the studied 136 patients, most common co-morbid condition was hypertension (86%) followed by diabetes mellitus (37.5%) and obesity (14.7%). Hypertension was found in 86 % of CKD patients in study by Rajnikumari et al[17] , and 80% in Ridao et al[23]. Similarly, Shafi S et al[24] reported that among CKD patient, 84.8% had hypertension and 7% had diabetes mellitus.

ECG and ECHO

ECG and ECHO are often used for evaluation of cardiac function. In our study LVH was found in 41% and ST Changes in 21% of the participants in ECG. In ECHO diagnostics LVH and DDF was top most findings observed in 46.3% and 42.6% participants.

Left ventricular hypertrophy was the most common ECG abnormality. Left ventricular hypertrophy in 56 (41.2 %) ,Prolong QT interval 23 (16.9%), ST segment changes in 34 (25%), tall T wave was seen in 12 (8.8%) patients and LA or RA abnormality(dilated chambers) was seen in 25(18.4%) patients. The present study is comparable with study done by Krivoshiev et al.[32] who also concluded that maximum patients came with CCG findings of LVH.

CKD patients have higher proportions of congestive heart failure that is associated with a higher mortality rate in these patients. Echocardiography is a valuable tool to assess the assess changes in function and structure of the heart that result from CKD. Abnormal LV geometry, reduction in interventricular septum strength, and

changes in LV mass index are important parameters that are affected by CKD in patients with preserved EF[25]. Previous studies have reported anaemia, volume overload, electrolyte abnormalities oedema, and hypertension as risk factors that alter the risk of CVD in CKD patients[26]. In the present study, hypertension is diagnosed in 86%, and diabetes mellitus in 37.5% of patients. A study by Tsilonis et al. reported diabetes mellitus in 24% of patients and hypertension in 22% of patients of CKD patients on Haemodialysis. Among Echo findings, the current study reports the most common cardiac abnormality to be LVH, found in 46.3% of patients, followed by LV diastolic dysfunction in 42.6% patients and LV systolic dysfunction in 29.4% of patients. A study conducted by Shivendra et al.[27] reported LVH in 48% of patients, diastolic dysfunction in 51.42% patients, and systolic dysfunction in 28.57% patients of CKD on maintenance HD. Agarwal et al. reported LV diastolic dysfunction in 53.2% patients and LV systolic dysfunction in 30% of patients having severe CKD. Another study by Laddha et al.[28] reported LVH in 74.3% patients, LV diastolic dysfunction in 61.4% patients, and systolic dysfunction in 24.3% patients. A similar study by Ahmed et al.[29] found LVH in 80% of patients, LV diastolic dysfunction in 53.3% patients, and LV systolic dysfunction in 36.3% patients. Some studies have reported LV systolic dysfunction in all patients of Haemodialysis,[30,31] which is very high as compared to our study and the above-mentioned studies. The possible reason for this high proportion may be that these studies used the positron emission tomography scan for determination of systolic dysfunction that uses contrast-induced ischemic changes for diagnosis of ischemia and is superior to echocardiography for determination of cardiac dysfunction.

Lipid profile

On comparing the value of triglyceride and VLDL the values were found to be markedly higher in CKD patients bue the difference in dialysis vs non dialysis group which was statistically nonsignificant with p value >0.05. The value of HDL was lower in CKD patients with hemodialysis than CKD patients without hemodialysis. LDL was also marginally raised in CKD. This difference was statistically significant with p value of 0.00001 for LDL.

In our study the mean value of triglyceride was markedly higher in CKD patients with hemodialysis then in CKD patients without hemodialysis i.e. 165.9 ± 53.67. The mean value of VLDL was higher in CKD patients with hemodialysis than CKD patients without hemodialysis i.e.32.05 + 11.69. The mean value of HDL was lower in CKD patients with hemodialysis than CKD patients without hemodialysis i.e. 29.52 ± 6.98. Mean value was slightly higher in CKD patients with hemodialysis as compared to CKD patients without hemodialysis (203.4 ± 54.5. The mean value of LDL slightly higher in CKD patients with hemodialysis than CKD patients without hemodialysis 135.4 ± 22.72 and this was statistically significant. These findings were consistent with Magar S et al[17] and Rajni Kumari et al[18]. Neelesh et al observed the higher value of total cholesterol, triglyceride, LDL and VLDL and lower value of value of HDL in CKD patients on regular hemodialysis as compared to CKD patients on irregular hemodialysis. All of which were found to be statistically significant in his study. On comparing the value of lipid profile with GFR categories it was found that total cholesterol, triglycerides, LDL, VLDL are showing progressive rise with successive category. HDL value show decline from G3 to G5 with slight rise in G4.

Conclusion

Hemodialysis effectively reduce the accumulation of nitrogenous waste product but fails to correct uremic dyslipidemia completely rather it may alter the pattern of dyslipidemia as seen in our study.

The value of triglyceride (TG) and VLDL were higher while the value of HDL was lower in CKD patients with hemodialysis than CKD patients without hemodialysis.

Total cholesterol and LDL were also marginally raised in patients of CKD on hemodialysis than CKD patients without hemodialysis, but this was not found to be statistically significant (p value >0.05). Hence timely intervention is essential for the prevention or delay of cardiovascular complications in these patients. Dyslipidemia, being modifiable risk factor, becomes an important component in the management of CKD patients. A strict monitoring of lipid profile can reduce the morbidity and mortality in these patients and will also improve the quality of life of patients of ESRD Thus, we recommend the use of lipid lowering agents in patients of dyslipidemia as per guidelines for improving cardiovascular outcome. ECG is an easily available non invasive and inexpensive diagnostic tool which can provide the vital picture of cardiac function, conduction disturbances and rhythm abnormalities which has prognostic significance especially those who are on hemodialysis. Hence we conclude that all the hospitalized CKD patients should undergo baseline and regular electrocardiography to screen for cardiovascular diseased as the earliest so that early intervention can be done. Echocardiography is better then electrocardiography in detecting LVH and cardiac functional status. ECG show cases the heart's electrical system, whereas ECHO show cases the heart's mechanical system. Hence both should be used for proper planning of the respective patient's treatment. There by improving the mortality and mortality among CKD patients.

Limitation of study

- Small sample size
- Confounding factors, lipid altering factors like smoking, alcohol were not taken into consideration in our study. Hence, there is need for further large scale study to extrapolate the finding and correlation founds in this study

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