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General Medicine

STUDY ON CARDIAC STATUS IN PATIENTS WITH CHRONIC KIDNEY DISEASE: AN ASSESSMENT BY NON INVASIVE TOOLS

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ABSTRACT **Background-** Cardiovascular disease is a major cause of morbidity and mortality in patients with chronic kidney disease (CKD). Major cardiac events are more common in patients undergoing hemodialysis. Early recognition and appropriate treatment is of paramount importance. Our study was aimed at detecting cardiovascular complications in chronic kidney disease patients by using non invasive methods like 12 lead electrocardiogram (ECG) and 2D echocardiography (ECHO). **Methods-** This was a descriptive cross sectional study enrolling 100 patients of CKD from JJM medical college, Davanagere, Karnataka. Renal profile, serum electrolytes, urine routine, ultrasound abdomen, 12 lead ECG and 2D ECHO were done for all patients. Statistical analysis was done using SPSS software and data were analysed by frequency, percentage, mean and standard deviation. **Results-** Left ventricular hypertrophy (LVH) was the most common cardiovascular finding in our study. 31% had LVH by ECG and 51% had LVH by ECHO. Other ECG abnormalities were bundle branch blocks (14%), myocardial ischemia (12%) and arrhythmias (9%). Most common echocardiographic abnormality was LVH(51%) , followed by diastolic dysfunction (37%). 13% of patients had pulmonary artery hypertension ,12% had regional wall motion abnormalities, 4% had dilated cardiomyopathy and 10% had pericardial effusion on ECHO. **Conclusion-** LVH was the most common cardiac abnormality detected followed by diastolic dysfunction. Cardiac abnormalities were more common in patients on hemodialysis.

KEYWORDS : Chronic kidney disease, ECG, 2D ECHO, LVH, Hemodialysis

INTRODUCTION

The spectrum of cardiovascular disease (CVD) in CKD patients include ischemic heart disease, heart failure, arrhythmias and peripheral vascular disease. The presence of CKD can complicate CVD. Patients with early stages of CKD are more likely to die due to cardiovascular events before progression to end stage renal disease, thus CKD can be considered as a coronary artery disease equivalent. [1] CVD accounts more than half of all deaths among patients with ESRD. Arrhythmias and cardiac arrest are responsible for more than one-third (37 percent) of CVD deaths. The prevalence of CVD is 69.6 percent among persons aged 66 years and older who have CKD, compared to 34.7 percent among those who do not have CKD[2]. Mechanisms underlying the association between decreased renal function and CVD are incompletely understood. Hypertension contributes to cardiac damage in CKD through induction of left ventricular (LV) hypertrophy (LVH),[3] CKD patients are often exposed to coronary ischemia as a result of a reduction in coronary reserve and capillary density.[4] An understanding of the pathophysiology of cardiovascular diseases in chronic kidney disease enables prevention, early diagnosis and prompt interventions to control the complications. Most of the cardiac complications arising in a CKD patient can be picked up at an early stage in a cost effective manner by using easily accessible non-invasive tools, simplest ones being 2D echocardiography and a 12 lead ECG.

MATERIALS AND METHODS

This was a descriptive cross sectional study conducted at JJM medical college, Davanagere, Karnataka . This study was done between November 2017 to October 2019. We enrolled 100 patients who satisfied the inclusion and exclusion criteria. Inclusion criteria: 1. Azotemia for more than 3 months 2. Symptoms or signs of uremia 3. Reduced kidney size bilaterally 4. Broad casts in urinary sediments 5. Symptoms or signs of renal osteodystrophy. Exclusion criteria: 1. Documented ischaemic heart disease. 2. Congenital heart disease. 3. Valvular heart disease. 4. Age less than 18 years. Prior to initiation of the study institutional ethical committee clearance was obtained (JJMMC/IEC/SY/24-2017) dated 7/11/2017. Informed consent was taken from all the patients. Statistical analysis was performed using SPSS software and data was analysed by frequency, percentage, mean and standard deviation. Detailed history focusing on symptoms like dyspnoea, angina, palpitations, edema and reduced urine output were asked. Time since diagnosis of CKD and time since initiation of hemodialysis were noted. Also duration of comorbid illnesses like hypertension, diabetes, dyslipidemia, peripheral vascular diseases were asked. Detailed physical examination was done. Presence of pallor and edema were noted. Blood pressure, pulse rate and jugular venous pressure were recorded for all the patients. Detailed systemic examination was done focusing on cardiovascular system.
Following set of investigations were done for all the patients

- Urine routine examination
- Urine albumin creatinine ratio
- Serum creatinine, urea, uric acid
- Serum electrolytes – sodium, potassium, calcium, phosphorous
- Lipid profile, fasting blood sugar, glycosylated hemoglobin
- Complete haemogram
- Chest X Ray
- Ultrasound abdomen to look for structural evidence of CKD
- 12 Lead ECG
- 2D ECHO

ECG was analysed for the presence of arrhythmias, bundle branch blocks, evidence of ischemia or hyperkalemia. Left ventricular study, ejection fraction, evidence of diastolic dysfunction, pericardial effusion and regional wall motion abnormalities were studied using 2D ECHO. Estimated glomerular filtration rate (eGFR) was calculated for all the patients using CKD – EPI (chronic kidney disease epidemiology collaboration) equation.5

RESULTS

Out of 100 subjects included, 66% were males and 34 % were females, with a male to female ratio of 1.9:1. Mean age of the study subjects were 57.75±13.25 years, mean weight being 59.85±8.02 kilogram. In our study group 30% were hypertensive, 19% had diabetes and 31% had both hypertension(HTN) and diabetes(DM). 20% of patients did not have both HTN AND DM. 70%of patients belonged to G5 eGFR category, 30% belonged to G4 eGFR category.

Mean Creatinine in the study group was 6.6 ± 3.43 mg/dl

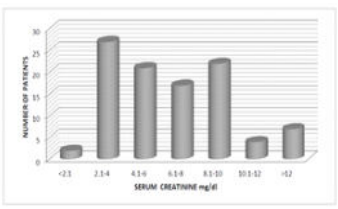

Figure 1: Serum Creatinine Levels

Mean blood urea level in this study was 103.16 ± 37.42. Majority (31%) had serum potassium values ranging from 4.6 – 5 meq/l. Also 26% had potassium levels >5.5 meq/l. Mean potassium level in the

study was 5.001±1.07. In our study 45% were on hemodialysis for less than 3 months, 37% were on hemodialysis for more than 3 months and 18 were not on hemodialysis.

Out of 100 patients included in this study, ECG changes were seen in 76%, whereas 24% had normal ECG. Most common finding was LVH (31%)

Table 1: ECG findings in the study group

SL. NO.	ECG FINDINGS	NO. OF PATIENTS
1.	NORMAL	24
2.	LBBB	6
3.	RBBB	8
4.	AV BLOCK	2
5.	AF	3
6.	SVT	1
7.	LAD	3
8.	LVH	31
9	MYOCARDIAL ISCHEMIA	12
10.	HYPERKALEMIC CHANGES	5
11.	ATRIAL ECTOPICS	1
12.	LOW VOLTAGE	1
13.	P PULMONALE	1
14.	BRADYCARDIA	2

Out of 100 patients in this study, most common echocardiographic finding was left ventricular hypertrophy (51%) followed by diastolic dysfunction which was seen in 37 patients.

Table 2: 2D Echo findings in the study group

SL NO.	ECHO FINDINGS	NO. OF PATIENTS
1.	NORMAL	20
2.	LVH	51
3.	DIASOLIC DYSFUNCTION	37
4.	PAH	13
5.	RWMA	12
6.	PERICARDIAL EFFUSION	10
7.	DCM	4
8.	LA DILATATION	2

Table 3 : Echocardiographic measurements in the study group

SL NO.	ECHO MEASUREMENTS	MEAN ±SD
1.	LVID	44.82±5.63mm
2.	IVS	11.28±1.87mm
3.	LVPW	11.36±.86mm
4.	EF	54.94 ± 8.42%.

Mean ejection fraction among patients included in this study was 54.94 ± 8.42%. 85% of them had ejection fraction between 50-70%. Among 56 patients who had LVH, 49 were on hemodialysis and 7 were not on hemodialysis. Among 44 patients who didn't have LVH 26 were on hemodialysis and 11 were not on hemodialysis. A chi square test of independence was performed to assess the relationship between presence of LVH and hemodialysis status of the patients. The relation between these variables was significant, X^2 (1, N=100) = 4.23, p= 0.039.

DISCUSSION

Cardiovascular complications amount to a major cause of mortality and morbidity in patients with CKD on dialysis and also who are not on dialysis. Multiple risk factors which are common to both CKD and CVD account for this. CKD itself by several mechanisms including vascular remodelling, oxidative stress, fluid overload etc. cause cardiovascular complications.

In this study maximum number of patients were in the age group of 50-59 (30%), with a mean age of 57.75 ± 13.25. This is similar to the study done by Sachdeva et.al [6] where the mean age was 57.62±13.7. Risk factors studied in current study was DM and HTN. 30% were hypertensive and is comparable to the study by Foley et.al [7] in 1995. In the present study 70% had eGFR<15, whereas in study done by Sachdeva et.al,[6] 58.3% had eGFR< 15. In this study mean urea level was 103.16 ± 37.42, in the study done by Foley[7] et al the mean urea level was 117 ±1.3. Mean serum creatinine in this study was 6.6 ± 3.43, whereas in study done by Shivendra et.al [8] in 2014 it was 8.13 ± 2.7. In this study 76% had elecrocardiographic abnormalities. LVH was commonest i.e, 31%, which is similar to study done by Sachdeva et.al[6]. In a study done by Abe et.al[9] only 17.1% had LVH. Conduction disturbances and arrhythmias in our study are comparable to study done by Abe et.al[9] in 1996. 8% had conduction disturbances and 9% had arrhythmias. Similar results were obtained in study done by Abe.et.al.[9] In this study 20% had normal echocardiographic findings, 51% had LVH in our study, similar findings were reported in the study done by Hickson et.al[10] (49%) in 2007. 37% had diastolic dysfunction in this study which is comparable to study done by sachdeva et.al.[6](38.33%). In the current study left ventricular internal diameter (LVID) was 44.82±5.63mm, posterior wall (PW) was 11.36 ± 1.86mm, Interventricular septal diameter (IVSd) was 11.28 ± 1.87mm and Ejection fraction was 54.94±8.42% which was similar to study done by Rakhit et.al.[11]

CONCLUSION

Cardiovascular events account for high mortality and morbidity in patients of chronic kidney disease, especially in patients who are on haemodialysis. Thus early recognition of these abnormalities and prompt treatment is necessary. In this study most prevalent cardiovascular abnormality is left ventricular hypertrophy followed by diastolic dysfunction and bundle branch blocks. Ischemic changes are also common in CKD patients. Cardiac abnormalities are more common in patients on haemodialysis as compared to patients not on dialysis. Both ECG and 2D ECHO are non invasive and easily available tools to assess cardiac function. 2D ECHO is a better tool compared to ECG to asses structural diseases of the heart. Arrhythmias are best assessed by ECG. Limitations of the study include smaller sample size and onset of cardiovascular events in relation to duration of CKD and hemodialysis were not clearly investigated. Also findings related to stages of CKD were not separately analysed.

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