

TITLE PAGE

Study of ECG and Echocardiographic Changes in Patient with Chronic Kidney Disease (CKD)

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ABSTRACT

Background and Objectives: Cardiovascular disease is the leading cause of morbidity and mortality in patients with Chronic Kidney Disease. This increased risk of Cardiovascular Disease may begin during early stage of Chronic Kidney Disease much before the onset of kidney failure. This high burden of cardiovascular disease mortality is well illustrated by comparing cardiovascular disease mortality in dialysis population to general population. Our study aim is to identify Electrocardiographic and Echocardiographic changes in patients with chronic kidney disease.

Method: A cross sectional study done in total of 100 Chronic Kidney Disease patients admitted to Shyam Shah Medical College & Sanajay Gandhi Memorial Hospital, were included in this study. The patients were evaluated as per the history, general physical examination, systemic examination, Blood Urea, Serum Creatinine, Urine Routine, ECG and Echocardiography.

Results: In the present study electrocardiographically determined cardiovascular abnormalities were observed in 72% of patients. LVH in 30% patients, Ischemia is observed in 16% patients. Intraventricular conduction disturbance in found in 8 patients (16%). P mitrale in noticed in 10 patients (10%). Arrhythmia found in 6 patients (6%). Echocardiographic abnormalities were observed in 68 patients (68%). Left ventricular hypertrophy was seen in 46 patients (46%). LA+LV dilatation was seen in 8 patients (8%). Regional wall motion abnormalities were seen in 12 patients (12%). Pericardial effusion was seen in 6 patients (6%).

Conclusion: Left ventricular hypertrophy is the commonest morphological abnormality observed. Myocardial ischemia, conduction disturbance were better made out electrocardiographically. Echocardiography is a more sensitive diagnostic procedure to detect left ventricular dysfunction.

Keywords: Electrocardiography, Echocardiography, Chronic Kidney Disease etc.

INTRODUCTION:

Cardiac and arterial changes such as arterial stiffness, left ventricular hypertrophy (LVH), and LV diastolic dysfunction (DD) have been associated with an unfavourable prognosis in CKD patients¹⁻³. Despite the prevalence of underlying CV abnormalities, symptoms might not manifest in many CKD patients⁴. A range of emerging cardiac and vascular imaging tools may overcome the limitations of current imaging modalities in assessing subclinical CVD. Speckle tracking echocardiography is a relatively new ultrasonic imaging modality that has shown to be a sensitive tool to detect early and subtle changes in LV function^{5,6}. Chronic kidney disease (CKD), ranges from asymptomatic to total kidney failure is being widely alarming in India. CKD is characterized by reduced estimated glomerular filtration rate (eGFR) $<60\text{ml}/\text{min}/1.73\text{m}^2$ for more than 3 months and by structural or functional abnormalities⁷⁻⁸.

From the above facts it is evident that, often there will be misinterpretation between CKD and CVD on clinical examination. It needs to be re-evaluated by easily available diagnostic procedures to prevent mortality and morbidity.

Cardiovascular disease accounts for about 50% of all deaths in patients with CKD. Left Ventricular dysfunction is estimated to be present in 65% of such patients. All patients with mild to moderate Left Ventricular systolic dysfunction had normalization of heart function with renal replacement therapy. To aim of the study the electrocardiographic and echocardiographic findings in chronic kidney disease patients. To evaluate the biochemical, radiological and ultrasonographic aspects of Chronic Kidney Disease at the time of diagnosis.

MATERIAL AND METHODS

The study was conducted in patients with CKD admitted in Department of Medicine, Sanjay Gandhi Memorial Hospital and Shyam Shah Medical College, Rewa (M.P.) during the period of April 2020 to June 2021.

The patients were evaluated as per the history, general physical examination, systemic examination, blood urea, serum creatinine, urine routine, USG abdomen, ECG and echocardiography. The following criteria were used in the selection of cases.

Inclusion criteria:-

- Random selection of cases with CKD without considering the etiology.
- Patient with chronic kidney disease on dialysis.
- Patients with GFR of 30-59 ml/min And/or
- Patients with bilateral contracted kidneys on abdominal ultra sound with poor cortical medullary differentiation.
- Patients with established CKD irrespective of etiology.

Exclusion Criteria:-

- Documented ischemic heart disease.
- Congenital heart disease.
- Valvular heart disease.
- Age less than 18 years.

RESULTS:**Table 1- Demographic profile**

Gender	No. of cases	Percentage
Male	80	80.0
Female	20	20.0
Age Distribution		
21-30	4	4.0
31-40	6	6.0
41-50	20	20.0
51-60	32	32.0
61-70	22	22.0
71-80	14	14.0
>80	4	4.0
Electrocardiographic Changes in CKD Patients		
Normal study	32	32.0
Left ventricular hypertrophy	42	42.0
LA+LV dilatation	8	8.0
Ischemia	12	12.0
Pericardial effusion	6	6.0

TABLE 2: Time period since the diagnosis of CKD patients.

Duration since the diagnosis of chronic kidney failure	No. of patients	Percentage
0-6 months	50	50.0
7-12 months	22	22.0
13-18 months	0	0
19-24 months	4	4.0
> 24 months	24	24.0
THE ETIOLOGY OF CKD		
Diabetes mellitus	18	18.0
Hypertension	8	8.0
Chronic glomerulonephritis	6	6.0
Combined Diabetes Mellitus + Hypertension	36	36.0
Other	32	32.0
TIME PERIOD SINCE INITIATION OF HEMODIALYSIS		
0-6 months	22	55.0
6-12 months	4	10.0
12-24 months	4	10.0
>24months	10	25.0

Table 3 BIOCHEMICAL PARAMETERS

BLOOD UREA LEVEL IN CKD PATIENTS	No. of patients	Percentage
50-100	50	50.0
101-150	36	36.0
151-200	12	12.0
>200	2	2.0
SERUM CREATININE LEVEL IN CKD PATIENTS		
2.1-4	36	36.0
4.1-6	10	10.0
6.1-8	20	20.0
8.1- 10	6	6.0
10.1- 12	20	20.0
>12	8	8.0
HEMOGLOBIN LEVELS IN CKD PATIENTS		
3.0-5	8	8.0
5.1-7	22	22.0
7.1-9	34	34.0
9.1-11	36	36.0
>11	2	2.0
SERUM POTASSIUM LEVEL IN CKD PATIENTS.		
<3	4	4.0
3.1-3.5	16	16.0
3.6-4.0	6	6.0
4.1-4.5	16	16.0
4.6-5.0	26	26.0
>5	32	32.0
LEVELS OF SERUM BICARBONATE IN CHRONIC KIDNEY DISEASE PATIENTS		
<20	54	54.0
20-22	28	28.0
22.1-24	14	14.0
24.1-26	2	2.0
26.1-28	2	2.0

DISCUSSION

AGE DISTRIBUTION

The age variation in the present study was 18-70 years. With the maximum number of the patients in the age group of 51-60 years. The mean age of the study population was 47.5 ± 16.48 . The mean age of the present study is in concordance with the mean age in the other studies, which are 41.1 ± 12.1 years in N.P. Singh et al ⁹, 48.7 ± 13.5 years in the Micheal Dahan et al ¹⁰, 51 ± 17 in Foley et al ¹¹.

SEX DISTRIBUTION

In the present study male to female ratio was 4:1. which was different from 0.85:1 in N.P. Singh et al ⁹, 1.8:1 in Foley et al. ¹¹, & 1.85:1 in Michel Dahan et al ¹⁰ but in concordance with 4.67:1 in DS Chafekar et al. ¹²

DURATION SINCE THE DIAGNOSIS OF CKD

The mean duration in months since the diagnosis of chronic kidney disease in present study was 9.58 ± 7.86 months which is comparable with 9.9 ± 2.5 months in N.P Singh et al ⁹ but mean duration of the disease since the diagnosis was 35.1 ± 50.9 months in D.S Chafekar

et.al¹² which is in disagreement with our present study.

ETIOLOGY OF CKD

The commonest cause for chronic kidney disease in present in the present study was diabetes mellitus in 18 patients (18%), chronic glomerulonephritis in 6 patient (6%), hypertension in 8 patient (8%), DM+HTN in 36 patient (36%), and other in 32 patient (32%).

N.P Singh et al⁹ found the most common cause to be CGN (67%) followed by DM (25%) whereas D. S. Chafekar et al¹² concluded that the most common cause for CKD to be CGN (38.75%) followed by DM (6.25%).

The data in other studies varies significantly with present study because of the random selection of the cases and regional variation in the incidence of diseases which are known to cause chronic kidney disease.

BLOOD UREA LEVEL IN CKD

The mean blood urea level in present study was 114.18 ± 42.95 mg/dl which is comparable with the study of N.P. Singh, et al⁹ (121.2 ± 30.6), Foley et al¹¹ (117 ± 15.3). In D.S. Chafekar et al¹² the mean blood urea level was 77.07 ± 25.39 mg/dl which is in discordance with the present study.

SERUM CREATININE IN CKD

The mean serum creatinine level in present study group was 6.63 ± 3.59 mg/dl. The level of mean serum creatinine varies with other studies for example N.P. Singh et al⁹ (3.5 ± 1.0) & D. S. Chafekar¹² (5.75 ± 1.32).

HAEMOGLOBIN LEVEL IN CKD PATIENTS

The mean Hb% in present study was 8.38 gm%, which is comparable with the study of D.S. Chafekar et al (7.84 ± 0.98)¹², Foley et al¹¹ (8.4 ± 1.70), Gerald M. London et al¹³ (5.45 ± 2.26) and N.P. Singh et al (6.7 ± 0.6)⁹.

SERUM POTASSIUM LEVEL IN CKD PATIENTS

The studies in literature say that hyperkalemia is the most common electrolyte abnormality in chronic kidney disease. In the present study 32% of patient had K^+ level >5 meq/l, with the mean K^+ level was 4.73 ± 1.13 mEq/dl which is comparable with the study of N.P. Singh et al⁹.

ECG CHANGES IN CKD PATIENTS.

In the present study, electrocardiographically determined cardiovascular abnormalities were observed in 72% of patients. LVH in 30% patients, ischemia in 16% patients, intraventricular conduction disturbance in 16 patients (16%), p mitrale in 10 patients (10%), arrhythmia in 6 patients (6%). ECG was normal in 28 patients (28%).

The above observation made in the present study is comparable with study done by Krivoshiev et al¹⁴ who also concluded that maximum patients came with findings of LVH in ECG whereas Soman et al¹⁵ at A.S. Menon et al¹⁶ concluded that maximum patients came with findings of ischemia in ECG.

ECHOCARDIOGRAPHIC CHANGES IN CKD PATIENTS

In the present study, echocardiographic parameters like LVIVS, LVPW, LVEDD, LVEF, RVID, LVESD showed left ventricular dysfunction. The values are comparable with other studies done by N P Singh et al⁹, D S Chafekar et al.¹² Gerald M London et al¹³ and Michel Dahan et al¹⁰.

Even though the echo parameter indicates left ventricular dysfunction, the mean EF % was within normal limits 54.98 ± 8.96 in present study & the mean values were, $58.48 \pm 8.50\%$

in Chafekar et al ¹², 56.02 ±6.66% in NP Singh et al ⁹ & 69.7± 9.75 Gerald M London et al ¹³.

In the present study, the commonest echocardiographically detected left ventricular dysfunction was left ventricular hypertrophy which was observed in 42 patients (42%), and is not comparable with other studies like NP Singh et al ⁹ (76.92%) & Foley et al ¹¹ (73.9 %) as they have taken only ESRD patients in their study.

Left atrial and left ventricular dilatation was observed in 4 patients (8%) in present study which was 35.5% in Foley et al ¹¹, 31% in Michel Dahan et al ¹⁰ & 46.1 % N. P Singh et al ⁹.

Pericardial effusion was observed in 3 patients (6%) in the present study, which was 32 % in A S Menon et al ¹⁶.

CONCLUSION:

- Left ventricular hypertrophy is the commonest morphological abnormality observed.
- Left ventricular dysfunction is commonest cardiovascular abnormality detected.
- Myocardial ischemia, conduction disturbance were better made out electrocardiographically.
- Echocardiography is a more sensitive diagnostic procedure to detect left ventricular dysfunction.

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