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Echocardiographic Evaluation of Left Ventricular Function in Chronic Kidney Disease on Hemodialysis

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Abstract

Background: There is increase in number of CKD patients. Many co morbidities are associated with CKD, cardiovascular diseases being major co morbid illness adding to morbidity and mortality. *Material and Methods:* Prospective study carried out in Medicine department, SIMS, Shimoga for 6 months from June 2016 to December 2016. 50 patients who are diagnosed to have chronic kidney disease were evaluated using echocardiograpy. Left ventricular ejection fraction was estimated using biplane Simpsons method and Correlation of LV dysfunction with creatinine clearance using Cockroft–Gault equation. Patients with clinical evidence of valvular heart disease, congenital heart disease and pericardial effusion were excluded from the study. *Result*: Most cases (60%) were between 31-50 yrs of age. Males constituted 58% and females 42% of the study group. 68% of cases had normal LV systolic function as defined by EF > 50%, as compared to 32% who had reduced LV systolic function. LV systolic dysfunction was not related to creatinine clearance value. *Conclusion:* LV systolic function was evaluated in patients with CKD using Simpsons method by echocardiography. This study showed reduced LV systolic function in 32% of CKD Patients and normal LV systolic function in 68%. Study also concluded that creatinine clearance value is not related to LV systolic dysfunction.

Keywords: CKD; Systolic Dysfunction; Echocardiography.

Introduction

Cardiovascular disease is the leading cause of death in chronic kidney disease (CKD) patients [1]. An increased risk of cardiovascular morbidity and mortality is also seen in earlier stages of chronic kidney disease (CKD). Multiple risk factors may contribute to the development of CVD, such as sodium and fluid retention, hypertension, anaemia and infection [2]. In CKD patients, left ventricular systolic dysfunction is a common finding and it is associated with an increased CVD-related mortality [3]. Many of the clinical consequences of cardiac disease results from Cardiomyopathy or Ischemic Heart Disease [4]. Cardiomyopathy may present as enlarged dilated Left Ventricle (LV) with or without systolic dysfunction or as diastolic dysfunction [5]. Anomalies of LV structure and function (systolic dysfunction, left ventricular hypertrophy) are very frequent among CKD patients and show a negative impact on cardiovascular prognosis [6].

LVH is associated with both diastolic and systolic dysfunction of the left ventricle. LVH is also associated with LV systolic dysfunction, expressed by reduced mid wall systolic fractional shortening, as previously reported in hypertensive patients with cardiac hypertrophy and also in patients with ESRD in whom it is a powerful predictor of worse CV outcome. Taken together, these findings suggest that a mild reduction in renal perfusion induced by slightly impaired LV systolic function, associated with pathological, highly pulsatile perfusion in the

kidney microvasculature might be the mechanisms through which a progressive reduction of renal function takes place in patients with pre-existing renal damage.

There is scanty information on the prevalence and natural history of LVH & left ventricular dysfunction in patients with milder degrees of chronic renal failure from India. This present study would be helpful in reviewing the prevalence and severity of LV systolic dysfunction in patients with varying degrees of CKD.

Aims and Objectives

1. To estimate left ventricular ejection fraction using biplane Simpsons method.
2. To correlate severity of lv dysfunction with creatinine clearance using Cockroft–Gault equation.

Normal Range [6,7]

LVIDd	:3.6 to 5.4 cms.
LVIDs	:2.4 to 4.2 cms.
EF (ejection fraction)	: ³ 50%

Materials and Methods

Study Design

This was a prospective study where CKD patients of MC Gann hospital attached to Shimoga institute of medical science, were selected randomly for enrollment into the study, after consideration of inclusion and exclusion criteria. A detailed history was taken, clinical examination and investigations performed in all cases.

Study Subjects

A total of 50 patients diagnosed to have CKD during June 2016 to December 2016 Informed consent was taken from all the study subjects.

In both cases and controls, investigations were done in the clinical biochemistry laboratory of mc gann hospital. Echocardiographic studies were performed by a non-interventional cardiologist.

Inclusion and Exclusion Criteria

Inclusion

I. 50 patients with established CKD aged between 18 and 65 will be included in the study.

Exclusion

I. Patients with diagnosed with rheumatic heart disease, pericardial effusion and congenital heart disease with CKD are excluded

II. Those aged below 18 and above 65 are excluded from the study

Methodology

A detailed clinical history of subjects was taken.

Each subject underwent a detailed physical examination & systemic examination.

A standard 12 lead ECG was recorded in all subjects to look for any abnormalities.

Routine hematological and biochemical investigations including, hemoglobin concentration, blood sugars, blood urea and serum creatinine were done.

Echocardiography

A qualified cardiologist performed the transthoracic echocardiographic examination on all subjects; Two-dimensional and M-mode Echocardiography was performed on Philips envizor using 4-11 MHz transducer. Blood pressure and heart rate were measured at the time of echocardiography. Ejection fraction was calculated using the Simpsons method.

Left ventricular systolic dysfunction was defined as LV ejection fraction < 50%

Statistical Methods

Chi-square and Fisher Exact test were used to find the significance of proportions of systolic dysfunction with various study parameters.. Analysis of variance has been used to find the significance of Echo parameters between the categories of systolic dysfunction.

1. Chi-Square Test[23,24]
2. Fisher Exact Test [23,24]
3. Analysis of Variance: F test for K Population means [23,24]

Statistical Software

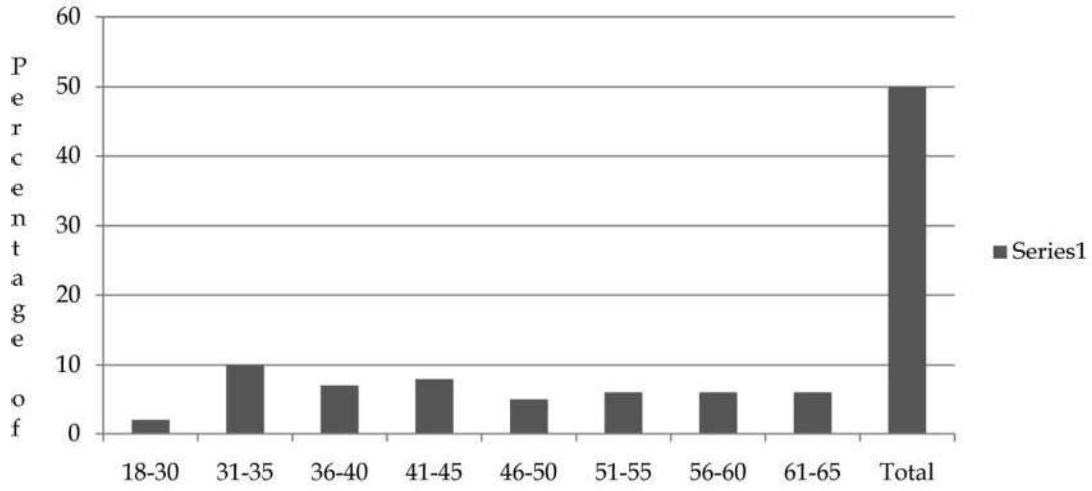
The Statistical software namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Demographics

A total of 50 hypertensive patients were included in the study. The number of males was 29 (58%) and that of females was 21 (42%). The patient's age ranged from 23 to 64 years. Fifty age and sex matched healthy controls were also evaluated to obtain the normal E/A ratio values in different age groups.

Table 1: Age distribution of cases

Age in years	Number	%
≤ 30	2	4.0
31-35	10	18.0
36-40	7	20.0
41-45	8	12.0
46-50	5	10.0
51-55	6	12.0
56-60	6	12.0
61-65	6	12.0
Total	50	100.0



Distribution of Age in Cases

Fig. 1:

Most cases (60%) were between 31-50 yrs. of age (Table 1).

Males constituted 58% and females 42% of the study group.

The mean systolic blood pressure and diastolic blood pressure in cases was 152.52±18.36 and 92.407.51mmHg respectively.

ECG changes in decreasing order of frequency were sinus tachycardia in 32.6%, LVH in 40.7%, ST - T changes in 26.7%, ventricular ectopics and Tall 'T' wave.

Table 2: Mean Echocardiography Parameters in Cases of ESRD

Mean values Left ventricular internal diameter in diastole (LVIDd) (mm)	47.55 ± 6.03
Left ventricular internal diameter in systole (LVIDs) (mm)	30.8 ± 6.02
Interventricular septum diameter in systole (IVS) (mm)	12.2 ± 1.71
Left ventricular posterior wall diameter (LVPWD) (mm)	11.0 ± 1.51
Left atrium diameter (mm)	35.01 ± 4.11
Ejection fraction (EF) (%)	52.91 ± 9.62

Cockroft–Gault equation used for evaluation of creatinine clearance and its value was correlated with left ventricular systolic function

Table 3 showing creatinine clearance and left ventricular function

Discussion

Cardiovascular diseases contribute to significant morbidity and mortality in patients with CKD. cardiovascular diseases are also because of premature atherosclerosis in these group of patients, LV hypertrophy, expansion of the nonvascular cardiac interstitium leading to intramyocardial fibrosis, progressive atherosclerosis and myocardial calcification. All these abnormalities promote systolic dysfunction [8].

In our study reduced systolic function was present in in 32% of patients as suggested by reduced LVEF estimated by Simpsons method. Robert N. Foley et al

Table 3: Showing creatinine clearance and left ventricular function

Creatinine Clearance	EF (Mean) in %
88-128 ml/min	51%
45-88 ml/min	54%
20-45 ml/min	52%
<20 ml/min	50%

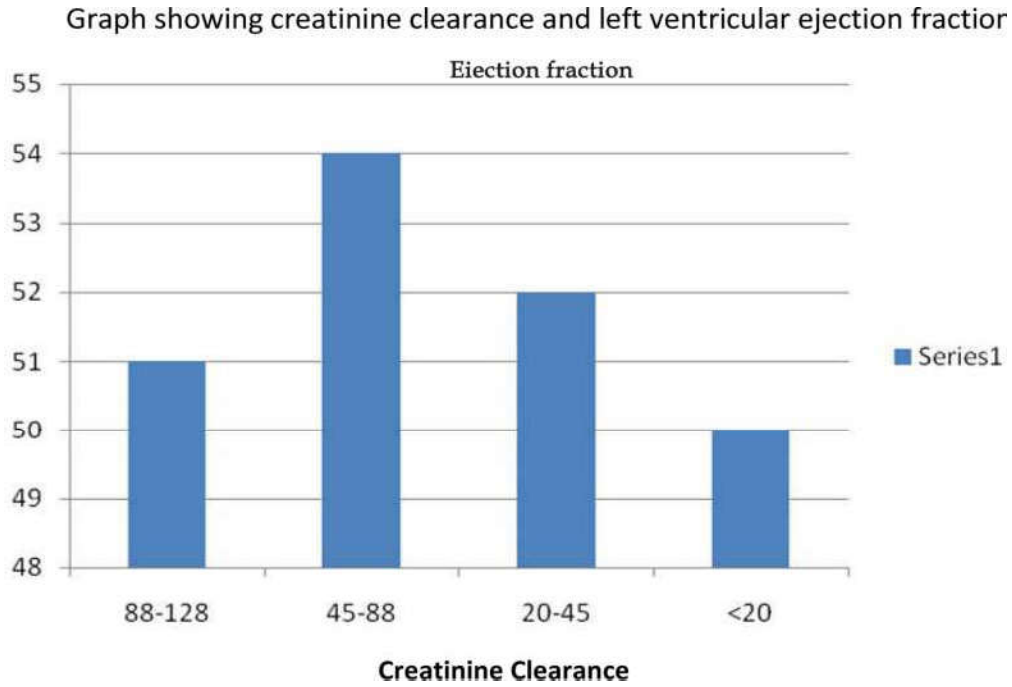


Fig. 2: Graph Showing Creatinine Clearance and Left Ventricular Ejection Fraction

Creatinine clearance and left ventricular function had no correlation as seen by graph and estimation of left ventricular systolic function by echocardiography and p value >0.01 .

Table 4: Sex distribution of cases with LV Systolic dysfunction defined by EF <50%.

Systolic Dysfunction Defined by EF <50%	Number (%)	
	Male	Female
Normal LVEF (34)	22	12
Reduced LVEF (14)	8	6

About 68% patients had normal lv function, and 32% had reduced lv function. Males were more in number in reduced LV function group.

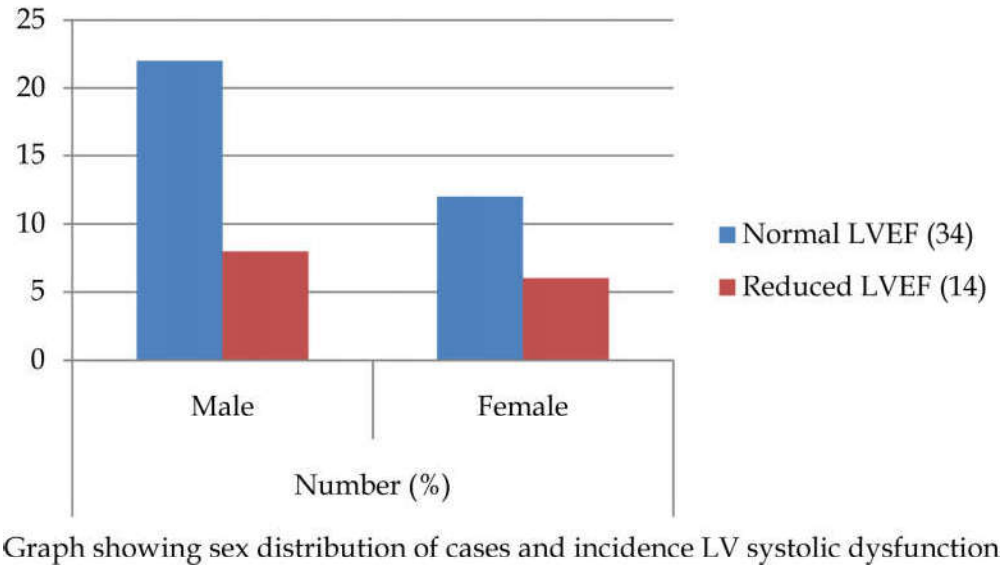


Fig. 3: Graph showing sex distribution of cases and incidence lv systolic dysfunction

(1995) had found abnormalities of left ventricular structure and functions were very frequent on baseline echocardiography: 73.9% had left ventricular hypertrophy, 35.5% had left ventricular dilatation and 14.8% had systolic dysfunction in ESRD patients [9].

NP singh et al (2000) had found LVH in 76.92%, diastolic dysfunction in 72% but did not find systolic dysfunction in CKD patients [10]. Zoccali et al.(2000) had found 77% LVH, 22% systolic dysfunction by LVEF measurement in haemodialysis patients [11]. S.Agarwal et al (2003) had observed diastolic dysfunction in 60% and systolic dysfunction in 15% of patients [12].

In the present study there was lv dysfunction was present in 32% of patients which was statistically significant. However there was no correlation with left ventricular function with creatinine clearance value.

Conclusion

LV systolic function was assessed in patients with chronic kidney disease in a tertiary care centre. Majority were males and constituted 58% of cases where as females constituted 42%. The reduced LV function as reduced LV ejection fraction < 50% was noticed in 32% of cases. LV systolic function was normal in 68% of cases where LVEF was > 50%. There was male preponderance in number of cases. There was no correlation between creatinine clearance and LV systolic function.

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