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Study of Left Ventricular Dysfunction in Chronic Renal Failure Patients

KEYWORDS: LEFT VENTRICULAR DYSFUNCTION,CHRONIC KIDNEY DISEASE

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ABSTRACT *In the recent years, the prevalence of Chronic Renal failure has increased in the community, resulting in increasing number of admission and decreased life expectancy. In the chronic renal failure (CRF) population left ventricular dysfunction (LVDys) is common . Aim of the present study is to estimate the prevalence of Left Ventricular Dysfunction by Echocardiography in patients with Chronic Renal Failure and to find out Correlation of Left Ventricular Dysfunction with severity of Chronic Renal Failure. This study revealed that there is significant increase in prevalence of LV dysfunction as severity of CKD increase. Burden of diastolic dysfunction is very large compared to systolic dysfunction even in CKD stage 1-3. And its prevalence is even greater than the prevalence of LVH in this group (14.8%).*

INTRODUCTION

In an era where diabetes and hypertension are the predominant causes of CKD, it is not surprising that there is an associated high incidence of cardiovascular disease. It is possible that CKD is also an independent risk factor for cardiovascular disease

In the chronic renal failure (CRF) population left ventricular dysfunction (LVDys) is common with a rate 10–30 times greater than that in the general pop-

ulation. The clinical diagnosis of congestive heart failure (CHF) in the CRF population, which may be due to decreased left ventricular function, correlates strongly with mortality.As the heart and kidney are inextricably linked at multiple levels including the sympathetic nervous system, the renin-angiotensin-aldosterone system (RAAS), antidiuretic hormone, endothelin, and the natriuretic peptides. So disease of one system affects other.

LVDys is often preceded by left ventricular hypertrophy (LVH) that in itself carries a poor prognostic value for mortality in patients with ESRD.

Echocardiography should be performed early in the course of CRF and may be valuable in the monitoring of therapy of these patients. Cardiac dysfunction is the major impediment to rehabilitation. Patients in developing countries are managed mainly on conservative therapy and therefore, suffer from chronic acidosis, malnutrition, anaemia, and azotaemia. These factors further aggravate the cardiac dysfunction in uraemic patients.

AIMS AND OBJECTIVES

To study prevalence of left ventricular dysfunction in patient with chronic renal disease patients.

MATERIAL AND METHODS

Source population: patients with chronic kidney disease attending OPD and admitted in Government Hospital were selected as case. Age and sex matched healthy volunteers are selected as control. Total no of study population is 100,in which 50 are case and 50 are control. Cases are selected by the criteria already described in review of literature as a definition of chronic kidney disease.

Groups : cases are devided into 2 subgroups:

Group A (n = 27) – patients with CKD stage 1-3 (GFR>30 ml/min/1.73 m2);

Group B (n = 23) – patients with CKD stage4-5) (GFR<30 ml/min/1.73 m2)).

The following patients were excluded from the study :
Patients with diabetes mellitus, patients with history of coronary artery disease and other cardiac disorders such as valvular heart disease, congenital heart disease etc, and patients with poor echo window.

(Both, patients on HD(hemodialysis) and patients not on HD are included in our study)

Informed consent was taken from all subjects participating in the study. Systolic and diastolic blood pressure of all subjects are recorded. then underwent various investigations: haemoglobin, s.protein, albumin. lipid profile s.creatinine. Height and weight of all patients are recorded. All patients underwent two dimensional directed M mode echocardiography performed on

Hewlett Packard SIM 7000, in left lateral decubitus position using 3.5 MHz transducer by a consultant physician experienced in echocardiography.

The LVEF and fractional shortening (FS) were taken as measure of left ventricular systolic function.

EF = LVVd - LVVs/ LVVd

EF was considered decreased if it was < 50%.

FS = (LVIDd-LVIDs)/ LVIDd x 100

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FS of 25% was taken as index of systolic dysfunction

Diastolic function was determined by measuring E/A ratio by special Doppler inflow velocity (E is peakearly diastole velocity and A is peak atrial filling

velocity of left ventricle across mitral valve). E/Aratio less than 0.75 and more than 1.8 was considered as diastolic dysfunction.

Statistical analysis

Comparison of the three groups was then done by analysis of variance (ANOVA) using 'F' test and 't' test . Comparison of two group was done by Chi. square test.

OBSERVATION AND RESULTS

As previously mentioned group A is CKD stage 1,2,3 (GFR > 30), Group B is severe CKD group stage 4,5(GFR < 30)

TABLE 1: LEFT VENTRICULAR SYSTOLIC FUNCTION INDICES(EF AND FS) IN CKD:

	Control	Group A	Group B	P value
EF %	57.89± 8.32	57.39± 9.66	56.93±10.71	
No.of pts. with EF<50	Nil	1(3.7%)	8(34.7%)	0.013
FS %	28.7± 4.278	28.46± 4.9	28.23 ± 5.4	
No.of pts. with FS<25	Nil	8(29.6%)	5(21.7%)	0.75

EF seems to gradually fall from control to mild/moderate CRF group and severe CRF group though mean EF remains>50 % in all 3 groups.

Incidence of systolic dysfunction(EF<50%) is significantly increase from group A to group B.

When Fs is considered, it seems to fall in CKD patients but there is not significant difference in both groups. Furthermore incidence of systolic dysfunction is more in group A than group B when FS is considered as a criteria

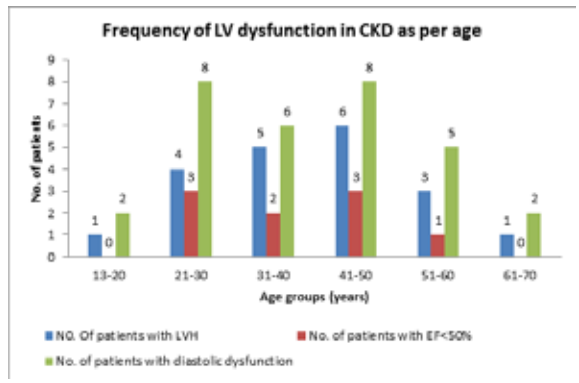
TABLE 2: DIASTOLIC DYSFUNCTION IN CKD:

	Control	Group A	Group B	P value
Patients with DD	Nil	14(51.8%)	19(82.6%)	0.04
Male with DD	Nil	9(69.2%)	11(84.61%)	<0.05
Female with DD	Nil	5(35.7%)	8(80%)	<0.05

There is significant increase in incidence of diastolic dysfunction as severity of CKD increases ,in both male and female.

TABLE 3: FREQUENCY OF LV DYSFUNCTION IN CKD AS PER AGE:

Age group (yrs)	Total no. patients.	No. Of patients with LVH	No. of patients with EF<50%	No. of patients with diastolic dysfunction
13-20	4	1(33%)	0(0%)	2(66.6%)
21-30	12	4(33%)	3(25%)	8(66.6%)
31-40	9	5(55.5%)	2(22.2%)	6(66.6%)
41-50	12	6(50%)	3(25%)	8(66.6%)
51-60	8	3(37.5%)	1(12.5%)	5(62.5%)
61-70	5	1(20%)	0(0%)	2(40%)



There is no significant impact of age on development of LVH, systolic or diastolic dysfunction is found except middle age group has somewhat higher prevalence of LVH and systolic dysfunction.

TABLE 4: FREQUENCY OF LV DYSFUNCTION IN CKD AS PER SEX:

Sex	Total no.patients	No.of pts. With LVH	No. of pts with EF<50%	No. of pts.with diastolic dysfunction
Male	26	11(42.3%)	5(19.2%)	20(76.9%)
Female	24	9(37.5%)	4(16.6%)	13(54.16%)

There is no significant impact of sex is found on development of LV dysfunction in my study except diastolic dysfunction is more prevalent in male .

DISCUSSION

Premature cardiovascular disease is a significant cause of morbidity and mortality among patients with CKD,.Traditional Risk Factors age, hypertension, diabetes, dyslipidemia, smoking, and obesity have been validated as traditional risk factors for CVD in patients with CKD. Four main structural abnormalities of the heart have been described in patients with CKD: LV hypertrophy, expansion of the nonvascular cardiac interstitium leading to inter-myocardiocytic fibrosis, changes in vascular architecture, and myocardial calcification. All these abnormalities promote systolic as well as diastolic LV dysfunction which predisposes to symptomatic heart failure, which in turn is a risk factor for premature death.

Cardiac assessment by echocardiography is non-invasive, inexpensive to perform and generates detailed information about gross cardiac anatomy, objective quantification of LVM and the geometry of left ventricle hypertrophy (LVH), along with measures of function during systole and diastole

In the present study, the mean ejection fraction in patients with both CRF groups showed a downward trend but neither of the CRF groups had mean LVEF < 50%. Among patients in the CRF group A, only (3.7%) patient had LVEF < 50%, while (34.7%) patients in CRF group B had LVEF < 50% which was significantly different from controls.Thus, these studies suggest that LVEF is well maintained in patients with CRF patients till late.

Correlation of FS as a systolic function index in CKD

In the present study, there was no significant difference in the mean fractional shortening among the three groups, however, 29.6% in group A and 21.7% patients in group B had fractional shortening ≤25%.

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In the present study, in patients within group A, the ejection fraction was depressed only in 3.7% whereas FS was depressed in 29.6%. It is because when the ventricle is stressed by a haemodynamic overload, it first uses its compensatory mechanism to maintain normal mechanical performance and the ejection indices (e.g. ejection fraction) within normal limits. It is only when all the compensatory mechanisms in the form of operation of Frank Starling's mechanism, development of hypertrophy, and endogenous adrenergic stimulation have been maximally used, there is decline in ejection phase indices. Ventricular systolic functions have invariably been evaluated using ejection phase indices, viz., ejection fraction, but this is highly sensitive to left ventricular loading conditions (pre load and after load) which are usually abnormal in CRF patients. Normalisation of loading conditions is invariably associated with restoration of normal ejection phase indices[59]. Similarly when FS is taken as index of systolic dysfunction, it is assumed that the ventricle must be contracting uniformly for them to reflect global function. FS assesses the status of basal chamber only; it may falsely be normal, depressed, or increased in segmentally depressed left ventricle.

Prevalence of diastolic dysfunction in CKD

There is significant increase in prevalence of diastolic dysfunction as severity of CKD increase. Burden of diastolic dysfunction is very large even in CKD stage 1-3. And its prevalence is even greater than the prevalence of LVH in this group(14.8%)

It may be difficult to interpret whether a normal E/A flow pattern is associated with normal heart function or might in fact be related to progressive diastolic heart dysfunction, with increased filling pressure. This study have included only E/A ratio as a criteria of diastolic dysfunction which alone has limited sensitivity and specificity.

This observation suggest that diastolic dysfunction can present even before and in absence of LVH.

SUMMARY AND CONCLUSION

Systolic function is preserved till quite late in Chronic kidney disease and its prevalence also correlates with the severity of Chronic kidney disease.

Fractional shortening as a marker of systolic function reduces earlier than does the ejection fraction in course of CKD. But its reliability is inferior to ejection fraction.

Diastolic dysfunction is quite prevalent in Chronic kidney disease, even preceds development of Left ventricular hypertrophy.The prevalence increase as severity of chronic kidney disease increase.

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