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General Medicine

A STUDY OF LEFT VENTRICULAR FUNCTION IN CHRONIC KIDNEY DISEASE PATIENTS

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ABSTRACT **Aims:** The prevalence of left ventricular abnormalities in people suffering from chronic kidney disease is largely unclear. Thus, the aim of this study was, firstly, to evaluate Left Ventricular Function In CKD patients and to identify abnormal systolic and diastolic function by echocardiography in an age-stratified population-based on sample size and analyse associated clinical parameters. **Methods and results:** This is a Prospective observational study conducted on patients with CKD, irrespective of treatment in the department of general medicine DR. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Vijayawada, from January 2021 to June 2022 with age inclusion criteria more then 18 yrs. Most subjects in the control group are in the age group of 41-50 years (35 %). Most subjects were belonging to the stage 3 chronic kidney disease (50 %) with male predominance. Majority of subjects were with diastolic dysfunction (76.19 %), followed by systolic dysfunction (19.04 %) and least with both systolic and diastolic dysfunction (4.76%). There was a highly significant statistical difference in the subject distribution on the basis of stage of CKD vs. type Left Ventricular Dysfunction (p value: 0.001). Most subjects were suffering from diastolic dysfunction with no statistical difference in the subject distribution on the basis of stage of CKD vs. severity of systolic dysfunction (p value: 0.185). There was a significant statistical difference in the subject distribution on the basis of stage of CKD vs. stage of diastolic dysfunction (p value: 0.01). Most subjects were in stage II diastolic dysfunction. There was a highly significant statistical difference between GFR values and LVD stages (p value: 0.001). **Conclusion:** Left ventricular diastolic dysfunction is more significantly associated with the decline in eGFR than systolic dysfunction in CKD patients. This is found to occur at an earlier stage of CKD, even without LVH. Thus diastolic dysfunction is a much better predictor for cardiovascular mortality. According to our study observations, eGFR has a negative co-relation with LVD and there is a highly significant statistical difference between both. This emphasizes the need for correction of not just hemodynamic factors but also the renal related factors. Echocardiography provides a simple, non-invasive investigation that can identify even asymptomatic patients at an earlier stage of CKD. So, earlier screening of CKD patients for LV diastolic dysfunction can be recommended.

KEYWORDS : Diastolic abnormalities; Diastolic dysfunction; Systolic dysfunction; Prevalence; Left Ventricular Dysfunction (LVD): Left Ventricular Hypertrophy(LVH): Chronic Kidney Disease(CKD): estimated glomerular filtration rate (eGFR).

INTRODUCTION

Independent of conventional cardiovascular risk factors, CKD, whose incidence is still rising globally, increases the risk of coronary artery disease (CAD), chronic heart failure (CHF), and/or death.1-4. The left ventricular diastolic dysfunction is linked to a greater mortality rate5.Systolic and diastolic dysfunctions in CKD may be caused by CKD severity, which is an independent predictor of higher LV filling pressure1.

In the initial phases of chronic kidney disease, left ventricular diastolic dysfunction is observed7.Clinically obvious congestive heart failure can be brought on by either systolic or diastolic dysfunction2.Studies indicate that it might be affected by the rise in LV preload brought on by the advancement of CKD stage[3].

The development of LV diastolic dysfunction in CKD patients may also be influenced by LV hypertrophy, coronary artery disease, altered fluid and electrolyte metabolism, and neurohumoral changes. Since even moderate CKD causes early cardiac fibrosis with mild LV diastolic impairment and retained systolic function, activation of the renin- angiotensin-aldosterone system (RAAS) may play a significant role in the pathogenesis[4].

One of the main causes of morbidity and mortality is cardiovascular disease. Cardiovascular problems are more common in people with CKD stage 4 than in earlier stages5.Patients pass away before developing ESRD. Hence we should look into the prevention of cardiovascular complications.

LVH is associated with both systolic and diastolic dysfunction. LVH associated with systolic dysfunction is expressed by decreased mid wall systolic fractional shortening and decreased ejection fraction. These findings show us that mild reduction in the renal perfusion which is caused by the slightly impaired LV systolic function, decreases blood supply to kidneys. This might be the mechanism through which a reduction of renal function takes place in patients with renal damage[6].

Diastolic dysfunction has with higher incidence of episodes of intradialytic hypotension and higher peri-operative death from pulmonary oedema at the time of renal transplantation. It is significant to recognize and correct the cardiovascular complications and risk factors before the commencement of dialysis7.This study aims to study Left ventricular function in chronic kidney disease.

STUDY DESIGN:

All patients with chronic kidney disease stage 1 to 5 presenting general medicine department between January 2021 to June 2022 will be screened for inclusion. Patients fulfilling the inclusion criteria and giving consent will be included in the study. The baseline characteristics such as Age, Gender, History of Diabetes Mellitus, Hypertension, Cardiac disease, etiology and duration of CKD, smoking and alcohol history was obtained. Blood pressure (BP) will be noted from the patient records. The following investigations was noted from the patients records: serum hemoglobin (Hb), random blood sugar (RBS), creatinine (Creat), calcium (Ca), phosphorous (Pi), Alkaline Phosphatase (ALP), albumin (Alb) and urine routine. Patients eGFR (Glomerular Filtration Rate) was calculated using Cockcroft Gault equation. A patient with investigations within 3 months was included for evaluation. Electrocardiogram and 2D echocardiography reports was done at the time of admission. The following parameters will be noted from 2D echocardiography report: Left ventricular end systolic dimension, end-diastolic dimension of intraventricular septum (IVSd), left ventricle internal diameter in diastole (LVIDd) and left ventricle end diastole posterior wall thickness (PWd), presence of LVH, ejection fraction, presence and severity of diastolic dysfunction. LV diastolic function is evaluated by measuring the mitral early to late diastolic flow velocity ratio (E/A), the ratio between early mitral inflow velocity and mitral annular early diastolic velocity (E/e′), the volume index of the LA and the tricuspid regurgitation velocity according to the existing guidelines. Qualitative data was represented in the form of frequency and percentage. Association between qualitative variables was assessed by Chi Square test. One Way Analysis (ANOVA) was used to compare more than two groups. A 'P' value of <0.05 was considered statistically significant.

RESULTS

The present single centered, prospective observational study was undertaken to evaluate the Left Ventricular function in chronic kidney disease (CKD) patients. 100 patients presenting to the out-patient and in-patient departments of the Department of General Medicine in Dr. Pinnamaneni Siddhartha Institute Of Medical Sciences and Research Foundation, Chinnaoutpalli, Gannavaram Mandal, Krishna District between January 2021 and June 2022 were studied.

In the present study, subjects were divided into 5 age groups with interval of 10. Most subjects were belonging to the age group of 41-50 years; 35 (35 %), followed by 26 (26 %) in the 51-60 years age group; 19 (19 %) in the 31-40 years age group; 18 (18 %) in the 61-70 years age group; 2 (2 %) in the 20-30years age group.

Most subjects were belonging to the stage 3, i.e., 47 (47%); followed by 40 subjects in stage 2 (40%), 10 subjects in stage 4 (10%), 3 subjects in stage 1 (3 %) and finally 0 subjects in stage 0 (0 %). It was found that most males were mostly suffering from CKD 62 (62%) when compared with females 38 (38 %). The ratio of which is 1.63:1. LVD was absent in 58 subjects (58 %) and present in 42 subjects (42 %). The ratio of which is 1.38:1

Table 1: Subjects were distributed according to Stage of CKD vs. Left Ventricular Dysfunction

Stage of CKD	LVD	Non-LVD	P-Value
Stage 1	0 (0%)	3 (5.17%)	0.1267
Stage 2	12 (28.57%)	28 (48.27%)	
Stage 3	25 (59.52%)	22 (37.93%)	
Stage 4	5 (11.90%)	5 (8.62%)	
Total	42	58	

The above table represents the data of CKD staging with respect to LVD. Out of 42 CKD subjects with LVD, 25 subjects (59.52 %) were in Stage 3; 12 subjects (28.57%) were in Stage 2; 5 subjects (11.90 %) were in Stage 4 and 0 subjects (0 %) were in Stage 0. Out of 58 CKD subjects without LVD, 28 subjects (48.27%) were in Stage 2; 22 subjects (37.93 %) were in Stage 3; 5 subjects (8.62 %) were in Stage 4; 3 subjects (5.17 %) were in Stage 0.

Majority subjects were with diastolic dysfunction, i.e., 32 (76.19 %), 8 subjects were with systolic dysfunction (19.04 %) and 2 subjects were with both systolic and diastolic dysfunction (4.76 %). Among 8 subjects with systolic dysfunction, 5 (62.5%) were in Stage 3; 2 (25%) were in Stage 2 and 1 (12.5%) was in Stage 4. Among 32 subjects with diastolic dysfunction, 20 (62.5%) were in Stage 3; 10 (31.25%) were in Stage 2 and 2 (6.25%) were in Stage 4. Among 2 subjects with both systolic and diastolic dysfunction, 2 (100%) were in Stage 4. The p value calculated was 0.001 indicating a highly significant statistical difference in the subject distribution on the basis of Stage of CKD vs. type Left Ventricular Dysfunction. Most subjects were suffering from diastolic dysfunction. Out of 2 subjects with mild systolic dysfunction, 1 (50%) was in stage 2 and 1 (50%) in stage 3. Out of 5 subjects with moderate systolic dysfunction, 3 (60%) were in stage 3; 1 (20%) was in stage 2 and 1 (20%) in stage 4. Out of 3 subjects with severe systolic dysfunction, 2 (66.67%) were in stage 4; 1 (33.33%) was in stage 3. The p value calculated was 0.185 indicating no statistical difference in the subject distribution on the basis of stage of CKD vs. severity of systolic dysfunction.

Table 2: Subjects were distributed according to Stage of CKD Vs stages of diastolic dysfunction

Stage of CKD/ stages of diastolic dysfunction	I	II	III	IV	P-Value
Stage 2	4 (57.14%)	5 (27.77%)	1 (16.66%)	0 (0%)	0.01
Stage 3	3 (42.85%)	12 (66.67%)	4 (66.67%)	1 (33.33%)	
Stage 4	0 (0%)	1 (5.55%)	1 (16.66%)	2 (66.67%)	
Total	7	18	6	3	

The above table represents the distribution of subjects according to stage of CKD vs. stage of diastolic dysfunction. Majority of subjects (18) were in stage II of diastolic dysfunction, out of which, 12 (66.67%) were in stage 3, 5 (27.77%) were in stage 2 and 1 (5.55%) were in stage 4. Out of 7 subjects of stage I diastolic dysfunction, 4 (57.14%) were in stage 2 followed by 3 (42.85%) in stage 3. Out of 6 subjects of stage III diastolic dysfunction, 4 (66.67%) were in stage 3, followed by 1 (16.66%) each in stages 2 and 4 respectively. Out of 3 subjects of stage IV diastolic dysfunction, 2 (66.67%) were in stage 4 followed by 1 (33.33%) in stage 3. The p value calculated was 0.01 indicating a significant statistical difference in the subject distribution on the basis of stage of CKD vs. stage of diastolic dysfunction. Most subjects were in stage II diastolic dysfunction.

Out of 42 subjects with LVD, majority 20 subjects (47.61%) were overweight; followed by 14 (33.33%) obese subjects and 8 subjects (19.04%) were with normal BMI. Out of 58 subjects without LVD, majority subjects 18 (31.03%) were overweight; followed by 17 subjects (29.31%) with normal BMI; 15 subjects (25.86%) were obese and 2 (3.45%) subjects were underweight.

The calculated p value was 0.2371 indicating no statistical difference in the distribution of subjects according to BMI vs. LVD.

Majority subjects were experiencing pedal edema, i.e., 29 (69.04 %); followed by 18 subjects (42.85 %) with dyspnoea; 14 subjects (33.33 %) with chest pain; 5 subjects (11.90 %) with palpitation and 4 subjects(9.52 %) with vomiting. The co-relation value was - 0.725 indicating a negative co-relation between GFR and LVD stages which means the LVD stage increase with a decrease in GFR value. P- value was 0.001 indicating a highly significant statistical difference between GFR and LVD stages.

DISCUSSION

CKD is emerging to be an important chronic disease globally. CKD has been shown to be associated with an increased risk for development of Cardiovascular disease (CVD), and mortality. This increased risk of CVD is noticed even with early stages of CKD, with progressively increasing risk with worsening cardiac function. The mechanism of development of CVD in CKD is multi-factorial, comprising of both traditional and non-traditional risk factors. The traditional risk factors include presence of diabetes, hypertension, obesity, dyslipidemia, smoking etc., while the non-traditional factors include presence of systemic inflammatory state, vascular calcification, uremic toxins, oxidative stress, increased parathyroid hormone and fibroblast growth factor 23 levels, altered calcium-phosphate metabolism, anemia etc. The development of cardiac disease as a complication of CKD encompasses the type 4 Cardiorenal syndrome, while the development of CKD in patients with chronic heart disease includes the type 2 cardiorenal syndrome. The different spectrum of CVD found in patients with CKD include: Left Ventricular Hypertrophy (LVH) (Eccentric LVH, concentric LVH and LV remodelling), Left Ventricular (LV) dysfunction (systolic and/or diastolic),Atherosclerosis, Ischemic Heart Disease, Valvular/Vascular Calcification, Pulmonary Hypertension etc. LVH is quite common in patients with CKD and is associated with increased risk of cardiovascular events heart failure and mortality, with a Odds ratio of upto 4.4.LVH with predominant wall thickening leads to concentric hypertrophy, while LVH with predominant chamber enlargement leads to eccentric hypertrophy. LV diastolic dysfunction is also frequently seen in patients with CKD, even during early stages of CKD, and can lead to heart failure. CKD severity has been shown to be an independent predictor for development of LV diastolic and systolic dysfunction. LV systolic dysfunction has been shown to be upto 15% in incident dialysis patients, with the prevalence of diastolic dysfunction estimated to be much higher. The development of LV diastolic dysfunction in CKD is dependent on the increase in LV filling pressures and preload, which can worsen progression of CKD. The other factors include presence of LVH, ischemic heart disease, microvascular abnormalities, myocardial fibrosis, abnormalities of fluid and electrolyte status, and alteration in the neurohumoral system. The results obtained from this study were compared with other similar studies and discussed as follows:

AGE GROUP

In the present study, subjects were divided into 5 age groups with interval of 10. Most subjects were belonging to the age group of 41-50 years; (35 %), followed by 26 % in the 51-60 years age group; 19 % in the 31-40 years age group; 18 % in the 61-70 years age group; 2 % in the 20-30years age group.

The results of our study were in co-relation with the past studies conducted by McDonald S et al 32, Cheung AK et al[33]and Foley RN et al[34]

STAGE OF CKD:
Most subjects were belonging to the stage 3, i.e., 47 %; followed by 40 % subjects in stage 2; 10% subjects in stage 4; 3 % subjects in stage 1 and finally 0 % subjects in stage 0. The results of our study were in co-relation with the past studies conducted by Wang AY et al35, Wang AY et al36and Mann JF et al[37]

GENDER It was found that most males were mostly suffering from CKD (62%) when compared with females (38 %). The ratio of which is 1.63:1. The results of our study were in co-relation with the past studies conducted by McDonald S et al 32, Cheung AK et al33and Foley RN et al[34]

LEFT VENTRICULAR DYSFUNCTION:
LVD was absent in 58 % subjects and present in 42 % subjects. The ratio of which is 1.38:1 The results of our study were in co-relation with the past studies conducted by Longenecker JC et al38, Foley RN et al39 and Ruilope LM et al[40]

STAGE OF CKD VS LEFT VENTRICULAR DYSFUNCTION:
Out of 42 CKD subjects with LVD, 59.52 % subjects were in Stage 3; 28.57 % subjects were in Stage 2; 11.90 % subjects were in Stage 4 and 0 % subjects were in Stage 0.

Out of 58 CKD subjects without LVD, 48.27% subjects were in Stage 2; 37.93 % subjects were in Stage 3; 8.62 % subjects were in Stage 4; 5.17 % subjects were in Stage 0.

Table 3: The results of our study were in co-relation with the past studies conducted by Longenecker JC et al38, Foley RN et al39 and Ruilope LM et al[40].

Stage of CKD	Study by (% subjects with left ventricular dysfunction)			
	Longenecker JC et al[38]	Foley RN et al[39]	Ruilope LM et al[40]	Present Study
Stage 1	0	0	0	0
Stage 2	44	45	40	28.57
Stage 3	52	50	50	59.52
Stage 4	4	5	10	11.90

P-Value

TYPE LEFT VENTRICULAR DYSFUNCTION
Majority subjects were with diastolic dysfunction, i.e., 76.19 %, 19.04 % subjects were with systolic dysfunction and 4.76 % subjects were with both systolic and diastolic dysfunction.

Table 4: The results of our study were in co-relation with the past studies conducted by Sarnak MJ et al41, Wang AY-M et al42and Levin A et al[43]

Type Left Ventricular Dysfunction	Sarnak MJ et al[41]	Wang AY-M et al[42]	Levin A et al[43]	Present Study
Systolic Dysfunction	20	25	21	19.04
Diastolic Dysfunction	75	73	77	76.19
Both Dysfunction	5	2	2	4.76

STAGE OF CKD VS. TYPE LEFT VENTRICULAR DYSFUNCTION:
Among 8 subjects with systolic dysfunction, 62.5% were in Stage 3; 25% were in Stage 2 and 12.5% was in Stage 4. Among 32 subjects with diastolic dysfunction, 62.5% were in Stage 3; 31.25% were in Stage 2 and 6.25% were in Stage 4. Among 2 subjects with both systolic and diastolic dysfunction, 100% were in Stage 4. The p value calculated was 0.001 indicating a highly significant statistical difference in the subject distribution on the basis of Stage of CKD vs. type Left Ventricular Dysfunction. Most subjects were suffering from diastolic dysfunction.

Table 5: The results of our study were in co-relation with the past studies conducted by Sarnak MJ et al41, Wang AY-M et al42and Levin A et al[43].

Study by	Stage of CKD	Type Left Ventricular Dysfunction			P-Value
		Systolic	Diastolic	Both	
Sarnak MJ et al[41]	Stage 2	25 %	32 %	2 %	0.001
	Stage 3	63 %	63 %	3 %	
	Stage 4	11 %	6 %	95 %	
Wang AY- M et al[42]	Stage 2	25 %	32 %	5 %	0.002
	Stage 3	65 %	63 %	15 %	
	Stage 4	13 %	7 %	80 %	
Levin A et al[43]	Stage 2	25%	35 %	5 %	0.002
	Stage 3	62 %	65 %	5 %	
	Stage 4	13 %	8 %	90%	
Present Study	Stage 2	25%	31.25 %	0 %	0.001
	Stage 3	62.5%	62.5%	0 %	
	Stage 4	12.5%	6.25%	100%	

STAGE OF CKD VS SEVERITY OF SYSTOLIC DYSFUNCTION:
Out of 2 subjects with mild systolic dysfunction, 50% was in stage 2 and 50% in stage 3.

Out of 5 subjects with moderate systolic dysfunction, 60% were in stage 3; 20% was in stage 2 and 20% in stage 4.

Out of 3 subjects with severe systolic dysfunction, 66.67% were in stage 4; 33.33% was in stage 3.

The p value calculated was 0.185 indicating no statistical difference in the subject distribution on the basis of stage of CKD vs. severity of systolic dysfunction.

Table 6: The results of our study were in co-relation with the past studies conducted by Sarnak MJ et al41, Wang AY-M et al42and Levin A et al[43].

Study by	Stage of CKD	Severity of Left Ventricular Dysfunction		
		Mild	Moderate	Severe
Sarnak MJ et al[41]	Stage 2	25 %	32 %	4 %
	Stage 3	65 %	60 %	3 %
	Stage 4	10 %	8 %	93 %
Wang	Stage 2	20 %	32 %	5 %
	Stage 3	60 %	63 %	12 %
	Stage 4	20 %	5 %	83 %
Levin A et al[43]	Stage 2	23 %	33 %	2 %
	Stage 3	65 %	65 %	8 %
	Stage 4	12 %	12 %	90%
Present Study	Stage 2	50%	20 %	0 %
	Stage 3	50%	60%	33.33%
	Stage 4	0%	20%	66.67%

STAGE OF CKD VS STAGES OF DIASTOLIC DYSFUNCTION
Majority of subjects (18) were in stage II of diastolic dysfunction, out of which, 66.67% were in stage 3; 27.77% were in stage 2 and 5.55% were in stage [4].

Out of 7 subjects of stage I diastolic dysfunction, 57.14% were in stage 2 followed by 42.85% in stage [3].

Out of 6 subjects of stage III diastolic dysfunction, 66.67% were in stage 3, followed by 1 16.66% each in stages 2 and 4 respectively.

Out of 3 subjects of stage IV diastolic dysfunction, 66.67% were in stage 4 followed by 1 33.33% in stage[3].

The p value calculated was 0.01 indicating a significant statistical difference in the subject distribution on the basis of stage of CKD vs. stage of diastolic dysfunction. Most subjects were in stage II diastolic dysfunction.

Table 7: The results of our study were in co-relation with the past studies conducted by Sarnak MJ et al32, Wang AY-M et al33and Levin A et al[34].

Study by	Stage of CKD	Stages of diastolic dysfunction				P-Value
		I	II	III	IV	
Sarnak MJ et al[41]	Stage 2	61 %	25 %	15 %	0 %	0.02
	Stage 3	32 %	67 %	69 %	35 %	
	Stage 4	7 %	8 %	16 %	65 %	

Wang AY-M et al[36]	Stage 2	55 %	33 %	19 %	1 %	0.04
	Stage 3	43 %	63 %	68 %	31 %	
	Stage 4	2 %	4 %	13 %	68 %	
Levin A et	Stage 2	58 %	28 %	17 %	1 %	0.03
	Stage 3	42 %	67 %	67 %	33 %	
	Stage 4	0 %	5 %	16 %	66 %	
Present Study	Stage 2	57.14 %	27.77 %	16.66 %	0%	0.01
	Stage 3	42.85 %	66.67 %	66.67 %	33.33 %	
	Stage 4	0 %	5.55 %	16.66 %	66.67 %	

BMI vs. LVD

Out of 42 subjects with LVD, majority 47.61% subjects were overweight; followed by 33.33% obese subjects and 19.04% subjects were with normal BMI.

Out of 58 subjects without LVD, majority subjects (31.03%) were overweight; followed by 29.31% subjects with normal BMI; 25.86 % subjects were obese and 3.45% subjects were underweight.

The calculated p value was 0.2371 indicating no statistical difference in the distribution of subjects according to BMI vs. LVD.

The results of our study were in co-relation with the past studies conducted by London GM et al44 and Schwarz U et al[45].

SYMPTOMS

Majority subjects were experiencing pedal edema, i.e., 69.04 %; followed by42.85 % subjects with dyspnoea; 33.33 % subjects with chest pain; 11.90 % subjects with palpitation and 9.52 %subjects with vomiting.

The results of our study were in co-relation with the past studies conducted by Cheung AK et al33, Dikow R et al46and Rubin MF et al47

CORRELATION BETWEEN THE GFR AND LVDD STAGES.

The co-relation value was - 0.725 indicating a negative co-relation between GFR and LVD stages which means the LVD stage increase with a decrease in GFR value.P- value was 0.001 indicating a highly significant statistical difference between GFR and LVD stages.

Table 8: The results of our study were in co-relation with the past studies conducted by Sarnak MJ et al41, Wang AY-M et al42and Levin A et al[43].

Study by	Correlation value	P-Value
Sarnak MJ et al[41]	- 0.712	0.001
Wang AY-M et al[42]	- 0.734	0.002
Levin A et al[43]	- 0.756	0.001
Present Study	- 0.725	0.001

SUMMARY

- The present study summarizes the following points:
- Most subjects in the control group were belonging to the age group of 41-50 years (35 %).
- Most subjects were belonging to the stage 3 of chronic kidney disease (50 %).
- Most males were mostly suffering from CKD (62%). Male: female ratio was 1.63:
- LVD was absent in most subjects (58 %). The ratio of LVD absence: presence was 1.38:1
- Majority of CKD subjects with LVD (59.52 %) were in Stage 3; Majority of CKD subjects without LVD (48.27%) were in Stage 2.
- Majority subjects were with diastolic dysfunction (76.19 %), followed by systolic dysfunction (19.04 %) and least with both systolic and diastolic dysfunction (4.76 %).There was a highly significant statistical difference in the subject distribution on the basis of stage of CKD vs. type Left Ventricular Dysfunction (p value: 0.001). Most subjects were suffering from diastolic dysfunction.
- There was no statistical difference in the subject distribution on the basis of stage of CKD vs. severity of systolic dysfunction (p value: 0.185).
- There was a significant statistical difference in the subject distribution on the basis of stage of CKD vs. stage of diastolic dysfunction (p value: 0.01). Most subjects were in stage II diastolic dysfunction.
- There was no statistical difference in the subject distribution on the basis of BMI vs. LVD (p value: 0.2371).
- Majority subjects were experiencing pedal edema (69.04 %); followed by (42.85%) subjects with dyspnoea; (33.33 %) subjects with chest pain; (11.90 %) subjects with palpitation and (9.52 %) subjects with vomiting.
- The co-relation value between GFR and LVD stages was - 0.725 indicating a negative co-relation between GFR values and LVD stages which means the LVD stage increase with a decrease in GFR value.
- There was a highly significant statistical difference between GFR values and LVD stages (p value: 0.001).

CONCLUSION

Left ventricular diastolic dysfunction is more significantly associated with the decline in eGFR than systolic dysfunction in CKD patients. This is found to occur at an earlier stage of CKD, even without LVH. Thus diastolic dysfunction is a much better predictor for cardiovascular mortality. According to our study observations, eGFR has a negative co-relation with LVD and there is a highly significant statistical difference between both. This emphasizes the need for correction of not just hemodynamic factors but also the renal related factors. LV diastolic dysfunction is more, if there is associated hypertension and anaemia. So, early identification and treatment of above conditions can retard the cardiovascular morbidity and mortality. Echocardiography provides a simple, non-invasive investigation that can identify even asymptomatic patients at an earlier stage of CKD. So, earlier screening of CKD patients for LV diastolic dysfunction can be recommended.

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