



FREQUENCY OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN PATIENTS WITH END STAGE RENAL DISEASE ON MAINTENANCE HAEMODIALYSIS

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ABSTRACT

OBJECTIVE: To determine the frequency of Left Ventricular diastolic dysfunction in patients with end stage renal disease on maintenance haemodialysis.

MATERIAL and METHOD: This cross sectional study was conducted in department of cardiology, Sheikh Zayed Hospital, Lahore for six months (From 1st June 2012 to 30th November 2012).

150 patients fulfilling the inclusion criteria were enrolled after informed consent presenting to Haemodialysis Unit, Sheikh Zayed Hospital, Lahore. Two dimensional, M mode, Doppler and color Doppler echocardiography in the left lateral decubitus position, using 3.5 MHz transducer by the researcher was used. Demographic data (age, name, sex, address were noted) and data regarding LV diastolic dysfunction in patients with end stage renal disease on haemodialysis was also recorded. The left ventricular ejection fraction (EF) and fractional shortening (FS) was also measured.

RESULTS: Majority of the patients were between 41-50 years of age i.e. 40% (n=60), mean and standard deviation was calculated as 43.54 ± 6.21 years, 50.67% (n=76) male and 49.33% (n=74) were females. Frequency of diastolic dysfunction in patients with end stage renal disease was 86% (n=129).

CONCLUSION: The frequency of Left Ventricular diastolic dysfunction is high among patients with end stage renal disease on maintenance haemodialysis. So, it is recommended that every patient who is on maintenance haemodialysis, should be sorted out for LV diastolic dysfunction along with systolic dysfunction. However, it is also required that every setup should have their surveillance in order to know the frequency of the problem.

KEY WORDS: End stage renal disease, maintenance haemodialysis, frequency, Left Ventricular diastolic dysfunction

Author's Contribution

AH: Conducted the study and wrote the article. QAS: Helped in conducting the study, did echocardiography and was consultant in charge of the patients and gave frequent advice, corrections and did the proof reading. HB: Re-arranged data and corrected article. SS: consultant in charge of the patients and gave frequent advice, corrections and did the final proof reading. AM: consultant in charge of the patients and gave frequent advice, corrections and did the proof reading also. QMT: Helped in re-arranging data and corrected article. ASM: Tables. WA: Tables and figures. MAR: Helped in analysis of data and typing.

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INTRODUCTION

Cardiovascular complications are the most important cause of death in patients with end stage renal disease (ESRD) on hemodialysis treatment.¹⁻³ The incidence of congestive heart failure is 3-fold greater than that of acute coronary syndrome in hemodialysis (HD) patients.⁴ Diagnosis of congestive heart failure (CHF) with concomitant renal failure presents a particular challenge. The incidence of patients with end-stage renal failure has increased progressively in the past decades.⁵ Patients with end-stage renal disease have three key mechanical contributors to CHF including pressure overload, volume overload, and cardiomyopathy.⁶

Diastolic heart failure is defined as a condition caused by increased resistance to the filling of one or both ventricles.⁷ Common causes of diastolic dysfunction are cardiac ischemia, hypertension, aging, obesity, aortic stenosis while uncommon



causes are Myocardial diseases, Infiltrative disease (e.g. amyloidosis, sarcoidosis, fatty infiltration), Non-infiltrative diseases (e.g., idiopathic and hypertrophic cardiomyopathy), Endomyocardial diseases (Hypereosinophilic syndrome), Storage diseases (Glycogen storage diseases), Pericardial disorders (Constrictive pericarditis, Effusive-constrictive pericarditis, Pericardial effusion).⁷

Diastolic heart failure occurs when signs and symptoms of heart failure are present but left ventricular systolic function is preserved (i.e., ejection fraction greater than 50 percent). The incidence of diastolic heart failure increases with age; therefore, 50 percent of older patients with heart failure may have isolated diastolic dysfunction. With early diagnosis and proper management the prognosis of diastolic dysfunction is more favorable than that of systolic dysfunction.⁷

Echocardiographic abnormalities are common among ESRD patients.⁶ Left ventricular diastolic filling is analyzed from recordings of mitral inflow Doppler velocities. The velocity of the septal and lateral myocardium, which has been shown to reflect the rate of myocardial relaxation, can be recorded with Tissue Doppler Imaging (TDI). Pulmonary vein flow velocities contribute to recognize diastolic dysfunction. Also the left atrial (LA) diameter and volume reflect the burden of left ventricular diastolic filling. Doppler echocardiographic examination is increasingly being used in the evaluation of diastolic dysfunction.⁸ Diastolic dysfunction is present in 30% to 62% of the ESRD patients on hemodialysis.^{9,10}

Most common causes of end stage renal disease (ESRD) in Pakistan are uncontrolled Diabetes and Hypertension.¹¹ Escalation in rates of diabetes, especially type 2 diabetes in Pakistan is posing threats to the economy and quality of life of people due to poor glycemic control and very high rates of complications.¹² Dialysis is an established form of treatment for ESRD. It is a life saving procedure. Transplantation much sought after treatment, gives a good quality of life.¹¹ Improvements in dialysis techniques and associated medical care have resulted in the expansion of dialysis programs in response to the increased number and greater longevity of patients suffering from ESRD.¹³

The rationale of this study was that there are a lot of studies conducted internationally which show variability and no such studies have been done in our setup, so we decided to assess it in our population. Early detection may reduce morbidity and mortality associated with diastolic dysfunction in

end stage renal disease patients on maintenance haemodialysis.

OBJECTIVE:

The objective of study was to determine the frequency of Left Ventricular diastolic dysfunction in patients with end stage renal disease on maintenance haemodialysis.

OPERATIONAL DEFINITION:

LV DIASTOLIC DYSFUNCTION:

LV Diastolic dysfunction in this study was based on one of the following doppler Imaging:

- Stage I was characterized by reduced left ventricular filling in early diastole with normal left ventricular and left atrial pressures and normal compliance; $E/A < 0.8$ and $DT > 200$ m/s.
- Stage II (pseudonormalization) was characterized by a normal Doppler echocardiographic transmitral flow pattern because of an opposing increase in left ventricular diastolic process. $E/A 0.8 - 1.5$, $DT 160-200$ m/s.
- Stage III, the final, most severe stage, was characterized by severe restrictive diastolic filling with a marked decrease in left ventricular compliance. $E/A > 2$, $DT < 160$ m/s.

MATERIAL & METHODS:

This cross sectional study was conducted at Department of Cardiology, Sheikh Zayed Hospital, Lahore for Six months (From 1st June 2012 to 30th November 2012).

Patients with age (18 to 50 years) of both genders with end stage renal disease on maintenance haemodialysis for six months to ten years and sinus rhythm (assessed on ECG) with LV Ejection fraction $> 50\%$ (assessed on echocardiography) were included in the study.

Patients with ischemic heart disease and organic valvular heart disease (confirmed on history and echocardiography) were excluded from the study.

150 patients fulfilling the inclusion criteria were enrolled after informed consent presenting to Haemodialysis Unit, Sheikh Zayed Hospital, Lahore. Two dimensional, M mode, Doppler and colour Doppler echocardiography in the left lateral decubitus position, using 3.5 MHz transducer by the researcher was used. The left ventricular ejection fraction (EF) and fractional shortening (FS) was measured as indices of LV systolic function. This measurement was taken according to American society of echocardiography guideline. Demographic data (age, name, sex, address were noted) and data regarding LV diastolic dysfunction in patients with end stage renal disease on haemodialysis was recorded on proforma attached.



Table 1: Age distribution of the patients (n=150)

Age (in years)	No. of patients	%
18-20	14	9.33
21-30	35	23.33
31-40	41	27.34
41-50	60	40
Total	150	100
Mean and sd	43.54±6.21	

Table 2: Gender distribution of the patients (n=150)

Gender	No. of patients	%
Male	76	50.67
Female	74	49.33
Total	150	100

Table 3: Frequency of LV diastolic dysfunction (n=129)

Diastolic dysfunction	No. of patients	%
Yes	129	86
No	21	14
Total	150	100

Table 4: Frequency of grades of diastolic dysfunction in patients on haemodialysis (n=129)

Grades of Diastolic Dysfunction	No. of patients (n=129)
I	93(72.09%)
II	26(20.16%)
III	10(7.75%)
Total	129(86%)

Table 5: Stratification for age in patients with LV diastolic dysfunction (n=150)

Age (in years)	No. of patients	LV Diastolic Dysfunction (n=129)	
		No. of patients	%
18-20	14	8	57.14
21-30	35	29	82.86
31-40	41	36	87.80
41-50	60	56	93.33
Total	150	129	86

Table 6: Stratification for gender in patients with LV diastolic dysfunction (n=150)

Gender	No. of patients	LV Diastolic Dysfunction (n=129)	
		No. of patients	%
Male	76	60	78.95
Female	74	69	93.24
Total	150	129	86

The data was entered and measured in computer software SPSS (version 11.0). The demographic data (age) was presented as mean ± S.D. Frequency and percentages of LV diastolic dysfunction in patients with end stage renal disease on maintenance haemodialysis and gender were calculated and presented in tabulated form. The stratification for the stages of LV diastolic dysfunction and dura-

Table 7: Stratification for duration of dialysis in patients with LV diastolic dysfunction (n=150)

Duration of dialysis (in years)	No. of patients	LV Diastolic Dysfunction (n=129)	
		No. of patients	%
0.5-1	24	16	66.67%
1-2	39	31	79.49%
2-5	65	64	98.46%
5-10	22	18	81.82%
Total	150	129	86

tion of haemodialysis was also done.

RESULTS:

A total of 150 cases fulfilling the inclusion criteria were enrolled to determine the frequency of Left Ventricular diastolic dysfunction in patients with end stage renal disease on maintenance haemodialysis.

Age distribution of the patients was recorded, which showed that majority of the patients were between 41-50 years of age i.e. 40%(n=60), 27.34%(n=41) were between 31-40 years, 23.33%(n=35) were between 21-30 years and only 9.33%(n=14) were between 18-20 years of age, mean and SD was calculated as 43.54 ± 6.21 years. (Table No.1)

Regarding gender distribution the 50.67%(n=76) were male patients and 49.33%(n=74) were female patients.(Table No. 2).

Frequency of diastolic dysfunction in patients with end stage renal disease revealed 86 % (n=129) while 14 % (n=21) had no findings of diastolic dysfunction. (Table No. 3)

Frequency of grades of diastolic dysfunction in patients on haemodialysis was recorded which showed 93 (72.09%) with Grade-I, 26 (20.16%) with Grade-II and 10 (7.75%) with Grade-III out of 129 cases. (Table No. 4)

Stratification for age in patients with LV diastolic dysfunction showed 8 (57.14%) out of 14 cases between 18-20 years, 29 (82.86%) out of 35 cases were between 21-30 years, 36 (87.80%) out of 41 cases were between 31-40 years, 56 (93.33%) out of 60 cases were between 41-50 years of age. (Table No. 5)

Stratification for gender in patients with LV diastolic dysfunction revealed 60 (78.95%) out of 76 males, and 69 (93.24%) out of 74 females. (Table No. 6)

Stratification for duration of dialysis in patients with LV diastolic dysfunction reveals 16 (66.67%) out of 24 cases had 0.5-1 year of duration of dialysis, 31 (79.49%) out of 39 were between 1-2 years of duration, 64 (98.46%) out of 65 cases



were between 2-5 years of duration, 18 (81.82%) out of 22 cases were between 5-10 years of duration of dialysis. (Table No. 7)

DISCUSSION:

Cardiovascular disease is a major cause of renal insufficiency, but conversely, renal insufficiency itself contributes to cardiac pathology in several ways. At least half of all the patients starting dialysis therapy have overt cardiovascular disease.¹⁴ Chronic pressure and volume overload leads to left ventricular (LV) remodelling, with the development of a concentric or eccentric LV geometry and LV hypertrophy. The prevalence of LV hypertrophy increases with progressive renal insufficiency¹⁵ to about 75% in dialysis patients.¹⁶⁻¹⁷

We planned this study with the view to determine the frequency of Left Ventricular diastolic dysfunction in patients with end stage renal disease on maintenance haemodialysis, as there are a lot of studies conducted internationally which showed variable results while local data is lacking. The benefit of the study is to create awareness of early detection which may help in reducing morbidity and mortality associated with diastolic dysfunction in end stage renal disease patients on maintenance haemodialysis.

Recently, it has been demonstrated that LV diastolic dysfunction provides independent and additional prognostic value for long-term mortality and cardiovascular deaths in patients with end-stage renal disease, above and beyond that of LVH and LVEF.⁹

In our study, the frequency of diastolic dysfunction in patients with end stage renal disease was 86%(n=129). These results are broadly in agreement with a study showing that diastolic dysfunction is present in 62% of the ESRD patients on hemodialysis,¹¹ as most of the cases in our study were chronic. Late induction of the haemodialysis and presentation with significantly raised creatinine are the possible reasons for increased frequency of LV diastolic dysfunction.

Results were further stratified for age, gender and duration of haemodialysis which showed increased frequency of LV diastolic dysfunction with an increase in age, duration of dialysis and somewhat more prevalence in females. The com-

parison of these findings with other studies cannot be done due to the reason that other studies did not stratify the data like us. However, the data of the study may be considered as primary which needs further local trials for its confirmation.

Our results were also stratified according to grading and duration of dialysis which showed that duration of dialysis is an independent factor of grading of LV diastolic dysfunction and it may be found out with its severe form i.e. grade III, even in shorter duration of haemodialysis, also these findings were also in agreement with a study conducted by Rudhani et al who assessed left ventricular and right ventricular diastolic function in patients on haemodialysis and the correlation with the duration of haemodialysis revealed that LV diastolic dysfunction had no correlation with the duration of haemodialysis.⁹

Considering the above mentioned studies showing agreement with the results of current study, we suggest that early detection may help in improving treatment and reduce morbidity and mortality associated with diastolic dysfunction in end stage renal disease patients on maintenance haemodialysis.

Regarding limitation of the study, we did not evaluate the volume status of study patients before and after HD treatment with the objective methods (like evaluation of weight gain) and it is possible that some patients on hemodialysis continued to have significant fluid overload even after HD treatment. Secondly, we did not know the predialysis diastolic dysfunction of the patients and it is possible that some patients on hemodialysis have predialysis diastolic dysfunction

These limitations may be avoided in further trials to strengthen the results of the current study.

CONCLUSION:

The frequency of Left Ventricular diastolic dysfunction is high among patients with end stage renal disease on maintenance haemodialysis. It is recommended that every patient who presents on maintenance haemodialysis, should be investigated for LV diastolic dysfunction along with systolic dysfunction and treated appropriately. It is also required that every centre should have their own surveillance in order to know the frequency of the problem.



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