

Significance of LA Volume in Cardiac Patients with Diastolic Dysfunction and Renal Failure and their LV Measurements

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ABSTRACT

Objective: Left atrial size and volume is significant clinical tool for testing diastolic function and chronicity of diastolic dysfunction by echocardiography. It involves measuring diameter in end systole internally and LA volume by prolate ellipse method.

Study Design: Cross-sectional study.

Place and Duration of Study: This study was conducted at the Department of Cardiology, Shaikh Zayed Hospital Lahore from July 2018 to December 2018.

Materials and Methods: One hundred and forty seven renal failure patients from both genders within an age group of 15-75 years were undergone echocardiography. The related clinical history and findings were recorded.

Results: There were 76 males and 71 females. The data analysis suggested that mean LA size was highest 38.35 in patients >50 years of age. Highest left ventricle ejection fraction (mean 69) and LV mass (mean 173) was presented in 31-40 years of age group. The greatest mean LA size (41.7±3.93) was noticed in severe graded patients.

Conclusion: The LV measurements showed that 41-50 years of age was most vulnerable for abnormal echocardiographical findings and The LA measurement is the HbA1C% of diastolic dysfunction.

Key Words: Ejection fraction, LV diameter, End stage renal failure, LA volume

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INTRODUCTION

There is a major burden of deaths caused by heart diseases and renal failure all over the globe. The prevalence of cardiac arrests is very high in developing countries due to multiple reasons including comorbidities, late diagnosis and unhealthy lifestyle.¹ Left atrial (LA) size is an independent predictor of cardiovascular events such as congestive heart failure, myocardial infarction, atrial fibrillation, stroke, and cardiovascular death.² Three commonly used methods for evaluation of LA volume are the biplane area length (AL), the biplane modified Simpson (SIMP), and the prolate ellipse (PE) methods. Each mathematical calculation assumes the LA to be a fixed shape, which may result either in over- or underestimation of true volume.³ The standard and most suitable reporting method of LA size is through measuring internal

diameter in end systole and LA volume by prolate ellipse method in echocardiographic patients.² It has a high significance in diagnosis of cardiac complications and their prognostic status^{1,4,5} In few cases such as valvular cardiac diseases the LA dimensions are very important in critical identifying and managing the schedule of surgical intervention.⁶⁻⁸ Overall LA measurements are an efficient and simple method for assessing cardiac dysfunctioning.⁹⁻¹¹ The left atrial diameter measurements can easily be gained at the time of Echocardiography/LVEF measurements. Past studies has proven the significance of LA and LV measurements and size in respect to cardiac morbidities. The increased left ventricle end systolic diameter is directly associated with higher frequency of cardiac failure.¹⁰ There is a strong association between LV diastolic function and heart failure. The conventional electrocardiographic measurements and radiography of chest are not sufficient for diagnosing LV diastolic dysfunction. The more appropriate method of diagnosis becomes echocardiography for attaining LV measurements and diagnosis of LV diastolic dysfunction.

The present study focuses on assessing the reliability of LA measurements during echocardiographic examine and also gradating the values of LA measurements in different age groups by categorizing them on the basis of LA dilation. This study is conducted for better diagnosis and early identification of issues with cardiac

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complications involving left ventricle dysfunction and to minimize the rate of cardiac mortalities related with late and inefficient diagnosis.

MATERIALS AND METHODS

This cross-sectional study conducted at Cardiology Department of Sheikh Zayed Hospital, Lahore from 31st July 2018 to 31st December 2018. The study included 147 patients from both genders. The age of the patients was <18 years upto 65 years. . Known cases of ischemic heart disease (confirmed on history and echocardiography) and known cases of organic valvular heart disease (confirmed on history and echocardiography) were excluded from this study. The patients having end stage renal failure and with LVEF greater than 50% were included in this study. The study was approved from Ethical Board of hospital. A written informed consent was taken from each participant before enrolling in this study. The information regarding demographic, clinical history was entered on a well prepared questionnaire by interviewing the patients. The most important variables included age, gender, LV measurements (LVIDD, LVPW, LV MASS and LA size). The data was entered and analyzed by using SPSS version 21. The formula used for measuring LA volume by the prolate ellipse (PE) method is L/A volume = 0.523× D1×D2×D3.

RESULTS

The left ventricle (LV) measurements were taken through echocardiograms of 147 patients having disturbed diastolic dysfunction. The echocardiogram reading contained two dimensional measurements, Doppler scan and M. Mode modalities. The minimum age of patients was <18 years while 53 patients were such which belonged to an age group >51 years. This group also had highest number of patients enrolled. An increasing patient’s frequency could be clearly noticed with increasing age (Table 1). In present study it was noticed that more male were admitted in cardiology department than females in relevance with cardiac diseases. Out of 147 patients 51.7% were males (Table 2).

Each enrolled patient was assessed for their diastolic functioning by echocardiographic reporting. The different left ventricle measurements showed that there was no significance difference among LVIDD of different age groups. However mean LVIDS was highest in 31-40 years patients while and IVS was highest in 41-50 years of patients. The LV mass also showed an increasing trend with increasing age with highest value recorded in 31-40 years patients. The LA size was greatest in patients above 50 years of age (Table 3).

The grading of diastolic dysfunction was as unchanged, mild, moderate, and severely abnormal. LA volume has no direct association with grading of diastolic dysfunction. However it was recorded that duration of diastolic dysfunction had a direct correlation with LA volumes and also had significant association with age, however 18-20 years of age showed higher LA volume with a history of ± two years of hemodialysis. There were 53 cases who were having normal LA volume, 39 cases who were having mild LA volume, 32 cases having moderate LA volume and 23 cases of severe LA volume Table 4.

Table No.1: Age distribution of the patients (n=147)

Age (years)	No.	%
<18	3	2.04
18-20	5	3.4
21-30	20	13.6
31-40	19	12.92
41-50	47	31.97
>51	53	36.05
Mean±SD	45.98±6.43	

Table No.2: Gender distribution of the patients (n=147)

Gender	No.	%
Male	76	51.7
Female	71	48.29

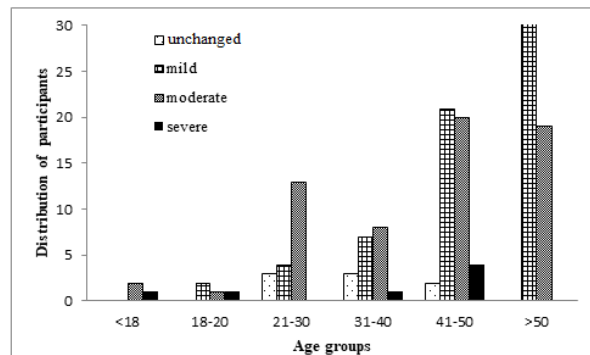


Figure No. 1: Frequency of diastolic dysfunction grade according to age

An association of age with grading (normal, mild, moderate or severe) of diastolic dysfunction was compared for better understanding of its effects. Majority of participants had mild diastolic dysfunction grade while 41-50 years of age was most vulnerable age with highest number of moderate and diastolic dysfunction grade cases. The severe diastolic dysfunction grade was also presented in two patients with a very young age (Fig. 1).

The LV grading showed that mean LV mass was highest in mild graded patients while LA size was highest in severe graded patients. Left ventricle ejection fraction was insignificantly changed between mild and moderate diastolic dysfunction grades with lowest mean value of severe graded cases (Table 5).

Table No. 3: Stratification of LV measurements according to age (n=147)

LV measurement	Age (years)					
	<18 (n=3)	18-20 (n=5)	21-30 (n=20)	31-40 (n=19)	41-50 (n=47)	>50 (n=53)
LVIDD	47±7.55	47.13±5.643	45.65±7.72	46.47±6.74	45.98±6.43	45.34±6.33
LVIDS	24.67±19.42	28.88±11.76	29.70±7.09	31.65±6.84	30.32±6.85	31.04±6.43
IVS	11.00±1.00	11.00±3.46	11.45±1.95	12.47±1.90	15.51±19.97	12.72±2.29
LVPW	12.00±3.60	10.75±2.60	11.00±1.74	12.00±1.90	12.30±1.66	12.11±1.62
LVEF	62.00±20.78	65.13±14.50	67.50±14.75	69.00±9.50	68.57±10.34	65.49±8.52
FS	28.67±11.93	31.25±9.49	33.60±5.09	33.65±5.75	33.30±6.32	37.40±41.20
LV mass	144.33±16.01	129.86±19.11	146.68±37.30	173.59±35.40	165.86±39.19	170.11±39.34
LA size	36.67±3.05	32.43±5.85	35.05±6.14	36.82±5.19	37.89±3.95	38.25±4.94

Table No.4: Comparison of age with LA volume and hemodialysis duration

Age (years)	LA volume	Hemodialysis duration
<18	25.53±9.76	2.00±1.15
18-20	30.75±16.20	2.80±2.49
21-30	32.19±17.37	3.81±2.54
31-40	29.40±10.69	3.84±3.04
41-50	33.81±10.36	4.06±2.74
>51	33.59±10.33	4.39±2.89

Table No. 5: The mean LV measurements in different LV grades

Diastolic dysfunction grade	LV Measurements							
	43±2.8	31.5±4.9	12±1.4	13.5±0.7	72±24	28±5.6	165.5±3.5	34±5.6
Unchanged	43±2.8	31.5±4.9	12±1.4	13.5±0.7	72±24	28±5.6	165.5±3.5	34±5.6
Mild	45.19±6.2	29.35±6.3	12.90±2.2	12.32±1.8	67.54±11.1	33.46±5.4	169.46±43.6	37.31±4.7
Moderate	46.7±7	31.5±7.3	12.0±2.1	11.8±1.6	68.4±9.9	32.9±6.1	155.5±32.9	37.3±5.4
Severe	49.5±5.4	36.8±6.1	12.5±2.07	10.8±2.2	61.7±8.35	29.0±3.4	159.5±21.2	41.7±3.93

DISCUSSION

Precise assessment of LA volumes is fundamental cardio logical practice, the present study suggests that LA size is an independent factor of LVEF and is strongly associated with diastolic dysfunction in renal impaired patients. The demographic variables of patients showed a significant number of males affected by cardiac complications than females. Another study also found a significant correlation between male gender and LV diastolic dysfunction with almost 50% men affected.¹²

St. John Sutton et al¹³ have proven that declined ejection fraction has a direct association with increased incidence of heart failures. The present study analyzes diastolic dysfunction as an independent factor for heart failure in patients with preserved ejection fractions. This study reports that increasing age had more cases of patients with diastolic dysfunction and renal impairment with a mean age as 34.54±6.21. A study elsewhere has also reported similar findings with a mean age of patients as 48±13 years as mean age. More men might be affected due to their hectic workloads and lifestyle disparities.

Left atrial volume is most reliable method in measuring LA diameters and represents the true picture of duration of diastolic dysfunction. If the duration of diastolic dysfunction is longer than LA volume will represent more severity in volumetric size. Left atrial volume is most reliably measure by prolate ellipse method as used in present study. Ujino et al¹⁴ also shown that ellipsoid method is based on three different diameters and can be characterized as prolate ellipse methods. This method is

most frequently used for better representation of LA volume.¹⁵

An evident cross sectional association can be reported between age and diastolic dysfunction depending upon left ventricle dilation grades. Aging declines diastolic dysfunction as reported in international studies.¹⁶⁻¹⁸ Diastolic function measurements attained by echocardiography shows almost 7% of patients > 45 years to have diastolic dysfunction between moderate to severe grades¹⁹⁻²¹, however in present study patients above 41 years had more chances of having severe diastolic dysfunction than patients above 50 years who had mild to moderate diastolic dysfunction.

CONCLUSION

The LA measurement is the HbA1C% of diastolic dysfunction and is more reliable in identifying diastolic dysfunction. The LA size increased with increase in age while LV mass has an independent significance irrelevant of age.

Author's Contribution:

Concept & Design of Study: Abubakar Hilal
 Drafting: Qazi M. Tufail
 Data Analysis: Rida Fatima,
 Qazi Abdul Saboor and
 Revisiting Critically: Abdubakar Hilal,
 Qazi M. Tufail
 Final Approval of version: Abubakar Hilal

Conflict of Interest: The study has no conflict of interest to declare by any author.

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