

Frequency of Asymptomatic Left Ventricular Systolic Dysfunction in High Risk Patients Presented in Gulab Devi Hospital Lahore

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ABSTRACT

Objective: The objective of this study is to determine the frequency of asymptomatic left ventricular systolic dysfunction in high risk patients.

Study Design: Cross sectional survey **Setting:** The study was conducted in the Department of Cardiology, Gulab Devi Hospital, Lahore. **Methodology:** 150 patients aged more than 50, who do not have signs and symptoms of heart failure like dyspnea on exertion, orthopnea and PND and having any 2 or more of these risk factors, Diabetes mellitus, Hypertension, IHD and Obesity were selected for this study. Each patient was asked about age, sex, diabetes mellitus, hypertension and symptoms of heart failure. Height and weight was checked and BMI was calculated in every patient. 6 minute walk test was done in every patient to rule out dyspnea on exertion. Echocardiography was performed in OPD of cardiology department. Left ventricular (LV) ejection fraction (EF) less than 50% was taken as LV systolic dysfunction.

Results: The mean age of the patients was 57.5 ± 7.04 years. There were 24 (16%) patients who had ejection fraction less than 50% and they were labeled as having left ventricular systolic dysfunction. Among these, 09 (06%) patients had ejection fraction less than 40%. Only 32 patients had ischemic heart disease, 16 of these (50%) had ALVSD. This is the highest frequency of ALVSD amongst the different risk factor groups.

Conclusion: In view of our results, we conclude that ischemic heart disease, diabetes mellitus, hypertension and obesity are important risk factors for the development of ALVSD. The frequency of ALVSD rises proportionately with increasing number of risk factors. Multiple risk factors have cumulative effect in the causing left ventricular systolic dysfunction

Keywords: Asymptomatic, Ejection fraction, High risk, Preventive Medicine, Public Health, Systolic dysfunction

INTRODUCTION

Congestive cardiac failure is a major public health problem, causing substantial morbidity and mortality in the later decades of life. The risk of heart failure rises with increasing age, with rates doubling every 10 years among older adults.^{1,2} According to one estimate the 5-year risk of heart failure among 40-year-old white persons is only 0.1 to 0.2%.³ The prevalence of HF is high in blacks than other races, and they present with symptoms of heart failure at younger ages.⁴ The reason for this high incidence of heart failure among blacks is not fully understood. May be this is due to the higher burden of risk factors such as hypertension and genetic predisposition to cardiomyopathy in blacks.⁵ Many patients who go on to develop heart failure pass through a phase in which they have significant systolic dysfunction but lack clinical symptoms and signs; so called asymptomatic left ventricular systolic dysfunction (ALVSD).^{6,7} Patients with ALVSD have an increased risk of heart failure (HF) and a worse life expectancy.⁷ Estimated prevalence of Asymptomatic left ventricular systolic dysfunction is 3% to 6%, and is at least as common in the community as systolic heart failure. AS it often occurs in the absence of known cardiovascular disease, this condition may go unrecognized and undertreated. Early diagnosis and treatment of ALVSD can decrease its substantial morbidity and mortality.^{7,8} Prevalence, determinants and prognostic value of ALVSD, yet are not fully known. Different studies have shown prevalence of 0.9%-12.9% depending on clinical characteristics of the population and EF values used to define ALVSD. This study was designed to detect ALVSD early. As HF is a very common problem in the community. This study is to determine the frequency of asymptomatic left ventricular systolic dysfunction in high risk patients. If we are able to detect this pre failure stage, we can prevent the development of overt heart failure.

Operational Definitions:

Left ventricular systolic dysfunction: It means left ventricular ejection fraction <50 % on 2-D echocardiography.

Asymptomatic high risk patients: Patients >50 years, who do not have signs of heart failure like dyspnea on exertion (on 6

minute walk test), symptoms of heart failure like orthopnea and paroxysmal nocturnal dyspnea and having any two or more of the risk factors; diabetes mellitus, hypertension, Ischemic heart disease, obesity

Ischemic Heart Disease: It will be diagnosed on ECG if any one of the following is present: T-wave inversion or Q-waves in two consecutive leads, Loss of R-wave in chest leads.

Diabetic: Previously diagnosed patients or the patients who have random blood sugar >200 mg/dl on more than two occasions.

Hypertensive: Previously diagnosed patients or the patients who have systolic blood pressure >140 and/or diastolic blood pressure > 90 mmHg on two or more occasions.

Obese: Patients having BMI >28 kg/m²

MATERIALS AND METHODS

Design & Setting: This cross sectional study was conducted in the Department of Cardiology, Gulab Devi Hospital, Lahore.

Sample Selection: Using non probability sampling a calculated sample of 150 new and follow up asymptomatic high risk patients as per operational definition (with 95% confidence level 7.5% margin of error and taking expected percentage of asymptomatic left ventricular systolic dysfunction 27% in high risk patients presenting to tertiary care hospital) was taken. Patients having acute myocardial infarction (excluded on basis of raised cardiac enzyme, troponin T level >0.1 ng/ml), patients of valvular heart disease (excluded on echocardiography), patients of dilated cardiomyopathy (excluded on echocardiography) were excluded

Data collection procedure: Demographic information like age, sex and address were obtained. The relevant information regarding number and type of risk factors (diabetes, hypertension, ischemic heart disease, obesity) were recorded in each patient. Each patient was asked about the symptoms of heart failure such as dyspnea on exertion, orthopnea and paroxysmal nocturnal dyspnea. 6 minute walk test was done in every patient to rule out dyspnea on exertion. All the patients were underwent echocardiography on TOSHIBA NIMEO 30 CW PW Colour Doppler 2-D Echo by a senior cardiologist with special interest in

echocardiography. Long-axis left parasternal and apical four chamber views were taken. Left ventricular end-systolic and end-diastolic dimensions (LVESD & LVEDD) were measured on M-mode. Ejection fraction (EF) was measured by calculating ratio of stroke volume to left ventricular end diastolic volume (LVEDV). Simpson's method was used for calculating EF in patients with regional wall motion abnormalities to avoid equivocal results. Left ventricular (LV) ejection fraction (EF) less than 50% was taken as LV systolic dysfunction. All the data was gathered on a specifically designed proforma

Data Analysis Procedure: All the data was entered in SPSS version 10 and analyzed through its statistical program. Quantitative variables like age were presented as means and standard deviations. Data was stratified according to two or more than two (2, or >2) risk factors. Presence or absence of asymptomatic left ventricular systolic dysfunction was presented by calculating frequencies and percentages.

RESULTS

The mean age of the patients was 57.5±7.04 years. There were 113 (75.3%) patients in the age range of 51-60 years, 34 (22.7%) patients in the age range of 61-70 years, 2 (1.3%) patients of age range of 71-80 years and 1 patient (0.7%) in the age range of 80-90 years. There were 34 (22.7%) male patients and 116 (77.3%) female patients. They were defined as obese. Ischemic heart disease was present in 32 (21.3%) patients, diabetes mellitus was present in 86 (57.3%) patients, hypertension in 140 (93.3%) and obesity was present in 100 (66.7%) patients. There were 96(64%) patients who had only two risk factors and 54(36%) patients in whom more than 2 risk factors were present. Out of 32 patients, 16 (50%) patients of ischemic heart disease were having LVSD. Among 86 patients with diabetes, there were only 13(15%) patients who were having LVSD. Figure.01 and Figure.02 shows distribution of patients according to the ejection fraction. There were 24 (16%) patients who had ejection fraction less than 50% and they were labeled as having left ventricular systolic dysfunction. Among these, 09 (06%) patients had ejection fraction less than 40% and rest 124 patients were having ejection fraction >50%

Table 1: Baseline Characteristics

Age (mean ± S.D) in years	57.5± 7.04
Gender n(%)	
Males	34 (22.7%)
Females	116 (77.3%)
Risk Profile n(%)	
Obese	100 (66.6%)
Hypertensive	140 (93.3%)
Diabetic	86 (57.3%)
Ischemic Heart Disease	32 (21.3%)
Patient with 2 risk factors	96 (64%)
Patient with > 2 risk factors	54 (36%)

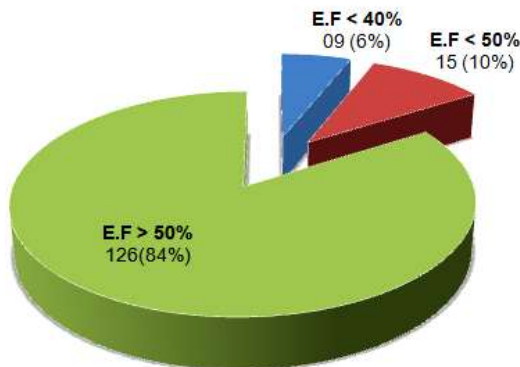


Figure 1: Distribution of Patients on the Basis of Ejection Fraction

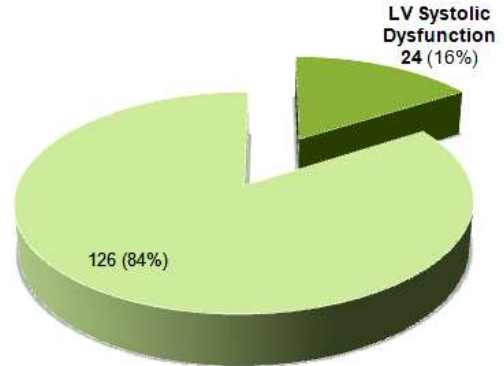


Figure 2: Frequency of Left Ventricular Systolic Dysfunction

DISCUSSION

Asymptomatic left ventricular systolic dysfunction is poor prognostic marker. Patients with ALVSD showed 9 times higher admission rate over six years.⁹ ALVSD increases with age and is more prevalent in men than in women.^{10,11} In this study most of the patients were between 50 to 60 years of age with a mean age of 57.5±7.04 years. Most of the patients were female (77.3%) and this might have adversely affected my results as ALVSD is more common in male population. In previous studies ALVSD was twofold to eightfold higher in men than in women.¹⁰ These differences can be due to differences in population, sampling techniques and distribution of risk factors.

Mean ejection fraction in our study was 51±2.5%. Different studies have used different cut off values of ejection fraction for defining ASLVSD. In four different studies, 70-90% of cases had ejection fraction between 40-54%.¹¹⁻¹⁴ However in this study patient with ejection fraction greater than 50% were also included. In present study only those patients were included who had at least two risk factors. Hypertension was the most common risk factor (93.3%) present in this sample followed by obesity (66.7%), diabetes (57.3%) and then ischemic heart disease (21.3%). It is important to note that ischemic heart though least common in this sample is very important risk factor for ALVSD.¹⁵ There were 54 patients who had greater than two risk factors. Among these 54 patients, 13(24.07%) had ALVSD. This may be representing a cumulative effect of risk factors.

Hypertension is an important risk factor for congestive heart failure.⁹ In my study 140 out of 150 patients (93.3%) were hypertensive. 22 out of 140 patients i.e.15.7% of hypertensive patients had ALVSD. In study conducted by Paolo Verdecchia et al, ALVSD was found in 3.6% of subjects with essential hypertension.⁹ The difference in frequency of ALVSD is because they did not include patients with ischemic heart disease.

Diabetes is associated with decreased systolic and diastolic function.¹⁶ Diabetic cardiomyopathy has been related to microangiopathy, autonomic dysfunction, defective calcium transport, structural changes in cellular proteins and collagen deposition.¹⁷ In our study, out of 86 patients having diabetes, 13 patients (15.11% of diabetics) had ALVSD. In general population about 0.3-0.5% of people has both heart failure and diabetes.¹⁸ In study conducted by Davis RC et al 21 patients (10.09%) out of 208 had asymptomatic left ventricular dysfunction.¹⁵ Higher frequency in our study can be attributed to other risk factors overlapping with diabetes.

Only 32 patients had ischemic heart disease, 16 of these (50%) had ALVSD. This is the highest frequency of ALVSD amongst the different risk factor groups. Davis RC et al also showed that previous myocardial infarction was the most powerful predictor of left ventricular dysfunction.¹⁵ Patients with ischemic heart disease should therefore be treated more aggressively.

Among 150 patients, 100(66%) patients had BMI >28. Obesity is a risk factor for ischemic heart disease, diabetes and

hypertension. In one study it was shown that obese patients had normal left ventricular ejection fraction compared with non-obese patients but decreased longitudinal and radial systolic myocardial peak velocities and early diastolic peak velocity.¹⁹ The results in our study are contrary to this study. In our study, 12 patients (12%) out of 100 obese patients had ALVSD. This might be attributable to other concomitant risk factors present along with obesity.

Our study had two noticeable limitations. The first was the small population but still the results are in accordance with the published international literature. Second, that diastolic dysfunction was not studied along with systolic dysfunction. Diastolic dysfunction can occur alone or along with systolic dysfunction. Importance of diastolic dysfunction is especially more in female patients and diabetic population because it is more common in these patient groups.^{10,17} In future studies diastolic dysfunction should also be studied as it is associated with higher mortality.²⁰

In our study, we noted that as there is accumulation of risk factors for LVSD, the frequency of ALVSD increases proportionately. Frequency of ALVSD was 11% in patients with 2 risk factors, while it is 24% in patients with more than 2 risk factors. Guidelines should be developed for screening patients having multiple risk factors for ALVSD based on further studies. In general, it can be advocated that every asymptomatic patient having more than two risk factors for LVSD should be screened for ALVSD.

Asymptomatic left ventricular dysfunction is a progressive disorder even without recurrent myocardial injury¹⁴⁶. Early detection of cases with ALVSD followed by early treatment may reduce the risk for congestive cardiac failure.

CONCLUSION

In view of our results and several other research workers, we conclude that ischemic heart disease, diabetes mellitus, hypertension and obesity are important risk factors for the development of ALVSD. The frequency of ALVSD rises proportionately with increasing number of risk factors. Multiple risk factors have cumulative effect in the causing left ventricular systolic dysfunction. More risk factors like smoking, atherosclerosis and cerebrovascular disease should be studied in double blind clinical trials. Diastolic dysfunction is associated with ALVSD. It should be sought in all patients with ALVSD.

There is emerging need to develop other non-invasive methods for screening patients with systolic dysfunction which can be employed effectively and have a good sensitivity and specificity. More emphasis is to be made on life style modifications. Every effort should be made to control modifiable risk factors. For this purpose, patient education through clinical seminars, public health awareness programs and electronic media should be made.

REFERENCES

1. Kannel WB. Incidence and epidemiology of heart failure. *Heart Fail Rev* 2000;5:167-73.
2. Rosamond W, Flegal K, Furie K, Alan G, Greenlund K, Haase N, et al. Heart disease and stroke statistics--2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2008; 117: e25-e146.
3. Lloyd-Jones DM, Larson MG, Leip EP, Beiser A, D'Agostino RB, Kannel WB, et al. Lifetime risk for developing congestive heart failure: the Framingham Heart Study. *Circulation* 2002;106:3068-72.
4. Hunt SA, Abraham WT, Chin MH, et al. ACC/AHA 2005 Guideline Update for the Diagnosis and Management of Chronic Heart failure in the Adult. *Circulation* 2005; 112: e154- 35.
5. Schocken DD, Benjamin EJ, Fonarow GC, Krumholz HM, Levy D, Mensah GA, et al. Prevention of heart failure: a scientific statement from the American Heart Association Councils on Epidemiology and Prevention, Clinical Cardiology, Cardiovascular Nursing, and High Blood Pressure Research; Quality of Care and Outcomes Research Interdisciplinary Working Group; and Functional Genomics and Translational Biology Interdisciplinary Working Group. *Circulation* 2008;117:2544-65.
6. Grewal J, McKelvie RS, Persson H, Tait P, Carlsson J, Swedberg K, et al. Usefulness of N-terminal pro-brain natriuretic peptide and brain natriuretic peptide to predict cardiovascular outcomes in patients with heart failure and preserved left ventricular ejection fraction. *Am J Cardiol* 2008; 102: 733-7.
7. Tarantini L, Pulignano G, Oliva F, Alunni G, DiLenarda A. Prevention, a primary objective according to the last revision of the European Society of Cardiology guidelines on chronic heart failure: is it possible to intervene early in high-risk patients? *Ital Heart J Suppl* 2005 ; 6:716-9.
8. Hedberg P. Left Ventricular Systolic Dysfunction in 75-year-old Men and Women: A Community-based Study of Prevalence, Screening and Mitral Annulus Motion for Diagnosis and Prognostics. [online] 2005 [cited 2009 Mar 18]. Available from: URL: <http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-5793>
9. Verdecchia P, Angelis F, Gattobigio R, Sardom M, Porcellati C. Asymptomatic left ventricular systolic dysfunction in essential hypertension: prevalence, determinants and prognostic value. *Hypertension* 2005; 45: 412-8.
10. Wang TJ, Levy D, Benjamin EJ, ScM, Vasan RS. The Epidemiology of "Asymptomatic" Left Ventricular Systolic Dysfunction: Implications for Screening. *Ann Intern Med* 2003; 138:907-16.
11. McDonagh TA, Morrison CE, Lawrence A, Ford I, Tunstall-Pedoe H, McMurray JJV, et al. Symptomatic and asymptomatic left-ventricular systolic dysfunction in an urban population. *Lancet* 1997 ;350: 829-33.
12. Devereux RB, Roman MJ, Paranicas M, Lee ET, Welty TK, Fabsitz RR, et al. A population-based assessment of left ventricular systolic dysfunction in middle-aged and older adults: the Strong Heart Study. *Am Heart J* 2001;141:439-46
13. Devereux RB, Bella JN, Palmieri V, Oberman A, Kitzman DW, Hopkins PN, et al. Left ventricular systolic dysfunction in a biracial sample of hypertensive adults: The Hypertension Genetic Epidemiology Network (HyperGEN) Study. *Hypertension* 2001;38:417-23.
14. Davies M, Hobbs F, Davis R, Kenkre J, Roalfe AK, Hare R, et al. Prevalence of left-ventricular systolic dysfunction and heart failure in the Echocardiographic Heart of England Screening study: a population based study. *Lancet* 2001;358:439-44.
15. Davis RC, Hobbs FDR, Kenkre JE, Roalfe AK, Hare R, Lancashire RJ, et al. Prevalence of left ventricular systolic dysfunction and heart failure in high risk patients: community based epidemiological study. *BMJ* 2002; 325: 1156.
16. Mishra TK, Rath PK, Mohanty NK, Mishra Sk. Left ventricular systolic and diastolic dysfunction and their relationship with microvascular complications in normotensive, asymptomatic patients with type 2 diabetes mellitus. *Indian Heart J* 2008; 60:548-53.
17. Hameedullah, Faheem M, Bahadar S, Hafizullah M, Najeeb S. Effect of glycaemic status on left ventricular diastolic function in normotensive type 2 diabetic patients. *J Ayub Med Coll* 2009; 21.
18. MacDonald MR, Petrie MC, Hawkins NM, Petrie JR, Miles Fisher, McKelvie R et al. Diabetes, left ventricular systolic dysfunction and chronic heart failure. *Eur Heart J* 2008; 29:1224-40.
19. Santos JL, Salemi VM, Picard MH, Mady C, Coelho OR. Subclinical Regional left Ventricular Dysfunction in Obese Patients with and without Hypertension or Hypertrophy. *Obesity* 2010.
20. Redfield MM, Jacobsen SJ, Burnett JC Jr, Mahoney DW, Bailey KR, Rodeheffer RJ. Burden of systolic and diastolic ventricular dysfunction in the community: appreciating the scope of the heart failure epidemic. *JAMA* 2003; 289:194-202.