

ASSESSMENT OF LEFT VENTRICULAR FUNCTION IN ISCHEMIC STROKE PATIENTS

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ABSTRACT

INTRODUCTION: Left ventricular dysfunction is associated with cardiovascular mortality. Its association with ischemic stroke has been mainly documented after myocardial infarction. But if the LV dysfunction is assessed in ischemic stroke patients prior to MI, cardiovascular complications such as overt heart failure, sudden cardiac death can be prevented. The prognosis of LV dysfunctional ischemic patients can be improved. Hence the aim and objectives is to assess left ventricular function in patients with ischemic stroke and to determine whether left ventricular dysfunction could be a surrogate marker for in hospital mortality in patients with ischemic stroke.

METHODS: LV function was assessed by transthoracic 2-dimensional echocardiography in all study population of ischemic stroke patients. Sample size calculated is 94. LV ejection fraction (a measure of LV systolic function) was measured and categorized as Normal (>50%), Mild LV dysfunction (41%-50%) Moderate LV dysfunction (31%-40%) and Severe LV dysfunction (<30%). LV diastolic dysfunction was categorized into three grades based on mitral flow velocities and filling time.

RESULTS: In our study LVSD was observed in 20 ischemic stroke patients (21.27%). Diastolic dysfunction was observed among 21 stroke patients (22.3%). Smoking was one of the most common risk factor observed among the ischemic stroke patients (43.6%). Diabetes mellitus was present in 45% of LVSD patients (P= 0.004). CAD was present in 66.66% of LVSD patients (P=0.003). LVSD was observed in 2 in hospital mortality patients (P=0.287).

DDF was observed in 5 in hospital mortality patients (P=0.008).

CONCLUSION: Early assessment of LV dysfunction can help in management and improvement of prognosis in ischemic stroke patients. The use of Anti heart failure drugs and Ventricular remodeling drugs such as ACE Inhibitors, ARBs, and beta blockers can prevent cardiovascular complications in such ischemic stroke patients. Further study and analysis is needed to determine whether LV diastolic dysfunction is a causative factor for mortality.

KEYWORDS: Left ventricular function, Stroke, diastolic, systolic, dysfunction.

INTRODUCTION

Cardiac disease is a major risk factor for stroke, next to age and hypertension.¹ With a twofold to three fold relative risk^{1,2}, Congestive Cardiac failure ranks second in cardiogenic stroke risk¹. The prevalence of cardiac failure increases substantially in prevalence with the age of population. High mortality is also seen in Cardiac failure, with a 15 year total mortality rate estimated at 72% for men and 39% for women³.

Ventricular systolic dysfunction is common and treatable. It accounts for 8% of people aged 25- 75 years and 12% of 45-75 years. Of the 8%, 4% are asymptomatic. People with ischemic heart disease, hypertension or diabetes, and smokers are at high risk of LVSD^{4,5}. However, it would be a daunting and costly process for echocardiographic screening of all hypertensive's, all diabetics and all smoker for LVSD. A more cost- effective approach might be to wait for the first presentation of a vascular episode such as myocardial infarction (MI), a transient ischemic attack (TIA), a cerebro vascular accident or peripheral vascular disease, and to perform routine echo screening at that time.

In normal clinical practice, MI patients during their hospital admission are now a days screened for LVSD. But, patients who have had CVA/ TIA/ PVD are not routinely screened for LVSD. Yet, the presentation with one vascular episode in the form of stroke could be a golden opportunity to detect and treat LVSD, and thereby reduce the subsequent incidence of overt heart failure, and perhaps even sudden cardiac death.

We are aware that LVDD is also a major risk factor especially in hypertensive's and elders contributing towards mortality. It is in this context we assessed LV function in patients who presented with atherothrombotic stroke. Based on this aim of our study was assess left ventricular function in patients with ischemic stroke and also to determine whether left ventricular dysfunction could be a surrogate marker for in hospital mortality in patients with ischemic stroke.

MATERIAL AND METHODS

This study was done in medical wards of Government medical college, Virudhunagar for a period of 18 month as a descriptive cross sectional study. Patients admitted with ischemic stroke in age group between 40 and 80 years are included for the study. Whereas patient with hemorrhagic stroke, valvular heart disease were excluded from this study. Ethical clearance was obtained from Institutional Ethical Committee. Informed consent was obtained from all the study patients.

Based on Study proforma, all patients had a thorough clinical, neurological examination with careful evaluation of history. Importance was given to symptoms and signs of cardiac disease in addition to neurological findings.

Routine laboratory tests included complete blood counts, blood glucose, and renal function test. Arterial hypertension was defined as blood pressure values $>140/90$ mmHg on admission or presence of a positive history of antihypertensive treatment. Any history of myocardial infarction or typical angina or the patients reporting of a positive diagnostic test (stress test, Coronary angiography) or drug treatment are included for Coronary artery disease. 12 lead ECG and CXR were taken for all the patients. The neurological work up included Computed Tomography Scan of Brain. The patients showing hemorrhage on the CT were excluded from the study group.

Transthoracic two dimensional echocardiography was performed in all study patients. And related parameters were noted. LVH was defined as⁴⁹ increase in interventricular septal thickness and posterior wall thickness beyond 1.1cm during diastole as excess by M-mode. LV measurements in parasternal long axis and apical views in left lateral position.

The information collected regarding all the selected cases were recorded in a Master chart. Data analysis was done with the help of computer by using SPSS 24 software. Using this software, 'p' values were calculated through One way anova test for raw data and Chi Square Test for consolidated data to test the significance of difference between variables. A 'p' value less than 0.05 is taken to denote significant relationship

RESULTS:

A total of 94 patients of the study group were divided into various sub groups. Ischemic stroke was most commonly observed between 51-60 years of age followed by patients aged 61-70 years. The mean age of the patients was 61 ± 10.41 years.

In our study population LV dysfunction was assessed and found out inn 20 patients and 8 had mild, 9 had moderate and rest 3 had severe LV dysfunction. Severity increases as

age increases. Similarly diastolic dysfunction was seen in 21 patients among which 10 were mild, 6 were moderate and 5 were severe.

In our study population, most of the patients were men (n=57, 60 %) as against women (n=37, 40%). There was not much relation between gender and severity of both systolic and diastolic dysfunction.

Coming to comorbidities, smoking was present in 4 patients, alcoholic were 17. 39 patients were hypertensive and 19 were diabetic. 9 patients had coronary heart disease. When severity of LV dysfunction was correlated presence of diabetes and CAD had a significant correlation, whereas with diastolic dysfunction severity CAD had significant correlation.

Smoking was one of the most common risk factor observed in 41 patients. All of these patients were men. Out of 67 men, 41 patients were smokers (61%). The mean age of the smokers was 58 years. Associated history of alcohol intake was seen in 17 male patients. Associated hypertension was seen in 5 patients. Coexisting diabetes mellitus was observed in 5 patients. Prior history of coronary artery disease was obtained in 3 patients. Past history of stroke was present in 17 patients. History of shortness of breath of varying degree suggestive of left heart failure was observed in 12 patients.

History of angina and palpitation was observed in 17 patients. Echocardiographically LVH was evident in 17 patients. LV diastolic dysfunction was present in 5 patients. Clinical picture of stroke was severe in smokers associated with altered mentation, dense hemiplegia and massive infarct on the C.T. In hospital mortality was observed in 2 patients.

Alcohol intake was observed in 17 of the 67 men (25%). All of them were men. 16 patients had associated history of smoking. 2 patients had diabetes mellitus and 2 patients had coronary artery disease. Shortness of breath on exertion was observed in 3 patients. History of angina, palpitation was present in 8 patients. Echocardiographically L.V.H was evident in 6 patients. L.V. systolic dysfunction was present in 2 patients. Diastolic dysfunction was present in 3 patients. One patient had in hospital mortality.

Hypertension was observed in 39 of the 94 patients studied (41.44%). It was most commonly observed in the age group between 50 – 70 years when compared to those below 50 years and more than 70 years of age group. It was more frequent in women compared to men in the ratio of 28:11. 19 patients had history of angina and palpitation. History of shortness of breath was observed in 20 patients. Co-existing diabetes mellitus was seen in 12 patients. 5 patients had associated coronary artery disease. Echocardiographically LVH was evident in 21 patients. 27 out of 39 patients had normal LV systolic function. 10 patients had LV systolic dysfunction. 10 patients had LV diastolic dysfunction. 2 patients had mortality

during the hospital stay.

In our study, 19 of the 94 patients had diabetes mellitus (20.2%). It was observed as a risk factor equally in both sexes. Previous history of coronary artery disease was present in 4 patients. Past history of stroke was present in 3 patients. History suggestive of angina and palpitation in 13 patients. Shortness of breath was observed in 8 patients which had no statistical significance. Among diabetics 9 patients had left ventricular systolic dysfunction echocardiographically which has significant statistical significance ($P = 0.004$). Five patients had left ventricular diastolic dysfunction. 9 patients had LVH. 1 patients had in hospital mortality.

History of coronary artery disease was present in 9 patients (9.5%). CAD was more frequent in men when compared to women in the ratio of 5:4. Most common age group with CAD was between 51-60 years. History of breathlessness on exertion of NYHA class III was more frequently observed in CAD patients. This association had statistical significance ($P = \text{value } .00$). Past history of stroke was obtained in 1 patient. Associated diabetes mellitus was present in 4 patients. Hypertension was seen in 5 patients. Echocardiographically LVSD was evident in 6 patients with statistical significance ($P = \text{value } 0.003$). 6 CAD. Patients had dense hemiplegia. One patient expired in the hospital.

History suggestive of angina was observed in 21 of 94 patients (22.3%). H/O of palpitation was observed in 25 of 94 patients (26.5%) in the absence of valvular heart disease. Exertional breathlessness of varying degree was present in 37 patients (39.3%). 2 patients had shortness of breath at rest. There was no statistically significant association between symptoms of left heart failure with diabetes mellitus and hypertension. Left ventricular systolic dysfunction was evident echocardiographically in 20 patients with severe heart failure symptoms. This association was statistically significant ($P = <0.05$).

Past history of stroke was present in 30 out of 94 patients (31.9%). Out of which most of them were between 51 – 60 years of age. Men had more incidence of past H/O stroke men compared to women in ratio of 23:7. Out of 30 patients 14 had dense hemiplegia, C.T changes of massive infarct was evident in 15 patients. The severity of the stroke and clinical picture with LV dysfunction had significant statistical correlation with a P value of <0.05 .

SYSTOLIC DYSFUNCTION

In our study, 73 out of 94 patients (77.6%) had normal left ventricular systolic unction echocardiographically. 8 patients had mild left ventricular systolic dysfunction (8.5%). 9 patients had moderate left ventricular systolic dysfunction (9.5%). 3 patients had severe left

ventricular systolic dysfunction (3.1%).

More number of patients were in the age group between 61-70 years followed by >70 years. More men had left ventricular systolic dysfunction when compared to women in the ratio of 11:9. 6 patients with left ventricular systolic dysfunction were smokers (P - 0.259). 2 patients with left ventricular systolic dysfunction were alcoholics (P - 0.512).

10 hypertensive had left ventricular systolic dysfunction (P value = 0.539). 9 diabetic patients left ventricular systolic dysfunction which was statistically significant (P value .004). 6 C.A.D patients had moderate to severe left ventricular systolic dysfunction (P value = 0.003). 5 patients with N.Y.H.A class III symptoms had L.V.S.D (P value = .01). 2 patients with N.Y.H.A class IV symptoms had L.V.S.D (P value = .043).

13 patients with Left ventricular systolic dysfunction has dense hemiplegia which has statistical significant correlation (P- 0.008). 14 patients with Left ventricular systolic dysfunction had massive infarct in C.T scan, which has statistical significant correlation (P- <0.001). 2 patients had mortality with LV systolic dysfunction which has no statistically significance.

DIASTOLIC DYSFUNCTION

In our study 73 out of 94 patients (77.6%) had normal left ventricular diastolic function echocardiographically. Among which 10 patients had Grade I Diastolic dysfunction (9.4%). 6 patients had Grade II Diastolic dysfunction (6.3%) and 5 patients had Grade III Diastolic dysfunction (5.3%).

More number of patients were in the age group between 51-60 years followed by 61-70 years. More men had left ventricular Diastolic dysfunction when compared to women in the ratio of 11:10. 5 patients with left ventricular diastolic dysfunction were smokers (P - 0.068). 3 patients with left ventricular diastolic dysfunction were alcoholics (P - 0.755).

10 hypertensive had left ventricular diastolic dysfunction (P value = 0.692). 5 diabetic patients left ventricular diastolic dysfunction which was statistically not significant (P value 0.758). 6 C.A.D patients had left ventricular diastolic dysfunction (P value = <0.001) which has significance statistically. 4 patients with N.Y.H.A class III symptoms had left ventricular diastolic dysfunction (P value = .07). 2 patients with N.Y.H.A class IV symptoms had left ventricular diastolic dysfunction (P value = .048) which has significance statistically.

13 patients with Left ventricular diastolic dysfunction has dense hemiplegia which has statistical significant correlation (P- 0.03). 12 patients with Left ventricular diastolic dysfunction had massive infarct in C.T scan, which has statistical significant correlation (P-

0.023). All 5 patients with LV diastolic dysfunction had mortality which has statistically significance (P - 0.008).

In our study, 5 out of 94 patients (5.3%) had in hospital mortality. The average period of hospital stay was 10 days among this group. 2 were aged between 51 to 60 years and 3 above 70 years. Death was observed more commonly in men (ratio of men: women being 3:2). 2 patients were smokers and 1 alcoholic. Hypertension was observed in 2 patients. 1 patient had diabetes mellitus. One patient had coronary artery disease. 4 patients had symptoms of cardiac dysfunction on admission.

Echocardiographic evidence of left ventricular dysfunction was observed in 5 patients. Out of which 2 patients had LV systolic dysfunction and 5 patients had L.V diastolic dysfunction. 2 patients had both LV systolic and diastolic dysfunction. The association between L.V. diastolic dysfunction and mortality was statistically significant (P value 0.008).

DISCUSSION

The number of patients enrolled in the study was 94. V function studies in association with ischemic stroke have been done by Allison G. Hays, M.D, Department of Medicine, New York (~1994-1997) in a subset of patients from the Northern Manhattan study 2006(NOMAS)⁶. In a study done by them, 270 patients of ischemic stroke were evaluated for LV function. Framingham study and VH of trial⁷ analyzed the various risk factors in association with LV dysfunction in ischemic stroke patients. E.C.G changes in stroke patients were analyzed by DS. Goldstein⁸ during 1979. In SOLVD⁹ study, heart failure in stroke patients was evaluated.

Among the patients studied 42.5% were between 51-60 years followed by 30.8% between 61-70 years. The average age of patients studied was 61 years. The lesser incidence in people below 50 years of age could be because in our study we excluded patients with valvular heart disease and the causes of young stroke. The age incidence in the current study was similar to the Northern Manhattan study. In the NOMA study also the age of patients more than 70 and younger than 50 years was less.⁶

60% of patients in the present study were men as against 40% who were women. This is probably because smoking and intake of alcohol was observed in a majority of men in our group. This contrasts with the Manhattan study figures (NOMA study)⁶ where 56% were women against 44% men. The higher incidence of stroke in women of NOMA study could be due to the associated habits of smoking and alcohol intake in western women.

43.6% of patients in current study were smokers where as in NOMA study 23% were

smokers. This difference could be due to the higher incidence of smoking in Indian men when compared to people of Western country where the habit of smoking was comparatively less than alcohol intake. The present study showed statistically significant association between smoking, hypertension and diabetes.

The incidence of alcohol intake was more in the NOMA study when compared to the present study. It was 40% in the NOMA study as compared to the 18 % of present study. This difference could be attributed to the higher incidence of alcohol intake in Western countries when compared to our country.

The incidence of hypertension was 41.4% in present study which was less when compared to NOMA study⁶ (i-e 78%). This could be due to the difference in the incidence of comorbid conditions like diabetes, C.A.D, dyslipidemia. The association of hypertension and C.A.D was statistically significant in the present study.

The incidence of diabetes in the present study was 20.2% as compared to the NOMA study of 43%. The above difference due to the sedentary life style of the western people and also due to the higher incidence of obesity among the people of western countries. There was a statistically significant correlation between diabetes and LVSD.

The incidence of C.A.D. was 9.5% in the present study as compared to the NOMA study of 31% the above difference could be due to the higher incidence of CAD in Western countries. Also this could be attributed to increase in associated comorbid conditions like diabetes, hypertension and dyslipidemia. The severity of the symptoms of left heart failure had statistically significant correlation with CAD in present study. LVSD was more commonly observed in present study with statistical significance.

Since we were assessing the echocardiographic evidence of LV dysfunction, we evaluated the cardiac dysfunction in detail. The symptoms of cardiac dysfunction was observed in the study group patients on admission. 21 patients had history of angina and 37 patients had shortness of breath of varying degree. 2 patients had shortness of breath at rest.. Shortness of breath of at rest had a significant correlation with LVSD in present study. Clinical picture of stroke with massive infarct and severity of the stroke had statistically significant correlation with cardiac symptoms.

Past history of stroke was obtained in all stroke patients in the present study. This was elicited to evaluate the significance of recurrent stroke in study group patients. H/O of recurrent of stroke was observed in more men when compared to women in the present study. This could be attributed to the difference in the number of men and women of study group. Associated smoking and alcohol habits were observed in men which was not observed in

women. The recurrent stroke rate is much higher than the rate of first-ever stroke in patients with cardiac failure. Sacco et al¹⁰.found a 45% 5- year recurrent stroke rate in patients with cardiac failure.

20 patients had left ventricular systolic dysfunction in the present study (21.27% . The L.V.S.D changes of present study group was compared with L.V.S.D changes of NOMA study group as follows: The incidence of LVSD was comparatively similar in both study groups. However, in the present study more men had LVSD than women in the ratio of 11:9. LVSD of any degree was significantly associated with ischemic stroke among all age groups in NOMA study (P value 0.57)

In the survival and ventricular Enlargement (SAVE) study¹¹, patients with an EF of 29% to 35% had a stroke rate of 0.8% per year; the rate in patients with EF of 28% or less was 1.7% per year. There was an 18% increment in the risk of stroke for every 5% decline in EF.

In our study 21 patients had diastolic dysfunction in the present study. Most of them were between 51-60 years followed by 61-70 years. Diastolic dysfunction was more frequent in hypertensive than diabetics in the ratio of 2:1. 6 patients with C.A.D had diastolic dysfunction. There is significant association between C.A.D and diastolic dysfunction in the present study (P= <0.001).

CONCLUSION:

Association of LV Dysfunction with clinical severity and extent of stroke had of positive correlation statistically. Early assessment of LV dysfunction can help in management and improvement of prognosis in ischemic stroke patients. The use of Anti heart failure drugs and Ventricular remodeling drugs such as ACE Inhibitors, ARBs, and beta blockers can prevent cardiovascular complications in such ischemic stroke patients. Further study and analysis is needed to determine whether LV diastolic dysfunction is a causative factor for mortality.

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