



Association of Left Ventricular Hypertrophy on Echocardiography with Hemorrhagic and Non-Hemorrhagic Stroke

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ABSTRACT

Introduction: Left ventricular hypertrophy (LVH) is related to increased risk of stroke. However, very few studies analyzed association of LVH assessed by Echocardiography (Echo) in ischemic and hemorrhagic stroke separately.

Aims & Objectives: To determine the association of left ventricular hypertrophy on echocardiography with hemorrhagic or non-hemorrhagic stroke.

Place & Duration of Study: Study was done in Department of Cardiology Shaikh Zayed Hospital Lahore for six months from 01-01-2019 to 30-06-2019.

Material & Methods: Total 190 patients, fulfilling inclusion and exclusion criteria were selected. All patients underwent for echo and LVH was noted. Left ventricular posterior wall (PW) and inter ventricular septum (IVS) thickness >11mm in males and >10mm in females labeled as LVH.

Results: Results of this study showed that risk of LVH was 1.66 times higher among patients who presented with Hemorrhagic: 57.9% vs Non-hemorrhagic stroke: 34.7%. Elderly age group patients (RR: 1.85), female patients (RR:2.53), overweight patients (RR:2.38), longer duration of stroke (RR:2.42) and diabetic patients had higher association with LVH in hemorrhagic stroke.

Conclusion: It was observed in this study that patients having hemorrhagic stroke had higher association of left ventricular hypertrophy (LVH) as compared to Non-Hemorrhagic stroke. Further studies are needed in this domain to address the association between LVH and hemorrhagic stroke.

Key words: Hemorrhagic, Non-hemorrhagic, Stroke, LVH, Echo

INTRODUCTION

Pathophysiology of both ischemic and hemorrhagic stroke is different and their long term cerebral and functional implications are also different. In hemorrhagic stroke brain is exposed to irritating effects of blood and in ischemic strokes there is diffuse or localize cerebral vascular pathology.¹

Strokes are generally more severe clinically in patients with hemorrhagic stroke and associated with a considerable increase of mortality within the first 3 months after stroke. Overall complications are high with hemorrhagic stroke.²

Hypertensive end organ damage in the heart is prevalent with reported rates of left ventricular hypertrophy (LVH) in hypertensive patients of 36%–41%.³ While LVH has been shown to be a significant independent predictor of myocardial

infarction, stroke, and cardiovascular death in the general population, but it has not been clearly established as a predictor of poor outcome in hemorrhagic stroke patients.^{4,5}

LVH is commonly measured by electrocardiography, echocardiography, and magnetic resonance imaging.⁶

One study found that in patients of stroke, 53% patients had LVH, 62% in the hemorrhagic group (n=50) and 44% in the ischemic group (n=50). But the difference was insignificant (p>0.05).⁷

Moreover, locally not much work has been done in this regard and also there is lack of local evidence. So, we are unable to know the extent of problem in local population. This study would help us in attaining local evidence which in future would help us in identifying high risk patients and implementing the early screening of stroke patient for their cardiac activity and preventive strategies can be developed to prevent the hazardous

consequences of LVH and hemorrhagic stroke in high risk patients.

MATERIAL AND METHODS

Our objective is to determine the association of left ventricular hypertrophy on echocardiography with hemorrhagic or non-hemorrhagic stroke.

Stroke is defined as sudden onset of weakness of one or more part of body and CT brain shows hypodense or hyper dense area confirmed by clinical neurologist and radiologist.

Hemorrhagic stroke is defined as rapidly developing clinical signs of neurological dysfunction attributable to a focal collection of blood within the brain parenchyma or ventricular system that is not caused by trauma assessed by consultant neurologist and confirmed on CT brain by consultant radiologist.⁸

Non-Hemorrhagic stroke is defined as an episode of neurological dysfunction with clinical evidence of cerebral, spinal cord, or retinal focal ischemic injury based on symptoms persisting ≥ 24 hours or until death caused by focal cerebral, spinal, or retinal infarction, assessed by consultant neurologist and confirmed on CT brain by consultant radiologist.⁸

LVH was labeled on echocardiography according to the American society of echocardiography recommendations, left ventricular posterior wall thickness and inter-ventricular septal thickness is found to more than 11mm in males and more than 10mm in females.⁹

Inclusion Criteria: All patients with stroke between 40-70 years of age, either gender with stroke, exposed Group Patients with hemorrhagic stroke, unexposed Group Patients with non-hemorrhagic stroke (ischemic).

Exclusion Criteria: Patients with recurrent stroke, those with cardiovascular disease before stroke, previous cardiac surgery, percutaneous coronary intervention or valvular heart disease (on medical record) were excluded.

This Cohort study was conducted for 6 months from 01-01-2019 to 30-06-2019 at Department of neurology presented with stroke and echocardiography done at Department of Cardiology, Sheikh Zayed Hospital, Lahore. After scrutiny those who were fulfilling inclusion and exclusion criteria, 190 patients selected by Non-probability, consecutive sampling and divided into two groups of hemorrhagic named exposed group and non-hemorrhagic stroke patients named unexposed group, 95 patients in each group. All the selected patients underwent transthoracic echocardiography (TTE) and images were obtained

by consultant Cardiologist using Toshiba Xario XG dedicated echocardiography machine. The study was carried out according to the criteria of the American Society of Echocardiography for left ventricular hypertrophy.⁹

Statistical analysis:

Data was analyzed through SPSS version 21 by entering the data in it. Mean \pm Standard Deviation was calculated for age, BMI and stroke duration. Percentages and frequencies calculated for gender, diabetes and hypertension and LVH. Calculation of the relative risk was done to measure association between hemorrhagic stroke and LVH, RR > 1 was considered as significant. Stratification of data done for age, gender, BMI, duration of stroke, diabetes and hypertension.

RESULTS

Risk of LVH was 1.66 times in patients with hemorrhagic stroke as compared to those patients with non-hemorrhagic stroke (Table-1). Highest risk of LVH was seen in patients in the elderly age group (> 60 years, RR=1.85) followed by patients in the age group 51-60 years. i.e. 1.81 (Table-2). Among female patients risk of LVH was 2.53 times higher among hemorrhagic patients and among male patients with hemorrhagic stroke it was 1.07 times higher (Table-3). Risk of LVH among exposed patients who were overweight and obese was 2.38 and 1.46 times higher as compared to patients who were un-exposed (Table-4). However, patients with normal BMI among them risk of LVH among exposed group was 1.72 times higher as that of unexposed patients. Patients with longer duration of stroke had higher association for LVH. i.e. RR:2.42 times higher as that of those patients with shorter duration of stroke. i.e. RR: 1.13 (Table-5). Among diabetic patients risk of LVH was 1.81 times higher with hemorrhagic stroke while patients who were hypertensive among them this risk was 1.52 times higher in patients with hemorrhagic stroke. (Table-6)

		Exposed	Unexposed	Total
LVH	Yes	55 (57.9%)	33 (34.7%)	88
	No	40 (42.1%)	62 (65.3%)	102
Total		95	95	190

Table-1: LVH in study Groups Relative Risk=1.66 (1.20-2.30)

Age	LVH	Exposed	Unexposed	RR	CI
40-50	Yes	22(57.9%)	11(45.8%)	1.26	0.75-2.11
	No	16(42.1%)	13(54.2%)		
51-60	Yes	20(60.6%)	10(33.3%)	1.81	1.02-3.23
	No	13(39.4%)	20(66.7%)		
>60	Yes	13(54.2%)	12(29.3%)	1.85	1.01-3.37
	No	11(45.8%)	29(70.7%)		

Table-2: LVH in study Groups stratified for age of patients

Gender	LVH	Exposed	Unexposed	RR (CI)
Male	Yes	24(51.1%)	19(47.5%)	1.07 (0.7-1.65)
	No	23(48.9%)	21(52.5%)	
Female	Yes	31(64.6%)	14(25.5%)	2.53 (1.54-4.17)
	No	17(35.4%)	41(74.5%)	

Table-3: LVH in study Groups stratified for Gender of patients

BMI	LVH	Exposed	Unexposed	RR (CI)
Normal	Yes	20(54.1%)	11(31.4%)	1.72 (0.97-3.05)
	No	17(45.9%)	24(68.6%)	
Overweight	Yes	18(52.9%)	6(22.2%)	2.38 (1.1-5.16)
	No	16(47.1%)	21(77.8%)	
Obese	Yes	17(70.8%)	16(48.5%)	1.46 (0.94-2.25)
	No	7(29.2%)	17(51.5%)	

Table-4: LVH in study Groups stratified for BMI of patients

	LVH	Exposed	Unexposed	RR (CI)
3-5	Yes	23(51.1%)	19(45.2%)	1.13 (0.72-1.75)
	No	22(48.9%)	23(54.8%)	
6-8	Yes	32(64%)	14(26.4%)	2.42 (1.47-3.97)

Table-5: LVH in study Groups stratified for duration of stroke

	LVH	Exposed	Unexposed	RR (CI)
DM	Yes	30 (63.8%)	18 (35.3%)	1.81 (1.17-2.78)
	No	17 (36.2%)	33 (64.7%)	
Hypertension	Yes	25 (52.1%)	15 (34.1%)	1.52 (0.93-2.5)

Table-6: LVH in study Groups stratified for DM & Hypertension status of patients

DISCUSSION

LVH is an abnormal increase in left ventricular mass. which is a marker for and contributes to coronary events, stroke, heart failure, peripheral arterial disease, and cardiovascular mortality in patients with hypertension.⁶

LVH reflects an overall increment in the mass of the left ventricle. This is a compensatory mechanism adopted by the myocardium in response to various stresses on the heart. A rise in the afterload (e.g., longstanding systemic hypertension or aortic stenosis) is by far the commonest cause. An increase in the volume (diastolic) load on the left ventricle (as in chronic aortic regurgitation) and coronary artery disease may also incur a stress on the myocardium to increase its volume. More than one factor may be operative and altogether they can augment this volume increment.^{10, 11}

In this study we assessed the association of LVH in patients who presented with hemorrhagic or non-hemorrhagic stroke. Results of this study showed that risk of LVH was 1.66 times higher among patients who presented with hemorrhagic stroke. i.e. Hemorrhagic: 57.9% vs. Non-hemorrhagic stroke: 34.7%

Findings of Osama Shukir Muhammed Amin were consistent with the results of the study who found that in patients of stroke, 53% patients had LVH, 62% in the hemorrhagic group (n=50) and 44% in the ischemic group (n=50). But the difference was insignificant (p>0.05).⁷ However in this study relative risk was calculated which was not calculated in Osama Shukir Muhammed Amin study which makes this study unique with a cohort study design.

According to the findings of EUROSTROKE study LVH was associated with a twofold increased risk of stroke (odds ratio 2.1 (95% CI 1.3 to 3.5). The risk was particularly pronounced for fatal stroke (4.0 (95% CI 2.1 to 7.9)), whereas the risk was non-significantly increased for non-fatal stroke (1.5 (95% CI 0.8 to 2.7)).¹²

In our study we evaluated patients with hemorrhagic and non-hemorrhagic stroke and found that LVH is associated with 1.66 times more with hemorrhagic stroke than non-hemorrhagic. Konstantinos Tziomalos in his study reported that LVH, which was calculated according to the Cornell voltage-duration product criteria, was associated with more extensive stroke and with higher mortality rate in hospital, in patients with acute ischemic stroke.¹³

A previous study which was done in 2363 hypertensive patients who were not treated with medicines have similar risk for ischemic stroke in

which LVH was diagnosed with ECG or echocardiography¹⁴ and in our study we observed that hemorrhagic stroke patients who are more than 60 year of age, female by gender, diabetics with hypertension had high association with LVH. Okin and colleagues¹⁵ concluded that the diameter of the carotid artery correlates well with the mass of the left ventricle.

In our study prevalence of LVH among hemorrhagic stroke patients who were overweight was 2.38 times higher and obese patients were having 1.46 times higher as compared to patients with non-hemorrhagic stroke.

Limitations:

Number of patients are less and there is no control group. The relationship of severity and duration of LVH with stroke mortality and morbidity needs to be addressed in larger prospective studies.

CONCLUSION

It was observed in this study that patients with hemorrhagic stroke had higher association with LVH as compared to patients who were presented with Non- Hemorrhagic stroke. Further studies are needed in this domain to address the association between LVH and hemorrhagic stroke.

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