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Association between Atrial Fibrillation, Atrial Enlargement and Left Ventricular Geometric Remodeling in Indian Population: A Prospective Study

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Abstract **Original Research Article**

Background: Left atrial (LA) enlargement is a marker for increased risk of atrial fibrillation (AF). However, LA remodeling is a complex process that is poorly understood, and LA geometric remodeling may also be associated with the development of AF. ***Materials and Methods:*** Hundredpatients who visited the Department of Cardiology, Gandhi Medical Collage for the echocardiography for any cause were studied. Wall thickness, LV diastolic diameter (LVDd), E/e', LA diameter (LAD), LA volume index (LAVI), and LV ejection fraction (LVEF) was evaluated. Patients were divided into four groups as follows: normal geometry (n = 50), concentric remodeling (normal LVMI and high RWT, n = 23), concentric hypertrophy (high LVMI and high RWT, n = 8), and eccentric hypertrophy (high LVMI and normal RWT, n = 20). ***Results:*** Normal geometry was more common among the younger patients (65.3 years) as compared to Concentric remodelling (76.4 years), Concentric hypertrophy (72.4 years) and Eccentric hypertrophy (71.4 years) (p=0.002).Diabetes, hypertension, hyperlipidemia, aortic stenosis, aortic regurgitation, mitral regurgitation and chronic kidney disease was more prevalence with geometric remodelling. Of Them Concentric hypertrophy was more common. ***Conclusion:*** The prevalence of AF was increasing according to LV geometric remodeling patterns.

Keywords: Geometric remodelling, cardio vascular disease, atrial enlargement.

INTRODUCTION

This is proven that increase in increase in left ventricular (LV) wall thickness reduces the LV wall stress [1]. This may lead to development of left ventricular hypertrophy (LVH). Previous studies have proven that increase in LVH can lead to significant increase in cardiovascular (CV) related morbidity and mortality [2, 3].

Several recent trials have highlighted the prognostic impact of more subtle LV geometric abnormalities. LVH pattern and geometric remodelling has become the prime focus of many researchers in the presence of hypertension and valvular heart diseases [4].

Previous studies have proved that in the presence of preserved ejection fraction (EF), Concentric LVH can lead to high mortality [5, 6]. Other studies have reported that relative wall thickness has less impact on prognosis in patients with coronary heart disease.

Dilation of LV and LVH can lead to increase in end-diastolic pressure, followed by enlargement of the left atrium. Prevalence of Atrial fibrillation (AF) is high among the old age patients leading to high morbidity and mortality. Left atrial (LA) remodeling, LA enlargement, and LV remodeling are related to AF development [7]. However, little is known about this relationship in Indian population. In present study we tried to find out the aassociation between atrial fibrillation, atrial enlargement and left ventricular geometric remodeling in Indian population.

MATERIALS AND METHODS

Present study was performed on 100 patients who visited the Department of Cardiology, Gandhi Medical Collage for the echocardiography for any cause.

After a detailed demography including age and sex, we evaluated data for patients' wall thickness, LV diastolic diameter(LVDd), E/e', LA diameter (LAD), LA volume index (LAVI), and LV ejection fraction (LVEF).ECG was used to record cardiac rhythm.

High LV mass index (LVMI) was defined as >115 g/m2 for male patients and >95 g/m2 for female patients.Relative wall thickness (RWT) was calculated using the following formula: (2 × LVPWTd)/(LVDd), which permitsphysicians to categorize an increase in the LV mass as either concentric (RWT >0.42) or eccentric (RWT≤0.42) hypertrophy and identify concentric remodeling (a normal LV mass with an increased RWT). TheLAVI was calculated using the biplane area-length method and body surface area and defined high as a value>42 mL/m2.

The LV mass was calculated using the formula recommended by the American Society of Echocardiography (ASE), and it was indexed to the body surface area as follows:

LV mass = 0.8 × 1.04 [(LVDd + LVPWTd + IVSTd)3 − (LVDd)3] + 0.6,

Where, LVDd was the LV diastolic diameter, IVSTd was the diastolic interventricular septa wall thickness, and LVPWTd was the diastolic LV posterior wall thickness. We then categorized 100 patients into four groups as follows: normal geometry (n = 50), concentricremodeling (normal LVMI and high RWT, n = 23), concentric hypertrophy (high LVMI and high RWT, n = 8), and eccentric hypertrophy (high LVMI and normal RWT, n = 20).

All the data analysis was performed using IBM SPSS ver. 20 software. Quantitative data is expressed as mean and standard deviation whereas categorical data is expressed as percentage. Descriptive analysis was performed for the baseline details. Multivariable logistic regression analysis was performed to find out the odds ratio of each variables. P value of <0.05 is considered as significant.

RESULTS

In present study normal geometry was more common among the younger patients (65.3 years) as compared to Concentric remodelling (76.4 years), Concentric hypertrophy (72.4 years) and Eccentric hypertrophy (71.4 years). The p value of this association was highly significant (p=0.002).

The ratio of men were 54%, 59%, 44%, and 46% in patients with a normal geometry, concentric remodeling, concentric hypertrophy, and eccentric hypertrophy, respectively.

Hypertension was more common among the patients with concentric remodelling (75%), concentric hypertrophy (92%), and eccentric hypertrophy (78%). Table-1 shows the comparison of other parameters with the concentric remodelling, concentric hypertrophy, and eccentric hypertrophy.

Table-1: Comparing different parameters with concentric remodelling, concentric hypertrophy, and eccentric hypertrophy

Parameters	Normal geometry	Concentric remodelling	Concentric hypertrophy	Eccentric hypertrophy	P value
Age (years)	65.3	76.4	72.4	71.4	0.002
Male (%)	54	59	44	46	0.001
Diabetes (%)	22.4	45.5	46.7	35	<0.001
Hypertension (%)	50	75	92	78	<0.001
Hyperlipidemia,(%)	24	38	45	34	<0.001
Aortic stenosis, %	1.2	12	13.4	6.2	<0.001
Aortic regurgitation, %	2.4	1.2	11.3	15.6	<0.001
Mitral stenosis, %	0.3	0.3	0.6	0.4	0.321
Mitral regurgitation, %	2.1	1.2	6.5	14.5	<0.001
Chronic kidney disease, %	12.4	23.4	39.4	26.7	<0.001
Overweight, %	26	32	35	30	0.241

Discussion

Over the past 50 years, several authors have worked on the pathophysiology of LVH. [8] Previous data showed that as per the law of LaPlace hypertrophy is a result of adaptive response to the wall stress. This lead to cardiac decompensation which occurs as a consequence of myocyte death and myocardial fibrosis [9, 10].

Geometric patterns of LV remodelling can define the hypertrophic response due to mechanical stress. Mechanical stress may be because of pressure known as concentric hypertrophy or due to volume over load known as eccentric hypertrophy.

Complex interaction between LV dilatation and myocardial thickening are responsible for pathophysiology of LVH. Several previous studies have recently examined an expanded four-group LVH classification: dilated/non-dilated concentric hypertrophy and dilated/non-dilated eccentric hypertrophy [11-13]. In this proposed four-group LVH classification, dilated concentric hypertrophy was associated with the worst prognosis and non-dilated eccentric hypertrophy had the most favourable profile [11, 12].

In present study we found that normal geometry was more common among the younger patients (65.3 years) as compared to Concentric remodelling (76.4 years), Concentric hypertrophy (72.4 years) and Eccentric hypertrophy (71.4 years). The p value of this association was highly significant (p=0.002).

The ratio of men were 54%, 59%, 44%, and 46% in patients with a normal geometry, concentric remodeling, concentric hypertrophy, and eccentric hypertrophy, respectively. Hypertension was more common among the patients with concentric remodelling (75%), concentric hypertrophy (92%), and eccentric hypertrophy (78%).A recent systematic review by Zheng et al showed a link between Concentric hypertrophy and higher prevalence of cardiometabolic risk factors and associated disease [14]. Prevalence of AF was significantly high with the Eccentric hypertrophy and lowest LV ejection fraction.

In same study by Zheng et al related to mortality, it was found that all-cause mortality was highest with concentric hypertrophy, howveer, there was an overlap of risk factors between concentric hypertrophy and eccentric hypertrophy [14].

In our study analysis of both AF and non-AF populations, LA enlargement and LVEF were significantly related to LV geometric remodeling. Therefore, the rate of AF was increasing per the LV remodelling patterns. Patel *et al*., reported that LAVI was associated only with LVMI, not RWT [15].

Smallsample size was the main limitation of the present study. A large randomized clinical trial is needed to provide strength to present study.

Conclusion

It was found that normal geometry was more common among the younger patients as compared to concentric remodelling, concentric hypertrophy and eccentric hypertrophy. The prevalence of AF was increasing according to LV geometric remodelling patterns in association with LA size and LVEF.

References

1. Zabalgoitia M, Berning J, Koren MJ, Støylen A, Nieminen MS, Dahlöf B, Devereux RB, LIFE Study Investigators. Impact of coronary artery disease on left ventricular systolic function and geometry in hypertensive patients with left ventricular hypertrophy (the LIFE study). The American journal of cardiology. 2001 Sep 15;88(6):646-50.
2. Casale PN, Devereux RB, Milner M, Zullo G, Harshfield GA, Pickering TG, Laragh JH. Value of echocardiographic measurement of left ventricular mass in predicting cardiovascular morbid events in hypertensive men. Annals of internal medicine. 1986 Aug 1;105(2):173-8.
3. Ghali JK, Liao Y, Cooper RS. Influence of left ventricular geometric patterns on prognosis in patients with or without coronary artery disease. Journal of the American College of Cardiology. 1998 Jun 1;31(7):1635-40.
4. Ganau A, Devereux RB, Roman MJ, De Simone G, Pickering TG, Saba PS, Vargiu P, Simongini I, Laragh JH. Patterns of left ventricular hypertrophy and geometric remodeling in essential hypertension. Journal of the American College of Cardiology. 1992 Jun 1;19(7):1550-8.
5. Patel DA, Lavie CJ, Milani RV, Ventura HO. Left atrial volume index predictive of mortality independent of left ventricular geometry in a large clinical cohort with preserved ejection fraction. InMayo Clinic Proceedings 2011 Aug 1; 86(8):730-737.
6. Oktay AA, Lavie CJ, Milani RV, Ventura HO, Gilliland YE, Shah S, Cash ME. Current perspectives on left ventricular geometry in systemic hypertension. Progress in cardiovascular diseases. 2016 Nov 1;59(3):235-46.
7. Tsang TS, Barnes ME, Bailey KR, Leibson CL, Montgomery SC, Takemoto Y, Diamond PM, Marra MA, Gersh BJ, Wiebers DO, Petty GW. Left atrial volume: important risk marker of incident atrial fibrillation in 1655 older men and women. InMayo Clinic Proceedings 2001 May 1; 76(5); 467-475.
8. Meerson FZ. Compensatory hyperfunction of the heart and cardiac insufficiency. Circulation research. 1962 Mar;10(3):250-8.

9. Diwan A, Dorn GW. Decompensation of cardiac hypertrophy: cellular mechanisms and novel therapeutic targets. Physiology. 2007 Feb;22(1):56-64.
10. Lorell BH, Carabello BA. Left ventricular hypertrophy: pathogenesis, detection, and prognosis. Circulation. 2000 Jul 25;102(4):470-9.
11. Khouri MG, Peshock RM, Ayers CR, de Lemos JA, Drazner MH. A 4-tiered classification of left ventricular hypertrophy based on left ventricular geometry: the Dallas heart study. Circulation: Cardiovascular Imaging. 2010 Mar;3(2):164-71.
12. Bang CN, Gerdts E, Aurigemma GP, Boman K, de Simone G, Dahlöf B, Køber L, Wachtell K, Devereux RB. Four-group classification of left ventricular hypertrophy based on ventricular concentricity and dilatation identifies a low-risk subset of eccentric hypertrophy in hypertensive patients. Circulation: Cardiovascular Imaging. 2014 May;7(3):422-9.
13. de Simone G, Izzo R, Aurigemma GP, De Marco M, Rozza F, Trimarco V, Stabile E, De Luca N, Trimarco B. Cardiovascular risk in relation to a new classification of hypertensive left ventricular geometric abnormalities. Journal of hypertension. 2015 Apr 1;33(4):745-54.
14. Zheng Q, Loo G, Le TT, Shi L, Chan ES, Chin CW. Prognosis associated with geometric patterns of left ventricular remodeling: systematic review and network meta-analysis. F1000Research. 2019 Jul 19;8(1130):1130.
15. Patel DA, Lavie CJ, Milani RV, Gilliland Y, Shah S, Ventura HO. Association of left ventricular geometry with left atrial enlargement in patients with preserved ejection fraction. Congestive Heart Failure. 2012 Jan;18(1):4-8.