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Comparison of echocardiographic changes among hypertensives and healthy controls in Indian population

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ABSTRACT

Introduction: Hypertension is a major risk factor for the development of coronary artery disease (CAD), the reliability of stress testing for the evaluation of chest pain in patients with abnormal blood pressure elevation is an important clinical problem. When compared to exercise electrocardiography, stress echocardiography (SE) provides similar sensitivity but superior diagnostic specificity.
Materials and Methods: A cross-sectional study was conducted in the Department of Physiology in collaboration with echocardiography lab of Santosh Medical hospital Ghaziabad, on a population of 200 cases more than 60 years of age. Amongst these patients, 100 patients with hypertension for more than 5 years were included in Group 1 and 100 healthy age matched control were included in Group 2. Physical parameters were recorded and all subjects underwent comprehensive echocardiographic examination. Data was analysed using SPSS 20 software. All parameters were presented as mean and standard deviation. A p-value <0.05 was considered as statistically significant.
Results: Gender distribution was 86% Male and 14% female in case group and 91% Male and 9% female subjects in control group. In echocardiographic parameters, the difference in values of L.A. Diameter in Group 1(2.94+0.27) vs Group 2 (3.43+0.32) was significant. Similarly, difference in value of Aortic Root in Group 1(2.94+0.27) vs Group 2 (3.02+0.32) was significant. The difference in value of IVSD in Group 1 (2.94+0.27) vs Group 2 (3.02+0.32) was also significant. However, difference in values of LVID in Group 1 (4.97+4.25) vs Group 2 (5.24+5.) was not statistically significant.
Conclusion: In current study, Left ventricular systolic function was within normal physiological limits in all hypertensive patients. However, when compared to healthy control group it was lower suggesting that chronic hypertension does affect left ventricular function gradually.

1. Introduction

Hypertension is a major risk factor for the development of coronary artery disease (CAD). During hypertension, left ventricular hypertrophy (LVH) is initially a useful compensatory mechanism to abnormal loading conditions, which is also the first step toward the development of overt clinical disease, such as congestive heart failure, ischemic heart disease, cardiac dysrhythmias and stroke.[1,2] The Framingham study has clearly demonstrated that once LVH is recognized clinically by electrocardiography[3] or echocardiography[4] it becomes a strong predictor for the prognosis of cardiovascular disease.

Use of exercise electrocardiography and nuclear techniques are burdened by a high rate of false-positive responses in the hypertensive population due to reduced coronary flow reserve in the absence of obstructive CAD.[5,6] When compared stress echocardiography (SE) provides similar sensitivity but superior diagnostic specificity.[5–7] The prognostic value of Stress Echocardiography is well established in hypertensive patients with suspected CAD[8,9] as well as in unselected cohorts of hypertensive patients.[10,11]

In recent time development of Doppler echocardiography has offered new insights into the pathophysio-

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logical and clinical implications affecting hypertensive patients.[4]Echocardiography is one of the very first clinical investigation that a hypertensive patient is recommended to undergo. It is obvious that echocardiographic assessment is very important in the clinical management of a hypertensive patients.

The procedure of Echocardiographic assessment of the heart of a hypertensive patient includes two levels assessment. Anatomic approach, includes measurement of the heart cavities and A functional approach, which includes assessment of indices of function. Echocardiographic evaluation of a patient with hypertension includes the following:

Left ventricular hypertrophy, cardiac mass and geometry, Left ventricular function, Left atrial volume and function, the thoracic aorta and coronary artery patency. The development of left ventricular diastolic dysfunction may precede hypertrophy and may be one of the earliest changes associated with hypertensive heart disease. If the left ventricular ejection fraction is initially evaluated <50%, there is an early tenfold increased risk for hospitalization for congestive heart failure as compared to hypertensive patients with a normal ejection fraction.[12–14]

Aging and hypertension have been shown to significantly increase aortic diameter, thickness and stiffness of aortic root is a frequent cardiovascular phenotype in hypertensive patients who are referred to echo laboratories for identification of increased cardiovascular morbidity and mortality.[15–17]

In addition to describing a parameter as normal or abnormal (reference values) clinical echocardiographic can help to quantify the degree of abnormality in terms of mild, moderate and severe.

2. Materials and Methods

A cross-sectional study was conducted in the Department of Physiology in collaboration with Echocardiography laboratory of Santosh Medical Hospital Ghaziabad. Sample size was of 200 cases, more than 60 years of age, divided in to two groups as Group 1 comprised of 100 patients with hypertension for more than 5 years and Group 2 had 100 healthy age matched control subjects. Duration of study was from July 2015 through December 2016. After obtaining ethical clearance from Institutional Ethical committee. The selection of the patient was done on the basis of detailed medical history and general physical examination. All subjects were interviewed for personal details such as, age, personal habits including recent and past medical history. All eligible subjects signed informed consent form before commencing the study.

2.1. Echocardiography

Types of echocardiography and steps were described to patients in their own language. Patient were made to lie down on a bed in a supine position then the sonographer will spread gel on a device (transducer), the transducer was firmly pressed, aiming an ultrasound beam through the chest to the heart. Prior to the procedure, anthropometric parameters were noted in each subject such as age (in years), height (in centimetres) and Body Mass Index (Quetelet's Index). BMI was calculated using weight and height values by the following formula; BMI = $\frac{Weight\ (in\ kg)}{Height\ (in\ m)2}$. The Physical parameters were recorded and all the subjects underwent comprehensive echocardiographic examination using the equipment (GE vivid P3 Model No.: H47082LA VP3). All patients were examined in left lateral position using grey scale second –harmonic imaging technique, with the adjustment of image contrast, frequency, depth and sector size for an adequate frame rate and optimal LV border visualization.

The image acquisition was performed during held end –expiration to minimize cardiac respiratory motion. A minimum of at least 3 cardiac cycles were recorded for analysis. M Mode, 2 D (frame rate >50-70 fps), colour Doppler, pulse wave Doppler, pulse wave tissue Doppler was obtained in all cases. Care was taken to avoid LV foreshortening in all apical views.[10]The following parameters were recorded; Measurements of left ventricle, Mitral Value: Normal/ Stenosis/ Regurgitation, Aortic Valve: Normal/ Stenosis/Regurgitation, Tricuspid Valve: Normal/ Stenosis/ Regurgitation, Pulmonary Valve: Normal/ Stenosis/ Regurgitation, Right Ventricle: normal/Dilated, Left Atrium: Normal/ Dilated, Interatrial Septum: Intact / defect, Interventricular Septum: Intact/ defect, Left ventricular wall movement: Normal/ Regional Wall Motion Abnormality / global Hypokinesia,[18] Pulmonary artery hypertension: Present/ absent.

2.2. Statistical analysis

The Data was entered in to MS Excel software and analysis was done using SPSS version 20 software. All the parameters were reported as mean and standard deviation. Differences between the groups were estimated by t-test. A p-value <0.05 was considered statistically significant and p-value > 0.05 was considered non - significant.

3. Results

The patients were equally divided in two groups, Group 1 comprising of 100 patients and Group 2 comprising of 100 subjects.

Table 1: Age wise distribution

S. No.	Group	Mean + SD
1	Group 1 (N=100)	54.33+2.85
2	Group 2 (N=100)	54.18+2.54

Table 2: Sex wise distribution

S. No.	Group	Male	Female	Total
1	Group 1 (N=100)	86	14	100
2	Group 2 (N=100)	91	9	100

Table 3: Showing Comparison of L.A. Diameter among cases and controls

S. No.	Group	L. A. Diameter (CM) Mean + SD	p value
1	Group 1 (N=100)	2.94+0.27	0.000
2	Group 2 (N=100)	3.43+0.32	

Table 4: Showing Comparison of AORTIC ROOT

S. No.	Group	Aortic Root (cm)Mean + SD	p value
1	Group 1 (N=100)	2.94+0.27	0.04
2	Group 2 (N=100)	3.02+0.32	

Table 5: Showing Comparison of thickness of interventricular septum in diastole (IVSD)

S. No.	Group	I.V.S.D. (CM) Mean + SD	p value
1	Group 1 (N=100)	1.01+0.13	0.000
2	Group 2 (N=100)	1.21+0.22	

Table 6: Showing comparison of left ventricle internal dimension (L.V.I.D.)

S. No.	Group	I.V.S.D. (CM) Mean + SD	p value
1	Group 1 (N=100)	4.97+4.25	0.08
2	Group 2 (N=100)	5.24+5.72	

4. Discussion

The following observations and results were found in our study. Age wise distribution of cases in Group 1 was 54.33+2.85 years and Group 2 subjects was 54.18+2.54 years. Genderwise distribution in Cases and subjects there were 86% Male and 14% female whereas in Control subjects in group 1 and there were 91% Male and 9% female subjects in group 2. The difference in LAD in Group 1 and Group 2 was found significant. Aortic Root dimensions difference between Group 1 and Group 2 was also found to be significant. IVSD dimensions difference between Group 1 and Group 2 it was found significant. LVID dimensions between Group 1 and Group 2 was not significant. In our study, Left ventricular systolic function was normal in all hypertensive patients although it was lower than healthy group (Group1). This result was similar to a study done by Miguel et al.[19] but contrary to another study done by Akintunde et al, which showed a lower ejection fraction occurred among long term hypertensive patients.[20] Left ventricular hypertrophy is a maladaptive response to chronic pressure overload and is mediated by various neurohormonal substances that independently exert trophic effects on myocytes in the heart.[21] In several studies, left ventricular hypertrophy has been well documented to be a marker of morbidity and mortality[22,23] in heart disease. In our study, we found Left ventricular hypertrophy, Left ventricular mass index were significantly higher in patient with hypertension duration more than 5 year. LV mass index in hypertensive patients was 57% vs 14% in healthy group. It is well known that relation between left ventricular mass index and cardiovascular risk exists. Concentric hypertrophy is a predictor of an increased incidence of cardiovascular diseases.[18,24] In our study Hypertension duration more than 5 year was directly correlated to left ventricular mass. This was supported by another study which stated that the duration of hypertension is one of the main predictors of hypertensive cardiac damage.[25] In our study LA size was significantly higher in patients. These results were similar to a study done by Millar et al., revealing a significant increase in LA Size.[26]

5. Conclusion

It can be conclude that duration of Hypertension (more than 5years) directly correlates to left ventricular mass and hence, overall function. Echocardiography is a useful technique that can detect cardiac morphologic and hemodynamic changes caused by systemic arterial hypertension. Therefore, echocardiography is a powerful tool for the evaluation of target organ damage, which is essential for the evaluation of cardiovascular risk.

6. Source of Funding

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7. Conflicts of Interest

None declared.

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