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ECHOCARDIOGRAPHIC 2D/M-MODE/DOPPLER VELOCITY PARAMETERS OF HYPERTENSIVE CASES VERSUS CONTROLS

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ABSTRACT **Introduction:** Hypertension is known to cause changes in the LV that impact negatively on the LA both structurally and functionally posing clinically significant risk to patients. LA size assessment until recently was limited to determination of LA linear diameter and much has not been elucidated with respect to left atrial volume as a surrogate for LA function. It is therefore important to see how LA size (linear diameter and volume) relate to LV function (Systolic and Diastolic) among hypertensive subgroups and normotensive subjects. **Objectives:** To compare hypertensive with normotensive using the echocardiographic 2D/M mode/Velocity parameters **Methods:** It is an echocardiographic based descriptive cross-sectional study. A total of 200 hypertensive patients and 100 normotensive controls (matched for age and sex in a 2:1 ratio) were recruited from the cardiology clinics using systematic sampling method. **Results:** The mean age of the study population was 58.7 ±13.96 (58.42±13.29 for Hypertensives and 59.26±15.27 for Controls) years while the median age was 59years.The female to male ratio was 1.06 among cases and 1.27 among the controls. Majority of the cases had isolated diastolic dysfunction n=149 (74.5%), thirty six (18%) had normal diastolic and systolic functions while 7.5% had combined systolic and diastolic dysfunction (n=15). The LA size (volumes and linear diameter) was significantly larger in the hypertensive group compared to the control arm. LA reservoir and contractile functions were found to be significantly higher in the hypertensive cohort while the conduit function was found to be lower among the hypertensive subjects. LA volumes correlated significantly with E/E'. Among Cases with Isolated LV Diastolic Dysfunction, LV mass correlated significantly with all measurements of LA size. LA minimum volume correlated significantly with E/A ratio. Among cases with LV Systolic and Diastolic Dysfunction, LA pre A wave volume correlated significantly with LV mass. LA volumes correlated better than LA linear diameter with specific parameters of LV diastolic dysfunction among all groups of cases and controls. There was no significant correlation between age, body mass index versus LA linear diameter and volumes among cases with Normal LV Systolic and Diastolic Function, isolated LV diastolic dysfunction and the group with both LV Systolic and Diastolic Dysfunction. There was significant association between ECG and Echocardiographic LA enlargement. LA maximum volume correlated significantly with average systolic blood pressure, pulse pressure and mean arterial pressure. **Conclusion:** Hypertensive patients have larger LA volumes than normotensive controls. LA volumes correlate better than LA linear diameter with diastolic function variables. It is therefore expedient to use LA volumes routinely in assessing LA size as it may detect early and subtle changes in LA size and function

KEYWORDS :

INTRODUCTION:

The burden of cardiac diseases is a major problem in the world, with hypertension, ischaemic heart disease and cardiomyopathies as major causes of mortality amongst people. This is particularly worse in developing countries in Africa where there is increased burden of both communicable and non-communicable diseases (for which hypertension and cancers are prevalent). This result in loss of manpower, financial stress on care givers and may also have other socioeconomic implications.[1,2]

Hypertension particularly is found to be more prevalent amongs. Blacks. Patients with hypertension have many target organ damage for which heart disease is an example. Others include stroke and chronic kidney disease. Hypertension notably causes problems of impaired relaxation of the heart (diastolic dysfunction) and this has been found to impact negatively on the heart chamber size particularly the left atrium and left ventricle.[1]

As our understanding of diastology increases and with availability of non-invasive techniques like echocardiography, this will lead to increase in the early diagnosis of diastolic/systolic dysfunction (a notable risk factor for increased cardiovascular morbidity) especially so in patients with systemic hypertension.This study will help increase knowledge base and ultimately improve intervention since most hypertensives are asymptomatic in early stages of the disease.This will create opportunities for clinicians, policy makers and those at decision making levels to adopt solutions towards preventing progression into overt heart failure.

METHODOLOGY:

It is an echocardiographic based descriptive cross-sectional study done in DELSUTH (Delta State University Teaching Hospital). A total of 200 hypertensive patients and 100 normotensive controls (matched for age and sex in a 2:1 ratio) were recruited from the cardiology clinics using systematic sampling method.P value less than 0.05 is regarded as

significant. Aims of the Study: To compare echocardiographic 2D/M mode/Doppler velocity parameters between hypertensives and normotensives:Hypertensives Inclusion Criteria:1)Males and females ≥18years.2)Hypertensive patients,irrespective of,blood pressure control,whether on antihypertensive medications or not and duration of hypertension. Exclusion Criteria;1)Overt heart failure .2)Cardiomyopathy,3)Suboptimal echocardiographic images,4)Rheumatic valvular heart disease (regurgitation or stenosis),5)Non consenting patients,6)Patients with atrial fibrillation7) Pregnant womenCONTROLS;100 apparently healthy controls without any known medical or cardiovascular disease that were 18 years and above and normotensive were recruited for the study. They were largely drawn from hospital workers, visitors and patient relatives. Those with evidence of structural heart disease and sub-optimal echocardiographic images were excluded from the study. They were matched against the test subjects for age and sex in a 1: 2 ratio.

RESULTS:

Table 1: Show echocardiographic 2D/M-mode/Doppler Velocity Parameters of hypertensives versus controls.

Echocardiography Parameters	Hypertensives (N=200)	Controls (N=100)	P-Value
IVSD (mm)	16.81±8.13	11.42±8.82	0.477
Aortic diameter (mm)	30.99±5.49	29.94±4.45	0.097
LVIDD (mm)	49.54±10.49	49.56±5.78	0.975
FS (%)	38.29±7.90	35.48±5.81	0.001*
LVEF (%)	66.93±10.60	64.31±7.30	0.013*
LVM (g)	219.96±118.72	190.01±76.82	0.023*
Relative wall thickness	0.51±0.23	0.48±0.35	0.505
MEW (cm/s)	66.36±22.90	69.52±13.33	0.133
MEWDT(sec)	0.197±0.05	0.206±0.042	0.124
MAW (cm/s)	73.11±19.59	61.15±8.48	<0.001*
IVRT(sec)	0.105±0.03	0.080±0.02	<0.001*
S VELOCITY (cm/s)	9.27±3.11	9.90±1.85	0.030*
E/E'	8.52±3.79	6.75±1.91	<0.001*
E/A	0.97±0.43	1.16±0.29	<0.001*
PULM A VELOCITY (cm/s)	20.94±12.07	48.72±14.38	<0.001*
PULM A DURATION(sec)	0.150±0.046	0.140±0.084	0.125

* = Student T test Significant = P<0.05

Key:IVSD-Interventricular Septal Thickness in Diastole, LVIDD-Left Ventricular Dimension in Diastole, FS- Fractional Shortening, LVEF- Left Ventricular Ejections Fraction, LVM- Left Ventricular Mass, CO- Cardiac Output, SV- Stroke Volume, MEW- Mitral E wave, MEWDT- Mitral E wave Deceleration time, MAW- Mitral A wave, Isovolumetric Relaxation Time,.

There was significant statistical difference in fractional shortening (P=0.001), LV ejection fraction (P=0.013) and LV mass (P=0.023) between cases and controls. Although there were differences in means of IVSD, Aortic diameter, LVIDD and Relative wall thickness, it was not statistically significant. There was significant statistical difference in Mitral A wave velocity (P=<0.001), ISRT (P=<0.001), S Velocity (P=0.030), Mitral E/E' (P=<0.001), mitral E/A ratio (P=<0.001) and pulmonary vein A wave velocity (P=<0.001) between cases and controls. Although there were differences in the means of CO, SV, MEW, MEWDT and Pulmonary A Duration, it was not statistically significant.

Table 2: Echocardiographic LA Indices of hypertensives versus Controls

Echocardiography Parameters	Hypertensive (N=200)	Controls (N=100)	P-Value
LA LINEAR DIAMETER (mm)	36.00±4.5	28.54±3.8	<0.001*
LA MAX VOLUME (mm^3)	68.08±8.51	39.10±13.54	<0.001*
LA PRE A VOLUME (mm^3)	48.39±11.48	29.97±11.77	<0.001*
LA MIN VOLUME (mm^3)	33.88±9.59	22.59±11.81	<0.001*
LA TOTAL EV (mm^3)	34.19±7.91	16.51±7.58	<0.001*
LA EXP INDEX (mm^3/m^2)	1.15±0.59	0.97±0.75	0.032*
LA CONDUIT VOL INDEX (mm^3/m^2)	46.97±35.32	61.11±22.36	<0.001*
LA ACTIVE EV (mm^3)	14.50±6.97	7.38±3.90	<0.001*
LA ACTIVE EF	0.29±0.13	0.27±0.14	<0.001*

* = P< 0.05 = Significant

Key: LA – Left Atrial, Min – Minimum, EF – ejection fraction, EV – emptying volume , Vol -volume

There was significant statistical difference in LA linear diameter (P=<0.001), LA maximum volume (P=<0.001), LA pre A wave volume (P=<0.001), LA minimum volume (P=<0.001), LA total emptying volume (P=<0.001), LA expansion index (P=0.032), LA active emptying volume (P=<0.001) and fraction (P=<0.001) among the hypertensive and control groups.

LA conduit volume index was found to be markedly higher in the control group compared to the hypertensive group.
(As shown in Table 2)

DISCUSSION

There was statistically significant difference in LA linear dimension between the hypertensive cohort and the control group. Other studies done in Nigeria showed significant difference between LA linear diameter among hypertensives and normotensive controls. However these studies were done on newly diagnosed patients. Okeahialam et al looked at apatient population with similar characteristics (newly diagnosed and those already on antihypertensive medications) with this study. They found no difference between LA linear dimension among hypertensives and normotensive controls. [3-5]

Phasic LA volumes (maximum, minimum, pre A) were shown to be higher among the hypertensive subjects and these findings have been consistently demonstrated in prospective studies and have been found to be more reliable in predicting cardiovascular outcomes than left atrial linear diameter. LA diameter assessment (M-mode) is less accurate than volume measurements; various cardiovascular diseases and compression on the left atrium can cause asymmetry in LA diameter. This may suggest that LA volume measurement may be a better way to assess LA function among hypertensive patients on treatment.The surrogates for assessing reservoir function (LA total emptying volume and LA expansionindex) were found to be higher in the hypertensive cohort. [4,6,7]

The conduit function using the LA conduit volume index was found to be lower among the hypertensive subjects while the contractile function (LA active emptying volume and fraction) were found to be significantly higher in the hypertensive group. Dernellis et al showed from their work that LA reservoir function and LA atrial ejection force (contractile function) were significantly higher among hypertensives and that the LA conduit function was lower in the hypertensive. [9,10]

Adebayo et al however, in a similar study done in Nigeria did not find any difference between the reservoir function of both groups and the LA conduit function was not assessed in their work. They showed that although LA reservoir volume did not significantly differ between the two groups, the pre atrial contraction length (a measure of reservoir volume) was higher in the hypertensive cohort compared to normotensive controls. However they attributed their findings to an early presentation since most of the subjects were newly diagnosed hypertensives. [4]

CONCLUSION

Hypertensive patients have larger LA volumes than normotensive controls. LA volumes correlate better than LA linear diameter with diastolic function variables. It is therefore expedient to use LA volumes routinely in assessing LA size as it may detect early and subtle changes in LA size and function

REFERENCES

1. Ike SO, Ikeh VO. The prevalence of diastolic dysfunction in adult hypertensive Nigerians. Ghana Med J. 2006;40(2):55-60.
2. Cooper R, Rotimi C. Hypertension in blacks. Am J Hypertens. 1997 Jul;10(7 Pt 1):804-12. PubMed PMID: 9234837.
3. Adewole AA, Akinyemi A, Okechukwu SO, Dike BO, Adekola D, Olulola OO, et al. Correlates of left atrial size in Nigerian hypertensives. Cardiovasc J South Afr 2005;16:158–61.
4. Adebayo AK, Oladapo OO, Adebiyi AA, ogunleye OO, Ogah OS, Ojji DB. Changes in the left atrial dimension and the function and LV geometry in newly diagnosed untreated hypertensive subjects. J Cardiovasc Med (Hagerstown). 2008;9(6):561-9.
5. Okeahialam BN, Anjorin FI. Hypertensive heart disease before overt heart failure:an

echocardiographic study. Cardiologie Tropicale. 1998; 24:11–4.
6. Erol MK, Yilmaz M, Acikel M, Karakelleoglu S. Left atrial mechanical function in patients with essential hypertension. Acta Cardiol. 2002 Oct;57(5):323-7. PubMed PMID: 12405568.
7. Matsuda Y, Toma Y, Ogawa H, Matsuzaki M, Katayama K, Fujii T, et al. Importance of left atrial function in patients with myocardial infarction. Circulation. 1983 Mar;67(3):566-71. PubMed PMID: 6821898.
8. Bukachia F, Waldenstro A, Mornera S, Lindqvista P, Heneinb MY, Kazzama E. Pulmonary venous flow reversal and its relationship to atrial mechanical function in normal subjects - Umea General Population Heart Study. Eur J Echocardiography. 2005;6:107-16.
10. Stefanadis C, Dernellis J, Toutouzas P. A clinical appraisal of left atrial function. Eur Heart J. 2001 Jan;22(1):22-36. PubMed PMID: 11133207.