



Echocardiographic findings in non-hypertensive subjects in Bayelsa, Nigeria

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ABSTRACT

Background: Echocardiography is one of the tools for the assessment of patients with hypertensive disease. Differences in parameters have been described based on race, gender and environment. **Aim:** In order to define what should be considered abnormal, we set to find out what the normal cardiac parameters are in our environment. **Methods:** This was a cross sectional of 80 non hypertensive adults. Transthoracic 2D echocardiography was performed with patients in the left decubitus position using standard techniques. **Results:** From this study, we found the left ventricular mass to be 129 ± 37.61 , the ejection fraction (%) 62.77 ± 10.55 and the fractional shortening (%) to be 34.18 ± 7.49 . Values for the intra-ventricular septal thickness, posterior wall diameter, left ventricle internal diameter (in diastole and systole) are $(0.92 \pm 0.19, 1.43 \pm 0.24)$, $(0.91 \pm 0.17, 1.47 \pm 0.23)$ and $(4.32 \pm 0.50, 2.83 \pm 0.42)$ respectively. All the parameters other than relative wall thickness and ejection fraction showed statistically significant difference ($P < 0.05$). **Conclusion:** We hope that the findings from this study will provide direction on what to consider as normal regarding echocardiographic findings in our environment.

Key words: Echocardiography, hypertension, cardiometabolic disorder, cardiovascular disorder, BMI, ventricular mass

INTRODUCTION

Hypertension is recognised globally as a public health problem and has been associated with reduced productivity when associated with complications.^[1] The prevalence of hypertension in Nigeria has been recorded to be 20% and in

Bayelsa State, it has been estimated to be as high as 27.8% and several risk factors and morbidities identified.^[2] Consultations, investigations, pharmacotherapy, lifestyle modification practices and in patient care are known to contribute to the cost of care of people living with hypertension.



Echocardiography has been identified as a veritable tool for the management of hypertensive patients and situations in which an echocardiogram is deemed to be appropriate for use in the management of hypertensive patients have been described.^[3,4] The use of Echocardiography appears to be widespread in Nigeria as there are numerous publications regarding the use of the investigation. It was however, only introduced into Bayelsa State within the last 5 years.

While the use of the echocardiogram has not been recommended for screening target organ damage involving the heart,^[3] several authors have tried to use the echocardiogram to determine if a difference exists in the cardiac findings of the offspring of hypertensive parents compared to the offspring of non-hypertensive parents.^[5,6]

Age, sex, ethnicity and body habitus are some of the factors known to affect cardiac morphology as determined by imaging studies and a wide variability of what is considered to be normal cardiac morphology existing amongst people of African descent.^[4,7]

While echocardiography (especially transthoracic) appears to be the more common investigation available for evaluation of the heart, magnetic resonance imaging may be superior in terms of measurement of apex of the heart and right ventricle and unlike echocardiography, does not make any assumptions when assessing the left ventricle.^[7] Three dimensional echocardiography is thought to underestimate left ventricular parameters though there has been improvements in measurements using this method however magnetic resonance imaging remains the reference point.^[8,9]

Poor health seeking behaviour and late presentation for health care has been documented amongst Nigerians^[10] and it is not surprising to find that people with newly diagnosed hypertension have significant cardiac morbidities present at the time of diagnosis.^[11,12] Based on several guidelines on the use of echocardiography, an indication for echocardiography exists in many of these patients.^[3] There are however no local studies

that provide a bench mark of normal echocardiographic findings against which findings in hypertensive subjects may be compared. This study aimed to bridge that gap by performing echocardiographic studies in non hypertensive patients.

METHODOLOGY

This was a cross sectional survey of 80 subjects. Subjects were medical students of the Niger Delta University, Ammasoma, Bayelsa State who volunteered for the study. Sample size for the study was determined using Epi-info 7 using a prevalence of 27%.^[2] Approval for this study was given by the Head of Department, Community Medicine, Niger Delta University, Ammasoma, Bayelsa State and all participants gave their consent prior to the study. Subjects who used tobacco products, were known to be hypertensive, on anti-hypertensive therapy, those diagnosed as hypertensive during the study (systolic BP >140 mmHg and Diastolic BP > 90mmHg on two different days) and those with an endocrine disease were excluded from the study. Socio-demographic data was obtained from participants using a research protocol developed for this study. Blood pressure was measured on the left arm with patient in the sitting position using a mercury sphygmomanometer (Accosson, United Kingdom) after participants had rested for at least thirty minutes. The weight and height of each subject as also measured and the body mass index (BMI) was calculated using the formula $BMI = \text{weight (kg)} / \text{height}^2 \text{ (m)}$

Echocardiography was performed with patients in the left decubitus position using a two dimensional echocardiography on a 2012, Phillips HD 11 ultrasound machine. All measurements were carried out according to guidelines put forward by the American Society of Echocardiography and the European Association of Cardiovascular Imaging.^[13] Echocardiograms were performed by a consultant radiologist with interest in cardiovascular imaging and then a consultant cardiologist.

Parameters assessed on echocardiography were the intra-ventricular septum diameter, left ventricular internal diameter, posterior wall

thickness of the left ventricle. These were assessed during systole and in diastole. The diameter of the left atrium was measured in diastole and the function of the left ventricle was assessed by measuring the ejection fraction and fractional shortening. The left ventricular mass was calculated using the formula^[14]

$$\text{Left ventricular mass (LVM)} = 0.8 \times 1.04 [(LVIDd + PWTd + SWTd)^3 - LVIDd^3] + 0.6$$

where

LVIDd = Left ventricle internal diameter in diastole, PWTd = Left ventricle posterior wall thickness in diastole, and SWTd = Inter-ventricular septal wall thickness in diastole. The relative wall thickness was calculated from the formula^[14]

$$\text{Relative wall thickness (RWT)} = 2(PWT) / LVIDd$$

Statistical analysis

Data were analysed using SPSS version 20.

Data are presented as mean±SD. The level of significance was set at $P < 0.05$.

RESULTS

Male participants constituted 57.8% (47/80) of the study population. Participants in this study were aged between 18 and 41 with a mean age of 22.19 ± 4.57 . There was no obese patient in this study and the mean BMI was 21.84 ± 3.33 . However, nine of the participants (11.25%) were noted to be overweight. Mean systolic blood pressure was 110.68 ± 10.88 and the mean diastolic blood pressure was 72.55 ± 9.50 . Results of other parameters are shown in table 1.

The various parameters were checked for differences based on gender. All the parameters other than relative wall thickness and ejection fraction showed statistically significant difference ($P < 0.05$) (table 2).

Table 1: Echocardiographic finding in study population

PARAMETER	VALUE
Inter ventricular septum in diastole (cm)	0.92 ± 0.19
Inter ventricular septum in systole (cm)	1.43 ± 0.24
Posterior wall diameter in diastole (cm)	0.91 ± 0.17
Posterior wall diameter in systole (cm)	1.47 ± 0.23
Left ventricle internal wall diameter in diastole (cm)	4.32 ± 0.50
Left ventricle internal wall diameter in systole (cm)	2.83 ± 0.42
Fractional shortening (%)	34.18 ± 7.49
Ejection fraction (%)	62.77 ± 10.5
Left atrium diameter (cm)	2.9 ± 0.38
Left ventricular mass (g)	129 ± 37.61
Relative wall thickness	0.42 ± 0.09

DISCUSSION

The aim of this study was to describe echocardiographic findings in non-hypertensive patients. We have tried to carry out the same measurements that are performed for people with hypertension so that values from this study

may serve as a reference point. With most of the participants in this study (90%) being in the second or third decade of life and this being an age group where hypertension is not a common finding, we are of the opinion that it is unlikely that any cardiac changes that precede the onset of clinical hypertension will have occurred in our subjects.

Table 2: Gender-based echocardiographic findings in study population

PARAMETER	MALE	FEMALE	P VALUE
Inter ventricular septum in diastole (cm)	0.97 ± 0.19	0.84 ± 0.17	0.00
Inter ventricular septum in systole (cm)	1.49 ± 0.28	1.35 ± 0.15	0.01
Left ventricle internal diameter in diastole (cm)	4.48 ± 0.49	4.09 ± 0.43	0.00
Left ventricle internal diameter in systole (cm)	3.00 ± 0.36	2.60 ± 0.39	0.00
Posterior wall diameter in diastole (cm)	0.97 ± 0.15	0.82 ± 0.15	0.03
Posterior wall diameter in systole (cm)	1.51 ± 0.24	1.39 ± 0.21	0.03
Fractional shortening (%)	32.72 ± 6.47	36.2 ± 8.4	0.03
Ejection fraction (%)	60.8 ± 9.1	65.49 ± 11.81	0.05
Left atrium diameter (cm)	3.06 ± 0.35	2.79 ± 0.38	0.03
Left ventricular mass (g)	147.04 ± 35.81	103.50 ± 22.3	0.00
Relative wall thickness	0.44 ± 0.91	0.41 ± 0.98	0.21

The need for a study like this in our environment is justified taking into consideration that ethnicity, genetics and environmental factors have an influence on the cardiac parameters found on echocardiography.^[4] Recommended relative wall thickness (RWT) values are between 0.32 and 0.42^[4] and people with a relative wall thickness >0.42 are thought to have undergone some form of cardiac remodeling. The mean RWT in this study in which no participant was hypertensive was found to be 0.42 ± 0.09.

The values obtained from this study are similar to values obtained from two other studies conducted in non hypertensive subjects^[5,6] although those studies tried to evaluate the effect of parental hypertension. These values were especially similar for the intra-ventricular septal diameter, left ventricle posterior wall diameter and the internal diameter of the left ventricle.

This study is limited by the fact that it did not consider the effect of parental hypertension or the effect of exercise which are considered to be valid external influences on the cardiac picture. The strength of this study is that it has provided a baseline against which echocardiograms taken from hypertensive patients can be measured against especially in our environment where people tend to present late and with

complications. It also serves to provide direction on any other research that may be undertaken regarding echocardiography.

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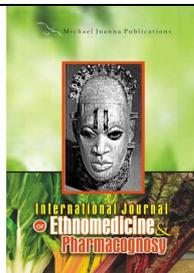
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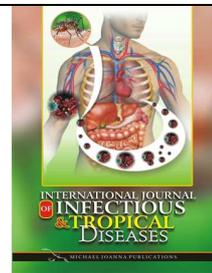
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