Pattern of Cardiac Diseases and Diagnostic Utility of Transthoracic Echocardiography in Delta State University Teaching Hospital, Oghara, Nigeria

Umuerri EM[1], Aigbe FI[1], Aiwuyo HO[1], Obasohan AO[1,2]*

Abstract

Introduction: Transthoracic echocardiography is a non-invasive tool used to assess cardiac structure and function. Information obtained can guide patient management. This study aim to describe cardiac anomalies encountered and the usefulness of transthoracic echocardiography in Delta State University Teaching Hospital(DELSUTH), Nigeria.

Materials and Methods: This study is retrospective observational in design. Echocardiograms of subjects aged 18years and above performed between August 2011 and April 2014 at the echocardiographic laboratory in DELSUTH using Xario diagnostic ultrasound system (model SSA-660A, Toshiba Medical Systems, Inc.) were reviewed. The data obtained was analyzed for age, sex, clinical indication and echocardiographic findings using Statistical Package for Social Sciences (SPSS) version 16. Results: Five hundred and ninety seven echocardiogram reports were reviewed comprising of 343 males(57.5%). The age range was 18-90years (mean=54.2±16.6years). The commonest indication for echocardiography was hypertension 289(48.4%). Others were non-cardiac pre-operative evaluation 77(12.9%), chest pain 49(8.2%), dilated cardiomyopathy(DCM) 37(6.2%), congestive cardiac failure 33(5.5%), rheumatic heart disease(RHD) 32(5.4%), routine medical examination 28(4.7%) and chronic kidney disease 20(3.4%).

Hypertensive heart disease(HHD) 274(45.9%) was the commonest echocardiographic diagnosis. Others were DCM 48(8.0%), RHD 43(7.2%), cor-pulmonale 18(3.0%), pericardial diseases 4(0.7%) and ischemic heart disease 2(0.3%). Out of the 205(34.3%) subjects with normal study, 75 were hypertensive. The sensitivity and specificity of clinical diagnosis of HHD, DCM and RHD were 76.8%, 33.3% and 44.2% respectively and 71.5%, 96.2% and 97.7% respectively.

Conclusion: This study reaffirms hypertensive heart disease as the commonest cardiac abnormality among adults in Nigeria and the importance of echocardiography as a diagnostic tool in cardiology.

Keywords: *Echocardiography, Cardiovascular Disease, Nigeria*

[1] *Department of Medicine, Delta State University Teaching Hospital, Oghara, Nigeria*
[2] *Department of Medicine, University of Benin Teaching Hospital, Benin-City, Nigeria*

[*]**Correspondence:** *Ejiroghene Martha Umuerri, Department of Medicine, Delta State University Teaching Hospital, P.M.B 07, Oghara, Nigeria. +234 803 348 7741, umuerriejiro@gmail.com*

Introduction

Cardiovascular disease is a common and important global public health challenge. It accounts for nearly a third of all-cause mortality worldwide[1]. This is particularly worse in developing countries like Nigeria being burdened with communicable diseases and now undergoing epidemiological transition as a result

of the emerging epidemic caused by non-communicable diseases of which cardiovascular diseases are prevalent[2]. A thorough knowledge of the prevalent patterns of heart disease and their presentations cannot be overemphasized as this will go a long way in strategic planning by policy makers and stakeholders to alleviate the burden of cardiovascular diseases.

The role of cardiac imaging cannot be over-stated in the understanding of cardiovascular diseases. Since it was first described by Edler and Hertz in the 1953, echocardiography has rapidly evolved in its clinical utility, revolutionizing diagnosis, and by extension, management in cardiovascular medicine[3]. Transthoracic echocardiography is a safe, relatively inexpensive non-invasive tool for assessing the structure and function of the heart. It has become an integral part of the practice of current clinical cardiology. In 2003, America had a record of over 20 million procedures[4]. Its use is gaining grounds in Africa and indeed Nigeria[5-13] as transthoracic echocardiography can be performed in some government owned and private health facilities across the country, although its availability is still a far cry from what is expected.

This study describes the pattern of cardiac diseases diagnosed by, as well as review the diagnostic utility of, transthoracic echocardiography in a tertiary health institution in Delta State, Nigeria.

Materials and methods

This study was carried out in Delta State University Teaching Hospital (DELSUTH), Oghara, Nigeria, a relatively new centre established in 2009. It is the only tertiary hospital owned by the Delta State government and serves as a main referral hospital within the State. Patients are also referred to DELSUTH from the neighbouring States of Edo and Bayelsa.

This retrospective observational study involved review of transthoracic echocardiographic studies performed in adults aged 18 years and above between August 2011 and April 2014. Transthoracic echocardiography is done in this centre on a twice weekly basis except for emergency situations at the echocardiography laboratory using Xario diagnostic ultrasound system (model SSA-660A, Toshiba Medical Systems, Inc.) equipped with a 3.5MHz linear array transducer. All patients had two-dimensional (2D), M-mode and Doppler (colour, pulsed-wave, continuous-wave and tissue) studies performed according to the recommendations of the American Society of Echocardiography (ASE)[14] by the cardiologists in the centre using standard views and measurements. Repeat echocardiography scans and requests without stated clinical indications were excluded. The age, sex, clinical indication and echocardiographic diagnosis were recorded.

Hypertensive heart disease was diagnosed in the presence of any or combination of the following echocardiographic abnormalities: left ventricular systolic dysfunction (ejection fraction < 50%), left ventricular diastolic dysfunction, left ventricular hypertrophy and dilated left atrium.

Dilated cardiomyopathy was diagnosed when there was dilated heart chambers with normal or decreased wall thickness and diffuse hypokinesia with impaired LV systolic function[15]. Nomenclature was prefixed with indicated known aetiology (for example diabetic dilated cardiomyopathy) while idiopathic dilated cardiomyopathy was reserved for cases with no indicated aetiology. It was described as ischaemic if there was regional wall motion abnormality rather than diffuse hypokinesia.

Valvular heart diseases was diagnosed based on the following: (i) Mitral stenosis: presence of

thickened and calcified mitral valve leaflets, loss of the classic M-shaped pattern of a normal mitral valve, diastolic doming and restriction of the mitral valve leaflet motions. (ii) Mitral Regurgitation: poor coaptation of the mitral valve leaflets in systole, thickened leaflets, dilated and hyperdynamic left ventricle. (iii) Aortic stenosis: presence of calcified aortic valve, reduction in aortic cusp separation, highly echo reflectant aortic valve leaflets. (iv) Aortic regurgitation: poor coaptation of the aortic cusps in diastole, dilated left ventricles and fine fluttering of the anterior mitral valve in diastole[16].

Pericardial effusion was diagnosed when there is echo free space between the visceral and parietal pericardium.

A formal ethical approval was obtained from the Health Research Ethics Committee of DELSUTH before commencement of the study.

Data Analysis: The data obtained were coded and analyzed using Statistical Package for Social Sciences (SPSS) version 16.0 software (SPSS Inc, Chicago, Illinois, USA). Descriptive analysis of the variables was performed and results expressed as frequency tables and percentages and continuous variables expressed as mean (±standard deviation).

The sensitivity, specificity , likelihood ratios, predictive values and accuracy of clinical diagnosis of cardiac disease compared with echocardiography was also determined.

Results

During the period under review, seven hundred and one echocardiography studies were performed but only five hundred and ninety seven echocardiogram reports met the study criteria and were reviewed. The age range was 18-90years (mean=54.2±16.6 years) and comprised of 343 males (57.5%) and 253 females (42.5%). The modal age group was 50-59 years (138 (23.1%)) while the number of persons in the age groups <40years, 40-49 years, 60-69years and ⩾ 70years were 126 (21.1%), 102 (17.1%), 106 (17.8%) and 125(20.9%) respectively.

The commonest indication for echocardiography was hypertension 289(48.4%). Others are as shown in table 1.

Table . Indications for Echocardiography

Indication	Frequency	Percentage (%)
Arrhythmia	6	1.0
Congestive Cardiac Failure	33	5.5
Chronic Kidney Disease	20	3.4
Chronic Obstructive Pulmonary Disease	12	2.0
Connective Tissue Disease	4	0.7
Cerebrovascular Disease	3	0.5
Dilated Cardiomyopathy	37	6.2
Diabetes Mellitus	1	0.2
Hypertrophic Cardiomyopathy	1	0.2
Hypertension	289	48.4
Chest Pain	49	8.2
Comprehensive Medical Check	28	4.7
Pre-operative Cardiac Evaluation	77	12.9
Pulmonary Hypertension	1	0.2
Thyrotoxicosis	3	0.5
Valvular Heart Disease / Cardiac murmurs	32	5.4
Total	597	100.0

Hypertensive heart disease(HHD) 274(45.9%) was the commonest echocardiographic diagnosis. Others were dilated cardiomyopathy (DCM) 48(8.0%), rheumatic heart disease (RHD) 43(7.2%), cor-pulmonale 18(3.0%), pericardial diseases 4(0.7%) and ischemic heart disease 2(0.3%) as shown in table 2. Among the 205 patients with normal study, 75(26.0%) were referred on account of hypertension, 6 (18.8%) for valvular heart disease , 7 (18.9%) for dilated cardiomyopathy, 45 (58.4%) for pre-operative cardiac evaluation, 30(61.2%) for chest pain and 25 (89.3%) for comprehensive health check.

Table . Echocardiographic Diagnoses

Echocardiography Diagnosis	Frequency	Percentage (%)
Hypertensive Heart Disease	274	45.9
Normal	205	34.3
Dilated Cardiomyopathy	48	8.0
• Idiopathic	27	
• Hypertensive	14	
• Diabetic	1	
• Alcoholic	2	
• Peripartal	2	
• Ischaemic	2	
Valvular Heart Disease	43	7.2
• Mitral Stenosis	3	
• Mitral Regurgitation	15	
• Mixed Mitral Disease	5	
• Mixed Mitral and Aortic Disease	9	
• Mixed Aortic Disease	3	
• Aortic Regurgitation	6	
• Aortic Stenosis	2	
Cor Pulmonale	18	3.0
Pericardial Effusion	4	0.7
Congenital Heart Disease	3	0.5
• Cor triatriatum dextrum	1	
• Mitral valve prolapse	2	
Ishcaemic Heart Disease	2	0.3

Assuming echocardiography was the gold standard for detecting cardiac disease, the diagnostic value of clinical diagnosis for hypertensive heart disease, dilated cardiomyopathy and rheumatic heart disease are as shown in table 3.

Table . Comparison of the accuracy of cardiac disease diagnosed by clinical examination with echocardiography

	CARDIAC DISEASE DIAGNOSED BY CLINICAL EXAMINATION		
	Hypertensive Heart Disease	Dilated Cardiomyopathy	Rheumatic Heart Disease
Sensitivity (%)	76.8	33.3	44.2
Specificity (%)	71.5	96.2	97.7
Positive Likelihood Ratio	2.70	8.71	18.8
Negative Likelihood Ratio	0.32	0.69	0.57
Positive Predictive Value (%)	65.4	43.2	59.4
Negative Predictive Value (%)	81.5	94.3	95.8
Accuracy (%)	73.7	91.1	93.8

Discussion

Hypertension and hypertensive heart disease were the commonest clinical indication and echocardiographic diagnosis respectively encountered in this study. These findings are not surprising but similar to previously reported studies across Nigeria[9-11, 17-20] and further buttresses the burden of hypertension in Nigeria. In this study, hypertensive heart disease, dilated cardiomyopathy and valvular heart disease accounted for more than 60% of the diagnoses made at echocardiography, in a decreasing order of frequency. The frequency of dilated cardiomyopathy and rheumatic heart disease were however far less than hypertensive heart disease. Ansa et al[11] and Agomuoh et al[8] also described a similar pattern in their study. The low frequency of echocardiographic diagnosis of valvular heart disease in this study may be a reflection of the decreasing prevalence of rheumatic heart disease as a result of improvements in the primary health care delivery system, with widespread use of appropriate antibiotic therapy for sore throats and other infectious disease conditions resulting in the prevention of rheumatic fever and rheumatic heart disease[21].

A quarter of the patients referred for echocardiography on account of hypertension had a normal study. Compared to earlier reports[11,18,19] the sensitivity and specificity of clinically detecting hypertensive heart disease was fairly moderate. The difference may be attributed to an increasing awareness of and need for prevention and early detection of hypertensive target organ damage among medical practitioners generally, leading to early referrals for echocardiography even when patients have clinically uncomplicated hypertension. The medical economics of this practice is however in question especially when medical bills are paid out of patients' pockets. Howbeit, it may be catastrophic to wait for florid clinical signs of hypertensive heart disease before referring

patients for echocardiography as there are greater benefits when the disease is discovered in its sub-clinical state.

Similar to findings by Ansa et al[11] Kolo et al[18], the sensitivity for detecting rheumatic heart disease was quite low. More patients had rheumatic heart disease than were clinically indicated. This finding corroborates the fact that clinical detection and evaluation of cardiac murmurs, an important clinical sign in RHD, may sometimes be difficult especially for the non-cardiologist. A noisy environment, low intensity murmur and tachycardia, low quality stethoscope as well as the untrained ear are some of the reasons cardiac murmurs may be missed. The specificity was however high. As have been suggested by other studies[11,22] , echocardiography is an important tool to 'rule in' or screen for rheumatic heart disease.

More than a third of the study population in this study had normal findings. This finding is similar to other reports and can be attributed to poor patient selection for echocardiography. Majority of the patients referred for comprehensive medical checks and pre-operative cardiac evaluation were among those with normal study. Cardiac diseases can often be detected clinically if carefully sought.

The frequency of chest pain as a clinical indication for echocardiography as well as ischaemic heart disease diagnosed by echocardiography were both low in this study. This finding corroborates earlier reports from Nigeria[8,9,11,13,17,18,23]. The current incidence of IHD in Nigeria is relatively low but rising and this trend has been highlighted by studies done across the country[23-26]. However, in this study, none of the patients with chest pain had ischaemic heart disease. This may be a pointer to an atypical presentation among the Nigerian population and therefore the need for a high index of suspicion especially as diabetes and obesity are on the increase. Other imaging studies such as stress echocardiography and myocardial perfusion imaging has also been shown to improve diagnostic yield of IHD even among patients with low risk[27].

Conclusion

The burden of hypertension and hypertensive heart disease is much and the role of echocardiography in the detection of heart disease cannot be over-emphasized as its findings influence management strategies. The use of other applications of echocardiography such as stress echocardiography in appropriately selected patients may help to unmask the true state of ischaemic heart disease in Nigeria.

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Citation

This article should be cited as: "*Umuerri EM, Aigbe FI, Aiwuyo HO, Obasohan AO*. Pattern of cardiac diseases and diagnostic utility of transthoracic echocardiography in Delta State University Teaching Hospital, Oghara, Nigeria. Afr. J. Trop. Med. & Biomed. Res 2013; 2 (2): 30-37".