ORIGINAL ARTICLE

Common echocardiographic abnormalities in Nigerians of different age groups

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Abstract

Background: Transthoracic echocardiography (TTE) is one of the most commonly performed cardiac investigations. It can provide comprehensive information about cardiac structure and function, helping to establish a diagnosis and guide therapy, and it is no longer the preserve of the specialist cardiology department. Previous studies on echocardiographic findings in our environment had documented valvular heart disease, hypertensive heart disease and congenital heart diseases as the commonest echocardiographic findings in Nigerians.

Aims: The study aimed to provide an update on the common echocardiographic findings in different age groups in this part of the world, since some of the previous similar studies were done over a decade ago.

Materials and Methods: We reviewed the echocardiogram reports of 608 consecutive patients done from July 2009 to October 2011 at a private echocardiographic laboratory in Enugu, South-East Nigeria. Data was analyzed for age, gender and echocardiographic findings.

Results: The age range of the patients was from 3 days to 98 years with a mean age of 46.4 ± 21.4 years. The mean age of the males was 47.6 ± 21.3 years, while the mean age of the females was 45.2 ± 21.1 years. The commonest echocardiographic abnormality in children was atrial septal defect, while rheumatic heart disease was the commonest in adolescents and young adults. Left ventricular diastolic dysfunction and degenerative valvular diseases respectively were the commonest in the middle-aged and elderly populations in this study.

Conclusion: This study has reaffirmed rheumatic heart disease (predominantly mitral valve regurgitation) as the commonest cardiac abnormality in adolescents and young adults. Degenerative valvular diseases, left ventricular diastolic dysfunction, and atrial septal defects were the commonest abnormalities in the elderly, middle-aged population and children, respectively.

Key words: Different age groups, echocardiographic abnormalities, Nigerians

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Introduction

Transthoracic echocardiography (TTE) is one of the most commonly performed cardiac investigations.[1] It can provide comprehensive information about cardiac structure and function, helping to establish a diagnosis and guide therapy, and it is no longer the preserve of the specialist cardiology department.[1] In Nigeria however, it is still performed and interpreted by cardiologists. Examinations are frequently requested by doctors in other branches of medicine.

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The commonest reason for undertaking an echocardiographic examination in adults is to assess left ventricular function.[2,3] Echocardiography is also valuable in patients with coronary artery disease, cardiac murmurs, atrial fibrillation, stroke, and transient ischaemic attack.[4,5] In some circumstances, the examination is an appropriate screening test even in the absence of cardiovascular symptoms, especially

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in first degree relatives of patients with hypertrophic cardiomyopathy and dilated cardiomyopathy.[6,7]

Two dimensional, M mode and Doppler echocardiography are widely used by pediatric cardiologists to evaluate cardiac structure and function in neonates, infants, and older children. Central cyanosis, ventricular septal defects and cardiac murmurs are the commonest indications for echocardiography in these age groups.[8,9].

Previous studies on the indications for echocardiography had documented valvular heart disease, hypertensive heart disease and congenital heart diseases as the commonest indications for echocardiography in Nigeria.[10,11,12] Similarly, these three conditions were also the commonest echocardiographic diagnoses in these studies.[10,11,12] Some of these studies were done over a decade ago, and there is a need for an update on the common results of echocardiographic examinations in different age groups in this part of the world. This is especially important in the face of the changing patterns of cardiovascular diseases in our environment and availability of more centers offering the service.

Materials and Methods

Conquest Medical Imaging, Enugu, is a private diagnostic center which offers radiologic and ultrasound diagnostic services in Enugu, South East Nigeria. It is one of the three centers in Enugu offering diagnostic echocardiographic services to over 30 million Nigerians living in this part of the country. Referrals to this center for echocardiography are from Private hospitals, Government General Hospitals and Teaching hospitals in South East Nigeria and beyond.

Consecutive echocardiogram reports of 608 patients done over a period of 2 years (July 2009-October 2011) were retrospectively reviewed out of a total of 612 scans. Repeat scans were excluded from the count, accounting for the difference in number.

Echocardiography was done with a Logic 500MD Echo machine (GE USA), equipped with a 3.5/5 MHz transducer, a video recorder and printout processor. The machine has the capability to perform M-mode, 2-Dimensional and Doppler studies. All the echocardiographic examinations were performed using standard views and interpreted by one cardiologist. All the measurements were taken according to the recommendations of the American Society of Echocardiography.[13] The procedure for the examination was explained to all the patients, and informed consent was obtained verbally from them.

Statistical analysis

Data obtained from the register for each patient included age, gender, height, weight, indication for echocardiography and findings. The data obtained were analyzed using SPSS version 15 software. Results were presented using tables. Student *t*-test was used for comparison of continuous variables, while Chi-square was used for comparison of discrete variables and Fisher's exact test where appropriate. The level of statistical significance was at $P < 0.05$.

Results

There were 612 echocardiogram reports during the period of review. Four repeat scans, and those of 9 patients with incomplete data were excluded from the analysis. A total of 599 reports were therefore analyzed, and comprised 342 males (57%) and 257 females (43%). The age range of the patients was from 3 days to 98 years with a mean age of 46.4 ± 21.4 years [Table 1]. The mean age of the males was 47.6 ± 21.3 years, while the mean age of the females was 45.2 ± 21.1 years. There was no statistically significant difference between the ages of the males and females ($P = 0.12$), but more males presented for echocardiography than females ($P < 0.0001$) [Table 1].

About 75% of all the patients referred for echocardiography at our center were in the age range of 30-79 years. The age range 50-59 had the highest number of patients (106) in this study [Table 2].

The commonest echocardiographic abnormality in children was atrial septal defect [Table 3]. The mean age of children with ASD was 1.3 ± 0.8 months for the males, and 2.6 ± 1.1 months for the females, with a male to female ratio of 1:1.7 [Table 1].

Rheumatic heart disease was the commonest abnormality in adolescents and young adults and was noted in 25 patients in this category out of a total of 50 seen during the period under review [Tables 3 and 4].

Table 1: Comparison of demographic and some clinical parameters

Parameter	Numbers	*P* value
Sex (*n*=599)		
Male (%)	342 (57)	<0.0001*
Female (%)	257 (43)	
Age (mean±SD)		
Mean (599)	46.4±21.4	0.12
Male (342)	47.6±21.3	
Female (257)	45.2±21.1	
Degenerative valve disease in the elderly (*n*=323)		
Aortic (%)	181 (56)	<0.0001*
Mitral (%)	142 (44)	
Atrial septal defect in children (*n*=11)		
Male (%)	4 (37)	0.3948[a]
Female (%)	7 (63)	

*Statistically significant (Chi-square); SD=Standard deviation, [a]Fisher's Exact test

Left ventricular diastolic dysfunction was the commonest abnormality in middle aged individuals and constituted 18% of all the abnormalities noted in this age category [Table 4]. However, of the 232 reports of left ventricular diastolic dysfunction, 54 were in the middle age bracket, representing 23% of all individuals with this abnormality.

Table 2: Age distribution of echocardiographic abnormalities

Age (years)	Number of patients (n=599) N (%)	Total number of echocardiographic findings*
0-9	42 (7.0)	47
10-19	33 (5.5)	36
20-29	50 (8.4)	52
30-39	83 (13.9)	90
40-49	91 (15.2)	101
50-59	106 (17.7)	127
60-69	103 (17.2)	183
70-79	69 (11.5)	100
80-89	21 (3.5)	46
90-99	1 (0.002)	4
Total	599	786

*Some subjects had more than one abnormality

Degenerative valvular diseases were the commonest abnormalities in the elderly population in this study. These abnormalities were almost universal in this population and were noted in about 95% of individuals aged 65 years and above, and affected the aortic valve more than the mitral valve ($P < 0.0001$) [Tables 1, 3 and 4].

Discussion

The commonest echocardiographic findings in children were atrial septal defects (ASD) and these also represented the commonest abnormalities in this age group. Ventricular septal defects (VSD) and Tetralogy of Fallot were the other common abnormalities in this age group. Sani *et al*., had documented

Table 3: Summary of commonest echocardiographic abnormalities in different age categories

Age categories (years)	Commonest abnormalities N(%)			
	1st	2nd	3rd	Others
Children (0-9) (n=42)	Atrial septal defects 11 (26)	Ventricular septal defects 9 (21)	Tetralogy of Fallot 5 (12)	22 (52)
Adolescents/Young adults (10-39) (n=166)	Rheumatic heart disease 25 (15)	Pericardial diseases 15 (9)	Hypertensive heart disease 12 (7)	126 (76)
Middle-aged (40-64) (n=240)	Left ventricular diastolic dysfunction 44 (18)	Hypertensive heart disease 41 (17)	Degenerative valvular diseases 31 (13)	204 (85)
Elderly (≥65) (n=151)	Degenerative valvular diseases 144 (95)	Left ventricular diastolic dysfunction 86 (57)	Left ventricular systolic dysfunction 34 (23)	264 (175)

Table 4: Frequency of common echocardiographic findings in different age groups

Age (y)	1st No. (%)	2nd No. (%)	3rd No. (%)	4th No. (%)	5th No. (%)	Others No. (%)
0-9 (n=42)	Atrial septal defect 11 (26)	Ventricular septal defect 9 (21)	Normal finding 9 (21)	Tetralogy of Fallot 5 (12)	Persistent ductus arteriosus 3 (7)	10 (23)
10-19 (n=33)	Normal finding 14 (42)	Rheumatic heart disease 5 (15)	Atrial septal defect 3 (9)	Pericardial diseases 2 (6)	Dilated left atrium 2 (6)	10 (30)
20-29 (n=50)	Normal finding 18 (36)	Rheumatic heart disease 11 (22)	Pericardial diseases 5 (10)	Dilated cardiomyopathy 4 (8)	Atrial septal defect 3 (6)	11 (22)
30-39 (n=83)	Normal finding 16 (19)	Hypertensive heart disease 10 (12)	Rheumatic heart diseases 9 (11)	Dilated cardiomyopathy 4 (5)	Pericardial diseases 3 (4)	48 (58)
40-49 (n=91)	Left ventricular diastolic dysfunction 18 (20)	Hypertensive heart disease 16 (18)	Normal finding 16 (18)	Rheumatic heart diseases 10 (11)	Left ventricular systolic dysfunction 6 (6)	35 (38)
50-59 (n=106)	Degenerative valvular disease 30 (28)	Left ventricular diastolic dysfunction 26 (26)	Hypertensive heart disease 25 (24)	Left ventricular systolic dysfunction 11 (10)	Rheumatic heart disease 4 (4)	31 (29)
60-69 (n=103)	Degenerative valvular disease 73 (70)	Left ventricular diastolic dysfunction 57 (55)	Left ventricular systolic dysfunction 15 (15)	Hypertensive heart disease 11 (11)	Thoracic aortic aneurysm 4 (4)	23 (22)
70-79 (n=69)	Degenerative valvular disease 51 (74)	Left ventricular diastolic dysfunction 21 (30)	Left ventricular systolic dysfunction 11 (16)	Hypertensive heart disease 5 (7)	Ischaemic heart disease 3 (4)	9 (13)
80-89 (n=21)	Degenerative valvular disease 19 (90)	Left ventricular diastolic dysfunction 7 (33)	Left ventricular systolic dysfunction 7 (33)	Hypertensive heart disease 3 (14)	Pulmonary hypertension 2 (10)	8 (38)
90-99 (n=1)	Degenerative valvular disease 1 (100)	Left ventricular diastolic dysfunction 1 (100)	Left ventricular systolic dysfunction 1 (100)	Aortic aneurysm 1 (100)		

ventricular septal defects, Tetralogy of Fallot and atrial septal defects in that order as the commonest echocardiographic abnormalities in children studied at the northern Nigerian city of Kano between 2002 and 2006.[14] In India, Kapoor *et al*., and Bhat *et al*., independently noted that ventricular septal defects, atrial septal defects and persistent ductus arteriosus in that order were the commonest abnormalities in two different studies involving over 46,000 patients.[15,16] The findings in our study are similar to those of Sani *et al*., on the commonest echo abnormalities in children, though the relative frequencies of these abnormalities showed some variations. The Indian studies and the study in Kano, as well as many other studies elsewhere have consistently shown that ventricular septal defects are the commonest congenital cardiac abnormalities in children.[17,18] In our environment, routine screening for congenital heart diseases is not done even when there are obvious indications. Many parents may not be able to afford an echocardiographic examination on their sick child when the doctor asks for it, and because VSDs have greater morbidity and mortality,[19,20] some of these children with VSDs may die before their parents save enough money for the investigation. Atrial septal defects are associated with lower mortality and morbidity compared to VSDs,[19,20] and may give enough time to some of these indigent parents to raise money for echocardiographic examination. These may be some of the reasons for the higher frequency of atrial septal defect in our study compared to some previous ones.

Most adolescents and young adults who presented at our laboratory had normal findings. The explanation for this may be related to the common belief among many Nigerians that laboratories make diagnosis for clinicians. In this context, many individuals who can afford the cost of laboratory investigations just walk into a laboratory and pay for investigations without obvious indications. This subset usually comprises of young men and women who are enlightened, have good paying jobs and can afford to throw money around. However, rheumatic heart disease, pericardial diseases and hypertensive heart disease were the commonest abnormalities recorded in this age group. These findings are similar to other studies done in the past.[21,22] Rheumatic heart disease was the commonest heart disease in this age group from this study, and had been reported in several studies to be the commonest cause of acquired heart disease in this age group, especially in the developing parts of the world.[23-25]

In the middle-aged subjects, left ventricular diastolic dysfunction, hypertensive heart disease and degenerative valvular diseases were the commonest echocardiographic abnormalities. Similar studies done in the past in this environment documented hypertensive heart disease as the commonest echocardiographic finding in adults.[26-28] These earlier studies did not isolate diastolic dysfunction and systolic dysfunction as distinct diagnoses, but rather lumped them under hypertensive heart disease and congestive cardiac failure, and this may be responsible for the differences between their findings and ours. Left ventricular diastolic dysfunction is one of the earliest manifestations of hypertensive heart disease, and it is also a common finding in middle-aged and elderly subjects, especially women.[29-31] It is possible that most of these subjects were hypertensive, and may have presented for echocardiographic examination without referral by clinicians, and subsequently had no clinical diagnosis/indication for the study.

In the patients aged 65 years and above (elderly population), degenerative valvular diseases, left ventricular diastolic dysfunction and left ventricular systolic dysfunction were the commonest abnormalities noted in our study. The aortic valves were affected more than the mitral, and regurgitation was significantly more prevalent than stenosis for both valves. Degenerative valvular diseases are common echocardiographic findings in the elderly population, and frequently result in cardiac chamber dilatation and consequent systolic and diastolic dysfunction of the ventricles.[32-34] Ageing and hypertension (which were common in our elderly subjects) are recognized causes of left ventricular diastolic dysfunction, and could be contributory to the preponderance of this abnormality in this population as noted in a previous study.[30] Hypertension, which is common in the elderly, is also an important cause of left ventricular systolic dysfunction and may be contributory to the prevalent nature of this abnormality in this population.[34]

Conclusion

This study has reaffirmed rheumatic heart disease (predominantly mitral valve regurgitation) as the commonest cardiac abnormality in adolescents and young adults, and degenerative valvular heart disease as the commonest in the elderly. Left ventricular diastolic dysfunction was the commonest abnormality in middle-aged adults, while atrial septal defect was the commonest in children.

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