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Full Length Research Paper

The Rejuvenation of Cardiac Catheterization for congenital heart diseases in Nigeria: Profiles, Challenges and Prospects

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Cardiac catheterization had not been available locally for about three decades but resurfaced about 3 years ago. This study aimed at documenting the profiles of the patients who had undergone cardiac catheterization since its availability, the challenges encountered and the prospects associated with the procedure at the study. Patients referred for cardiac catheterization between May 2010 and September 2012 were studied consecutively. Profile of the patients including diagnosis at referral and indication for cardiac catheterization were documented. Twenty-four patients were recruited into the study, 21 (87.5%) from public hospital and 3 (12.5%) from private hospital. The age ranged between one to 62 years with a mean age ± SD of 14.5± 9.0 years. 66.7% were females while 33.3% were males with M/F of 1: 2. Fifteen (62.5%) had acyanotic congenital heart disease while 9 (37.5%) had cyanotic congenital heart disease. Thirteen had diagnostic cardiac catheterization while eleven had device closure of acyanotic congenital heart defect. Diagnostic and interventional cardiac catheterization is now available in Nigeria, high degree of manpower training, cost and local availability of consumables are major limiting factor to its use. Regional and International collaboration could be mutually beneficial.

Keywords: Cardiac catheterization, congenital heart disease, cyanosis, acyanosis, profile.

INTRODUCTION

Cardiac catheterization has a long and illustrious history, beginning in 1929 when Werner Forssmann, a surgical resident and future urologist, performed the first cardiac catheterization from an arm vein on himself (Forssmann, 1929). In the 1950s, the catheterization laboratory (Cath lab) was used to understand the physiology of congenital Heart defects. By the 1960s to 1970s, advances in cardiac surgery required more detailed anatomic information, which was addressed using axial angiography (Bargeron et al., 1977; Fellows et al., 1977). In Nigeria, diagnostic cardiac catheterizations were carried out in some centers in the 1970s and early 1980s. In the 1980s, two-dimensional (2-D) echocardiography made it possible for some patients to be diagnosed and treated without cardiac catheterization. In the 1990s, transoesophageal echocardiography and magnetic resonance imaging produced various cardiac images, de-

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Table 1. Profile of patients for diagnostic catheterization and diagnosis.

Patient	Patient ID	Age in years	Sex (M/F)	Diagnosis	Social Class	Mode of sponsorship
1	RO	1.65	F	Truncus Arteriosus with severe PAH	4	Government
2.	YF	2	F	Down syndrome with Large inlet VSD, moderate PDA, Severe PAH	4	Government
3	SO	5	M	Tetralogy of Fallot	5	Government
4	MF	6	F	Tetralogy of Fallot	5	Government
5	KG	8	F	Partial AVSD, cleft in left AV valve, severe PAH	5	Charity
6	AT	8	M	Tricuspid Atresia type 1B	5	Government
7	ET	10	M	Tricuspid Atresia type 1B	5	Charity
8	KA	15	F	Large secumdum ASD Tricuspid stenosis Hypoplastic RV Restrictive VSD	5	Government
9	IM	23	F	Tetralogy of Fallot	5	Government
10.	DM	24	F	Large secundum ASD with severe PAH	5	Government
11.	OJ	25	M	Tetralogy of Fallot	5	Government
12	RO	26	M	Tetralogy of Fallot	5	Government
13	OA	55	F	Primium ASD with moderate PAH	5	Government

AVSD- Atrioventricular septal defect
PAH- pulmonary artery hypertension
ASD- Atrial septal defect
RV- right Ventricle
VSD- Ventricular septal defect
PDA- Patent Ductus Arteriosus

Table 2. Profile of patients for both diagnostic and interventional catheterization.

Patient	Patient ID	Age in years	Sex (M/F)	Diagnosis	Social Class	Mode of sponsorship
1	VO	3	F	Patent Ductus Arteriosus	5	NGO
2	SR	3	F	Patent ductus Arteriosus	5	Government
3	SA	3	M	Patent Ductus Arteriosus	4	Government
4	AD	4	F	Patent ductus Arteriosus	4	Government
5	BY	4	M	Patent ductus arteriosus	4	Government
6	OS	5	F	Patent ductus Arteriosus	4	Government
7	FT	6	F	Patent Ductus arteriosus	5	Charity
8	EE	10	F	Patent Ductus arteriosus	5	Government
9	DS	16	M	Patent Ductus Arteriosus	5	Charity
10	PO	34	F	Secundum Atrial septal defect	1	Employer
11	AE	62	F	Secundum Atrial septal defect	5	Charity

creasing the need for diagnostic cardiac catheterization. In the management of patients with structural heart disease, cardiac catheterization is recommended to confirm the presence of a clinically suspected condition, define its anatomic and physiologic severity, and determine the presence or absence of associated condi-

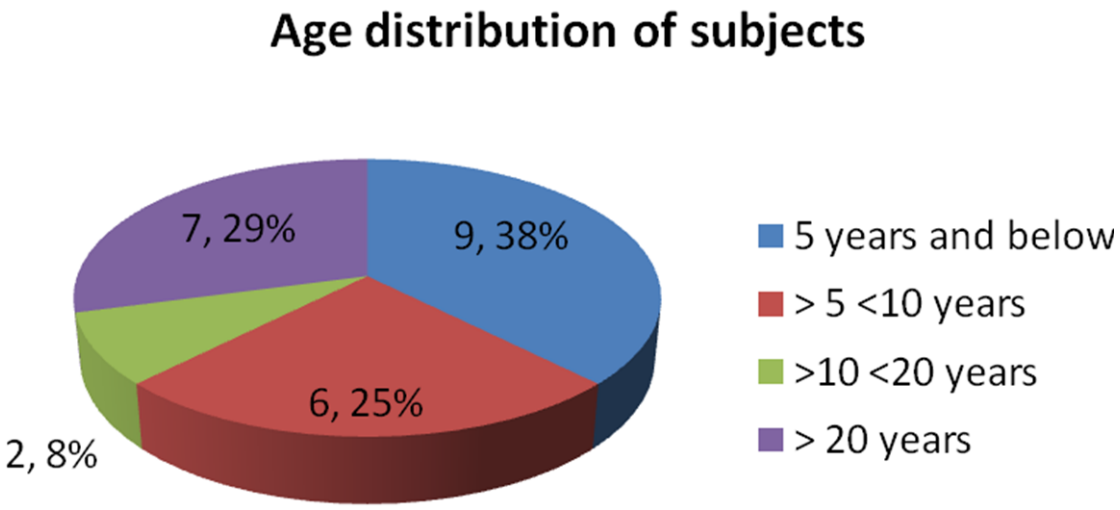

Figure 1. Age distribution of the subjects.

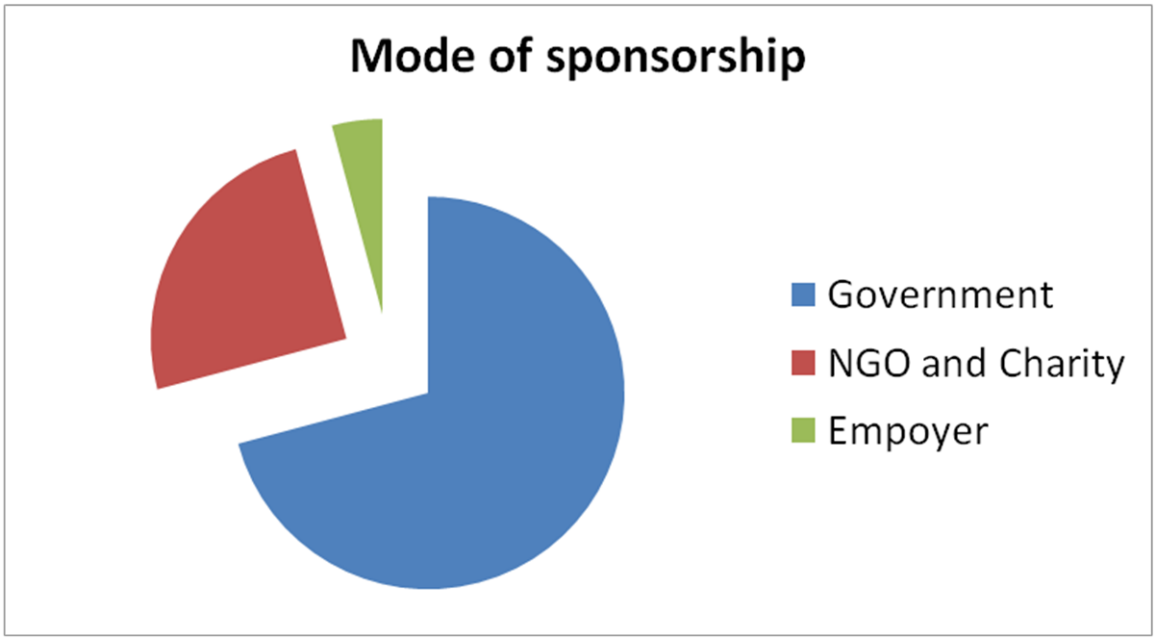

Figure 2. Mode of sponsorship.

tions when a therapeutic intervention is planned in a symptomatic patient (Donald, 2006) especially when complete anatomic diagnosis or necessary hemodynamic information cannot be obtained by noninvasive methods or clinical signs and symptoms are not consistent with a patient's diagnosis or a patient's clinical course is not progressing as expected (Ronald, 2008).

Although few would disagree that consideration of heart surgery is an adequate reason for the performance of catheterization, clinicians differ about whether all patients being considered for heart surgery should undergo preoperative cardiac catheterization. By providing the surgical team with a precise and complete road map of the course ahead, cardiac catheterization can permit a carefully reasoned and maximally efficient operative procedure. Furthermore, information obtained by cardiac catheterization may be invaluable in the assessment of crucial determinants of prognosis, such as left ventricular function, status of the pulmonary vasculature, and the patency of the coronary arteries. Another broad indication for performing cardiac catheterization is to aid in the diagnosis of obscure or confusing problems, even when a major therapeutic decision is not imminent (Donald, 2006). Structural heart disease contributes significantly to

the health burden of children in Nigeria (Okoromah et al., 2008). Cardiac catheterization, an essential component of full cardiovascular system evaluation, had not been available locally for about three decades. This may have contributed to inconclusive management of patients locally and exodus to overseas countries by patients in search of cure. Although cardiac catheterization is now available in Nigeria for the management of patients with structural heart disease, it is currently underutilized with less than 5% of patient requiring it having access to this facility. Hence we aimed to highlight the profiles of the patients who have undergone cardiac catheterization for congenital heart diseases since the availability of the facility, the challenges encountered factors which had been responsible for the limited use of the facility and the prospects associated with the procedure.

METHODS

This was a prospective and cross sectional study carried out at the Reddington Multi-specialist Hospital, Lagos, Nigeria between May 2010 and September 2012. The subjects included 24 consecutive patients who presented at the study centre for cardiac catheterization in preparation for definitive interventions. They all had congenital heart disease which was confirmed with a baseline Transthoracic echocardiographic studies which were performed on each using a Hewlett-Packard SONOS 5500 machine and transducer with a frequency of 5MHz. Ethical clearance for the study was obtained from the Ethical Committee of the Reddington Multispecialist Hospital, Lagos and Informed consent was sought from parents or caregivers of subjects and subjects as appropriate before enrolment into the study. Social class was assessed using the methods described for Nigerian families based on educational attainment and occupation of parents (Oyedeji, 1985). Data was analyzed using Microsoft Excel program. Mean, standard deviation and other parameters were generated as necessary for continuous data. Statistical significance was set at p-value < 0.05.

RESULTS

A total of 24 patient were recruited into the study, 21 (87.5%) from public hospital and 3 (12.5%) from private hospital. The age distribution of the patients is enumerated in Figure 1. About 60% of the patients are 10 years of age and below.66.7% were females while 33.3% were males with M/F of 1: 2. Fifteen (62.5%) had acyanotic congenital heart disease (ACHD) while 9 (37.5%) had cyanotic congenital heart disease (CCHD). The profiles of the patients are shown in tables I and II; Table 1 enumerates the profile of patients for diagnostic catheterization and diagnosis while table II enumerates the profile of patients for both diagnostic and interventional catheterization. Fifteen (62.5%) had acyanotic congenital heart disease while 9 (37.5%) had cyanotic congenital heart disease. They comprise nine (37.5%) patients with patent ductus arteriosus (PDA), 5 patients with Tetralogy of Fallot (21%), Large secundum Atrial Septal Defect (ASD) with severe Pulmonary Artery Hypertension (PAH) in three (12%), Partial Atrioventricular septal defect with severe PAH in two (8%) single ventricle pathology in three patients (12%), Truncus arteriosus with severe PAH and large inlet VSD with PDA each in one patient respectively. All but one patient were in the low socioeconomic class (social class 4 and 5). Payment for the procedure was sponsored in all the patients. Seventy one percent by the government and 25% by charity and non-governmental organizations and 4% by the parent employers as represented in figure 2.

DISCUSSION

The present study aimed to highlight the profiles of the patients who have undergone diagnostic cardiac catheterization for congenital heart diseases since the re-emergence of the availability of the facility, the challenges encountered and the prospects associated with the procedure. Our study showed that the mean age of the subjects was 14.9$\pm$ 16.24 years. This mean age is very high, considering that most of the subject here had congenital heart diseases which should have been diagnosed either before birth or shortly after birth, the high mean age may be due to late diagnosis, which may also be due to late presentation and hence late diagnosis of the condition. It may also be due to the low socioeconomic status of the patients as found in this study in which all but one of the patients belong to the low socioeconomic class and hence are likely to be unable to afford the cost of care even in those in which diagnosis were made earlier. A higher proportion of patients studied had acyanotic congenital heart disease; this is in conformity with documented incidences of acyanotic compared with cyanotic congenital heart disease in earlier Nigerian studies (Antia, 1974; Ibadin et al., 2005; Bode-Thomas et al., 2000). This study also documented a higher proportion of patients studied to be females with M/F of (1:2), this may be explained by the fact that most of these patients had patent ductus arteriosus and atrial septal defect which have been documented to be commoner in females. (Antia, 1974; Ibadin et al., 2005; Bode-Thomas et al., 2000). It is also noteworthy that more males in this study had cyanotic

congenital heart disease which is also in consonance with earlier documented Nigerian report (Antia, 1974; Ibadin et al., 2005; Bode-Thomas et al., 2000). In the current study, a total of twenty-four patients had cardiac catheterization for congenital heart disease during the study period (May 2010-September 2012), this is an average of about two per month. This turn out is low compared with the number of patients diagnosed with congenital heart disease who needs intervention, For example, over a period of two years, in the institution of one of the authors (BAA) about 250 new patients were diagnosed with congenital heart diseases out of which about 126 patients needed cardiac catheterization. The reasons for the low turnout recorded for cardiac catheterization in the study centre include lack of funds by the patients to pay for the procedure. This may be corroborated by the fact that all the subjects studied were sponsored, mostly by government (71%). It may also be due to lack of awareness of the availability of the procedure in the country since it has not been available for more than three decades and many medical practitioners have had to refer patients abroad to earn the procedure and necessary intervention. Furthermore it may also be due to lack of availability of consumables locally which restricts the performance of the procedure and definitive interventions in newborns and infants who constitute more than 60% of the diagnosed cases mentioned above. One major reason why the number of cases are small is that availability of definitive surgical procedure is also limited in our locality hence patients selected for the procedure are only those in whom the likely definitive interventions needed is available in the locality. Hence the patients studied do not represent the spectrum of congenital heart disease in our locality. In addition, lack of support services to handle the very complex cases of congenital heart diseases makes practitioners to still refer such cases abroad to earn diagnostic cardiac catheterization and necessary interventions in higher centers where these are available. Another finding in this study is that all but one patient were of low socioeconomic status, although congenital heart disease is found in all socioeconomic class, a higher proportion among those in the low socioeconomic group found in this study is similar to the report of Agha et al (Agha et al., 2011) but contrary to that of Fixler et al (Fixler et al., 1993) where median family income and household educational level did not show any significant age at referral. The finding in this study may be due to the fact that majority (87.5%) were referred from government hospital where healthcare services is highly subsidized or free. A major challenge was the cost of the procedure which is still relatively high compared with other procedures, this may be due to the fact that none of the consumable are made locally and hence all have to be imported thereby making the overall running of the lab to be expensive and making the cost of the procedure to be high and considering that almost all the patients studied were in the low socio-economic status, and all the patients were sponsored, this will further corroborate the reason for late presentation and intervention as the patients could not afford the cost of care. It is remarkable that the procedure were successful in all the patients and it provided more information on the disease condition which has made it possible for all the patients studied to earn their definitive surgical or transcatheter procedure locally, this has emphasized the importance of having cardiac catheterization facility available locally if definitive surgical procedure must be carried out, sustainability of the facility will aid early diagnosis, early intervention at a cheaper cost which the patient will be able to earn in their natural environment. This facility if well developed will also serve as a source of foreign reserve to the country and reduce the current exodus of patients abroad to seek for definitive cure. One of the challenges identified in the study is the fact that there is only one functioning cardiac catheterization laboratory in the country, the need for establishment of more functioning cardiac catheterization labs in the country is obvious, in a country with a population of more than 150 million, and having the incidence of congenital heart disease as eight per thousand, and having more than 126 patients needing this procedure and definitive surgical intervention over a period of 2 years from just one of the diagnostic centers in the country, it is obvious that there are many who are yet to benefit. Establishment of more centre will not only help sort out more patients, it will also help reduce the overall cost of the procedure and make it more affordable, it will also encourage investors to establish factories where consumable can be made locally which will further help to reduce cost and conserve foreign reserves. Another major challenges is lack of trained manpower, in the studied centre, there were very few trained personnel who often have to be over stretched during the procedure and monitoring of patients after the procedure hence the need to encourage the training of more personnel both for the current centre and for other centers to be able to thrive. There is a need to create awareness on the availability of cardiac catheterization facility in Nigeria with the strengthening of referral chain and partnership, encourage local manufacturing and sale of consumables and collaboration among practioners, establishment of more functioning cardiac catheterization laboratories with training and re-training of manpower.

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Authors' contributions

Animasahun B.A was the project leader. Bode-Thomas F and Johnson A participated in the design, supervision and writing. OO Ogunkunle and IO Idowu participated in the conceptualization, design and supervision of the study. Sunita Maheshwari, Omokhodion SI, Njokanma OF participated in conceptualization and critical review of the manuscript. All authors read and approved the final manuscript.

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