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Surgical Treatment of Valvular Heart Disease in Nigeria: A 6-Year Experience

Ikechukwu A. Nwafor, MBBS, FWACS[1]; John C. Eze, MD, FWACS[1]; Maureen N. Nwafor, PharmD[2]

[1] Department of Surgery, National Cardiothoracic Center of Excellence, University of Nigeria Teaching Hospital, Enugu, Nigeria
[2] Department of Pharmacy, National Cardiothoracic Center of Excellence, University of Nigeria Teaching Hospital, Enugu, Nigeria

Surgical treatment of valvular heart disease in Nigeria, the most populous country in sub-Saharan Africa, is adversely affected by socioeconomic factors such as poverty and ignorance. To evaluate our experience in this context, we identified all patients who underwent surgery for acquired or congenital valvular heart disease at our Nigerian center from February 2013 through January 2019. We collected data from their medical records, including patient age and sex, pathophysiologic causes and types of valvular disease, surgical treatment, and outcomes. Ninety-three patients (43 males [46.2%]; mean age, 38.9 ± 10.0 yr [range, 11–80 yr]) underwent surgical treatment of a total of 122 diseased valves, including 72 (59.0%) mitral, 26 (21.3%) aortic, 21 (17.2%) tricuspid, and 3 (2.5%) pulmonary. The most prevalent pathophysiologic cause of disease was rheumatic (87 valves [71.3%]), followed by functional (20 [16.4%]), congenital (8 [6.6%]), degenerative (5 [4.1%]), and endocarditic (2 [1.6%]). All 3 diseased pulmonary valves had annular defects associated with congenital disease. Surgical treatment included mechanical prosthetic replacement of 92 valves (75.4%), surgical repair of 29 (23.8%), and bioprosthetic replacement of 1 (0.8%). We conclude that, in Nigeria, valvular disease is mainly rheumatic, affects mostly younger to middle-aged individuals, and is usually treated with prosthetic replacement ***(Tex Heart Inst J 2021;48(5):e197080)***

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Corresponding author:
Ikechukwu A. Nwafor, MBBS, Department of Surgery, National Cardiothoracic Center of Excellence, University of Nigeria Teaching Hospital, Ituku-Ozalla, PMB, 01129, Enugu, Nigeria 400001

E-mail:
ikechukwu.nwafor@unn.edu.ng

Valvular heart disease (VHD) ranks just below coronary artery disease, hypertension, and heart failure as a major cause of cardiovascular death and morbidity worldwide.[1] It is more prevalent in developing countries (0.3%–18.6%)[2,3] than in developed countries (0.7%–2.5%).[4] The rheumatic type is a particular problem in developing countries, where poor infrastructure, political and economic instability, poverty, overcrowding, and malnutrition contribute to a persistently high burden of rheumatic fever and its sequelae, VHD and infective endocarditis.[5,6] Affected individuals in such regions tend to be younger, poorer, and less educated and have less access to health care.[5,6] These conditions necessitate treatment strategies different from those used in the developed world to treat mainly elderly patients with VHD.[7-9]

Rheumatic valve lesions are more varied and complex than degenerative lesions. The characteristic inflammatory process in rheumatic valves results in thickening of leaflets and other components. This thickening distorts and impairs valve movement, which in turn causes stenosis, regurgitation, or both.[5] Repairing rheumatic lesions is much more demanding and challenging than repairing degenerative valves,[10] often resulting in worse outcomes.[10]

Rheumatic VHD remains endemic in sub-Saharan Africa, including the region's most populous country, Nigeria. Repair is feasible in many cases,[11] but it is often associated with high rates of failure and reoperation.[12,13] Therefore, prosthetic valve replacement has become the preferred option.[12,13] Meanwhile, the increasing rarity of acute rheumatic fever and rheumatic VHD in the West has decreased scientific interest in and surgical experience with rheumatic valvular repair.[14] Consequently, many patients with rheumatic VHD who may be eligible for repair undergo replacement instead.

Given the known advantages of repair over replacement[15-17] and evolving techniques for treating rheumatic lesions,[18-22] the continued widespread use of prosthetic valve

replacement to treat rheumatic and other types of VHD in sub-Saharan Africa is questionable.[14] Valve replacement is generally more costly than repair, and long-term pharmacologic strategies that have been developed and used mainly in the West warrant reconsideration in an African context.[14] To gather relevant data on this question, we evaluated our center's experience with surgical treatment of different types of VHD.

Patients and Methods

We retrospectively reviewed the medical records of patients who underwent surgical treatment of acquired or congenital VHD at our cardiovascular center from February 2013 through January 2019. We excluded patients who had congenital subaortic valve membranes that were resected during intracardiac repair or who had another congenital heart disease. We collected data on patient age and sex, pathophysiologic causes and types of VHD, types of surgical treatment, and outcomes. This retrospective review was exempt under Nigeria's National Code of Health Research Ethics, and our institutional ethics committee agreed that it did not require approval.

Our center is the main referral center for patients with cardiovascular diseases in Nigeria. During the study period, surgeons at our center partnered with a total of 7 foreign cardiac surgical mission teams to treat patients with VHD. Patients who received warfarin postoperatively were given written instructions for its use at discharge from the hospital. All patients returned for follow-up visits with local cardiothoracic surgeons at our surgical outpatient clinics every 2 to 3 weeks for the first 2 months after hospital discharge. Then, once a month for the next 4 months, patients either returned to outpatient cardiology/anticoagulation clinics to be seen by cardiologists, or were telephoned by staff from our center's social welfare department. After that, patients had follow-up visits every 6 months. Patients living in remote areas where telephone network coverage was poor or nonexistent were visited by social welfare staff when possible.

Data were analyzed with use of SPSS version 20.0 (SPSS, an IBM company) and reported as number and percentage or mean ± SD.

Results

From February 2013 through January 2019, 93 patients (43 males, 46.2%; mean age, 38.9 ± 10.0 yr [range, 11–80 yr]) underwent surgical treatment of acquired or congenital VHD at our center (Table I). Most patients (59.1%) were younger to middle-aged, including 23 patients (24.7%) aged 31 to 40 years, 21 (22.6%) aged 41 to 50 years, and 11 (11.8%) aged 51 to 60 years. Only 11 patients (11.8%) were older than 61 years, including 6 aged 61 to 70 years and 5 aged 71 to 80 years.

TABLE I. Age and Sex of the 93 Patients

Age Range (yr)	Sex, No. (%)		
	Male (n=43)	Female (n=50)	Total (N=93)
0–10	3 (7.0)	4 (8.0)	7 (7.5)
11–20	3 (7.0)	7 (14.0)	10 (10.8)
21–30	4 (9.3)	6 (12.0)	10 (10.8)
31–40	8 (18.6)	15 (30.0)	23 (24.7)
41–50	9 (20.9)	12 (24.0)	21 (22.6)
51–60	8 (18.6)	3 (6.0)	11 (11.8)
61–70	4 (9.3)	2 (4.0)	6 (6.5)
71–80	4 (9.3)	1 (2.0)	5 (5.4)

The 93 patients had a total of 122 diseased valves, including 72 (59.0%) mitral valves, 26 (21.3%) aortic, 21 (17.2%) tricuspid, and 3 (2.5%) pulmonary (Table II). Eight patients had triple VHD involving mitral, aortic, and functional tricuspid valve regurgitation. The pathophysiologic cause of disease in most valves was rheumatic (87 [71.3%]). In the rest, it was functional (20 [16.4%]), congenital (8 [6.6%]), degenerative (5 [4.1%]), or endocarditic (2 [1.6%]). All 3 diseased pulmonary valves had annular defects associated with congenital disease, including tetralogy of Fallot in 2 cases and isolated pulmonary artery stenosis in one case.

Among the 72 mitral valves, the most frequent disease types were mixed stenosis and regurgitation in 25 (34.7%) and regurgitation in 24 (33.3%) (Table III). The least frequent type was stenosis in 6 valves (8.3%).

Among the 26 aortic valves, the most frequent disease types were mixed stenosis and regurgitation in 6 (28.1%) and regurgitation in 4 (15.4%) (Table IV). The least frequent type was stenosis, concomitant with poststenotic ascending aorta aneurysm, in one valve (3.9%).

Of the 21 tricuspid valves, 19 (90.5%) had functional disease secondary to structural mitral, aortic, or mixed VHD. The other 2 had structural disease.

Most of the 122 diseased valves were replaced with a prosthesis, including a mechanical prosthesis in 92 instances (75.4%) and a bioprosthesis in one (0.8%) (Table V). This included all 87 rheumatic valves (64 mitral and 23 aortic). All other diseased valves were repaired (23.8%).

Postoperative morbidities in our 93 patients included cerebrovascular accident in 2 patients (2.2%), low cardiac output syndrome in 3 (2.5%), bleeding necessitating reoperation in 4 (3.4%), and postoperative fever in 6 (5.1%). Four patients (3.4%) died in the hospital, and 5 (4.2%) died after hospital discharge. The mean time to postdischarge death was 11.3 months (range, 10–48 mo).

TABLE II. Pathophysiologic Causes of Disease in 122 Valves

Cause	Valve Type, No. (%)				
	Mitral (n=72)	**Aortic** (n=26)	**Tricuspid** (n=21)	**Pulmonary** (n=3)	**Total** (N=122)
Rheumatic	64 (88.9)	23 (88.5)	0	0	87 (71.3)
Functional	1 (1.4)	0	19 (90.5)	0	20 (16.4)
Congenital	4 (5.6)	0	1 (4.8)	3 (100)	8 (6.6)
Degenerative	2 (2.8)	3 (11.5)	0	0	5 (4.1)
Endocarditic	1 (1.4)	0	1 (4.8)	0	2 (1.6)

Discussion

The most frequent cause of diseased valves in our study population (71.3%) was rheumatic VHD. This was consistent with findings in similar studies from southern China, India, Turkey, and South Africa.[23-27] By comparison, in the Euro Heart Survey (EHS),[28] rheumatic VHD accounted for only 22%. Rheumatic valves were slightly more prevalent among females in our study (53.8%). However, in similar studies done in developing countries, the female preponderance was more marked.[29]

Most patients in our study population were younger to middle-aged. The age group most affected among females and overall was 31 to 40 years; among males, it was 41 to 50 years. This agrees in part with findings by others. In a subgroup of 589 patients with severe VHD, Triki and colleagues[30] found that those with mitral stenosis (mean age, 49 ± 14 yr) or aortic regurgitation (mean age, 46 ± 20 yr) were younger than those with aortic stenosis (mean age, 69 ± 15 yr) or mitral regurgitation (mean age, 61 ± 18 yr). In developing countries, where rheumatic fever and subsequent carditis remain a major public health problem, affected individuals are often young, poor, uneducated, poorly compliant with prophylactic or therapeutic anticoagulation regimens, and unable to obtain medical care easily.[10]

In our patient population, the most frequent mitral valve disease was mixed stenosis and regurgitation (25 of 72 valves [32.9%]); the least frequent was stenosis (6 [8.3%]). The most frequent aortic valve disease was mixed stenosis and regurgitation (6 of 26 valves [23.1%]); the least frequent, stenosis with poststenotic aortic aneurysm (1 [3.9%]). This differed from the distribution of single-valve disease reported by Triki and colleagues[30] for 959 patients with significant VHD (as defined by EHS): mitral stenosis in 423 patients (44.1%), mitral regurgitation in 198 (20.6%), aortic stenosis in 84 (8.8%), and aortic regurgitation in 40 (4.2%). The remaining 214 patients (22.3%) with VHD in that study had multiple diseased valves.[30]

The most frequent surgical intervention in our patients was prosthetic valve replacement, for several reasons. First, such interventions were spearheaded not by local teams, but by experienced surgeons on foreign cardiac surgical mission teams that visited our center 2 to 3 times each year. Second, most of our patients who underwent prosthetic valve replacement presented late with severe rheumatic VHD, as defined by World Heart Federation echocardiographic criteria (namely, definite evidence of valvular regurgitation or stenosis, and at least 2 morphologic abnormalities, such as restricted leaflet mobility, focal or generalized valvular thickening, and abnormal subvalvular thickening of the affected valve).[31] Late presenters usually have calcific and severely fibrotic valvular apparatus. Third, the patients treated by the foreign mission teams were generally poor and likely had little or no access to standard postoperative follow-up care and adequate anticoagulation therapy, factors that can increase the risk of prosthetic valve failure.[32] Fourth, patients with atrial fibrillation were already receiving anticoagulation prophylactically to prevent thromboembolism and were therefore good candidates for prosthetic valve replacement. Finally, our local cardiac team, which assumed the postoperative care of patients after the foreign mission teams left, had experience managing postoperative anticoagulation regimens, even in women of childbearing age.[33,34] Relatively few patients in our study population benefited from repair, including those with a tricuspid valve congenitally

TABLE III. Types of Disease in 72 Mitral Valves

Disease Type	**No.** (%)
Isolated	55 (76.4)
Mixed MS/MR	25 (34.7)
MR	24 (33.3)
MS	6 (8.3)
Concomitant	17 (23.6)
MR + fTR	9 (12.5)
MR + AR + fTR	8 (11.1)

AR = aortic regurgitation; fTR = functional tricuspid regurgitation; MR = mitral regurgitation; MS = mitral stenosis

missing anterior and posterior leaflets[35] and those with associated functional dilation of the tricuspid or mitral valve annulus.

Repair of rheumatic mitral valves with autologous pericardium, prosthetic chordal replacement, and an annular ring is possible.[36] However, this complex repair is not usually indicated because the autologous tissue calcifies over time and because rheumatic valves are chronically inflamed.[37,38] The long-term durability of such repair when compared with mitral valve replacement is unknown and warrants research.[36,39]

For several reasons, our results showing the prevalence of valve replacement at our center are at odds with results of other studies showing valve repair to be the better option in young sub-Saharan African populations with rheumatic VHD.[14] First, complications related to prosthetic valve replacement reduce life expectancy, especially in children and young adults, regardless of the original pathology.[40] Reported mean survival rates after mitral valve replacement have ranged from 63% to 66% at 10 to 15 years of follow-up.[41] Second, the rate of reoperation after valve replacement in young patients is high because of somatic growth and valve thrombosis.[42] Third, even though valve repair is also associated with a high reoperation rate, the survival rate after repair is better than after prosthetic valve replacement.[43-45] Fourth, there has been a recent trend toward aggressive resection of all fibrotic valvular tissues followed by partial or complete valve reconstruction with autologous or heterologous material.[46]

Several groups have reported long-term outcomes after surgical repair of rheumatic mitral valves. Chauvaud and colleagues[47] reported a 20-year actuarial survival rate of 82% ± 18% and a 20-year freedom-from-reoperation rate of 55% ± 25%. El-Oumeiri and associates[21] reported very high 8-year rates of freedom from cardiac death (98% ± 2%) and freedom from reoperation (94% ± 5%). Other earlier reports noted 5-year freedom-from-reoperation rates of less than 75%.[48]

Heart surgeons in Nigeria have long faced difficult challenges.[14,49] Some challenges have been eased by occasional periods of political stability, by donations of medical equipment, by medical training of some of our staff abroad in India,[50] and by continued collaboration with foreign cardiac mission teams.[51] However, poverty and ignorance in the general population persist. Consequently, many patients present late, usually in New York Heart Association functional class IV, when their diseased valves are inoperable. The cost of heart valve surgery is often beyond the means of the average Nigerian, and open heart surgery is not yet universally covered

TABLE IV. Types of Disease in 26 Aortic Valves

Disease Type	**No.** (%)
Isolated	13 (50.0)
Mixed AS/AR	6 (23.1)
AR	4 (15.4)
AS	3 (11.5)
Concomitant	13 (50.0)
AR + MR + fTR	8 (30.8)
AR + MR + AAA	2 (7.7)
AR + fTR	2 (7.7)
AS + poststenotic AAA	1 (3.9)

AAA = ascending aortic aneurysm; AR = aortic regurgitation; AS = aortic stenosis; fTR = functional tricuspid regurgitation; MR = mitral regurgitation

TABLE V. Surgical Treatment of 122 Diseased Valves

	Valve Type, No. (%)				
Treatment	**Mitral** (n=72)	**Aortic** (n=26)	**Tricuspid** (n=21)	**Pulmonary** (n=3)	**Total** (N=122)
Replacement	67 (93.1)	26 (100)	0	0	93 (76.2)
Mechanical prosthesis	66 (91.7)	26 (100)	0	0	92 (75.4)
Bioprosthesis	1 (1.4)	0	0	0	1 (0.8)
Repair	5 (6.9)	0	21 (100)	0	29 (23.8)
Functional*	0	0	20 (95.2)	0	20 (16.4)
Mechanical**	5 (6.9)	0	1 (4.8)	0	6 (4.9)
Annuloplasty with minuscule valve	0	0	0	3 (100)	3 (2.5)

* Repair to prevent functional regurgitation, defined as backward flow of blood due to annular and ventricular chamber dilation.

** Repair to prevent mechanical regurgitation, defined as backward flow of blood through physically impaired leaflets or other valvular components.

by Nigeria's National Health Insurance Scheme. An exodus of skilled surgeons from Nigeria makes it difficult for our center to staff an independent heart valve surgical team. Meanwhile, inadequate and inconsistent governmental support hampers the development of the infrastructure and highly skilled manpower necessary to ensure safe and effective heart surgery. Therefore, our center's cardiac surgery program remains dependent on foreign cardiac surgeon mission teams and other nongovernmental organizations.

At present, open heart surgery has still not taken firm root locally at our center or nationally,[52] and any real change in the current patterns of valve surgery will come through the training and retention of local personnel. Reul and Cohn[53] observed that the substantial learning curve required to become proficient in mitral reconstructive techniques can greatly influence a surgeon's ability to repair rather than replace a diseased valve, as well as affect the incidence of residual mitral regurgitation, systolic anterior motion, or annuloplasty ring dehiscence and the consequent need for reoperation. They concluded that the excellent overall freedom from morbidity reported in patients undergoing mitral valvuloplasty from several centers was a testament to the durability of repair techniques.

Regardless of surgical approach, acquiring open heart surgical skills at our center is key. As our study shows, much of this skill acquisition has come from treating VHD lesions in collaboration with foreign mission teams. Meanwhile, open heart surgery for correction of other cardiac lesions is also not yet routine. We have established an animal surgical laboratory that is intended to help our core medical personnel gain valuable hands-on experience and skill in performing general open heart surgical procedures.

In any case, valve replacement by cardiac mission teams continues to meet a pressing need in Nigeria, despite a lack of adequate funds and facilities for consistent follow-up. Two cases illustrate this point. In 1988, a 17-year-old boy had his mitral valve replaced at our center with a Starr-Edwards ball-and-cage valve. He did well until 2016, when poor compliance with his anticoagulant therapy regimen resulted in a cerebrovascular accident and hemiplegia. In 1992, a 22-year-old woman from outside Nigeria came to our center for surgery to replace a failed bioprosthetic mitral valve that had been implanted 5 years earlier by a cardiac mission team in her country. This time, a mechanical prosthesis was implanted.

One way to achieve the desired training in Nigeria and other developing countries is to continue hosting foreign cardiac teams to perform surgical procedures alongside local surgical teams. Through such skill transfer, the local teams can learn and practice current techniques in valve repair.

Conclusion

Valvular heart disease in Nigeria is mainly rheumatic, affects mostly younger to middle-aged individuals, and is usually treated surgically with prosthetic valve replacement. However, heightened surgical training of core medical staff and continued interaction with cardiac mission teams may help make valve repair a reasonable alternative in Nigeria.

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