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CLINICAL RESEARCH

The VALVAFRIC study: A registry of rheumatic heart disease in Western and Central Africa

Étude VALVAFRIC. Un registre des valvulopathies rhumatismales en Afrique de l'Ouest et Centrale

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Abbreviations: 2D, two-dimensional; EF, ejection fraction; GDP, gross domestic product; LV, left ventricular; NGO, non-governmental organization; NYHA, New York Heart Association; PASP, pulmonary artery systolic pressure; RHD, rheumatic heart disease.

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KEYWORDS
Rheumatic heart disease;
Rheumatic fever;
Africa

Summary
Background. — There are few African data available on rheumatic heart disease (RHD).
Aim. — To provide data on the clinical characteristics and treatment of patients with RHD hospitalized in sub-Saharan Africa.
Methods. — The VALVAFRIC study is a multicentre hospital-based retrospective registry of patients with RHD hospitalized in African cardiology departments from 2004 to 2008.
Results. — Among 3441 patients with at least one mild RHD lesion seen on echocardiography in 5 years in 12 cardiology departments from seven countries, 1385 had severe lesions (502 men; 803 women; mean age 29.3 ± 15.6 years). The ratio of severe to any RHD valvular lesion was higher in countries with the lowest gross domestic product (GDP). Mitral valve regurgitation was seen in 52.8% of cases, aortic regurgitation in 32.1%, mitral stenosis in 13.4% and aortic stenosis in 1.8%. Combined valvular lesions were observed in 13% of cases. Heart failure was present in 40% of patients. Major left ventricular dilatation was observed in 13.6% of patients, ectasic left atrial dilatation in 13.8%, dilatation of the right cardiac chambers in 19.8% and pulmonary hypertension in 28.7%. Patients with no formal schooling (41.5%) were older and had a higher New York Heart Association (NYHA) class and a lower ejection fraction (EF). Among patients aged < 20 years (mean age 14.5 ± 3.8 years), those who were schooled had a lower NYHA class (2.86 ± 0.92 vs 3.42 ± 0.93; $P < 0.01$) and a higher EF (60.3 ± 11.7 vs. 54.8 ± 12.8; $P < 0.05$) than those who were not. RHD-related delays or school failures were affected by NYHA class, EF and the number of children in the household. Although 1200 of 1334 patients required valve repair or replacement, only 27 had surgery. In-hospital outcomes included death (16%), heart failure (62%), arrhythmias (22%), endocarditis (4%) and thromboembolic events (4%). Subsequently, 176 patients were readmitted (13.6%).
Conclusions. — Patients with RHD hospitalized in sub-Saharan Africa are young, socially disadvantaged, with a high mortality rate and extremely low access to surgery. Poverty, as quantified by GDP and educational level, affects RHD-related severity, NYHA class and left ventricular dysfunction.

MOTS CLÉS
Valvulopathie rhumatismale ;
Rhumatisme articulaire aigu ;
Afrique

Résumé
Contexte. — Les données africaines sur les valvulopathies rhumatismales (VR) sont peu nombreuses.
Objectif. — Préciser les caractéristiques cliniques et le traitement des patients avec VR en Afrique subsaharienne.
Méthodes. — L'étude VALVAFRIC est un registre rétrospectif multicentrique des patients hospitalisés pour VR.
Résultats. — Parmi 3441 patients avec VR observés en échocardiographie en 5 ans dans 12 services de cardiologie de 7 pays, 1385 (502 H, 803 F, âge moyen 29,3 ± 15,6 ans) ont une atteinte sévère, plus fréquente dans les pays à produit intérieur brut (PIB) les plus bas. Une régurgitation mitrale est observée dans 52,8 % des cas, une régurgitation aortique dans 32,1 %, une sténose mitrale dans 13,4 %, une sténose aortique dans 1,8 %, des lésions valvulaires combinées dans 13 %, une insuffisance cardiaque dans 40 %, une dilatation ventriculaire gauche majeure dans 13,6 %, une dilatation auriculaire gauche ectasique dans 13,8 %, une dilatation des cavités droites dans 19,8 % et une hypertension artérielle pulmonaire dans 28,7 %. Les patients sans aucune scolarisation (41,5 %) sont plus âgés, ont une classe NYHA plus élevée et une fraction d'éjection plus basse. Parmi ceux de moins de 20 ans les scolarisés ont une classe NYHA classe inférieure (2,86 ± 0,92 vs 3,42 ± 0,93 ; $p < 0,01$) et une FE supérieure (60,3 ± 11,7

vs 54,8 ± 12,8 ; $p < 0,05$) à ceux sans scolarisation. Les retards et échecs scolaires liés à une VR sont impactés par la classe NYHA, la FE et le nombre d'enfants dans la fratrie. Une plastie ou un remplacement valvulaire est nécessaire chez 1200 malades sur 1334. Seuls 27 ont été opérés. Les complications hospitalières comprennent décès (16 %), insuffisances cardiaques (62 %), 129 arythmies (22 %), endocardites (4 %), complications thrombo-emboliques (4 %). Au cours de l'étude, 176 patients sont re-admis (13,6 %).
Conclusions. — Les malades hospitalisés pour VR en Afrique subsaharienne sont jeunes, socialement défavorisés, avec un accès très limité à la chirurgie et une mortalité élevée. La pauvreté, quantifiée par le PIB ou le degré de scolarisation, est corrélée à la sévérité des VR, la classe NYHA et la dysfonction VG.

Background

Although theoretically preventable for several decades, rheumatic heart disease (RHD) remains one of the leading causes of non-communicable diseases in developing and low-income countries. The prevalence of RHD is estimated worldwide at 15.6 million people, affecting mostly socially and economically disadvantaged populations, and accounting for up to 233,000 deaths per year [1—4]. RHD still ranks among the major cardiovascular healthcare challenges in sub-Saharan Africa. The RHD prevalence has been estimated mainly from surveys of school-going children, and varies from 2.7/1000 in Kenya to 14.3/1000 in Congo [3,5,6]. While mortality rates of chronic valvular RHD have been estimated at 1.5% of patients per year [1], this may be largely underestimated in sub-Saharan Africa [7]. Indeed, despite the magnitude of the problem, systematically collected African data on disease characteristics, treatments and subsequent prognosis are scarce. Recently, the Global Rheumatic Heart Disease Registry (REMEDY) provided data from 12 African countries, including Ethiopia, Kenya, Malawi, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Sudan, Uganda and Zambia [8]. The present VALVAFRIC study, a retrospective hospital-based registry of patients with rheumatic valve disease, aimed to gather clinical, echocardiographic, treatment and prognostic data, as well as information about RHD-associated socioeconomic factors, from patients with severe RHD in Western and Central sub-Saharan Africa.

Methods

Study design

The VALVAFRIC study is a multicentre international hospital-based retrospective registry of patients with RHD hospitalized in African cardiology departments from 2004 to 2008. Patients were included from 12 referral cardiac centres in eight African countries [Cameroon, Ivory Coast, Gabon, Guinea (Conakry), Mali, Nigeria, Senegal and Togo]. The study was initiated during the annual meeting of the Working Group on Tropical Cardiology of the French Society of Cardiology, which is intended to promote collaborative works by academic cardiology teams from sub-Saharan Africa and France. The study was intentionally designed to be entirely performed using logistics and data obtained by the African participating centres, without any methodological or financial support from the French Society of Cardiology.

The participating cardiology departments had to fulfil the following requirements: availability of an archive department to store medical records; availability of Doppler-coupled ultrasound echocardiography; and availability of a trained cardiologist to perform two-dimensional (2D) Doppler ultrasound examinations. Among the 12 centres from the eight countries initially intended to take part in the study, one (Gabon) failed to fulfil the criteria for participation because of the lack of a suitable echocardiography laboratory archive department.

The study rationale was to provide data on disease characteristics, treatment and, when available, prognosis of RHD in sub-Saharan African referral centres for cardiovascular diseases. All referral centres in the countries participated in the study, except the one that failed to fulfil the inclusion criteria (Gabon). Referral centres involved in the study are listed in the Supplementary data, Online Table (online only supplement). A 5-year retrospective analysis of patients hospitalized in these departments for any cardiac disease was performed, using patients' hospital files, medical notes and echocardiographic examinations. Clinical presentation of patients, type and severity of valvular lesions, past and/or ongoing complications, key treatments and readmissions were noted. Patients were checked for educational level (none, Koranic, primary, secondary/high school, university), occupation (unemployed or housewife, craftsman or merchant, clerk, employee or manager), habitation (concrete block house or mud, cardboard or straw hut) and educational, social and professional adverse consequences of their heart disease (delays and school failure, prolonged periods off work, termination of employment).

Patients

We included patients aged at least 3 years, regardless of sex, with a suspicion of heart disease on the basis of clinical examination, and in whom the diagnosis of at least one valvular heart disease was clearly established by 2D Doppler-coupled echocardiography. All patients listed on the echocardiography registries' files between January 2004 and December 2008 were included. The European Society of Cardiology and American Heart Association/American College of Cardiology guidelines were used for assessment of severity of valve lesions, left ventricular (LV) systolic dysfunction (LV

ejection fraction [EF] ≤ 54%) and LV dilatation (LV ≥ 50 mm in children and ≥ 55 mm in adults) [9,10].

Patients without evidence of echocardiography-ascertained valvular disease were excluded. Also, patients with other causes of valvular damage, such as infective endocarditis, congenital, post-traumatic, dystrophic and degenerative lesions, cardiomyopathy and ischaemic or inflammatory diseases were excluded.

Data collection

Demographic and socioeconomic data, past history of cardiac complications, clinical and echocardiographic findings were recorded on case report forms at research sites and transmitted to the coordination site of the main investigator (S.K.). Data were collected using a standardized form (Supplementary data, Online Figs. A and B; online only supplement). Patients were classified into two groups in terms of the severity of valvular lesions, LV function and clinical impairment: patients with at least one valvular lesion suggestive of RHD, even mild; and patients with severe valvular lesions.

Heart failure was diagnosed in patients using clinical criteria, and classified using the New York Heart Association (NYHA) classification [11].

Ultrasound examination

The degree of expertise of the physicians who performed the ultrasound examinations (consultants, senior registrars) was not specified, but all examinations were performed by trained cardiologists. There were no echocardiography-trained technicians in any of the echocardiography laboratories involved in the study. According to simplified criteria recommended by current guidelines [9—13], the diagnosis of RHD was based on the presence of one or more of the following patterns: mitral valve [commissural fusion; typical marked thickening of the leaflet margins, cusps, chordae tendinae; thickening and shortening of chordal structures; restricted leaflet motion, excessive leaflet tip motion during systole, prolapse; funnel shape or buttonhole shape in case of mitral stenosis; annular and valvular calcifications; significant mitral regurgitation (jet length ≥ 2 cm in two planes, high velocity with mosaic pattern, pansystolic)]; aortic valve [irregular or focal thickening; coaptation defect; restricted leaflet motion; prolapse, calcification; significant aortic regurgitation (jet length ≥ 1 cm in two planes, high velocity with mosaic pattern, pandiastolic)]; multivalvular involvement in the same patient.

Statistical analysis

Continuous variables are expressed as means and standard deviations and categorical variables as frequencies and percentages; these were computed using the SPSS statistical software package (version 13.0; IBM, Armonk, NY, USA) and Epi Info™ (version 3.5.1; Centers for Disease Control and Prevention, Atlanta, GA, USA). Means comparisons were made using Student's *t*-test. Percentages were compared using Pearson's Chi^2 test. A probability of $P < 0.05$ was considered to be statistically significant.

Results

Patients

Among a total of 27,882 patients examined with 2D echocardiography between January 2004 and December 2008 in the 12 cardiology centres involved in the study, 3441 (12.3%) presented with a suspicion or at least one mild valvular lesion suggestive of RHD. There were 1388 men or young boys (40.3%) with a mean age of 28.3 ± 16.5 years, and 2053 women or young girls (59.7%) with a mean age of 31.1 ± 17.7 years. The age and sex distributions of patients are listed on Fig. 1.

Among 2056 patients with mild RHD lesions, only 358 (17.4%) were hospitalized (including for non-cardiac diseases) and fulfilled the inclusion criteria. The lack of suitable medical records available for the remaining patients with mild RHD precluded their subsequent analysis.

Significant or severe rheumatic valvular lesions were observed in 1385 of included patients (40.2%), including 502 men or young boys and 803 women or young girls, with a mean age of 29.3 ± 15.6 years. This subgroup was analysed in the study. Patients were included in Cameroon ($n = 301$), Guinea ($n = 358$), Ivory Coast ($n = 80$), Mali ($n = 118$), Nigeria ($n = 51$), Senegal ($n = 462$) and Togo ($n = 15$). Political instability during the study period resulted in inclusions of small numbers in Nigeria and Ivory Coast, where total numbers of patients with at least one mild RHD lesion were not obtained. Apart from Togo, where only 15 patients were included, the ratio of severe to at least one mild RHD lesion was higher in the countries with the lowest gross domestic product (GDP) (Table 1).

Patients were characterized by a low educational level. Using data suitable for analysis recorded from available files, 41.5% of patients had no formal schooling, 6.4% had Koranic schooling only, while 32.8% had completed primary school; the remainder had completed high (secondary) school (15.3%) or graduated from university (2.8%). Multiple children households were common, with a mean of six children in a household. In many instances, the clinical condition associated with RHD progression resulted in delays or school failure (66.2%) in children and prolonged periods off work (62%) or termination of employment (51%) in adults. Among

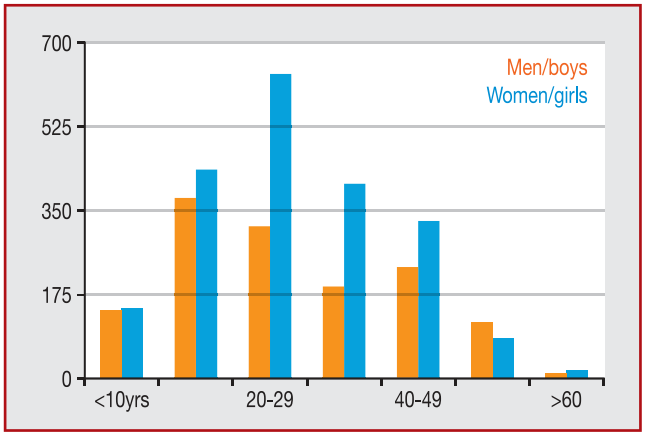

Figure 1. Age and sex distribution of 3441 patients with rheumatic heart disease.

Table 1 Percentage of patients with severe rheumatic heart disease lesions and gross domestic product per inhabitant.

	Patients with any lesion, at least mild (*n*)	Patients with severe RHD lesions (*n*)	Patients with severe RHD lesions (%)	Gross domestic product per inhabitant (USD)
Cameroon	1623	301	18.5	1328
Ivory Coast	—	80	—	1528
Guinea	477	358	75	523
Mali	120	118	98	715
Nigeria	—	51	—	3005
Senegal	980	462	47.5	1046
Togo	241	15	6.2	634

RHD: rheumatic heart disease; USD: United States dollars.

adults, 60% of patients were housewives or unemployed, 35% were craftsmen or merchants and 5% were clerks, employees or managers. Among patients for whom data were recorded ($n = 320$), their habitations were concrete block houses in 73% of cases or mud, cardboard or straw huts in 27% of cases.

Clinical findings

Patients were seen late in the course of the disease, with 40% presenting with heart failure and NYHA class III or IV. Clinical complications were documented in 585 of 1385 patients, including heart failure ($n = 363$, 62%), arrhythmia/atrial fibrillation ($n = 129$, 22%), thromboembolic events ($n = 23$, 4%) and infective endocarditis ($n = 23$, 4%). In-hospital death occurred in 94 patients (16%). Overall, 176 patients (13.6%) were readmitted to the hospital during the study period.

Echocardiographic findings

Patients presented predominantly with single valve involvement. Isolated mitral regurgitation was observed in 52.8% of patients, isolated aortic regurgitation in 32.1% and mitral stenosis in 13.4%. Only 13% of patients presented with combined mitral and aortic lesions. The distribution of rheumatic valve lesions is listed in Table 2. In addition, patients with mild RHD lesions presented different features. Isolated mitral regurgitation was observed in 73.4% of monovalvular lesions, whereas combined aortic and mitral minor lesions were seen in 2.8% of patients only (Table 2).

Major left ventricular dilatation (LV end-diastolic diameter > 70 mm) was observed in 188 patients (13.6%), ectasic left atrial dilatation (left atrium diameter > 60 mm) in 192 patients (13.8%), dilatation of the right cardiac chambers in 275 patients (19.9%) and pulmonary hypertension in 398 patients (28.7%).

Impact of educational level on RHD

Complete socioeconomic, educational, clinical and echocardiographic data suitable for analysis were obtained in 492

Table 2 Echocardiographic findings in patients with rheumatic heart disease.

Type of lesion	Patients with severe lesions ($n = 1385$)	Patients with mild lesions ($n = 2056$)
Monovalvular lesions reported	1205 (87.0)	1605 (78)
Mitral valve incompetence	637 (52.8)	1178 (73.4)
Aortic valve incompetence	386 (32.1)	381 (23.7)
Mitral valve stenosis	161 (13.4)	—
Aortic valve stenosis	21 (1.8)	—
Combined lesions reported	180 (13.0)	46 (2.8)
Combined mitral lesions + combined aortic lesions	11 (6.0)	—
Combined mitral lesions + aortic valve regurgitation	34 (19.0)	—
Mitral stenosis + aortic valve regurgitation	11 (6.0)	—
Mitral regurgitation + aortic regurgitation	124 (69.0)	46 (2.8)
Minor, unspecified	—	451 (21.9)
Other echocardiographic findings (out of 1385 cases)		
Major left ventricular dilatation (LVEDD > 70 mm)	188 (13.6)	—
Ectasic left atrial dilatation (LA > 60 mm)	192 (13.8)	—
Dilatation of right heart chambers	275 (19.9)	—
Pulmonary hypertension	398 (28.7)	—

Data are expressed as number (%). LA: left atrium; LVEDD: left ventricular end-diastolic diameter.

Table 3 Impact of educational level on rheumatic heart disease severity in 492 patients.

	No formal schooling ($n=177$)	Koranic school ($n=28$)	Primary school ($n=172$)	High school (secondary school) ($n=104$)	University graduate ($n=11$)	P[a]
Age (years)	32.4 ± 15.7	28.5 ± 14.1	24.1 ± 13.8	26.2 ± 12.1	26.2 ± 12.1	< 0.01
NYHA class	3.38 ± 0.91	2.95 ± 1.1[c]	3.11 ± 0.95[b]	2.84 ± 0.91[b]	3.07 ± 0.83	< 0.01
EF (%)	53.4 ± 14.5	60.1 ± 10.9[c]	59.6 ± 11.5[b]	60.1 ± 12.3[b]	63.9 ± 7.4[c]	< 0.01

Data are expressed as mean ± standard deviation. NYHA: New York Heart Association; EF: ejection fraction.
[a] Any schooling versus no formal schooling.
[b] $P < 0.01$ compared with no formal schooling.
[c] $P < 0.05$ compared with no formal schooling.

Table 4 Impact of educational level on rheumatic heart disease severity in 239 patients aged < 20 years[a].

	No formal schooling ($n=41$)	Koranic school ($n=8$)	Primary school ($n=60$)	Secondary school ($n=35$)	Primary or secondary school ($n=95$)	P[b]
NYHA class	3.42 ± 0.93	3 ± 1	2.84 ± 0.88	2.89 ± 0.89	2.86 ± 0.92	< 0.01
EF (%)	54.8 ± 12.8	70.3 ± 6.4	60.7 ± 10.9	59.6 ± 13.7	60.3 ± 11.7	< 0.05

Data are expressed as mean ± standard deviation. NYHA: New York Heart Association; EF: ejection fraction.
[a] Mean age 14.5 ± 3.8 years.
[b] Any schooling versus no formal schooling.

patients, including 180 men or young boys and 312 women or young girls.

Patients with no formal schooling had a higher NYHA class and a lower EF than those who received any schooling, regardless of the level completed (Koranic, primary or high school or university) (Table 3). As patients without any schooling were older than those who completed any schooling, we analysed the subgroup of patients aged < 20 years to confirm that the effect of educational level was not associated with age-related disease progression only. Among this subgroup of 239 patients (mean age 14.5 ± 3.8 years), those who completed either primary or secondary schooling had a lower NYHA class (2.86 ± 0.92 vs. 3.42 ± 0.93; $P < 0.01$) and a higher EF (60.3 ± 11.7 vs. 54.8 ± 12.8; $P < 0.05$) than those who had no schooling at all (Table 4).

There was no statistically significant difference among educational level subgroups regarding left atrial area and pulmonary artery systolic pressure (PASP). However, the proportion of patients in whom a tricuspid regurgitation suitable for PASP measurement was obtained was lower among patients with some degree of education (66% vs. 49%; $P = 0.05$); this may reflect the fact that the highest PASPs were recorded predominantly. By contrast, normal PASPs in patients with less severe RHD lesions are more likely to have been missed.

Socioeconomic and educational patterns are also affected by RHD severity. RHD-related delays or school failure were affected by NYHA class, EF and child numbers in the household (Table 5).

Outcome

Among 1334 patients for whom a treatment strategy was discussed, 1200 (83%) were considered to require a surgical intervention (mitral valve repair or replacement); however, this was rarely performed. A total of 27 patients were operated on (2.2%), whereas 1173 (97.7%) were not, mostly for financial reasons ($n = 994$, 84.7%). Surgery was contraindicated in 64 patients (5.5%), and six patients or parents refused surgery. Unfavourable in-hospital out-

Table 5 Rheumatic heart disease-related delays or school failure — effect of New York Heart Association class and ejection fraction.

	Delays or school failure ($n=24$)	No delays or school failure ($n=53$)	P
Children in household (n)	7.25 ± 2.06	6.03 ± 1.91	< 0.05
NYHA class	2.88 ± 0.82	2.35 ± 0.83	< 0.01
EF (%)	54.1 ± 11.4	59.7 ± 12.2	< 0.05

Data are expressed as mean ± standard deviation. NYHA: New York Heart Association; EF: ejection fraction.

come was documented in 585 patients, including in-hospital deaths ($n = 94$, 16%), heart failure ($n = 363$, 62%), arrhythmias ($n = 129$, 22%), endocarditis ($n = 23$, 4%) and thromboembolic events ($n = 23$, 4%). Apart from in-hospital complications, which occurred in 538 of 1385 patients (39%), factors associated with an unfavourable outcome were not available from the study records. During the study period, 176 of 1291 patients (13.6%) who were discharged from the hospital were readmitted. As the study was retrospective, follow-up was not documented. Also, follow-up data on medical management, secondary prognosis and cardiovascular medications, including anticoagulation, were not available.

Discussion

Although rheumatic fever and RHD remain extremely common in low-income countries, and are associated with severe health consequences, there are only a few reports available that are specifically devoted to the epidemiology, management and prognosis of the disease in sub-Saharan Africa, apart from South Africa. However, in rising to the challenge of preventing and treating RHD, we need to establish the scope and magnitude of the problem, with large African epidemiological studies. Recently, the Global Rheumatic Heart Disease Registry (REMEDY) provided data from 12 South and East African countries [8]. The VALVAFRIC retrospective registry aimed to provide information on the current patterns of RHD observed in referral cardiology centres from seven sub-Saharan Central and Western African countries for which data were lacking.

Among the 27,822 patients hospitalized in the 12 centres involved in the study, 3441 (12.3%) presented with 2D Doppler-coupled echocardiography-confirmed RHD, and 1385 had severe valve lesions. Our data show that patients hospitalized for RHD were young, with a mean age of 29.1 years for men and 31.1 years for women. As previously observed in other African countries [8], there was a female predominance (60%). Both educational level and socioeconomic status were low. A large majority of our patients (73%) had no formal schooling or had completed primary schooling only — a significantly higher rate than among patients from other low-income African countries, such as those included in the study by Zuhlke et al. (45%) [8]. Multiple children households were common, with a mean number of six children in a household. Also, clinical conditions resulted in delays and school failure in 66% of children and in termination of employment in 51% of adults.

Previous reports have suggested different outcomes among patients with RHD. Patients with mild cases have been reported to have a fairly favourable long-term prognosis anyway, whereas those with more severe valve lesions do not [14—16]. However, the reasons why some patients remain with mild lesions and other progress to severe RHD remain unknown, apart from secondary prophylaxis of rheumatic fever that has been shown to halt the progression of the disease.

In the present study, we tried to correlate socioeconomic and educational factors with the severity of RHD. Patients without any formal schooling, a subgroup with a markedly disadvantaged lifestyle and poor healthcare access conditions, were characterized by a more severe effect of RHD valve lesions. Indeed, they presented with more severe functional disability, a higher NYHA class and a lower EF than patients who had completed either primary school or college. However, as a result of the educational policies developed by most African countries over the past two decades, patients without any schooling are nowadays older than those who received primary or secondary schooling more recently. We therefore performed the same analysis among the subgroup of patients aged < 20 years. Similar results were found in this subgroup, thereby confirming the effect of lack of schooling and poverty on RHD lesion severity.

We also observed variations in the ascertainment of severity of valve injury and clinical complications by country. Similar findings were observed in the study by Zuhlke et al., in which these variations were related to the very different income statuses between countries with high, medium or low incomes [8]. In our study, in which low-income African countries were classified by GDP per inhabitant, the severity of RHD lesions, as quantified by the ratio of severe to any RHD lesion, was substantially higher in countries with the lowest GDP, such as Guinea and Mali. As data from Ivory Coast and Nigeria, the countries with the highest GDP, were missing, we were unable to establish a correlation or clear-cut relationship between GPD and the severity and/or progression of RHD in our patients.

One of the prominent findings of the VALVAFRIC study was the high rate of in-hospital deaths (16% of patients). Although factors associated with mortality were not analysed, severe in-hospital complications were documented for 531 of 1385 patients (39%) hospitalized with severe RHD in the registry.

Access to cardiac surgery was extremely low in this cohort from West and Central Africa. Only 27 of 1200 patients (2.2%) requiring a surgical intervention were ultimately operated on, all after transfer to receive cardiac surgical care abroad. No patient was operated on by a visiting surgical team from a non-governmental organization (NGO). This may be explained in part because NGO cardiac surgery humanitarian projects tend to focus on the correction of congenital heart disease in children. Similar findings were reported by Grimaldi et al. in East Africa, who found that large numbers of Ugandan patients did not receive intervention, despite being referred to a surgical programme supported by NGOs [17]. The extremely low rate of use of valve replacement or valve repair in the VALVAFRIC study may also be linked to the very-low-income and GDP of the Western and Central African countries involved in the registry study, in accordance with similar results reported by Zuhlke et al. in South and East Africa [8].

Study limitations

There are several limitations to this study. First, the VALVAFRIC study was a retrospective hospital-based registry that could not address the burden of RHD in the African community. Owing to the need for availability of both cardiology expertise and echocardiography facilities for the diagnosis of RHD in the study, we enrolled cases of mild-to severe symptomatic RHD typically seen at referral centres, thereby missing patients with subclinical involvement, which would have depicted true mild RHD disease more appropriately.

Second, as the study was retrospective, standard criteria for echocardiographic diagnosis of RHD were used, and valve assessment in accordance with recently released specific guidelines on RHD was not implemented [12,13,18,19]. Third, as a result of the follow-up shortcomings encountered in very-low-income countries, such as those involved in VALVAFRIC registry, many patients were lost to follow-up. However, suitable data available from the registry already showed the poor prognosis of severe RHD, even in young patients in sub-Saharan Africa. It seems unlikely that patients who were lost to follow-up would have had a better outcome. Finally, in this retrospective African study, the amount of missing data was considerable, a drawback that potentially affects the conclusions the statistical analysis may affirm; this precluded any suitable comparison of patients with mild and severe RHD lesions. Accordingly, a prospective registry focusing on selected patterns that the VALVAFRIC study highlighted has been scheduled by our cooperative group.

Conclusion

Patients with RHD hospitalized in sub-Saharan Africa are young, socially disadvantaged, with a high mortality rate and extremely low access to surgery. Poverty, as quantified by GDP and educational level, affects RHD-related severity, NYHA class and LV dysfunction. As subclinical and/or mild RHD may be the forerunner of progressive valve deformity with regurgitation or stenosis, primary echocardiographic detection and an early preventive strategy may be useful in areas of high poverty, where RHD is more likely to progress [20—22]. Although the hypothesis that early echocardiographic identification of subclinical or mild RHD would enable the initiation of secondary prophylactic therapy with penicillin has not been tested, such a strategy may provide hope, given the very limited access of patients with more severe valve damage to surgery. The large proportion of school-going children and young women of child-bearing potential among those disadvantaged patients emphasizes the importance of early prevention to avoid progression to severe RHD, school delays or failure in children and life-threatening risks associated with pregnancy [23,24].

Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.acvd.2015.12.004.

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