The profile of rheumatic heart disease at a tertiary hospital in KwaZulu-Natal, South Africa

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ABSTRACT

Background: Rheumatic heart disease (RHD) is a disease of poverty and a significant public health concern in developing countries. There is little data on the profile of RHD in KwaZulu-Natal (KZN), South Africa.

Objectives: To describe the demographic, clinical profile, and outcomes of RHD in patients referred to a tertiary cardiology facility in KwaZulu-Natal.

Methods: This is a 5-year (2012 - 2016) retrospective analysis of all patients with RHD referred to the cardiology department at Inkosi Albert Central Luthuli Hospital (IALCH). A structured format was used to extract demographic, clinical, echocardiographic and outcome data of 981 eligible patients aged >12 years. Descriptive analysis was used to report on quantitative data and logistic regression was used to identify significant associations and independent variables.

Results: The majority of patients were Black (87.9%); the median age was 24 years (IQR 15 - 36 years) and the female to male ratio was 2.3:1. Dyspnoea (92.2%) was the commonest presenting symptom and mitral regurgitation (56.4%) was the commonest valve lesion. The most frequent complications at presentation were atrial fibrillation (AF) (44.9%) followed by heart failure (HF) (28.6%). AF mostly affected the 41 - 60 year age group (OR 2.075, 95% CI 1.22 - 3.52, p=0.007). Compared to the adolescent group (13 -2 0 years), HF was less common in the 21 - 40 years and 41 - 60 years age groups (OR 0.455, 95% CI 0.286 - 0.723, p=001 and OR 0.495, 95% CI 0.288 - 0.852, p=0.011, respectively). Valve replacement was performed in 723 (88.4%) – (mitral valve 62.2%; aortic valve 4.8%; mitral and aortic valves 29%; 3 valve surgeries 4%) – of the 818 patients who had interventional procedures. The mortality rate was high at 20.1%. Mortality was highest in the younger patients (<20 years of age) (p=0.016). Predictors of death were severe disease at a young age (OR 1.268, 95% CI 1.050 - 1.532, p=0.013) and double valve replacement (OR 1.521, 95% CI 1.009 - 2.229, p=0.045).

Conclusion: RHD remains a significant cause of morbidity and mortality in KZN. HF during the teenage years reflects ongoing carditis with haemodynamic failure resulting in death if unoperated.

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INTRODUCTION

Rheumatic heart disease (RHD) is a significant public health problem in low- and middle-income countries.[1,2] It is estimated to affect 30 - 40 million people globally.[3] At least 319 400 deaths were recorded in 2015[1,3] with 60% of the deaths classified as premature (below 70 years of age).[1,3,4]

In Africa, a high prevalence of RHD has been reported from Uganda (15 / 1000 persons),[5] and an even higher prevalence from Mozambique (30.4 / 1 000 cases), when using echocardiographic screening.[6] In the 1980s the prevalence of RHD was reported to be 6.9 per 1 000 persons in South African schoolchildren from Cape Town and Soweto.[7] An even lower prevalence of acute rheumatic fever (ARF) and RHD in children less than 14 years of age has been reported by later studies (1993 - 1995) from Soweto in Gauteng[8] and Limpopo.[9]

There are limited studies on the burden and the outcomes of RHD in KwaZulu-Natal (KZN).[10] Maharaj, et al. reported a much lower prevalence of 1 / 1 000 cases in a school survey from Inanda district of Durban in 1987.[11] This was ascribed to the poor uptake of the survey due to poor school attendance as a result of political turmoil at that time.[11] While there has

been a notable decline in RHD in schoolchildren in Gauteng, Cilliers, et al. recently reported a higher prevalence in the rural parts of KZN and the Eastern Cape[9] but provided very little data on the pattern and severity of the disease. In this study, we describe the clinical profile and outcomes in patients with RHD patients referred for tertiary care in the province of KZN.

OBJECTIVES

The aim of the study was to describe the demographic profile, clinical presentation, complications, management, and treatment outcomes of patients with RHD referred to the cardiology unit at Inkosi Albert Luthuli Central hospital (IALCH) during 2012 - 2016.

METHODS

A retrospective chart review was performed using the hospital SpeedMiner software programme (Speedminer, Malaysia) to extract the relevant patient records. Patients' records were identified using the ICD-10 codes for RHD (I05-I09.8): ARF, mitral stenosis (MS), mitral regurgitation (MR), aortic stenosis (AS), aortic regurgitation (AR), and mixed valve disease (MVD) were used for data abstraction. All adult patients (aged 12 years and over), with an echocardiographically confirmed diagnosis of RHD were included in the study. The diagnosis of RHD on echocardiography was based on the World Heart Federation (WHF) criteria.[12] A structured data collection tool captured demographic characteristics, New York Heart Association (NYHA) functional class, valve involved, clinical findings, complications, comorbidities, echocardiographic findings, and the outcomes of intervention. For patients who were lost to follow-up we attempted to contact the patients and / or their families to determine their outcomes.

Data was analysed using Statistical Package for Social Sciences (SPSS) version 24 (International Business Machine). Simple descriptive analysis was used to document clinical characteristics, and results are presented as frequencies, means, and percentages. Continuous variables are expressed as medians ± interquartile ranges (IQR). The Student's t-tests and the chi-square tests were used to compare continuous variables and categorical variables, respectively. A p-value of <0.05 indicated significant findings for the variables being measured. Logistic regression analysis was used to estimate the association between study variables and the disease severity and outcomes.

ETHICAL APPROVAL

Ethical approval for this study was obtained from the Biomedical Research Ethics Committee (BREC) of the University of the KwaZulu-Natal (UKZN) (BE 598/17), the KZN provincial Department of Health and from IALCH.

RESULTS

Demographic characteristics

A total of 984 eligible patients were identified and of these 3 records were excluded due to insufficient data. The demographic characteristics of the remaining 981 patients are shown in Table I. The median age was 24 years (IQR 15 - 36 years); most patients were Black African (87.9%) and 70% were women. Over half (52.6%) of the Black African patients were residing in peri- urban areas. Human immunodeficiency virus (HIV) tests were performed in 880 (89%) patients and of these 159 (18.1%) were positive (Table I).

Clinical presentation

Half of the patients (49.5%) presented within 6 months of symptom onset (Table II). Dyspnoea was the commonest presenting symptom (92.2%), especially in the 41 - 60-year age group (OR 3.335, 95% CI 1.39 - 7.98, p=0.007) (Table II). Almost one third of patients (31.3%) presented with heart failure (NYHA class III/IV).

Pattern of valve involvement

A total of 1 337 valve lesions (mitral and aortic valves) were identified in the study population. The mitral valve was the commonest valve involved (71.9%): MR (57.6%), MS (14.5%) and mixed mitral valve disease (MMVD) (27.9%). Aortic valve lesions occurred in 376 (28.1%) cases: AR (72.6%), AS (16.5%) and mixed aortic valve disease (MAVD) (10.9%). Most aortic valve lesions (94.7%) coexisted with MVD. Only 20 (5.3%) patients had isolated aortic valve disease (AR, n=2), (AS, n=3) and (MAVD, n=15) (Table II).

Tricuspid regurgitation (TR) was present in 51.5% of patients and was functional, secondary to pulmonary hypertension in most cases. Almost one third (31.8%) had moderate to severe elevated PAS (Table II). In 18 cases in whom the pulmonary systolic pressure was less than 35mmHg, and echocardiography showed valve thickening with restriction of leaflet motion, tricuspid valve disease was deemed organic, secondary to RHD.

The severity of the mitral and aortic valve lesions stratified by age groups and sex, is shown in Figure 1. Severe MR was the

TABLE I: Demographic data of rheumatic heart disease at IALCH (2012 - 2016).

Characteristics	Total cohort n (%)	Black n (%)	White n (%)	Indian n (%)	Coloured n (%)
Age median (IQR) (years)	24 (15 - 37)	23 (14 - 37)	27 (20 - 49)	24 (15 - 36)	16 (14 - 24)
Age subgroups					
<20	402 (42.2)	390 (97)	0	11 (2.7)	1 (0.3)
20 - 40	355 (37.2)	316 (89)	1 (0.3)	33 (9.3)	5 (1.4)
41 - 60	174 (18.2)	120 (69)	8 (4.6)	45 (25.9)	1 (0.6)
>60	22 (2.3)	14 (63.6)	2 (9.1)	6 (27.3)	0
Area of Residence					
Rural	340 (35.3)	340 (100)	0	0	0
Peri-urban	506 (52.6)	457 (90.3)	0	46 (9.1)	3 (0.6)
Urban	116 (12.1)	47 (40.5)	11 (9.5)	54 (46.6)	4 (3.5)
Type of housing					
Formal	634 (66.3)	345 (36.1)	11 (1.1)	100 (10.4)	7 (0.7)
Informal	323 (33.7)	494 (51.6)			
Referral Hospital					
District Regional	202 (20.7)	197 (97.5)	0	5 (2.5)	0
Tertiary	656 (67.1)	545 (83.1)	11 (1.7)	95 (14.5)	5 (0.8)
No records	110 (11.2)	108 (98)	0	0	2 (2)
Direct admission	11 (1)	10 (91)	0	1 (9)	0
Province					
KwaZulu-Natal	864 (88.3)	748 (86.7)	10 (1.2)	101 (11.7)	5 (0.6)
Eastern Cape	115 (11.8)	112 (97.4)	1 (0.9)	0	2 (1.7)
HIV Positive	159 (18.1)	154 (96.9)	0	4 (2.5)	1 (0.6)

Except where stated all values are expressed as patient numbers (n) with the percentage in brackets.
IALCH: Inkosi Albert Luthuli Central Hospital.

commonest valve lesion in both men (31%) and women (69%), with no statistical significance between the genders (p=0.125) (Figure 1A). In contrast, severe AR was commoner in women (77.8%) than men (22.2%), (p=0.003) (Figure 1A). Severe valve lesions were more frequent in the <20 year and 21 - 40-year age groups, (MS p=0.019, MR p=0.043, AS p=0.002, AR p=0.132) (Figure 1B).

COMPLICATIONS

Over half of the patients (57.4%) presented with complications of RHD (Table II). The commonest complication was atrial fibrillation (AF) (44.9%), followed by heart failure (HF) (28.6%), stroke (14.4%) and infective endocarditis (IE) (12.1%). On univariate analysis AF was significantly less common in the elderly (>60 years age group) (p=0.040) (Table IIIA). On multivariate analysis the risk of AF was 2 times higher in the 41 - 60 year age group compared to the younger population (<20 years) (OR 2.075, 95% CI 1.22 - 3.52, p=0.007) (Table IIIB). No differences were observed in the prevalence of AF (OR 1.181, 95% CI 0.76 - 1.82, p=0.442) or HF (OR 1.06, 95% CI 0.67 - 1.67, p=0.793) between women and men. Infective endocarditis (IE) was less common in men (12.1%) than in women (22.9%), (OR 0.47, 95% CI 0.27 - 0.80, p=0.006). In the multivariate analysis HF was less common in the 21 - 40 year (OR 0.455, 95% CI 0.28 - 0.72, p=0.001) and 41 - 60 year age group (OR 0.495, 95% CI 0.28 - 0.85, p=0.011), compared to the reference age group (<20 years) (Table IIIB). The median ejection fraction (EF) was 53% (IQR 45 - 58). An EF less than 40%, was documented in 12.4%.

MANAGEMENT OF RHEUMATIC HEART DISEASE

A total of 818 patients (83.4%) underwent intervention surgery (88.4%) and percutaneous mitral balloon commissurotomy (PMBC) (11.6%); the remaining 16.6% were managed with medical therapy (Table II). Mitral valve replacement (MVR) was

TABLE II: Clinical characteristics, valve lesions, and outcomes rheumatic heart disease (n=981) at IALCH.

	n (%)
Clinical features	
History of rheumatic fever	138 (14)
Onset of symptoms <6 months	486 (49.5)
Dyspnoea (NYHA I-IV)	905 (92.2)
Dyspnoea (NYHA) III-IV	307 (31.3)
Cough	183 (18.6)
Lower limb oedema	308 (31.3)
Fatigue	357 (36.4)
Valve disease	
Mitral valve lesions	961 (71.9)
Aortic valve lesions	376 (28.1)
Valve lesion distribution	

	Aortic only n	MR n	MS n	MMVD N	Total
Mitral only		362	85	158	605
AR	2	183	21	67	273
AS	3	0	23	36	62
MAVD	15	9	10	7	41
Total	**20**	**554**	**139**	**268**	**981**

	n (%)
Tricuspid valve regurgitation[a]	506 (51.5)
Echo derived pulmonary artery systolic pressure	
Median PASP[b] (mmHg) (IQR)	38 (28 - 45)
Normal <35mmHg	18 (3 .6)
Mild 36 - 45mmHg	327 (64.6)
Moderate 46 - 60mmHg	132 (26.1)
Severe >60mmHg	29 (5.7)
Complications	
Atrial fibrillation	253 (44.9)
Infective endocarditis	68 (12.1)
Stroke	81 (14.4)
Heart failure	161 (28.6)
Ejection Fraction	
Median EF (IQR)	53 (45 - 58)
No data	27 (16.8)
EF <40%	20 (12.4)
EF 41% - 49%	30 (18.6)
EF >50%	84 (52.2)
Treatment modality	
Medical treatment only	163 (16.6)
Interventions	
PMC	95 (11.6))
Surgery	723 (88.4)
MVR	450 (62.2)
AVR	35 (4.8)
DVR	210 (29.0)
More than one intervention[c]	28 (4)
Mortality data	
Total died	197 (20.1)
While awaiting surgery	53 (26.9)
Peri-operative (within 24 hours of surgery)	61 (30.9)
Post-operative	36 (18.3)
Cause not established (death confirmed by telephone)	47 (23.9)

Except where stated all values are expressed as patient numbers (n) with the percentage in brackets.
PMC: Percutaneous mitral commissurotomy, MVR: mitral valve regurgitation, AVR: aortic valve replacement, DVR: double valve replacement, IQR: interquartile range.
[a]detected-on echocardiogram, [b]PASP pulmonary arterial systolic pressure, [c]Details of more than 1 surgical procedure: PMC followed by MVR 19 (68), PMC followed by DVR 6 (21.4%), MVR followed by DVR 2 (7.1%), MVR followed by AVR 1 (3.5%).

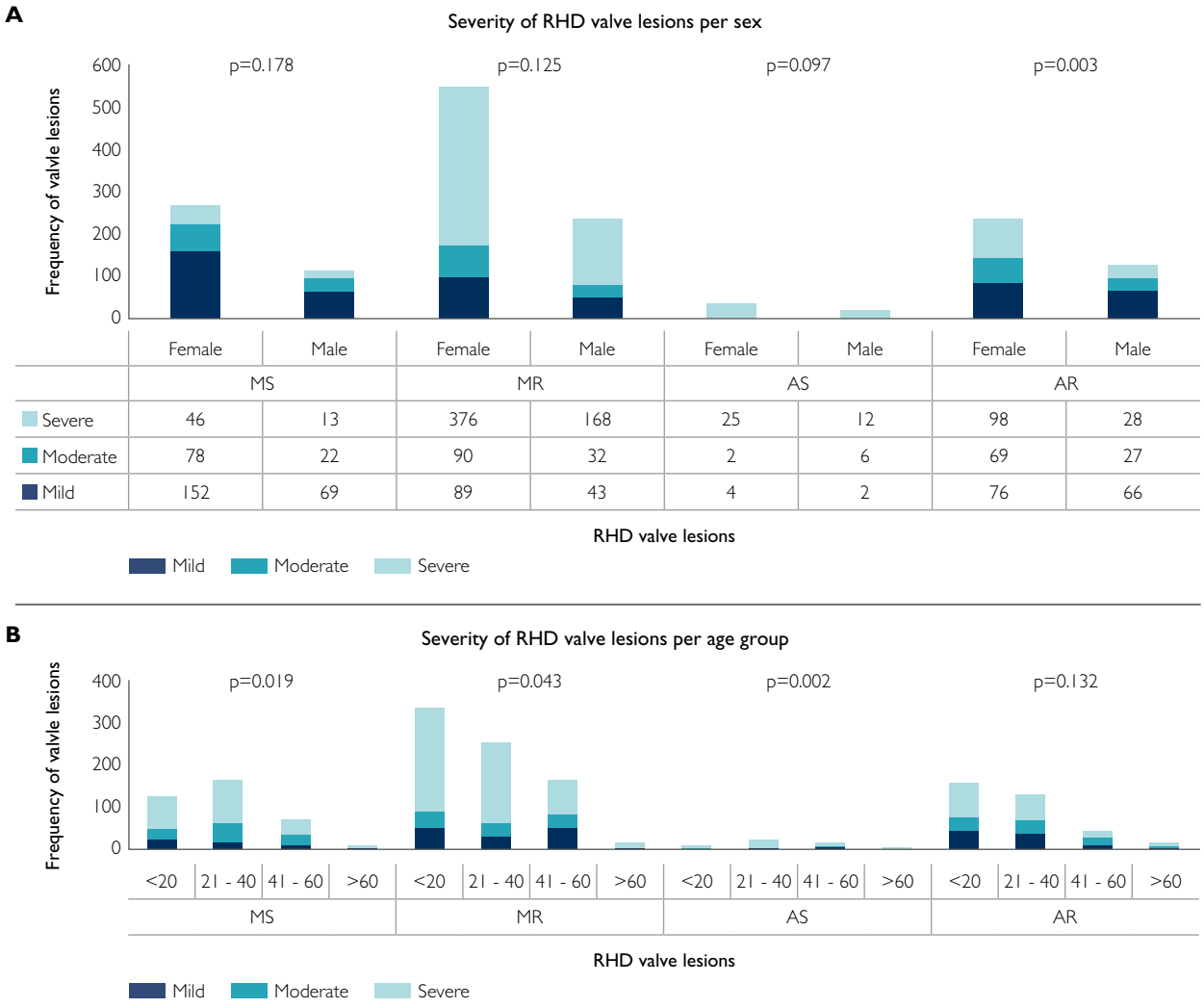

FIGURE 1: Severe MR was the commonest valve lesion in both genders (middle chart). Both mitral and aortic valve lesions were commoner in females (A) and occurred more frequently in the younger age groups (<20 and 20 - 40 years) compared to those over 40 years of age (B). Except for AS, which was the least common valve lesion, all other lesions (MS, MR, and AR) were more severe and occurred more frequently in the younger age groups (<20 years and 21 - 41 years).

the most common surgical procedure performed (62.2%) (Table II); and it was the most frequently performed procedure in the <20 year age group compared to the other age groups (p=0.033) (Table IIIA). Aortic valve replacement (AVR) was more frequently undertaken in the older age groups (41 - 61 year (OR 3.49, 95% CI 1.45 - 8.38, p=0.005) and >60 year (OR 5.17, 95% CI 1.01 - 26.4, p=0.048) compared to the reference group (<20 years) (Table IIIB). After controlling for sex, double valve replacement (DVR) was more commonly performed in the 21 - 40 years age group (OR 1.57, 95% CI 1.09 - 2.25, p=0.013) compared to the other age groups (Table IIIB). Women were more likely than men to have undergone MVR (OR 1.585, 95% CI 0.92 - 2.72, p=0.004) and less likely to have had DVR (OR 0.626, 95% CI 0.44 - 0.8, p=0.007) or AVR (OR 0.389, 95% CI 0.19 - 0.78, p=0.009).

Percutaneous mitral balloon commissurotomy (PMBC) for tight MS was performed in 95 patients. Most procedures (88,2%) were performed in the younger subjects under the age of 40 years [(<20 years n=35, (41.2%) and 21 - 40 years n=40, (47%)]) compared to the older age groups 40 - 60 years (n=10, (11.8%) (Table IIIA). Most of the patients (n=95, 53%) who underwent PMBC subsequently went on to have surgery for MVR due to restenosis of the mitral valve, 2 or more years after the PMBC.

TABLE IIIA: Complications, interventions, and outcomes of RHD stratified by age group and gender.

	<20 years n (%)	21 - 40 years n (%)	41 - 60 years n (%)	>60 years n (%)	p-values
Complications					
AF	71 (29.1)	103 (42.2)	64 (26.2)	6 (2.5)	0.040
IE	26 (38.8)	26 (38.8)	13 (19.4)	2 (3)	0.823
HF	68 (44.7)	49 (32.2)	29 (19.1)	6 (4)	0.003
Stroke	24 (30.8)	33 (42.3)	20 (25.6)	1 (1.3)	0.659
Complications in women					
AF	44 (24.3)	82 (45.3)	49 (27.1)	6 (3.3)	0.068
IE	14 (37.8)	12 (32.4)	9 (24.3)	2 (5.5)	0.519
HF	42 (38.5)	38 (34.9)	23 (21.1)	6 (5.5)	0.047
Stroke	10 (19.6)	25 (49)	15 (29.4)	1 (2)	0.279
Complications in men					
AF	27 (42.2)	21 (32.8)	15 (23.4)	1 (1.6)	0.177
IE	12 (40)	14 (46.7)	4 (13.3)	0	0.569
HF	26 (59.1)	11 (25)	6 (13.6)	1 (2.3)	0.056
Stroke	14 (51.9)	8 (29.6)	5 (18.5)	0	0.781
Interventions					
PMC	39 (41)	45 (47.4)	10 (10.5)	1 (1.1)	0.110
MVR	203(46.8)	140 (32.3)	83 (19.1)	8 (1.8)	0.033
AVR	10 (29.4)	10 (29.4)	12 (35.3)	2 (5.9)	0.013
DVR	80 (39.0)	90 (43.6)	31 (15.0)	5 (2.4)	0.009
Outcomes					
Died	68 (34.5)	78 (39.6)	48 (24.4)	3 (1.5)	

AF: atrial fibrillation, IE: infective endocarditis, HF: heart failure, PMC: percutaneous mitral commissurotomy, MVR: mitral valve replacement, AVR: aortic valve replacement, DVR: double valve replacement.

TABLE IIIB: Multivariate analysis stratified by age group at diagnosis.

	21 - 40 years OR	95% CI	p-value	41 - 60 years OR	95% CI	p-value	>60 years OR	95% CI	p-value
Symptoms									
Dyspnoea	2.361	1.32 - 4.22	0.004	3.335	1.39 - 7.98	0.007	2.591	0.32 - 19.06	0.376
PND	1.379	1.00 - 1.89	0.048	2.478	1.70 - 3.60	0.000	2.483	1.04 - 5.92	0.004
Cough	1.534	1.04 - 2.25	0.029	1.955	1.24 - 3.06	0.003	2.271	0.84 - 6.07	0.102
Leg oedema	1.320	0.96 - 1.80	0.082	1.395	0.95 - 2.04	0.088	2.138	0.89 - 5.10	0.087
Surgical procedures									
PMC	1.320	0.81 - 2.15	0.264	0.568	0.26 - 1.21	0.147	0.565	0.72 - 4.42	0.587
MVR	0.592	0.42 - 0.81	0.001	0.924	0.61 - 1.38	0.701	0.656	0.23 - 1.80	0.414
AVR	1.368	0.55 - 3.37	0.496	3.494	1.45 - 8.38	0.005	5.172	1.01 - 26.4	0.048
DVR	1.575	1.09 - 2.25	0.013	0.969	0.60 - 1.55	0.896	1.537	0.51 - 4.58	0.441
Complications of RHD									
AF	1.552	0.99 - 2.41	0.051	2.075	1.22 - 3.52	0.007	1.070	0.32 - 3.47	0.910
HF	0.455	0.28 - 0.72	0.001	0.495	0.28 - 0.85	0.011	1.161	0.35 - 3.76	0.083

Age <20 years is the reference group.
PND: paroxysmal nocturnal dyspnoea, PMC: percutaneous mitral valvulotomy, MVR: mitral valve replacement, AVR: aortic valve replacement, DVR: double valve replacement, AF: atrial fibrillation, HF: heart failure.
Dyspnoea was the commonest presenting symptom in 41 - 60 years and 21 - 40 years. MVR was commonly performed in young patients (<20 and 21 - 40 year). AF was the common complication in patients >20 years old and HF in patients <20 years.

RHEUMATIC HEART DISEASE MORTALITY

One hundred and forty-seven (15%) were referred back to continue follow-up at their base hospitals (Table II). Of these patients 7 had declined surgery and 15 were deemed unfit for surgery due to comorbid illnesses (advanced HIV (CD4 cell count <200cells/mm^3) (n=6), anaemia (n=2), hypothyroidism (n=1), untreated syphilis (n=1), and cardiomyopathy (n=5). A minority of patients (n=58) were lost to follow up.

A fifth of patients (20.1%) died during the 5-year period of the study and the median age at the time of death was 27 years (IQR 18 - 44 years). The 197 deaths comprised those who died: (a) while awaiting surgery (26.9%), (b) during the peri-operative period (49.2%) and (c) those were reported by their families to have died (23.9%) upon telephonic follow-up. Deaths were due to HF / cardiogenic shock (40.6%), AF (48.7%), IE (2.0%) and septic shock (4.6%); and stroke (4.1%).

There was a negative relationship between age and mortality (p=0.016) (Table IV). Most deaths occurred in the 21 - 40 years age group (39.6%), followed by <20 year age group (34.5%), and the 41 - 60 years age group (24.4%), and the least in the >60 years (1.5%). Severe disease at a young age (OR 1.268, 95% CI 1.050 - 1.532, p=0.013) and DVR (OR 1.655, 95% CI 1.109 - 2.472, p=0.014), emerged as independent predictors of death. As expected, surgical intervention was lifesaving (OR 0.471, 95% CI 0.339 - 0.665, p=0.000), with fewer deaths occurring in the patients who underwent single valve surgery (n=122, 16.7%) compared to those who did not have surgery (n=75, 29.3%) (Table IV). Amongst patients who underwent surgical intervention, DVR carried the highest risk of death after surgery (OR 1.521, 95% CI 1.009 - 2.229, p=0.045).

DISCUSSION

This study shows that patients with RHD in KZN present with a full spectrum of advanced chronic manifestations, often occurring at a much younger age. These findings are in keeping with early studies[13,14,15] which described severe valvular damage from recurrent carditis. The peak presenting age in our study was in adolescence and young adults, compared to the third decade in the Heart of Soweto study.[16] A striking finding was that 42.2% of our patients were below 20 years of age at the time of diagnosis and 57.6% of those below 20 years had severe, advanced rheumatic valve disease. Most of our younger patients were referred with severe symptoms of NYHA III / IV dyspnoea, often in decompensated HF with RHD complications. These findings are similar to early reports from the district of Inanda, Durban in 1987,[11] Uganda and Nigeria all of which described severe MR presenting in advanced HF.[17,18,19] Severe disease presenting in early age has been reported in an Australian study[20] which showed a high incidence and rapid progression of RHD within a year after the first episode of ARF. Recently, Okello, et al. reported that suboptimal adherence to benzathine penicillin injections was associated with incident HF and mortality over 1 year from initial presentation.[19,20]

The pattern of severe valve involvement at an early age suggest an accelerated rheumatic process resulting in mitral regurgitation and HF,[25,26] which have recently been described in Cameroon,[27] in Gauteng,[29] and in Uganda.[30] While the frequent coexistence of MVD and AVD at a young age in our study is typical of the natural history of RHD.[21] Severe double valve involvement in our study suggests recurrent carditis with severe valve damage requiring DVR at an early age. This pattern of accelerated valve damage was also seen in the group with tight MS. Forty percent of these subjects that underwent PMBC were under the age of 20 years. Severe MS in the teenage years indicates an accelerated fibrotic process with organisation of valvular tissue resulting in early narrowing of the valve orifice and tight valvular stenosis.[31] Rheumatic involvement of the tricuspid valve is uncommon.[32] In the majority of our patients tricuspid regurgitation was attributed to pulmonary hypertension.[32,33] However, this lesion was also detected at near normal pulmonary artery pressures in subjects with TR who had leaflet thickening and restriction of motion in 3.6% patients, pointing to organic tricuspid valve disease (TVD) secondary to the rheumatic process. This has been described in a cross-sectional study from Nepal[34] and a World Health Organisation (WHO) review by Sultan, et al. who found TVD in 7.7% of cases, with 99.3% of these patients having co-existing MVD.[35]

The majority (88.4%) of our study population underwent valve replacement surgery because patients presented with severe regurgitant lesions and multiple valve involvement. The choice of the intervention modality was informed by the type of valve disease and suitability of the valve morphology, the severity of valve damage[36] and operator skills.[37] PMBC for isolated tight MS was performed in the remaining 11.6% whom the interventionalist judged suitable for the procedure. Although PMBC has been reported to have a favourable short and long-term outcome in carefully chosen candidates,[38,39] recent attention has been drawn to a high rate of restenosis following this procedure.[40] This was borne out in our sample since the majority

TABLE IV: The association of age and valve surgery with mortality in all patients.

	Alive n (%)	Died n (%)	Total n (%)
Age categories			
<20	337 (43)	68 (34.5)	405
21 - 40	277 (35.3)	78 (39.6)	355
41 - 60	126 (16.7)	48 (24.4)	174
>60	44 (5.6)	3 (1.5)	47
Treatment category			
No surgery	106 (65)	57 (35)	163
Surgery	678 (82.9)	140 (17.1)	818
Total	784 (79.9)	197 (20.1)	981

Pearson Chi-square = 10.26, p=0.016. The odds of dying decreased with age.
Surgical procedures were protective against death (Pearson Chi-square = 18.95, pr=0.000).

proceeded to valve replacement 2 years after the procedure, due to valve restenosis, indicating that PMC was being performed in subjects with less than ideal valve morphology.

The mortality related to RHD remains a serious burden affecting young patients from low- to middle- income countries,[41] with a 2-year case fatality rate of 500 deaths (16.9%) in Africa.[41] Our study found a mortality rate of 20.1% which is higher than the case fatality rate of 16.9% described in the Global Rheumatic Heart Disease Registry (REMEDY study).[41] In keeping with other reports[3,41,42] most of the deaths in our study were due to advanced disease with valve destruction resulting in haemodynamic failure, as well as very large atria with atrial fibrillation and clot formation. The median age at the time of death was 27 years (IQR 18 - 44.7 years) was very similar to 28.7 years described in the REMEDY study. In contrast to the REMEDY[41] study, we found that age less than 20 years was a predictor of death. This is explained by the severity of disease observed in this age group, which carried a high mortality risk, especially in subjects undergoing DVR. As expected, valve surgery was life-saving, with fewer deaths observed among those with severe disease who underwent surgery. We found no significant association between mortality and clinical variables such as demographic characteristics, comorbidities, severe symptoms (NYHA class III / IV) and complications.

STUDY LIMITATIONS

The limitations of this study are largely related to its retrospective design. These include missing or incomplete follow up data for analysis, thereby limiting our ability to interrogate data relating to outcomes of complications and mortality. Furthermore, the centralisation of referrals of severe disease to a single state tertiary centre has created an inherent referral bias, so that results may selectively represent severe RHD, as it does not include patients managed at peripheral hospitals and clinics with milder forms of the disease. While the study sample is therefore limited with regards to ethnicity and grades of disease severity, it does reflect the profile of patients in poorer communities and at highest risk of severe RHD. A strength of our study, however, is that echocardiography was used to document the clinical profile of RHD at a tertiary referral hospital in KZN, enabling us to provide a detailed morphology of the underlying rheumatic pathology and its associated complications. Lastly, it must be pointed out that the study portrays a 5-year view and longer-term outcome was not evaluated in this study.

There is evidence that susceptibility to and severity of ARF and RHD differs amongst different ethnic groups.[22] Although we could not assess this in our study, due to small numbers of subjects in the other ethnic groups, the majority (90%) of patients in our study were Black African with over half (52.6%) residing in peri- urban areas. These areas are not only densely populated but also characterised by a rapid rise in informal settlements in KZN where low socioeconomic standing and overcrowding, together with poor access to health care facilities contribute to the development of ARF and RHD.[23,24] In this environment untreated recurrent streptococcal infection and ARF are missed opportunities for primary and secondary prophylaxis measures[2,18,21] and result in ongoing valvular damage[3] requiring surgical intervention at a young age.

CONCLUSION

This study shows that RHD with its sequelae remains a significant cause of cardiovascular morbidity and mortality especially among young Black Africans from disadvantaged communities in KZN. Most patients presented at an advanced stage of the disease requiring urgent valve replacement surgery which was lifesaving. Advanced disease at young age and DVR emerged as significant predictors of mortality. Of note, HIV infection did not appear to adversely influence the disease outcome.

The study highlights the importance of early diagnosis and management of RHD, through continued rheumatic fever surveillance at community level, as well as the availability of point-of-care echocardiographic services to facilitate early diagnosis and referral of patients from peripheral hospitals.[43] These issues have become more imminent in current times and serve to reemphasise the need for effective penicillin prophylaxis to combat streptococcal infection and prevent recurrent carditis and the devastating consequences of this disease. Establishment of a RHD registry in KZN will reflect the true burden of RHD at the community level and inform policies and programmes to increase awareness of RHD in the communities and ensure effective screening and therapeutic measures.

Conflict of interest: none declared.

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