Demographic and clinical profile of patients undergoing echocardiography at a tertiary institution in central South Africa

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ABSTRACT

Introduction: Worldwide, cardiovascular disease is associated with substantial economic challenges and profound morbidity and mortality. Considering the dearth of information on cardiovascular disease for the central region of South Africa, this study aimed to assess the profile of patients who were referred to an echocardiography laboratory at a tertiary institution.

Method: A hospital-based, observational, descriptive study was conducted. Demographic, anthropometric, socio-economic, clinical and echocardiographic data were collected. Standard transthoracic echocardiograms were performed.

Results: The study population had a mean age of 51.8 ± 17.38 years, was predominantly black (64%) with a slight female preponderance (55%). The majority of patients were from a low-socioeconomic background (H0 - H2; 91%). Two-thirds of the participants were hypertensive (64%) and 57% had a body mass index exceeding 25kg/m². Sixty-three percent of referrals were for routine echocardiographic assessment. Abnormal echocardiographic findings were reported in 74% of patients. Diastolic dysfunction and left ventricular hypertrophy were detected in almost half of all patients (n=1 034; 41%), followed by cardiomyopathies and systolic dysfunction in about one-third (n=804; 32%).

Conclusion: This is the first study describing the profile of patients referred for echocardiography in central South Africa. A high percentage of patients had underlying cardiac pathology, especially myocardial dysfunction. SA Heart® 2024;21:18-27

INTRODUCTION

The global burden of cardiovascular disease (CVD) is well documented.[1] The impact of CVD has become evident in many countries on different continents, contributing to premature death, increased morbidity and disability, and substantial economic challenges.[1,2] Regardless of continued success in extending life expectancy through ongoing research, CVD remains a prominent cause of death and disability.[3] Listed by the World Health Organisation as one of the most significant causes of death, the worldwide concern is understandable. It is alarming that a third of cardiovascular deaths occur in people younger than 70.[4] Availability of timely diagnostic services and access to treatment may reduce premature deaths caused by CVD.[5,6,7] Several studies were conducted on the African continent to investigate cardiac conditions.[8,9] The "Hearts of Soweto" study evaluated the prevalence of cardiac disorders in residents of Soweto, South Africa.[10] Results revealed that rheumatic heart disease (RHD) and heart failure (HF) were the most common abnormalities found in this predominantly black African population. This and further research also concluded that the burden of heart disease had an immense effect on the health of vulnerable communities consisting of low- to middle-income people.[10,11,12] The increase in CVD in South Africa is a considerable challenge,[5] inflicting economic and social problems on the region.[13] However, diagnosis can be complex in patients with subclinical disease states.[14] Echocardiography is the ultimate tool for early diagnosis of structural and functional cardiovascular conditions.[14] It is a key modality for diagnosis in patients with cardiac symptoms and patients with multiple abnormalities, revealing disease severity, guiding therapy and follow-up of disease state.[15] Various studies highlighted the valuable role of echocardiography in assessing and managing cardiac disease.[15] The effectiveness of prompt diagnosis as

provided by echocardiography should be recognised in central South Africa, as the lack of patient profile data may urge the implementation of prevention and management practices to reduce the economic and social effects of this treatable disease. To date, there is a dearth of information on the frequency and nature of CVD in the central region of South Africa. Investigating trends in patient referrals for echocardiographic evaluation may provide valuable insight into service utilisation and needs. Furthermore, data on referral and disease patterns can provide the scientific platform for redressing inequalities in healthcare delivery in South Africa. This study aimed to assess the profile of patients who were referred to an echocardiography laboratory in the central region of South Africa.

METHOD

Study design

This is a hospital-based, observational, descriptive study. Data were from the time of the patient's first visit to the echocardiography laboratory. Retrospective data were extracted from patient medical records.

Study setting

The study was conducted at the echocardiography laboratory of the Department of Cardiology at the Universitas Academic Hospital (UAH), the only referral centre for echocardiographic examinations for the population of the Free State province, Northern Cape province and neighbouring country, Lesotho.

Inclusion / exclusion criteria

Adult patients aged 18 years and older who presented for echocardiographic evaluation for the first time were included in the study. Patients with suboptimal echocardiographic images were excluded from the study.

Definitions

Suboptimal echocardiographic images were defined as poor acoustic windows that made it impossible to confirm or exclude the presence of cardiac abnormalities.

Inpatients were defined as patients who stayed overnight in the hospital facilities for treatment and special investigations.

Patients from outpatient departments, primary care clinics and district hospitals who did not spend the night in the hospital were classified as outpatients.

Routine echocardiographic evaluations were defined as echocardiograms performed according to the British Society of Echocardiography (BSE) protocol for the minimum dataset[19] for workup of patients prior to administration of chemotherapy, intraoperative risk assessment or before chronic renal replacement therapy commenced.

In this study, systolic dysfunction was defined as a left ventricular ejection fraction (LVEF) of less than 52%. Left ventricular hypertrophy (LVH) included concentric hypertrophy, LV remodelling (abnormal LV geometry) and eccentric hypertrophy. Aortic sclerosis, aneurysm and dissection were defined as aortic abnormalities. In accordance with the 2018 European Society of Cardiology and the European Society of Hypertension guidelines, hypertension was defined as a systolic blood pressure greater than or equal to 140mmHg and / or a diastolic blood pressure greater than or equal to 90mmHg.[16] Renal referrals with hypertension were excluded from the analysis of hypertension. Body mass index (BMI) represented the key index for relating weight to height and was calculated as body weight in kilograms divided by height squared in metres.[17] Myocardial dysfunction refers to ventricular systolic or diastolic dysfunction in the absence of primary valvular heart disease.[18]

Patient enrolment

Patients were recruited prospectively from July 2019 up to the end of December 2020. In addition, retrospective data from September 2018 onward were included to mitigate the impact of the COVID-19 epidemic on referral patterns. Patients were categorised by hospitalisation status as inpatients and outpatients and reason for referral.

Echocardiographic studies

Standard transthoracic echocardiograms (TTE) were performed according to the British Society of Echocardiography protocol for comprehensive adult TTE studies.[19] If abnormal echocardiographic findings were detected, additional views, measurements and calculations were performed as deemed appropriate by the clinical echocardiography professional and then referred to the cardiologist for review and action.

Data collection

Demographic data, including age (years), sex and race / ethnicity, and anthropometric data (height [cm] and weight [kg]) were collected. Patients' BMI was calculated as weight / height^2.[17] The allocated classification of a patient by the Department of Health according to income was used to define the patient's socio-economic status. The different categories were as follows: H0, H1, H2, H3 and H4MA, where H0 indicated full subsidisation of health services, H1 to H3 partial subsidisation and H4MA full paying patients. The place of residence was recorded for all referrals. Referrals were classi-

fied by province, and patients from the Free State were segmented by municipal district. Referrals from specialist health care services were categorised by hospitalisation status. Clinical data included echocardiographic findings and blood pressure measurements. Blood pressure was measured before the echocardiogram investigation using an automatic electronic device.

Data analysis

Data analysis was performed in collaboration with a biostatistician using GraphPad Prism version 5.0 standard Statistical Analysis (GraphPad software, San Diego, California). Raw data were captured on Excel spreadsheets. A t-test was conducted to compare normally distributed data. Nonparametric data were compared using a Mann-Whitney U test. Where required, a Chi-square test or Fisher's exact test was utilised for comparisons. A p-value of less than 0.05 was considered to be statistically significant.

Ethics

Ethical approval (UFS-HSD2019/0353/2506-0003) was obtained from the Health Sciences Research Ethics Committee of the University of the Free State. The Free State Department of Health granted permission for the research to be performed at provincial facilities.

RESULTS

A total of 2 624 patients were referred to the echocardiography laboratory for evaluation over the 28 months from September 2018 - December 2020. Of these, 101 patients were excluded from the study either due to non-consent, poor image quality limiting the accuracy of measurements and diagnosis, or patients younger than 18. One thousand five hundred and sixty-seven patients (62%) were recruited prospectively, and 956 patients were added retrospectively.

Demographics and clinical data

Demographic and anthropometric data of patients at the time of echocardiographic evaluation are presented overall and by hospitalisation status in Table I. Inpatient and outpatient referrals were almost equal (n=1,211; 48% vs. n=1,312; 52%). Overall, the mean age of patients was 51.8 years (SD ± 17.38 years). Echocardiography was performed in slightly more females (n=1,397; 55%) than males (n=1,107; 44%). About two-thirds (n=1,615; 64%) of the study population was black Africans as opposed to Asians (n=23; 1%), who comprised the smallest racial group. Most patients (n=2,298; 91%) were categorised as either H0, H1 or H2; thus, most patients were of low income and presumed to be of low socio-economic status. The mean BMI of patients was 27.34kg/m^2 (SD ± 7.78kg/m^2), and almost half of the patients (n=1,199; 48%) were overweight or obese.

Blood pressure assessments at the time of echocardiographic evaluation are presented overall and by race / ethnicity in Table II. Blood pressure data were recorded for 2 039 patients (81%). Of these, 1 870 patients (92%) were included in the blood pressure assessment analysis set. It was not known whether hypertension was previously diagnosed, treated, or controlled at the time of referral. Two-thirds of patients referred by nephrology specialist services (n=169; 66%) had increased blood pressure at the time of echocardiography and were excluded from data analysis. Results demonstrated that two-thirds of all patients (n=1 202; 64%) were hypertensive and that more than half of patients in each race / ethnicity group, except Asian, were hypertensive. Significantly more black African patients presented with hypertension compared to Caucasian patients (p=0.0466).

Place of residence

The distribution of referrals is presented by geographical location of residence for the total study population in Figure 1. Most referrals were from health facilities in the Free State (n=2 056; 81%), followed by referrals from the Northern Cape (n=345; 14%).

The municipal district in Figure 2A presents referrals within the Free State against the provincial population. Almost half of these referrals (n=938; 46%) were from healthcare facilities in the Mangaung metropolitan municipality, although this district accommodated only 28% of the provincial population (Figure 2B). Considering the relative population of the Thabo Mofutsanyana (27%) and Fezile Dabi (17%) districts, referrals featured only about half of these percentages, 15% and 10%, respectively (Figure 2A).

Echocardiographic referrals from specialist healthcare services

Referrals from specialist health care services are presented by hospitalisation status in Figure 3. Approximately half of all referrals to the echocardiography laboratory were from cardiac services (n=1 245; 49%), followed by referrals from nephrology (n=255; 10%). Almost three-quarters of cardiac referrals were as outpatients (n=903; 73%), whereas almost all referrals from vascular surgery (n=138; 98%) and nephrology (n=241; 95%) were as inpatients. All oncology referrals were marked as outpatients; however, some of these patients were hospitalised in a secondary healthcare facility within the Mangaung metro.

TABLE I: Demographic and anthropometric data at the time of echocardiographic evaluation, overall and by hospitalisation status.

Variable	Overall (n=2 523)	Inpatients (n=1 211) 48%	Outpatients (n=1 312) 52%
Age (years) (mean [SD])	51.8 (17.38)	50.8 (17.69)	52.8 (17.05)
Sex			
Male (n; %)	1 107 (43.9%)	580 (47.9%)	527 (40.2%)
Female (n; %)	1 397 (55.4%)	617 (50.9%)	780 (59.5%)
Unknown (n; %)	19 (0.8%)	14 (1.2%)	5 (0.4%)
Race / ethnicity			
Black African (n; %)	1 615 (64.0%)	814 (67.2%)	801 (61.1%)
Caucasian (n; %)	700 (27.7%)	302 (24.9%)	398 (30.3%)
Mixed race (n; %)	185 (7.3%)	88 (7.3%)	97 (7.4%)
Asian (n; %)	23 (0.9%)	7 (0.6%)	16 (1.2%)
Socio-economic status			
H0 (n; %)	549 (21.8%)	253 (20.9%)	296 (22.6%)
H1 (n; %)	1 630 (64.6%)	804 (66.4%)	826 (63.0%)
H2 (n; %)	119 (4.7%)	51 (4.2%)	68 (5.2%)
H3 (n; %)	26 (1.0%)	15 (1.2%)	11 (0.8%)
H4MA (n; %)	136 (5.4%)	50 (4.1%)	86 (6.6%)
Unknown (n; %)	63 (2.5%)	38 (3.1%)	25 (1.9%)
BMI (kg/m^2) (mean [SD])	27.34 (7.78)		
Underweight (n; %)	185 (7.3%)	97 (8.0%)	88 (6.7%)
Normal (n; %)	733 (29.1%)	357 (29.5%)	376 (28.7%)
Overweight (n; %)	532 (21.1%)	241 (19.9%)	291 (22.2%)
Obese I (n; %)	368 (14.6%)	125 (10.3%)	243 (18.5%)
Obese II (n; %)	163 (6.5%)	57 (4.7%)	106 (8.1%)
Obese III (n; %)	136 (5.4%)	54 (4.5%)	82 (6.3%)
Unknown (n; %)	406 (16.1%)	280 (23.1%)	126 (9.6%)

BMI: Body mass index, overweight BMI ≥25, obese class I BMI ≥30, class II BMI ≥35, class III BMI ≥40; H0 to H4MA: categories by patient income; n: number of patients included in the study; n: number of patients per category; %: n divided by N, multiplied by 100; SD: standard deviation.

TABLE II: Blood pressure assessments at the time of echocardiographic evaluation, overall and by race / ethnicity.

Variable	Overall (n=2 523)	Inpatients (n=1 211) 48%	Outpatients (n=1 312) 52%		
Systolic blood pressure (mmHg) (mean [SD])	158 (17.19)	157.93 (17.51)	157.85 (17.06)	156.09 (15.21)	160.75 (19.62)
Diastolic blood pressure (mmHg) (mean [SD])	99 (9.09)	100.08 (9.43)	98.00 (8.40)	95.49 (5.24)	104.67 (22.03)
Hypertension Yes (n; %) No (n; %)	 1 202 (64.3%) 668 (35.7%)	 754* (66.8%) 374 (33.2%)	 356* (61.9%) 219 (38.1%)	 85 (58.6%) 60 (41.4%)	 7 (31.8%) 15 (68.2%)
P values			Caucasian vs. Black African Caucasian vs. Mixed Race		0.0466* NS

BMI: Body mass index, overweight BMI ≥25, obese class I BMI ≥30, class II BMI ≥35, class III BMI ≥40; H0 to H4MA: categories by patient income; n: number of patients included in the study; n: number of patients per category; %: n divided by N, multiplied by 100; SD: standard deviation, NS: not significant.

Routine echocardiographic evaluation

Requests for routine echocardiographic evaluation accounted for about two-thirds of all referrals (n=1 582; 63%), of these, almost one-third was part of regular pre-operative (n=197; 13%) and pre-chemotherapy (n=238; 15%) protocols. The remaining 941 (37%) patients required emergency echocardiography.

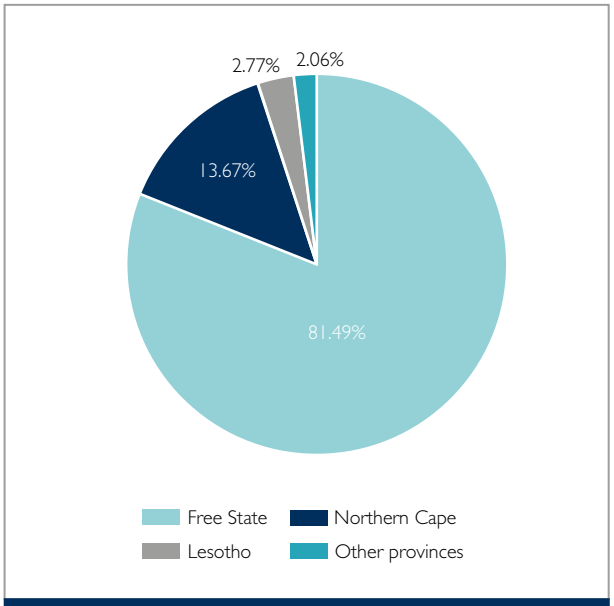

FIGURE 1: Distribution of referrals by geographical location of residence (study population).

Echocardiologic findings

Echocardiographic findings are presented by the referring specialist health care services in Figure 4. Findings were categorised as "normal" or "abnormal". Abnormal echocardiographic findings were observed in three-quarters of all referred patients (n=1 868; 74%). Of these, about half were found in patients referred by cardiac services (n=996; 53%), followed by nephrology (n=211; 11%) and internal medicine and haematology (n=112; 6%).

Cardiac pathology is detailed by referring to specialist healthcare services in Table III. Overall, myocardial dysfunction was the most frequent abnormal echocardiographic finding. Diastolic dysfunction and LVH were detected in almost half of all patients (n=1 034; 41%), followed by cardiomyopathies and systolic dysfunction in about one-third (n=804; 32%). Almost half of the patients from the cardiac services presented with LVH (of all causes) and diastolic dysfunction (n=572; 46%), followed by cardiomyopathy and systolic dysfunction (n=486; 39%), valvular disorders (n=467; 38%) and aortic abnormalities (n=432; 35%) in more than one-third of cases. In nephrology patients, the most frequent abnormal echocardiographic findings were diastolic dysfunction and LVH (n=159; 63%), pulmonary hypertension (n=94; 37%) and systolic dysfunction (n=77; 30%). One-third of oncology referrals presented with myocardial dysfunction (n=56; 33%). Other pathologies such as hypercontrac-

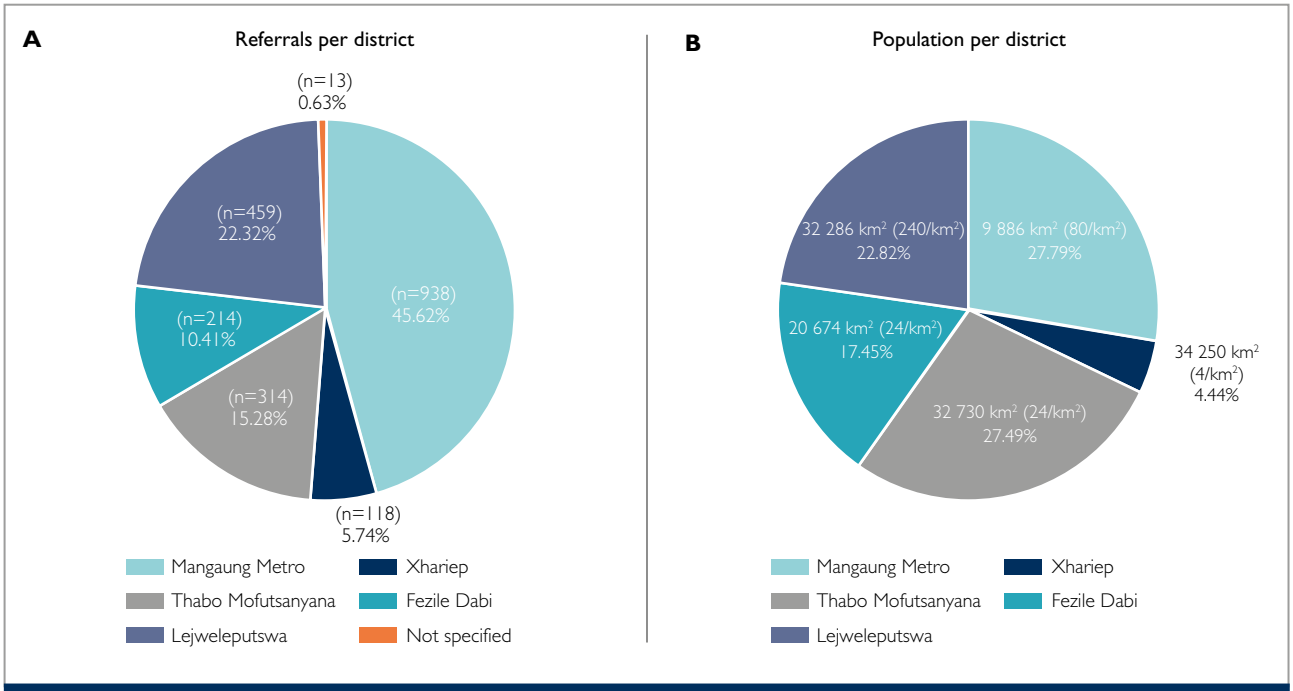

FIGURE 2: Referrals within the Free State (2A) against the provincial population by municipal district (2B).

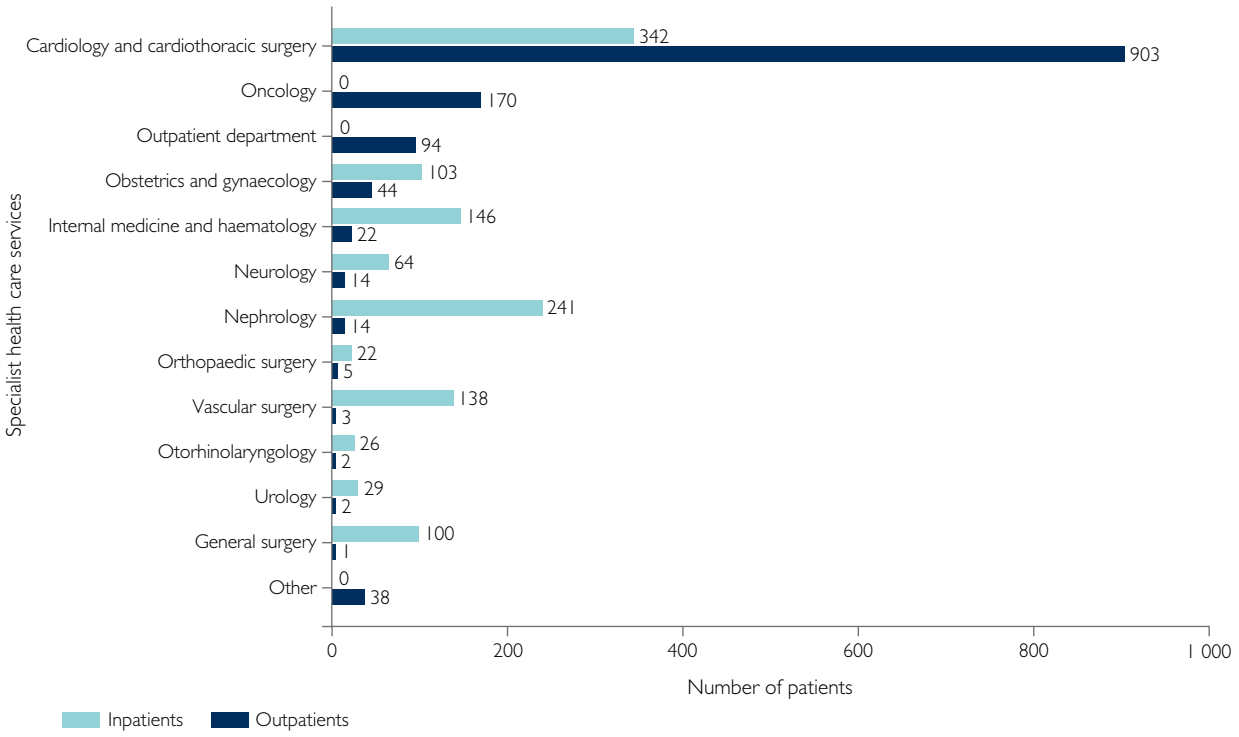

FIGURE 3: Echocardiographic referrals from specialist healthcare services by hospitalisation status.

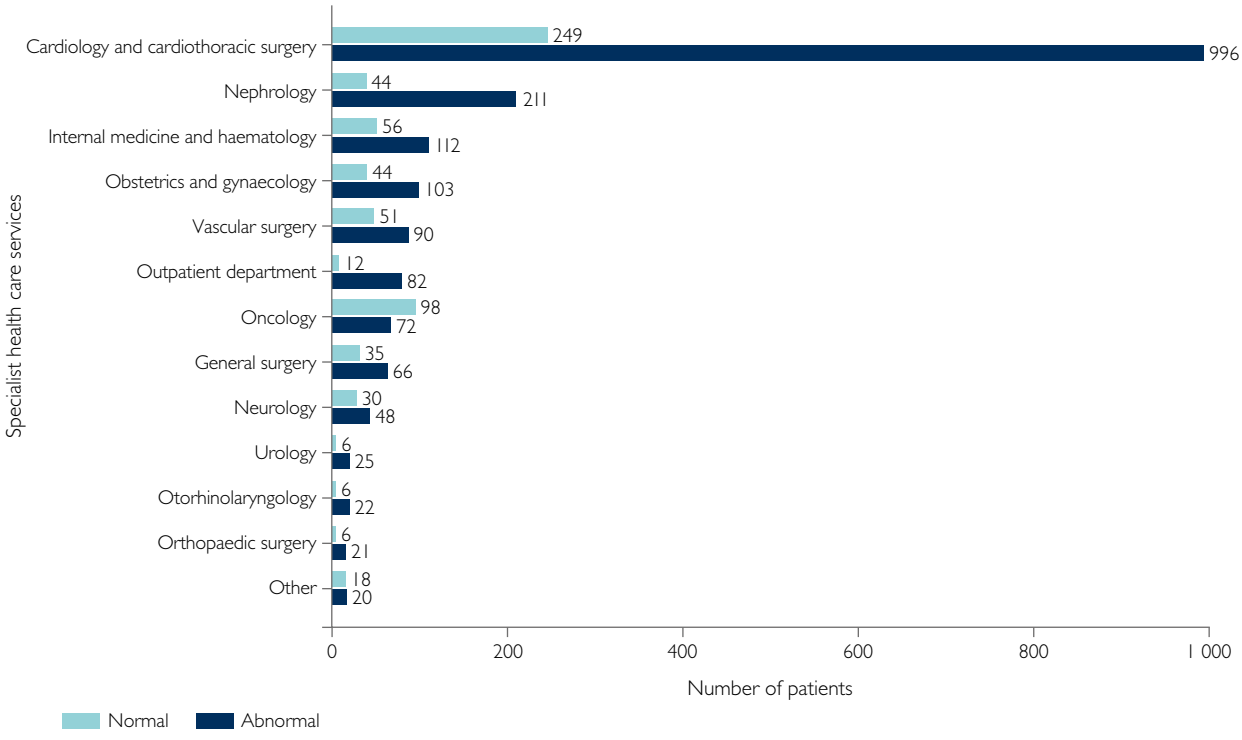

FIGURE 4: Echocardiographic findings.

TABLE III: Cardiac pathology.

Referring services	Valvular disorders (n=679)	Peri-cardial disease (n=37)	IHD (n=151)	Aortic abnor-malities (n=710)	Infective endo-carditis (n=18)	Throm-bus; tumour (n=5)	Systolic dysfunc-tion; cardio-myopathy (n=804)	LVH; diastolic dysfunc-tion (n=1 034)	CHD (n=59)	PHT (n=651)	Other (n=88)
Cardiology and cardiothoracic surgery (n=1245)	467 (68.8%)	15 (40.5%)	107 (70.9%)	432 (60.8%)	10 (55.6%)	3 (60.0%)	486 (60.4%)	572 (55.3%)	38 (64.4%)	341 (52.4%)	38 (43.2%)
Nephrology (n=255)	34 (5.0%)	4 (10.8%)	9 (6.0%)	50 (7.0%)	1 (5.6%)	0	77 (9.6%)	159 (15.4%)	2 (3.4%)	94 (14.4%)	9 (10.2%)
Oncology (n=170)	14 (2.1%)	3 (8.1%)	0	14 (2.0%)	0	1 (20.0%)	30 (3.7%)	26 (2.5%)	1 (1.7%)	18 (2.8%)	9 (10.2%)
Internal medicine and haematology (n=168)	28 (4.1%)	5 (13.5%)	4 (2.6%)	29 (4.1%)	2 (11.1%)	0	42 (5.2%)	4 (0.4%)	0	41 (6.3%)	11 (12.5%)
Obstetrics and gynaecology (n=147)	36 (5.3%)	3 (8.1%)	4 (2.6%)	4 (0.6%)	0	0	31 (3.9%)	49 (4.7%)	9	32 (4.9%)	5 (5.7%)
Vascular surgery (n=141)	11 (1.6%)	2 (5.4%)	7 (4.6%)	61 (8.6%)	0	0	31 (3.9%)	49 (4.7%)	0	32 (4.9%)	5 (5.7%)
General surgery (n=101)	17 (2.5%)	(2.7%)	5 (3.3%)	31 (4.4%)	2 (11.1%)	1 (20.0%)	28 (3.5%)	30 (2.9%)	1 (1.7%)	22 (3.4%)	5 (5.7%)
Neurology (n=78)	9 (1.3%)	0	5 (3.3%)	18 (2.5%)	2 (11.1%)	0	13 (1.6%)	29 (2.8%)	3 (5.1%)	7 (1.2%)	1 (1.1%)
Outpatient referral department (n=94)	39 (5.7%)	2 (5.4%)	6 (4.0%)	25 (3.5%)	0	0	35 (4.4%)	34 (3.3%)	4 (6.8%)	28 (4.3%)	2 (2.3%)
Urology (n=31)	4 90.6%)	0	0	14 (2.0%)	0	0	10 (1.2%)	13 (1.3%)	0	8 (1.2%)	0
Otorhinolaryn-gology (n=28)	10 1.5%)	1 (2.7%)	2 (1.3%)	8 (1.2%)	0	0	9 (1.1%)	8 (0.8%)	0	10 (1.5%)	2 (2.3%)
Orthopaedic surgery (n=27)	6 (0.9%)	1 (2.7%)	2 (1.3%)	10 (1.4%)	1 (5.6%)	0	8 (1.0%)	11 (1.1%)	0	11 (1.7%)	11 (1.7%)
Other (n=38)	4 (0.6%)	0	0	14 (2.0%)	0	0	4 (0.5%)	9 (0.9%)	1 (1.7%)	7 (1.1%)	0

Some patients presented with more than one abnormal finding.
CHD: congenital heart disease, IHD: ischaemic heart disease, LVH: left ventricular hypertrophy, n: number of patients per category, PHT: pulmonary hypertension.

tile left ventricle, interatrial septum aneurysm, lipomatous interatrial septum and mitral valve prolapse were detected in less than 5% of all referrals (n=88; 4%).

DISCUSSION

Demographics and socio-economic status

In our study, two-thirds of all referrals to the echography laboratory at the UAH were black Africans. This corresponded with the demographic profile of the serviced regions. Most of the patients were classified in the low-income categories H0 to H2, which may highlight the plight of the dominantly rural nature of the central region of South Africa. The UAH provided the only public echocardiography service for the entire central region. Many patients had to travel long distances to reach these facilities and could most likely not afford transport if the interhospital commuter services were not available.

Age may impact referral patterns. CVD inflicts early death in young and middle-aged adults. However, other factors such as high blood pressure and increased BMI contribute to mortality besides ageing. Insufficient cognisance regarding cardiovascular health and healthy ageing should be increased across all ages.[20] Considering the current life expectancy of South Africans, the mean age of patients in our study was relatively old (51.8 years [SD ± 17.38 years].[21] This corresponds with the findings of the "Hearts of Soweto" study (mean age 53 years).[14] This is also in agreement with an echocardiographic survey from Nigeria, which revealed a mean age of 54 years.[22] In contrast, a review of confirmed CVD cases from Ethiopia reported a

considerably younger mean age of 32 years. However, the inclusion criteria of the Ethiopian review allowed for the selection of patients from the age of 12 years contrary to our study, where patients 18 years and older were included.[23] Similarly, a study from Cameroon reported a mean age of 48.7 years (SD ± 18 years) in a population with an age range of 5 days and 103 years old.[24] Recent research, with a focus on CVD in a community in rural South Africa, revealed a mean age of 61.7 years. However, the study selected only men and women aged 40 years and older.[25] The distribution of males and females in our study was almost similar, which is in alignment with studies from African countries and the United Kingdom (UK); the latter is considered a high-income country.[10,26,27,28]

Clinical findings

Half of the patients in our study were overweight or obese. This result concurs with findings from 2 South African studies. Gómez-Olivé, et al. recorded high a prevalence of overweight and obesity in 70% of women and 44% of men in a South African community.[25] Similarly, Sartorius, et al. described a high prevalence (38%) of obesity among South African women.[29] The finding is also consistent with results from studies conducted in Tanzania and Sudan and statistics by the American Heart Association, which described the prevalence of obesity in excess of 30% in different populations globally.[30,31,32] It is an important observation as obesity is associated with CVD but is preventable and modifiable. It should be noted that our study was not designed to determine whether obesity is linked to cardiac diseases. Still, the fact that almost 50% of patients were overweight or obese is a cause for concern and emphasises the need for strategies to counter the problem and educate the public of central South Africa.

Two-thirds of patients were hypertensive at the time of echocardiographic evaluation. This is similar to studies in other predominantly black African populations with heart disease.[10,30,33,34] Conversely, a study from Ethiopia reported hypertensive heart disease in 15% of the black African population.[27] As for countries outside of Africa, van Heur, et al. described hypertension as the most frequent cardiovascular abnormality (47%). In a study performed in the Netherlands, Voskuil, et al. reported that a third of adults in the Netherlands suffered from hypertension.[35,36] In our study, blood pressure measurements were collected at the time of echocardiography. The high incidence of hypertension highlights the gravity of the findings and identifies the need for urgent intervention programmes in the central South African population.

Geographical referral patterns

Most referrals were from health facilities within the Free State, with uneven distribution from the different municipal districts. Within the Free State, the Mangaung metro contributed most of the referrals. Although this municipality covered the smallest share of land area, it comprised the largest share of the Free State population. Furthermore, the tertiary institution of concern was located in this district, together with 2 large district hospitals and 1 regional hospital within short travel distances. The lowest number of referrals was from the Xhariep district (6%). Comprising the smallest share of provincial population, this district had only 3 small district hospitals. The Lejweleputswa and Thabo Mofutsanyane districts had 5 and 3 district hospitals and 1 and 2 regional hospitals, respectively. For the Free State, data suggested that more patients were referred for echocardiography evaluation from hospitals located closer to the central referral facility than remote hospitals.

Patients from the Northern Cape accounted for 14% (n=345) of all referrals to the echocardiography laboratory at the UAH. The Northern Cape is the largest province by land area in South Africa, yet it comprises the smallest share of the country's population.[21] At the time of the study, Lesotho had a larger population than the Northern Cape, yet contributed only 3% (n=70) of all referrals. The small number of referrals from distant regions may reflect the impact of travel distances and the access to health services within these regions.

Referral status

Unexpectedly, the number of requests for echocardiography evaluation was almost evenly distributed between inpatient and outpatient referrals. In contrast, many echocardiographic studies showed a predominance of outpatient referrals.[10,22,24,29,37] The dissimilar outcome of our study may be attributed partially to the nature of service delivery at the UAH. This referral facility provided for all tertiary health care services, including complex surgical procedures, nephrology services and other complicated admissions, and held the only public echocardiography laboratory in the region. The referral burden on the centrally-located diagnostic facility may be relieved by delivering basic echocardiography services at the district level to enable the triage of patients.

Referring specialist health care services and reason for referral

Echocardiography referrals were made mainly by 12 different clinical specialities. About half of all referrals were from cardiac services, followed by 10% from nephrology. All other services contributed less than 10% each.

Echocardiographic evaluation before initiation of chemotherapy was requested for 15% of routine referrals, mainly for assessment of left ventricular function. A mean LVEF of 54% was determined for oncology referrals, with LVEFs predominantly within the reference range as anticipated. Although speckle tracking is more appropriate for oncology patients, the modality was not available at the time of this study. Echocardiographic evaluation as part of pre-operative risk assessment comprised 13% of routine referrals. Almost all patients requiring vascular surgery were inpatients, with aortic sclerosis being the most frequent pathology (43%).

Suspected peripartum cardiomyopathy was the main reason for obstetrics and gynaecology referrals. In these patients, diastolic dysfunction and LVH were the most frequent findings (33%), followed by valvular disorders (25%), pulmonary hypertension (22%), cardiomyopathy and systolic dysfunction (21%). In a recent study of pregnant women in the central region of South Africa, Makgato, et al. attributed 48% of cardiac abnormalities found in these patients to RHD.[38] In our study, the relatively high prevalence of valvular disorders is of concern as it too may reflect the ongoing presence of RHD in central parts of the country. Although several referrals from different services indicated suspected embolic sequelae as a reason for referral, intracardiac thrombi were reported in less than 1% of all patients. Although transthoracic echocardiography is used as the first choice to investigate the presence of cardiac thrombi, reduced image quality in some patients may limit the sensitivity; therefore, transoesophageal echocardiography might be better for the detection of intracardiac thrombi.[39]

Our study showed that cardiac abnormalities were present in three-quarters (74%) of referred patients, which is consistent with research results from the African continent. In a study from Tanzania, Raphael, et al. found relevant cardiac abnormalities in 72% of referrals, with normal echocardiography in only 22% of patients.[30] Similarly, cardiac abnormalities in 69% and 75% of patients were reported in studies from Nigeria and Cameroon, respectively.[22,26] An audit of echocardiographic findings prior to non-cardiac surgery revealed abnormal diagnoses in 84% of the Australian population.[40] Contrarily, research from the UK showed abnormalities in only a third (29%) of participants.[27] Echocardiography provides valuable support for the detection of CVD. In view of the prevalence of cardiac abnormalities revealed in our study, basic echocardiography services at district level may expedite the referral and treatment of patients in central South Africa.

LIMITATIONS

Limitations that may affect the interpretation of results include the exclusion of patients with non-diagnostic images and the fact that speckle tracking was not used in the assessment of oncology patients. The exclusion of patients with chronic kidney disease may have led to underestimation of the frequency of LVH. Also, contrast studies and TEE were not used, which might have contributed to the low frequency of thrombus detection Intra / inter-observer variability was not evaluated in this study. LVH may have been underestimated since patients were not asked whether they were on hypertensive medication.

Part of the study data was sourced during the time of COVID-19 restrictions, which affected the number of referrals, bed occupancy, and availability of outpatient services. Furthermore, our study focused on referrals to a single tertiary hospital only. As only first-time referrals were investigated, results may not reflect the full range of CVD presenting at this institution.

CONCLUSION

This study describes the profile of patients referred for echocardiographic evaluation in central South Africa. Patients were mainly of advanced age, of black African descent and held low socio-economic status. Significant comorbidities included hypertension and obesity. Travel distances and obtainability of health services appeared to have impacted referral patterns. Hospitalisation status did not influence referrals. Routine requests provided for more than 60% of the echocardiographic workload. A high prevalence of cardiac abnormalities was detected, with myocardial dysfunction being the dominant pathology.

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