ORIGINAL RESEARCH

An audit of Heart failure management among ambulatory adult patients at Queen Elizabeth Central Hospital (QECH), Malawi

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Abstract

Background

There are limited data on the clinical characteristics and use of guideline directed medical therapy among patients with heart failure in Malawi. We conducted a study to assess patient characteristics and clinical management given to heart failure patients at Queen Elizabeth Central hospital in Malawi.

Methods

In a cross sectional study, patients with a diagnosis of heart failure who were followed up in the adult chest clinic at QECH were recruited to ascertain their characteristics and the therapy they were receiving. Echocardiograms and electrocardiograms were performed to identify abnormalities.

Results

A total of 79 patients were recruited and 62% (49 out of 79) were female. The median age was 60 years (IQR 40.5-70.5). Most patients were hypertensive with NYHA (New York Heart Association) class I and II symptoms. Left ventricular(LV) systolic dysfunction was found in 55% (36 out of 65), with 68% (39 out of 65) having features of left ventricular remodeling. Most patients were on at least a single neurohormonal drug with 77% (61 out of 79) on ACEI (angiotensin converting enzyme inhibitor), 52% (42 out of 79) on a beta blocker and 34%(27 out of 79) on aldosterone antagonists. The recommended doses of medications were achieved in 14% (9 out 61), 24% (10 out 42), 22% (6 out of 27) on ACEI, beta blockers and aldosterone antagonists respectively.

Conclusions

Hypertension is the commonest comorbidity in patients with heart failure, who are mostly females with NYHA class I or II symptoms. Most had LV remodeling changes and are on at least one neurohormonal antagonist but most remain sub optimally treated.

Keywords: Heart Failure, Guideline directed medical therapy

Introduction

In many parts of sub Saharan Africa(SSA), most patients with a diagnosis of heart failure have poor outcomes[1,2]. In people with heart failure with reduced ejection fraction (HFrEF), pharmacotherapy with neurohormonal antagonists has been shown to improve outcomes[3–5]. The recent European Society of Cardiology (ESC) heart failure guidelines recommend the use of angiotensin converting enzyme inhibitors (ACEI), beta blockers and aldosterone antagonists, to modulate the renin-angiotensin aldosterone and sympathetic system, as a foundational cornerstone in the management of HFrEF[6]. After sequential or simultaneous introduction, when no contraindications are present, these medications are up titrated slowly to clinical trial defined target doses or tolerable doses if this is not possible. However, uptake and implementation of such guidelines has not been uniform especially in SSA countries, with varying rates of use of ACEI, beta blockers and aldosterone antagonists reported in various studies[1,2,7].

There are limited contemporary data on patient clinical characteristics and the standard of heart failure guideline directed medical therapy in most hospitals in Malawi[8,9]. This study was conducted to assess the characteristics and management of heart failure patients at the outpatient chest clinic at Queen Elizabeth Central Hospital a large tertiary teaching hospital in Southern Malawi.

Methods

Study design and description of participants

A cross sectional study of adult patients who were receiving care for heart failure was conducted at the outpatient chest clinic of Queen Elizabeth Central Hospital (QECH), a large tertiary teaching hospital in Southern Malawi, between November 2020 and December 2021. The QECH is a referral hospital for almost 5 million Malawians living in the Southern region of the country. Our target sample size was 131 patients.

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Study procedures

Patients were recruited from the weekly adult outpatient chest clinic at QECH. Patients with more than 2 clinic visits with a labelled diagnosis of heart failure were recruited regardless of the aetiology using convenient sampling method. A structured questionnaire was used to collect data on the demographics, comorbidities, medications and adherence. This was done through semi structured interviews and a review of the patient's clinic records. Medication adherence was assessed using a validated 8 point Morisky medication adherence scale[10]. A targeted cardiovascular clinical assessment was then conducted. Following this, an outpatient appointment was given and an echocardiogram and a 12 lead electrocardiogram were performed.

Recorded electrocardiograms were analyzed for the presence of evidence of left ventricular hypertrophy (using the Sokolow Lyon criteria), ST segment changes, presence of Q waves, QRS axis, atrioventricular and intraventricular conduction delays. ST segmentation elevation was defined as ST segment deviation of more than 1mm in limb leads and more than 2mm in precordial leads V2 and V3. Pathological Q waves were those which had negative deflections preceding the R waves lasting more than 40ms and 2mm deep in 2 contiguous leads.

Two dimensional echocardiography was performed by a single experienced echocardiographer with acquisition of standard views (parasternal long axis, RV inflow and outflow, parasternal short axis, apical 4 chamber, apical 2 chamber, apical 3 chamber, suprasternal and sub xiphoid views). Pulse wave, continuous wave, colour Doppler and tissue Doppler imaging were performed. Chamber dimensions were calculated with reference to the current guidelines[11]. Left ventricular ejection fraction was measured in the M-mode parasternal long axis view and by using Simpsons biplane method in the apical 4 chamber and apical 2 chamber views. Diastolic function was measured using mitral inflow velocities, lateral and septal e' velocities12. LV mass was calculated using the formula: LV mass = 0.8[1.04(LVD + IVS + PW)3 – LVD3] + 0.6 g. Relative wall thickness(RWT) was calculated using the formula: RWT = 2*Left ventricular posterior wall/left ventricular diameter in diastole. Left ventricle mass index and Left atrium volume index were calculated by dividing the LV mass and LA volume with the body surface area respectively. A 3 lead electrocardiogram was recorded at the time of echocardiography to help with the timing and measurement of events.

Data management

Data collected was anonymized prior to entry and analysis using R statistical software (version 4.0.5). For descriptive data medians (interquartile range), mean(SD) and confidence intervals were calculated. Chi squared statistic was used to compare categorical data.

Ethics

Ethical approval for the study was obtained from the College of Medicine Research and Ethics committee (approval certificate number P.03/20/2982). All participants gave written informed consent to participate prior to carrying out any study procedures.

Results

The recruitment process is illustrated in figure 1

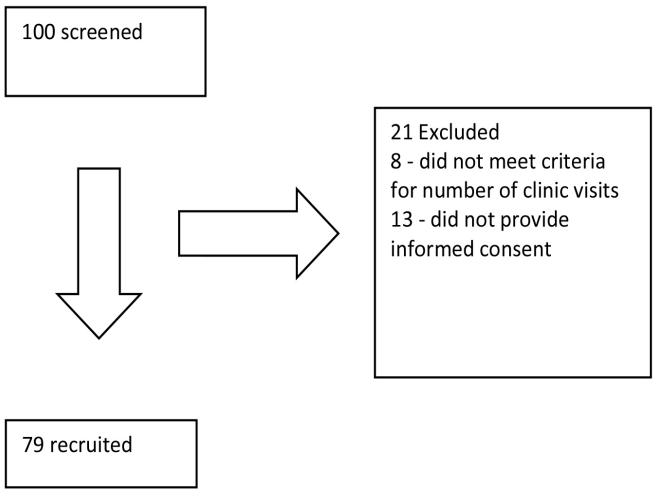

Figure 1: Recruitment flow chart

A total of 79 patients were recruited for the study and 62% were female. Two thirds of the patients had comorbid hypertension and a confirmed diagnosis of HIV was present in 15% of the patients.

Three quarters of the patients had New York Heart Association class I and II heart failure symptoms. Forty-two percent had a high BMI and a similar percentage had a systolic blood pressure of more than 140mmHg. Less than 10% had features of volume overload on clinical examination.

Current heart failure therapy

The distribution of the patient as per drug therapy regimen is shown in Table 2 below. Three quarters of the patients were on an angiotensin converting enzyme inhibitor (61 out of 79) and half (42 out of 79) of the patients were on a beta blocker. 12 out of the 17 women who were in the reproductive age group (15 to 49 years) were on ACEI therapy. Further details are shown in Table 2.

Optimum Doses of Medications

There was no evidence of a difference in symptoms among those who were on optimum dose of at least one class of medication and those who were not (p value < 0.74).

Medication Adherence

Self-reported medication non adherence was at 25%. Using the 8 point validated Morisky questionnaire, close to half had high adherence and close to a tenth had low adherence. The reasons for non-adherence were attributed to drug shortages in 13%.

ECG findings

Prolonged QRS interval > 120ms was present in 25% of patients, with 15% having a prolonged PR interval. QTc interval was prolonged in 21% and 27% of males and females respectively.

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Table 1: Baseline characteristics of heart failure patients(N=79)

	n (%)
Demographics	
Age in years; median (IQR)	60(40.5-70.5)
Females	49 (62)
Comorbidities	
Diabetes	4 (5)
Hypertension	53 (67)
HIV	12 (15)
Alcohol history	13 (16)
Renal impairment	0
Functional Status	
NYHA I	24 (30)
NYHA II	45 (57.6)
NYHA III	8 (10.2)
NYHA IV	1 (1)
Physical Examination	
BMI (kg/m^2)*, median (IQR)	24.4 (21-31.2)
<18.5	7 (8)
18.5-24.9	30 (38)
>25	33 (42)
Systolic BP (mmHg), median (IQR)	136(110-149)
Diastolic BP (mmHg), median (IQR)	78(65-93)
Systolic BP >140mmHg	33 (41)
Diastolic BP >90mmHg	22 (28)
Systolic BP >140 & Diastolic BP >90mmHg	17 (21.5)
Pulse rate (beats per minute), mean (SD)	78 (16)
Jugular venous pressure elevated	5 (6)
Basal crackles	4 (5)
Pedal oedema	9 (11)
Presences of third heart sound	5 (6)

*9 missing values for BMI

Table 2 Current Heart Failure therapy(N=79)

Variable	n (%)
Class of Heart Failure medication	
ACEI	61 (77)
Beta blocker	42 (52)
Aldosterone antagonist	27 (34)
Hydralazine & nitrates	0
Present combinations of medications for heart failure patients	
ACEI + Beta blocker	24 (30.3)
ACEI + Beta blocker + Spironolactone	10 (12.6)
ACEI + Spironolactone	10 (12.6)
Beta blocker + Spironolactone	1 (1.2)
ACEI single agent	17 (21.5)
Beta blocker single agent	7 (8.8)
Spironolactone single agent	6 (7.5)
Loop diuretics(Furosemide) only	4 (5.1)

Therapies by Gender	n male=30, female = 49
ACEI	
Male	24(40%)
Female	37(75.5%)
Beta blocker	
Male	14(46.7%)
Female	28(57%)
Aldosterone Antagonist	
Male	16(53.3%)
Female	11(22.4%)

Table 3: Optimum Dose of Medications

Medication	All patients on medication	Patients on Target doses (% of all patients on medication)
Enalapril	61	9(14%)
Spironolactone	27	6(22%)
Atenolol	42	10(23.8%)
Hydralazine and Nitrates	0	

Echocardiographic findings

Echocardiography was performed in 65 participants only (9 did not attend their clinic appointment,1 was undergoing isolation due to covid19, 2 were uncontactable by phone, 2 had relocated). Reduced left ventricular ejection fraction was present in 36 of the 65 patients. Left ventricular ejection fraction was depressed (EF <50%) in 36 out of 65 patients. Eccentric hypertrophy was the most common left ventricular remodeling phenotype.

Discussion

We highlight the characteristics and clinical management of heart failure among adult patients attending outpatient chest clinic at Queen Elizabeth Central Hospital in 2021. Females were in majority, and most patients had a history of hypertension and echocardiographic evidence of LV remodeling and systolic dysfunction.

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Table 4: Comparison between presence of symptoms of heart failure and being on optimum medication of heart failure medications

		Symptoms of Heart Failure				
		NO	YES	NA	TOTAL	
Optimum dose of medications	YES	5	17	0	22	p value=0.742
	NO	17	35	1	53	
	NA	2	2	0	4	
	TOTAL	24	54	1	79	

Table 5: Adherence to heart failure medications (N=79)

Variable	n (%)
Self-reported non-adherence	20 (25)
Morisky Medication Adherence Scores	
High adherence (MMAT score 8)	37 (47)
Medium adherence (MMAT score 6 -7)	29 (37)
Low adherence (MMAT score < 6)	10 (13)
Reasons for non-adherence	
Drug shortages/stock out	10 (13)
Side effects	1 (1)

Table 6: ECG findings

ECG Parameter	N = 65
	Median(IQR)
Ventricular Rate	72(62-84)
PR interval(ms)	175(156-196)
QRS duration(ms)	110(104-120)
QT interval(ms)	416(396-440)
QTc interval(ms)	459(438-482)
	n(%)
Sinus Rhythm	59(90.7%)
Atrial Fibrillation	5(7.6%)
Left Bundle Branch Block	8(12%)
Right Bundle Branch Block	5(7%)
Left Axis deviation	17(26%)
Normal Axis	48(74%)
ST elevation	10(15%)
ST depression	4(6%)
Q waves	12(18%)
QRS duration >120ms	16(25%)
PR interval > 220ms	10(15%)

Table 7: Echocardiographic Findings (N=65)

2D Echo Parameter	
	Median(IQR)
Left Ventricle(LV)	
Ejection Fraction %	47.5(23.8-60)
End diastolic diameter	52(45-63)
End systolic diameter	40(30-53)
Stroke Volume	55.5(38.8-79.2)
LV mass index	93.8(76.6-130)
LV mass	170(132-230)
Left atrium	
LA maximal antero-posterior diameter	41(34-46)
LA volume index	32.4(20.7-48.4)
Diastolic Function parameters	
Mitral Valve E velocity(m/s)	0.66(0.52-0.82)
Mitral Valve E/A ratio	0.83(0.7-1.6)
Mitral Valve E/e' ratio	9.27(5.89-13)
Mitral annular septal e' velocity(cm/s)	6(5-8)
Mitral annular lateral e' velocity(cm/s)	7(5-10)
mitral annular average e' velocity(cm/s)	7(5-10)
Systolic and Diastolic Function	n(%)
Ejection Fraction <50%	36(55.3%)
Diastolic Function	
Diastolic function in patients with Preserved EF	
Normal diastolic function	23(35.3%)
Indeterminate	6(9.2%)
Diastolic Dysfunction	0
Diastolic function in patients with Depressed EF	
Indeterminate	18(27.6%)
Grade I	6(9.2%)
Grade II	3(4.6%)

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Table 7 Cont...

Grade III	9(13.8%)
LV Geometry*	n(%)
Normal LV geometry	21(32.3%)
Concentric LVH	6(9.2%)
Eccentric LVH	24(36.9%)
Concentric remodeling	9(13.8%)
Valve Abnormalities	n(%)
Mitral Regurgitation	34(52%)
Mitral Stenosis	19(29%)
Tricuspid Regurgitation	29(44%)
Aortic Stenosis	12(18%)
Aortic Regurgitation	20(30%)

* 5 missing body surface area

Most patients were on at least a single neurohormonal antagonist, but only a small proportion were on the recommended heart failure medication combinations and doses.

In this specialist clinic, patients were started on neurohormonal antagonists with most being on at least 1 class of a recommended agent; only 5% were found to be on furosemide only. ACEI inhibitor use was comparable to the average found in the INTER-CHF study recently conducted in 5 African countries (77% vs 74% respectively), but use of beta blockers (52% vs 66.5%) and aldosterone antagonists (34% vs 48%) was lower[2]. We did not see the trend of lower rates of prescription of ACEI among women compared to men that has previously been described in other heart failure studies[13–16], likely due to the underrepresentation of men in our cohort. There is need to ensure that the recommended combinations are in place and that medications are up titrated overtime as only 14% (9 out of 61) of patients on enalapril, 22% (6 out of 27) on spironolactone and 24%(10 out of 42) of those receiving atenolol were on the recommended target doses.

In this cohort of patients only 11 out of 79 (14%) had medications up titrated from the last visit despite the majority being on suboptimal doses with clinicians not clearly indicating any contraindications to drug up titration. During the period of observation, only 16 out of 79(20%) had a documented creatinine result from the previous 6 months. Frequent stock outs of reagents used in biochemistry assays experienced in this setting, meant interrupted access to renal function testing. For drugs with potassium sparing effects, limited measurement of renal function could be a contributory factor as to why clinicians may be less inclined to blindly up titrate these medications. It might be justified to spare resources to ensure heart failure patients are able to access renal function testing at least once or twice a year.

Using the validated Morisky questionnaire, half of the patients were found to have a high adherence. In Tanzania, 74.7% of patients presenting for admission due to decompensated heart failure had reported poor adherence to medications in the preceding 7 days[17]. In this regard it is likely that half of our patient cohort was at risk of hospitalization due to decompensation of their heart failure, underpinning the need for measures to promote good adherence. Intermittent drugs stock outs remain an issue on a national level but was only reported in 10 out 79 (13%) of patients in this study. This may be an under representation of the true picture. Many patients may not recognize the different types of medications they are supposed to receive and therefore fail to notice a medication stock out if this information is not given to them by the pharmacist. Patient education on the different medication types maybe helpful so that patient can take ownership of their prescriptions. It is also possible that the lack of drug stock outs implies improvements in health system management at our facility.

The echocardiograms and electrocardiograms performed highlight several issues, among them the relatively reduced contribution of ischaemic heart disease as a possible cause of heart failure. Left ventricular geometric changes were noted in 68% of patients who had echocardiograms performed. The commonest form of remodeling was that of eccentric hypertrophy which is consistent with reports from 5 other African countries[2]. The presence of left ventricular hypertrophy itself is an independent risk factor for cardiovascular morbidity[18]. The presence of a wide QRS complex, a poor prognostic marker in patients with heart failure, in 25% of the patients, is also concerning as there is no capacity for cardiac resynchronization therapy in Malawi and indeed many parts of SSA[2]. This highlights the need for patients to be on adequate medical therapy to halt and reverse some of the myocardial remodeling which occurs in heart failure.

The aetiology of heart failure in SSA has been reported to vary by region but is mostly driven by valvular rheumatic heart disease and hypertension, with ischaemic heart disease being less common[1,2,19]. As expected we notice a significant presence of valve disease, and mitral stenosis in 29% of patients highlights the ongoing contribution of rheumatic heart disease as a cause of heart failure syndromes in Malawi. Hypertension is the commonest comorbidity and likely to be the significant driver of heart failure syndromes in the country, being present in 67% of this small patient cohort; and among these, 40% had poor blood pressure control. Despite this being an observational study, this picture points to the urgent need for more focused measures to prevent and control hypertension[20].

Challenges

The study faced severe disruptions as it coincided with the waves of the Covid 19 pandemic and the subsequent lockdowns. Limitations in clinic numbers necessitated by social distancing measures and patient apathy to visit clinics when social distancing measures were lifted slowed the recruitment. This meant the study took longer to complete than initially planned. This increased period of observation might have influenced clinician practice. It was difficult to obtain all echocardiograms and ECGs in part due to the logistical challenges during the covid 19 waves and patient factors. The diagnosis of heart failure in all cases was initially

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clinical hence some cases with preserved ejection fraction and normal diastolic function could have alternative explanations to their shortness of breath.

Conclusion

Hypertension is the commonest comorbidity in patients with heart failure, who are mostly females with NYHA class I or II symptoms. Majority have LV remodeling changes and are on at least one neurohormonal antagonist but most remain sub optimally treated.

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