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Pharmacological Management of Cardiovascular Diseases at a Teaching Hospital in Ghana

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Abstract

A global report by World Health Organization estimated that the disease burden of cardiovascular diseases in Africa has reached epidemic level. Increasing urbanization and westernization in Africa is likely to escalate the prevalence of cardiovascular diseases on the continent, which is already burdened with infectious diseases. The aim of this study was to compare the existing pharmacotherapy for cardiac arrhythmias of clinical relevance, ischaemic heart diseases (IHD) and heart failure to recommendations in national and international guidelines. A purposively designed data sheet was used to extract data from 248 patients presenting with confirmed diagnosis of heart failure, arrhythmias and ischaemic heart disease from January-June 2015 at the cardiac clinic, Directorate of Medicine, Komfo Anokye Teaching Hospital, Kumasi, Ghana. Data obtained included demographic characteristics, laboratory investigations, medical history and treatment. The average age of participants was 60 ± 17.9 years. Heart failure was present in 72% of the patients (n=209) followed by arrhythmias 15% (n=42) and IHD 12% (n=37). The predominant medicines in heart failure patients were loop diuretics (89%), angiotensin converting enzyme inhibitor/angiotensin receptor blockers (80%), beta-blockers (63%), aldosterone antagonists (56%), antiplatelets (44%) and cardiac glycosides (32%). IHD was managed principally with beta-blockers (73%), antiplatelets (75.7%), statins (70.3%) and angiotensin converting enzyme inhibitors/angiotensin receptor blockers (70.2%). Patients with arrrhythmias (mostly atrial fibrillation) received beta-blockers (71.5%), antithrombotics (70%) and other antiarrhythmic agents (11.9%). Assessment of pharmacotherapy conformity to selected local and international guidelines yielded 99.2%. In conclusion, heart failure was the most common cardiovascular disease seen, followed by arrhythmias and IHD respectively; and they were managed with appropriate pharmacological agents in line with recommendations in guidelines.

Keywords

Cardiovascular Disease, Pharmacological Management, Heart Failure, Ischaemic Heart Disease, Arrhythmias

1. Introduction

Cardiovascular diseases (CVDs) are among the leading cause of deaths globally [1]. In 2002, out of 57 million deaths worldwide, 16.7 million deaths (29.2%) were attributed to CVDs as against 5 million deaths (8.8%) due to Tuberculosis, Human Immune Deficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS) and Malaria combined [2]. Global deaths from CVDs increased to 17.3 million in 2008 and it is estimated that CVD mortalities would reach 23.3 million deaths by 2030 and therefore become the single highest cause of death worldwide[1, 3].

In 2010, a global report by WHO indicated that sub-

Saharan Africa had the least CVD burden (8.8%) compared to other parts of the globe and this disease burden is currently considered to have reached near epidemic level. Projections attributed to CVDs in Africa by 2030 are 13.4% of total deaths [4, 5].

Heart failure, cardiac arrhythmias and ischaemic heart disease (IHD) are among the numerous CVDs that have substantial negative impact on the health and quality of life of the affected patients [6, 7]. Increasing urbanization and westernization of lifestyle is feared to accelerate the cardiovascular disease burden on the continent. Morbidity and mortality rates are also high possibly due to inadequate logistics and trained health personnel, late detection of high risk patients as well as inaccessible and unaffordable pharmacological agents to treat affected patients [8]. Although efforts are being made to bridge the gap in cardiovascular research in Africa, the data available is scanty compared to other parts of the globe.

This research aimed to evaluate the pharmacological management of patients with cardiac arrhythmias of clinical relevance, IHDs and heart failure seen at the Directorate of Medicine, Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana within the study period. The cardiovascular risk factors among participants and pharmacotherapy for arrhythmias, heart failure and ischaemic heart disease were evaluated. In addition, the pharmacological agents prescribed for these patients were assessed for conformity to recommendations in selected national and international guidelines.

2. Method

2.1. Study Site

KATH, located in the Ashanti region of Ghana was selected for the study based on a number of reasons. The hospital receives referral cases from private, quasi government and district hospitals mainly within the northern and middle belts of Ghana. An efficient medical team of consultants, specialists, pharmacists, laboratory technicians and radiologists are available to offer quality medical care. The hospital is also well equipped with facilities to undertake laboratory investigations which enhance diagnosis of cardiovascular diseases and monitoring of therapy. Outpatient cardiac clinic of the medicine directorate served as a vital site for patient recruitment as patients were adequately managed after discharge from the hospital. Moreover, the hospital is a renowned research centre for scientific research.

2.2. Study Design

This was a non-randomized cross-sectional study carried out at the outpatient department of the hospital. Only patients diagnosed with IHDs, arrhythmias and heart failure were recruited over a 6-month period (January 2015-June 2015).

2.3. Study Population

Two hundred and forty-eight (248) patients were recruited for the study. The sample was drawn from a population of patients attending outpatient cardiac clinic with the confirmed diagnosis of the CVDs of interest and are being managed with pharmacological agents. Eligible participants were newly or previously diagnosed patients with heart failure, ischaemic heart disease or arrhythmias aged 13 years and above who were not receiving treatment for life threatening diseases such as cancer. Patients who were unconscious and critically ill requiring immediate hospital admission, and those who refused to give consent for the study were excluded.

2.4. Data Source

A purposively designed data collection form was pretested on 15 patients to ascertain the sensitivity and usefulness of the tool for data capture. The findings of the pre-test, enabled modification, deletion of ambiguous, irrelevant data or addition of missing data items respectively. Data was obtained through patient interview and/or data extraction from patient folders. Eligible patients were identified by clinicians of the research team as they made their routine attendance to the cardiac clinic at the outpatient department.

2.5. Demographic Characteristics and Risk Factors Definition

Demographic and anthropometric measures captured included age, sex, family history of cardiovascular disease, height, weight and blood pressure. All reference ranges used in the study were based on WHO accepted ranges. Trained nurses measured the weight and height of participants using calibrated beam scales and stadiometer. The Body Mass Index (BMI) was calculated using the formula: weight/height^2 (kg/m^2). According to WHO criteria, subjects were classified as underweight (<18.6kg/m^2), ideal (18.6 - 24.9 kg/m^2), overweight (25 - 29.9 kg/m^2), and obese (≥30 kg/m^2). Information on behavioral risk factors such as alcohol and smoking habits was collected through self- report or extracted from folders. A positive family history of cardiovascular was present if at least one of the patient's parents or siblings had documented IHD/ angina/ heart attack, stroke [9].

Systolic and diastolic blood pressures were measured on right arm in sitting position after a 5-10 minutes rest using mercury sphygmomanometer. Hypertension was defined as a blood pressure (BP) of 140/90 mmHg or taking antihypertensive medications [10]. Diabetics with BP ≥130/85 mmHg were considered hypertensive. Diabetes mellitus was defined as a fasting glucose ≥ 7.0mmol/L (126 mg/dL), 2h plasma glucose ≥11.1 mmol/L (200 mg/dL) or use of insulin or hypoglycemic medications [10].

A range of overnight fasting biochemical parameters (total cholesterol, triglycerides, LDL-C and HDL-C available in laboratory results over the previous year were also recorded

to ascertain other risk factors. Hyperlipidemia was defined by the following parameters: total cholesterol ≥ 4.0 mmol/L, triglyceride ≥ 1.7 mmol/L and / or LDL-C ≥ 2.0 mmol/L and or HDL-C ≤ 1.0 mmol/L in men and ≤ 1.2 mmol/L in women [10]. Hyperthyroidism was defined as a self-reported history of hyperthyroidism, or from patient medical history. Patients were also considered anaemic if haemoglobin, Hb < 13 g/dL in men and < 12 g/dL in women[11]. Data on medical history and co-morbid conditions were extracted from the patients' folders.

2.6. Conformity Assessment to Guidelines

The pharmacotherapy for each patient was compared to standard guidelines to ascertain conformity of therapy to evidence based practices. The medication, dose and frequency of therapy were used to ascertain conformity based on the following guidelines:

1) Standard Treatment Guidelines (Ghana), 6th Edition
2) National Institute for Health and Care Excellence (NICE) guidelines
3) European Society of Cardiology (ESC) guidelines.
4) American College of Cardiology Foundation/American Heart Association (ACC/AHA) Practice Guidelines

2.7. Ethical Considerations

Ethical approval was obtained from the Committee for Human Research, Ethics and Publication at the School of Medical Sciences, KNUST, Kumasi, Ghana to undertake the research. Informed consent was taken directly from patients or obtained from a guardian or parent whereby patient was below 18 years.

2.8. Data Analysis

Completed data collection forms was screened to ascertain validity of data and transferred unto computer spreadsheet (Microsoft Excel, 2013). Subsequently, data was analyzed with SPSS statistics for windows, version 22, Armonk, NY: IBM Corp. The preliminary analysis comprised results acquired through basic statistical summaries computed from the dataset either quantitative (continuous) data or qualitative (categorical) data. Simple averages and its corresponding standard deviation were used to summarize the quantitative data (continuous) such as age, patient weight etc. whereas the proportion were used to summarize the categorical data such as sex, alcohol intake etc. Comparison of both sexes was computed using Student t-test. Analysis of adherence of guidelines, drug interaction and adverse effects were also done with respective proportions or numbers. Also, graphs and other charts were used were necessary to present some of the results using Microsoft excel version 15.

3. Results

3.1. Demography

Out of the 248 patients, 56.4% were females and 43.6% males. The age range for participants was from 13 – 105 years. The average age was 60 ± 17.9 years. Mean age for women was less than that of men (Women: 59.1 ± 18.4; Men: 62.0 ± 16.8 p=0.216). Figure 1 shows the age distribution of participants. Over 55% of all the patients were above 50 years.

The average weight and height of the patients were 67.6 ± 17.8 kg and 1.62 ± 0.09 m respectively hence giving an average BMI of 25.5 ± 10.4 kg/m^2. The mean BMI for females was higher than males (Female: 25.9 ± 6.8; Male: 24.9 ± 5 p=0.313. The BMI proportions of participants for underweight and ideal categories were 9% and 43% respectively. The remaining 48% (n=119) of patients were within the overweight and obese categories, with overweight persons forming 29% (n=72).

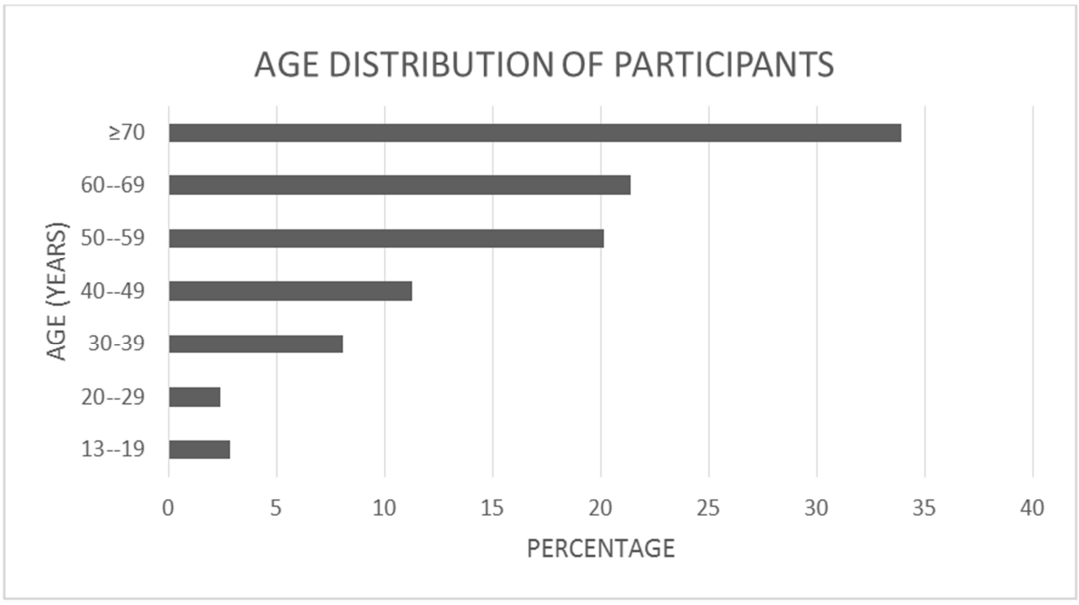

Figure 1. *Age distribution of patients per gender.*

3.2. Risk Factors and Co-morbidities for the Various Diseases

Heart failure was present in 72% of the patients (n=209) followed by cardiac arrhythmias 15% (n=42) whereas 12% of the patients had IHD (n=37). Table 1 indicates the distribution of risk factors and co-morbidities for the selected cardiovascular diseases.

Table 1. *Other demographic characteristics and co-morbidities for the various diseases.*

INDICATOR	DISEASE		
	Cardiac Arrhythmias n=42	**Coronary Heart Disease N=37**	**Heart Failure n=209**
Demography/Risk factors			
Age(y)	50±21	67±13	56±22
Male	40%	46%	50%
Female	60%	54%	50%
Blood Pressure (mm/Hg)	134/80	141/90	141/90
BMI (kg/m^2)	24.6±5.9	26.7±7.3	25.8±6.4
Family History	7(17%)	5(14%)	8(4%)
Alcohol Intake	8(19%)	6(16%)	7(3%)
Smoking	3(7%)	1(3%)	3(1%)
Co-morbidities			
Hypertension	28(67%)	27(73%)	32(74%)
Diabetes Mellitus	5(12%)	14(38%)	13(30%)
Hyperlipidemia	5(12%)	9(24%)	7(19%)
Cardiomyopathy	13(31%)	2(5%)	5(12%)
Obesity	3(8%)	9(24%)	4(9%)
Valvular Heart Disease	4(10%)	3(8%)	3(7%)
Stroke	2(5%)	1(3%)	3(7%)
Asthma/COPD	2(5%)	1(3%)	3(7%)
Thyroid Disorder	2(5%)	0(0%)	2(5%)
Rheumatic Heart Disease	2(5%)	0(0%)	0(0%)
Kidney Failure	2(5%)	0(0%)	0(0%)
Anaemia	2(5%)	0(0%)	0(0%)
Miscellaneous[1]	11(26%)	13(35%)	8(19%)

Note 1: Diseases include peptic ulcer/gastritis, HIV, malaria, liver disease, microbial infection, spondylosis, gouty arthritis, pneumonia, osteoarthritis, sickle cell disease, deep vein thrombosis.

COPD-Chronic Obstructive Pulmonary Disease

3.3. Pharmacotherapy and Conformity of Therapy to Guidelines

In tables 2, 3 and 4, the percentage medication use in patients and recommendations from various guidelines are presented. Out of the 248 prescriptions evaluated, 99.2% (n=245) conformed to standard guidelines for therapy but 3 prescriptions (0.8%) did not.

Note: The tick symbols in tables 2, 3 and 4 (√) represent endorsement by the respective guidelines whereas the dash symbol (-) represents no indication or recommendation by the guidelines.

Table 2. *Pharmacotherapy of patients with arrhythmias and recommendations from guidelines.*

ARRHYTHMIAS					
DRUG CLASS	**% ON DRUG**	**GUIDELINES**			
		STG	**NICE**	**ESC**	**ACC/AHA**
Cardiac glycoside	42.9	√	√	√	√
Beta-blocker	71.4	√	√	√	√
Antiplatelet	45.2	√	√	√	√
Anticoagulants	23.8	√	√	√	√
Antiarrhythmic agent [a, b]	11.9	-	√	√	√
Dihydropyridine CCB	14.3	-	√	√	√
Non dihydropyridine CCB	4.8	-	√	√	√
Statin	26.2	-	-	√	√
ACEI	28.6	-	√	√	√
ARB	50	-	√	√	√
Aldosterone antagonist	24.3	-	√	√	√

Note: Amiodarone (a) and flecainide (b) were the common antiarrhythmic agent
CCB-Calcium channel blocker
ACEI-Angiotensin Converting Enzyme Inhibitor
ARB-Angiotensin II receptor blocker

Table 3. *Pharmacotherapy of patients with ischaemic heart disease and recommendations from guidelines.*

ISCHAEMIC HEART DISEASE					
DRUG CLASS	**% ON DRUG**	**GUIDELINES**			
		STG	**NICE**	**ESC**	**ACC/AHA**
Beta-blocker	73.0	√	√	√	√
CCB	37.8	-	√	√	√
Organic nitrate	16.2	√	√	√	√
Other antiangina drug [a]	5.4	-	-	-	-
Antiplatelet	75.7	√	√	√	√
Anticoagulant	10.8	√	√	√	√
ACEI	29.7	√	√	√	√
ARB	40.5	√	√	√	√
Statin	70.3	√	√	√	√
Aldosterone antagonist	24.3	-	√	√	√

Note: a-Trimetazidine

Table 4. *Pharmacotherapy of patients with heart failure and recommendations from guidelines.*

HEART FAILURE					
DRUG CLASS	**% ON DRUG**	**GUIDELINES**			
		STG	**NICE**	**ESC**	**ACC/AHA**
Loop diuretic	89.0	√	√	√	√
Thiazide and thiazide-like diuretic	8.1	√	√	√	√
Beta-blocker	62.7	√	√	√	√
Aldosterone antagonist	56.5	√	√	√	√
ACEI	38.3	√	√	√	√
ARB	47.4	√	√	√	√
Cardiac glycoside	32.1	√	√	√	√
Anticoagulant	8.7	-	√	√	-
Antiplatelet	44.1	-	√	√	-
CCB	17.7	-	√b	-	-
Antiarrhythmic agent	0.9	-	√a	-	-
Statin	22.5	-	-	-	-

Note: a- Amiodarone use is determined by specialist
b- Amlodipine is recommended in co-morbid hypertension and heart failure.

4. Discussion

With the advent of more effective medications to combat infectious diseases and improved health care delivery for chronic diseases, life expectancy of the population is expected to increase. Several studies attest to the increased incidence of cardiovascular diseases in the aged. The mean age of participants in the current study was 59.1 ± 18.4 years and this is consistent with previous studies in Ghana [6, 10, 19].

The study affirmed the widespread knowledge that hypertension is a predominant aetiological factor associated with CVDs, as more than two-thirds of the study participants were associated with this cardiovascular risk factor. Similar studies in South Africa and Nigeria obtained proportions of 56% and 85% in the studied populations respectively [12, 13]. These previous studies including this study carried out in sub-Saharan Africa vary widely from a study in a Spanish adult population, which revealed a much lower proportion of hypertensives (34%) among patients with cardiovascular diseases [14]. Marginal reduction in hypertension as an underlining cause of heart failure in Spain as against the sub-Saharan African countries may be due to early detection and optimized care that reduced cardiovascular complications. A meta-analysis of underlining causes of heart failure across the world showed a high prevalence of hypertension in sub-Saharan Africa (32.6%) and Central and Eastern Europe (35%)[14].

BMI measurements in the patients revealed that about two-fifth of the study participants were either overweight or obese. A similar account was reported in a church-based study in Kumasi, Ghana [15]. Results from that study showed a higher prevalence of obesity in Ghanaian women than men. This disparity could possibly be attributed to reduced physical activity in women than men, hormonal influences during gestation, post-partum, birth control (contraceptives) and menopause. Similar evidence has been noted among women in South Africa as well [16].

Among the three selected cardiovascular diseases which were studied, heart failure has been asserted by a number of clinical and epidemiological studies to be predominant in diverse populations because of high incidence of underlining conditions like hypertension, diabetes, dyslipidemia and other chronic metabolic disorders. Mean age of heart failure was within the 5th decade, which is similar to earlier studies in Nigeria (56 ± 15) [17]. Mean age of heart failure in Europe have been found to be around the 7th decade[18]. This shows that heart failure presents at an earlier age in sub-Saharan Africa due to early onset of rheumatic heart disease, cardiomyopathy and hypertension. Prevalence of rheumatic heart disease and cardiomyopathy

in sub-Saharan Africa are estimated to be about 21.6 % and 17.4% respectively [19]. In this study, fewer individuals presented with rheumatic heart disease. Prompt diagnosis and treatment of rheumatic fever in children is required to avert unwanted cardiovascular complications. Several studies indicate IHD prevalence in sub-Saharan Africa to be low and this fact has been confirmed in this study as well. Poor record systems, limited expertise and relevant resources to make a definate diagnosis of IHD are largely unavailable in sub-Saharan Africa. These may be responsible for the seemingly low prevalence of IHD seen on the continent.

High use of disease modifying drugs in the current study is commendable. About 7 times more heart failure patients received beta-blockers (carvedilol, metoprolol or bisoprolol) than patients studied in Nigeria as the proportion in the latter study was slightly less than 10% [17]. The Eurostudy on heart failure on the other hand indicated a higher beta-blocker administration in patients than this study. Evidence from this study, Nigeria and Europe (multicentred study) indicated that over 80% of patients were prescribed loop diuretics and ACEI/ARBs as recommended in guidelines [11, 17, 18]. This is due to the fact that ACEI/ARBs are very efficacious in reducing mortality resulting from hemodynamic, autonomic, neurohormonal and structural remodeling in heart failure [18].

About 85% of arrhythmias were attributed to atrial fibrillation and the use of antiplatelets and anticoagulants cannot be over emphasized due to their role in reducing risk of stroke. A study in Cameroon indicated a higher proportion of patients being prescribed antiplatelet in atrial fibrillation patients (71%) compared to this study (45%) [20]. Anticoagulant use was however similar in both studies; ie. about 20%. Though assessment of stroke risk was not evaluated in this study, evidence gathered from the study in Cameroon shows a lesser use of anticoagulants among atrial fibrillation patients in Africa [20]. Possible reasons assigned for reduced anticoagulant use include economic reasons and difficulties in evaluating adequate anticoagulation in Africa.

Prescribed medicines in the study showed low integration of relatively new cardiovascular agents (e.g. trimetazidine and rivaroxaban) as used in management of CVDs in some European and American countries. Though both medicines are not included in the standard treatment guidelines in Ghana, a number of studies completed and ongoing prove their efficacy in CVD management. Their choice in patient therapy however would be based on factors such as availability, accessibility, cost and disease outcome. Evaluation of compliance of pharmacotherapy to guidelines indicates high and laudable efforts of clinicians to utilize recommendations from these guidelines in patient management. Patient education on lifestyle changes and appropriate pharmacological agents by healthcare providers in these chronic conditions can also reduce the adverse implications of CVDs.

5. Study Limitations

Evidence generated in this study may not be generalized to the whole country, as a small sample size was used and the study was carried out at a single facility. Another major limitation was the little or no patient response to smoking habits, alcohol and family history as it made evaluation of these risk factors difficult. Inability of researchers to assess stroke risk in patients with atrial fibrillation limited assessment of anticoagulation therapy or otherwise. In spite of these shortfalls, the study provides good evidence for possible development or review of guidelines at KATH for the management of the cardiovascular disorders studied.

6. Conclusion

Heart failure was the commonest CVD encountered amongst the patients studied, followed by arrhythmias and IHDs. The risk factors identified in most patients were age, hypertension, diabetes mellitus, obesity and cardiomyopathy. The most frequently prescribed medicines for the CVDs were ACE/ARBs, beta-blockers, statins, antiplatelets and diuretics. Almost all medications prescribed conformed to recommendations in national or international guidelines.

Appendix

Table A1. *Drugs in pharmacotherapy categorized by class.*

CLASS	DRUGS
ALDOSTERONE ANTAGONIST	Spironolactone
ANGIOTENSIN CONVERTING ENZYME INHIBITOR (ACEI)	Lisinopril, Ramipril
ANGIOTENSIN RECEPTOR BLOCKER (ARB)	Losartan, Candesartan
ANTIARRHYTHMIC AGENT	Amiodarone, Flecainide
ANTICOAGULANT	Rivaroxaban, Warfarin
ANTIPLATELET	Aspirin, Clopidogrel
BETA-BLOCKER	Bisoprolol, Carvedilol, Metoprolol
CALCIUM CHANNEL BLOCKER (CCB)	
Dihydropridine CCB	Amlodipine, Nifedipine
Nondihydropyridine CCB	Verapamil
CARDIAC GLYCOSIDE	Digoxin
DIURETIC	
Loop diuretic	Furosemide
Thiazide/Thiazide-related	Bendroflumethiazide, Metolazone
NOVEL ANTIANGINA AGENT	Trimetazidine
ORGANIC NITRATE	Nitroglycerine, Isosorbide Dinitrate
STATIN	Atorvastatin, Rosuvastatin, Fluvastatin

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