Emergence of ischemic cardiomyopathy as the main cause of heart failure in urban Sudanese population

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Abstract

Heart failure is a rapidly growing cardiovascular (CV) problem in Sudan due to affluence and lifestyle changes producing high rates of CV risk factors and consequent coronary heart disease in addition to the historical causes of hypertension and rheumatic heart disease.

This study is intended to measure the prevalence of heart failure (HF) among hospital admissions and study the recent trends in etiology, clinical features and methods of treatment.

Methods: All admissions at Sudan Heart Institute between January 2000 and June 2011 were studied. Patients went through detailed history taking and physical examination. Investigations included 12 lead ECG and chest X-ray, echocardiography and cardiac catheterization was also carried out where indicated.

Results: A total of 12453 cases were collected and 1073 case of HF were verified by the authors and an independent cardiologist, constituting 8.6% of CV disease admissions. Female to male ratio was 1:1.6 and age 15 to 96 years (median 58 years). 74.6% of all patients were urban dwellers. Left ventricular (LV) systolic dysfunction accounted for 71.6% and preserved systolic function 28.4%. Ischemic aetiology accounted for 44.6% of cases, hypertension 24.8%, RHD 14.4% and idiopathic 12.4%.

Conclusion: Ischemic cardiomyopathy emerged as the main cause of HF among urban population probably due to changes in lifestyle. Treatment and prevention of these risk may reduce the prevalence of heart failure.

Key words: heart failure, ischemic cardiomyopathy in Sudan, heart failure in Sudan, rheumatic heart disease, idiopathic dilated cardiomyopathy, hypertensive heart failure.

Introduction

One of the earliest documented clinical observations of the syndrome of heart failure (HF) originated from Africa. In the ancient Egyptian medicine the contents of the Ebers papyrus which described HF as “weakness of the heart” or “the over flooded heart”, may represent the earliest documented observations of the syndrome of HF. The first reported prevalence of coronary heart disease (CHD) among cardiovascular disease (CHD) admissions was 12.6% in 1961 and slowly increased to 17.8% by 1984. A population based report of coronary events in Khartoum (1996) reported an annual prevalence rate of 112/100 000 and a fatality rate of 36/100 000. The pattern of CHD had shown major changes during the last three decades (1980-2010) and noticeable increase in the rates of CHD was noted by many clinicians and government health authority. A recent hospital based study of CV admissions in Al Shaab Hospital, a cardiac referral hospital in Khartoum, has shown HF accounted for 73% of admissions to coronary care unit. The pattern of heart disease in the same study reported CHD reaching 65% among all CVD admissions. Hypertension was 28% and rheumatic heart disease (RHD) 7% only.

Falling death rates from communicable diseases as a result of socioeconomic development, improved vaccination and other primary health care services resulted in increased life expectancy from 46 years in 1966 to 61.45 years in 2010. The last three decades have also witnessed visible change in lifestyle of urban population due to improvement in transport, telecommunications and living conditions. Access to media and satellite broadcasts has promoted western lifestyle. Eating has changed as refined carbohydrates, fast foods and saturated fats replaced the traditional high fiber African food. In addition, there has been a state of rapid urbanization as many rural communities adopted urban life style. The burden of communicable disease was thus compounded by the appearance of a new wave of CV risk factors and consequently high rates of non-communicable disease headed by coronary heart disease and cancer. The wave of epidemiological transition seems to have afflicted Sudan as it did with other sub-Saharan African countries.

Heart failure is a growing health problem both in western and third world countries. The prevalence of HF in Sudan has not been defined, and although the existing data suggests that RHD and hypertension are the main causes, a reappraisal of the etiology in the light of the recent changes is becoming necessary. The objective of this study is to measure the prevalence of HF among hospital admissions and study the recent trends in etiology, clinical features and methods of treatment.

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Table 1: Heart Failure, definitions and criteria

<table>
<thead>
<tr>
<th>Definition</th>
<th>Criteria</th>
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<tr>
<td>LV systolic dysfunction</td>
<td>LV Ejection Fraction &lt;40%</td>
</tr>
<tr>
<td>Systolic Heart Failure</td>
<td>Clinically documented HF in the presence of LV systolic dysfunction</td>
</tr>
<tr>
<td>LV diastolic dysfunction</td>
<td>As measured by E/A ratio and deceleration time as per ASE recommendations</td>
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<tr>
<td>Diastolic Heart Failure</td>
<td>Defined according to the European Society of Cardiology criteria for the diagnosis of diastolic HF</td>
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<tr>
<td>Ischemic cardiomyopathy</td>
<td>LV Ejection Fraction&lt;40% with proof of coronary artery disease by echocardiographic regional wall motion abnormality and/or coronary angiography.</td>
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<tr>
<td>Hypertensive heart failure</td>
<td>The following three criteria must be fulfilled: 1. Clinically documented HF 2. BP&gt; 180/100 or &gt;5 years treatment for hypertension 3. IVS thickness &gt;14mm, diastolic dysfunction and/or systolic dysfunction (adopted from Stewart and Wilkinson)</td>
</tr>
<tr>
<td>Rheumatic heart disease</td>
<td>Heart Failure due to chronic valvular rheumatic heart disease as evidenced by diagnostic echocardiographic findings.</td>
</tr>
<tr>
<td>Idiopathic dilated cardiomyopathy</td>
<td>LV Ejection Fraction &lt;40%, LVEDD &gt;60mm, absence of coronary artery disease confirmed by coronary angiography.</td>
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LV= Left ventricle, LVEDD= LV endiastolic diameter, ASE= American Society of Echocardiography, HF= heart failure.

Study Design

A cross sectional prevalence study was designed to evaluate all admissions to Sudan Heart Institute (SHI) from its inception in the year 2000 and until June 2011. SHI is a tertiary care national referral center for CV disease. It is situated in the capital Khartoum. Patients with CV disease are referred from all parts of the country for diagnosis, medical treatment, cardiac catheterization and cardiac surgery. The center encompasses acute admissions unit, referred outpatient clinics, coronary care unit, intensive care unit, wards, cardiac catheterization and echocardiography laboratories in addition to cardiac operating rooms.

Hospital admissions during the study period were scrutinized and files with diagnosis of HF were extracted. All files with adequate history and clinical findings were selected. Files should also have full initial investigation such as 12-lead ECG and chest X-ray and a full transthoracic echocardiographic examination (TTE) performed by a cardiology specialist according to ASE guidelines. Systolic HF is used synonymously as congestive HF and conforms to Framingham diagnostic criteria for congestive HF. Diastolic HF was assessed according to the European Society of Cardiology Criteria. More detailed definitions of etiological factors, based on criteria adopted from European Society of Cardiology Guidelines and American College of Cardiology/American Heart Association Guidelines are described in (Table 1).

Coronary angiography was used to confirm the diagnosis in cases where doubt existed regarding coronary disease and for therapeutic intervention. Cardiac catheterization was also used to rule out ischemic myopathy in patients labeled as idiopathic dilated cardiomyopathy. A smoker is defined as any person who smokes regularly any number of cigarettes or any amount of mouth tobacco. Mouth tobacco is a powder tobacco which is rolled as a ball and inserted between the lower lip and gum margin. A patient is considered overweight if the BMI is above 25 and obese if above 30. Acute decompensated heart failure (ADHF) included patients known to have HF who were readmitted in acute decompensation, while acute left ventricular failure (ALVF) included only patients with first time presentation. Biographic data, clinical presentation, physical findings, investigations and treatment were stored in a data sheet. The following parameters were calculated: age, gender, mode of presentation, coronary risk factors. Prevalence, etiology, duration, frequency of re-hospitalization, treatment options, complications and mortality from HF were calculated.

Statistics

Collected data was entered into storage datasheet. Analysis was carried out using SPSS Statistics 17 software (IBM SPSS). Means were calculated (±STD) and frequencies were expressed as percentage with 95% CIs where appropriate. Comparisons

Figure 1: Initial presentation of patients with heart failure
CCHF = chronic congestive HF, ADHF = acute decompensated HF, ALVF acute left ventricular failure, ARRHYTH = Arrhythmia.

Figure 2: Cardiovascular risk factors profile in patients with ischemic cardiomyopathy
of continuous data were made using the Student t-test and those of categorical data using Chi-square. Significance is reached when p<0.05.

Results

A total of 12626 cases, representing CVD admissions during the study period, were collected. 173 cases were excluded from the study due to incomplete data. HF admissions accounted for 1073 cases (out of 12453) constituting a prevalence rate of 8.6% of the total CV disease admissions. Female to male ratio was 1:1.6. Age ranged from 15 to 96 years with a median age of 58 years. 63.1% were below the age of 65 and 39.9% were above the age of 65. 83% of patients with HF due to rheumatic heart disease were below 34 years. The study has shown that 74.6% of the patients with HF belonged to urban community. Profile of initial clinical presentation is shown on (Figure 1). Echocardiographic findings showed (LV) systolic dysfunction in 71.6%, diastolic dysfunction in 28.4% and combination of both was seen in 18.8%. Hypertensive diastolic HF was seen in 19%, while hypertensive systolic HF was seen in 5.8%. Coronary angiography was performed in 32.7% of patients and Brain Natriuretic Peptide (BNP) in 3.6%. Sinus cardiac rhythm was seen in 75% of patients, atrial fibrillation in 22% and complete atrioventricular dissociation (AVD) in 3%.

The prevalence of CV risk factors among patients with ischemic cardiomyopathy (ICM) is shown in (Figure 2) and the causes of HF are shown in (Figure 3). Eighty eight per cent of the patients with ICM were from urban community. Other causes of HF included 18 cases of adult congenital heart disease, 12 cases of chronic obstructive pulmonary disease, 5 cases of thyrotoxicosis, 5 cases of anemia and 6 cases of pericardial constriction.

Therapeutic agents used in the treatment of HF including inotropic agents are shown in (Figure 4). Duration of HF ranged between 1 – 4 years with mean duration of 2.4 years (STD=1.14). 53.1% of patients were rehospitalized once, 30.8% twice, 12% three times and 4% were rehospitalized more than 4 times per year. Mean hospitalization/year was 1.68 (STD=0.863). In hospital mortality of HF accounted for 7%. The most common comorbidities showed infection contributing to 30%, renal impairment to 16.2%, stroke to 3.7%, Liver cirrhosis to 1.2% and deep vein thrombosis to 1%.

Discussion

Although HF is a growing health problem in Sudan its real size and etiology were not well defined. The main objective of this study was to define the etiology of HF and shed light on the different diseases that contribute to its pathogenesis.

Ischemic cardiomyopathy

The study defined the prevalence, etiology and clinical features of HF in a group of Sudanese patients. While ischemic cardiomyopathy accounts 2/3 of the patients with HF in United States and nearly similar figures in Europe causes of HF in Africa are dominated by non-ischemic cardiomyopathies such hypertension and rheumatic heart disease16,17. Earlier studies had shown that RHD and hypertension accounted for nearly 70% of all CVD admissions2. However, the recent affluence and change of lifestyle encouraged the appearance of high rates of coronary risk factors and consequently more affluent forms of heart disease. Contrary to all expectations ICM emerged, in this study, as the main cause of HF and accounted for 44.6% of all the cases, followed by hypertension, RHD and idiopathic dilated cardiomyopathy. This finding was ascertained by the typical clinical presentation, echocardiographic findings and confirmatory cardiac catheterization. Similar pattern were reported by Mayosi who stated that the increase in CHD in Sub-Saharan Africa since the 1980s is related to the increasing prevalence, among African populations, of the classical risk factors for CAD: smoking, a diet high in saturated fat, hypertension, obesity, diabetes mellitus, and lack of physical exercise18.

HF prevalence rate, in this study, was found to be 8.6% (86/1000) of CVD admissions and in hospital mortality of 7% (20/1000) which is comparable to other African countries such as Zimbabwe and Nigeria where patients with HF contributed about 6 – 10% of hospital admission19,20.
The median age of our population was 58 years. 63.1% were below the age of 65 and only 39.9% were above the age of 65 suggesting that HF afflicts younger generation when compared to HF in the developed countries. Young patients with HF were specially seen in cases of RHD where 83% of patients were below 34 years. Advanced HF was the main presenting feature and may be related to lack of awareness to early symptoms of coronary heart disease and the low health seeking habit among patients, while the absence of lytic therapy and cardiac catheterization, in most hospitals, lead to high rates of case fatalities and advanced stages of HF.

The THESUS-HF study, the sub-Saharan HF studies showed the overall prevalence of ICM as 7.7%, but ICM was the main cause of HF in Kenya and second cause in Sudan, Ethiopia, Senegal, Cameroon and South Africa. Other high rates were also reported from Lome where Damorou has shown ICM to account for 46% of HF admissions. It is therefore acceptable to claim that our findings are in keeping with the trend of emerging high rates of ICM in all of sub-Saharan Africa. Other causes of HF reported in this study are also in keeping with figures quoted from Cameroon, Ghana, Guinea, Kenya, Nigeria and Senegal. Our rate for ICM 12.4 % is similar to findings from South Africa and Uganda, where it accounted for 10% to 17% consecutively of autopsies.

There are several factors contributing to the high rates of ICM in urban population among them are the emerging high rates of risk factors. Until the late fifties and early sixties the prevalence of smoking was less than 3% in the urban population and much less in rural areas. This was attributed, at that time, to the belief that smoking was socially and religiously obnoxious. In this study smoking rate was 34%, hypertension 51% and diabetes 30.3%. Findings are somewhat high even when compared to westernized communities.

Another observation was that nearly two thirds of the patients were below the age of 65 years. This is the very group that embraced the new affluent type of lifestyle and consequently harbored most of the new high rates of coronary risk factors. Additionally the rapid urbanization which characterized the last three decades has contributed greatly to the zealous adoption of the new lifestyle.

Heart failure due to Hypertension and Rheumatic heart disease:

While hypertension and rheumatic heart disease contributed to nearly 70% of the causes of HF, this study has shown that lone hypertension in the absence of associated CHD is a minor cause of systolic HF and was seen in 5.8% of all causes, while hypertensive diastolic heart failure contributed 19% of the cases. This was previously recognized by other workers who reported that evidence is lacking that LV hypertrophy (LVH) due to hypertension is a major risk factor for HF in the absence of coronary artery disease. Other workers recognized that hypertension may lead to HF due to systolic dysfunction in association with underlying coronary heart disease and myocardial infarction but in people with hypertensive LVH diastolic HF may prevail. The Heart of Soweto study showed hypertension as the main cause of HF accounting for (33 %) of the study population, but did not specify how much percent was contributed by each of the two types. Hypertension is the most common cause of HF in most of sub-Saharan African countries and although comparable rates are seen in Kenya 17.6% and Ghana 22.6% higher rates are reported from Cameroon 54%, Nigeria 58% and Senegal 47%.

Idiopathic dilated cardiomyopathy (IDCM): IDCM constituted 12.4% of the cases of HF in this study and is emerging as a fourth common cause. The use of echocardiography routinely in assessment of cardiac cases has unveiled higher rates of this condition which was previously mislabeled as ischemic heart disease. In our series the diagnosis of IDCM was confirmed by the presence of normal coronary arteries during cardiac catheterization. IDCM is a common cause of HF among many of West African countries and occurs in 37.4% of cases in Guinea and 28% in Senegal.

Comorbidities

Infection including chest infection, malaria, and diarrhea contributed to 30.7% of comorbidities, however, rates for stroke (3.7%) and deep venous thrombosis (1%) were low compared to western communities. Other unexplainable comorbidities are the low level of renal impairment 16.2% in contrast to the ADHERE study in which 33.4% of men and 27.3% of women were diagnosed with renal insufficiency.

Treatment

Treatment of HF (Figure 4.) showed adequate utilization of angiotensin converting enzymes inhibitors, beta blockers and spironolactone in keeping with current guidelines. However, devices are not yet available for treatment of HF. Nitrate hydralazine combination which was shown to be effective in African American is still not utilized.

Study limitations

One limitation to this study is that the main data was extracted from medical records which are disadvantaged by lack of accurate documentation which resulted in the exclusion of 16% of the files. Another limitation is that the results obtained cannot be extrapolated to the whole population as more than 70% of the patients are from urban localities and consequently the high rates of ICM depict urban population.

Conclusion

ICM emerged as the main cause of heart failure in urban Sudanese population. The finding may be explained by the recent changes in the standard of living and lifestyle and the consequent high rates of cardiovascular risk factors. Rural communities still have favorable level of critical risk factors and efforts to retain health promoting aspects of the traditional African lifestyle should be taken by health authorities.

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Authors’ contribution

Siddiq Ibrahim Khalili: planning the study, drafting and final revision of the manuscript
Suha Khalili: design of tables and figures, initial analysis from SPSS, revision and copy editing of the manuscript.
Hajir Khalid Al Badri: collection of data and datasheet setting.
Mohamed Khalid: data entry in SPSS and initial analysis.
Files selection, scrutiny, and initial data sheet filing: Sara Ibrahim Mohamed, Amna Moawia Alhaj and Khalid Gaafar Abdelwahid

Declaration
All authors have no conflict of interest and nothing to declare.

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