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Heart Failure Etiologies and Challenges to Care in the Developing World: An Observational Study in the Democratic Republic of Congo

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Abstract

Background: Limited data are available regarding causes and outcomes of heart failure as well as organization of care in the developing world.

Methods and Results: We included consecutive patients diagnosed with heart failure from November 2014 to September 2016 in a university and private hospital of Lubumbashi, Democratic Republic Congo. Baseline data, including echocardiography, were analyzed to determine factors associated with mortality. Cost of hospitalization as well as challenges for care regarding follow-up were determined. A total of 231 patients (56 ± 17 years, 47% men, left ventricular ejection fraction $29 \pm 15\%$, 20% atrial fibrillation) were diagnosed, more during heart failure hospitalizations (69%) than as outpatients (31%). Main risk factors for heart failure included hypertension (59%), chronic kidney disease (51%), alcohol abuse (38%), and obesity (32%). Dilated cardiomyopathy was the most prevalent etiology (48%), with ischemic cardiomyopathy being present in only 4%. In-hospital mortality rate was 19% and associated with an estimated glomerular filtration rate of $<60 \text{ mL} \cdot \text{min}^{-1} \cdot 1.73 \text{ m}^{-2}$ ($P < .01$) and atrial fibrillation ($P = .02$). One hundred six patients (46%) were lost to follow-up, which was mainly related to lack of organization of care, poverty, and poor health literacy. Of the remaining 95 subjects, another 33 (35%) died within 1 year after presentation. The average cost of care for a 10-day hospitalization was higher in a private than in a university hospital (885 vs 409 USD).

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Disclosures
None.

Conclusions: Patients admitted for heart failure in DRC have a high incidence of nonischemic cardiomyopathy and present late during their disease, with limited resources being available accounting for a high mortality rate and very high loss to follow-up.

Keywords

Heart failure; developing world; challenges to care

Recent estimates of the global burden of disease indicate that cardiovascular disease (CVD) is ranked among the leading causes of adult mortality in the developing world, notably in Africa.^{1–5} The high mortality of complications of CVD, such as heart failure (HF), is in part due to late diagnosis, poor adherence to treatment, limited resources, and poor infrastructure.⁶ Challenges to care are compounded by poor knowledge of risk factors and comorbidities, lack of medical insurance, and in some instances, cultural or religious beliefs that keep chronically ill patients from accessing care at modern health care facilities.^{7–9} We designed an observational study that sought to elucidate the causes of HF, risk factors for mortality, and challenges to care in Lubumbashi, a semiurban city of ~2 million people in the Democratic Republic of Congo (DRC).

Methods

Study Design

We conducted a retrospective analysis of information obtained by clinical history and examination from consecutive subjects diagnosed with HF by the first author (D.M.-L.), an experienced heart failure internist, at a university and a private hospital from November 2014 to September 2016 in Lubumbashi, DRC.

Data Collection

The first 2 authors (D.M.-L. and D.N.-N.) collected and analyzed the data and vouch for its completeness. Twelve-lead electrocardiograms were acquired with the use of a Cardiac PC system (Imed, Budapest, Hungary) and coded according to the Minnesota code classification.¹⁰ Detailed 2-dimensional echocardiography was performed with the use of a Vivid i ultraportable echo system (GE Medical Systems, Tirat Carmel, Israel) following international guidelines.^{11,12} The adapted Heart of Soweto criteria were used to assign a single diagnosis based on echocardiography findings.¹³ On the morning following the first visit, a blood specimen was collected for routine analysis with the use of an automated platform (Human Diagnostics, Wiesbaden, Germany). The study protocol was approved by the Ethics Committee of the University of Lubumbashi (UNILU/CEM/044/2014) and patients' consents were obtained.

Statistical Analysis

Pearson chi-square test and Student *t* test were used to compare proportions and means, respectively, across study groups of interest. All analyses were performed at a significance level of $P < .05$ with the use of Stata software version 12.1.

Results

Baseline Characteristics

A total of 231 patients were included of which most were diagnosed during a hospitalization for acute heart failure 69% (n = 159), and only 31% (n = 72) during an outpatient visit.

Patients were relatively young (56 ± 17 years) and had poor left ventricular ejection fraction ($29 \pm 15\%$) and elevated right ventricular systolic pressure (40 ± 17 mm Hg) on diagnosis. Baseline characteristics are presented in Table 1.

Dilated cardiomyopathy (DCM) was the main etiology of HF (48%; n = 110). Cor pulmonale, organic mitral valve disease (regurgitation or stenosis) mostly of rheumatic origin, and peripartum cardiomyopathy (PPCM) were seen in 12% (n = 28), 11% (n = 26), and 8% (n = 19) of 231 subjects, respectively. Ischemic cardiomyopathy was found in only in 9 patients (4%; Table 2).

Patients with DCM were predominantly male (59%; n = 65; $P < .01$), were older than those without DCM ($P < .01$), and had a higher prevalence of alcohol abuse ($P = .02$) and overweight/obesity ($P = .02$). The mean left ventricular ejection fraction was significantly lower in patients with DCM than in those with other etiologies ($P < .01$). Left bundle branch block was more common in patients with DCM ($P < .01$) and associated with a length of stay 10 days.

Commonly prescribed medications included furosemide, angiotensin-converting enzyme inhibitor, angiotensin receptor blocker, beta-blocker, digoxin, isosorbide dinitrate, hydralazine, and spironolactone in 91% (n = 211), 66% (n = 105), 7% (n = 12), 60% (n = 96), 13% (n = 20), 8% (n = 13), 1% (n = 2), and 48% (n = 76) of 231 patients, respectively. Use of medication was similar between in- and outpatients.

Outcomes

In-hospital mortality rate was 19%. Of the 231 study participants, 106 patients (46%) were lost to follow-up, which was mainly related to lack of organization of care as well as poverty (Fig. 1; Box 1). Of the remaining 95 subjects, 33 (35%) died within 1 year of presentation (Fig. 1).

In-hospital death (19%; n = 30) was significantly associated with an estimated glomerular filtration rate $< 60 \text{ mL} \cdot \text{min}^{-1} \cdot 1.73 \text{ m}^{-2}$ ($P < .01$) and atrial fibrillation ($P = .02$). No significant baseline differences in the aforementioned characteristics were found between those treated as inpatients (n = 159) or outpatients (n = 72) or between those lost to follow-up (n = 106) and those reachable at 1 year (n = 62).

Significant differences regarding cost of HF hospitalization existed between the private and university hospital, which mainly related to the cost of the room. However, the average cost of care for a 10-day hospitalization was well above the monthly income estimated by the United Nations Development Program (UNDP) to be only 80 USD in DRC (Table 3).

Discussion

This study of consecutive HF patients in a private and a university hospital of Lubumbashi, DRC, yielded several key findings. First, nonischemic cardiomyopathy, often related to alcohol abuse, is the most prevalent etiology, with ischemic origin being rare. Second, patients with HF are relatively young and present late during their disease course, with high in-hospital and outpatient mortality. Third, there is a very high rate of loss to follow-up, which is related to the lack of organization of health care, limited resources, and poor health literacy.

The most common etiology of HF in Lubumbashi was dilated cardiomyopathy, followed by cor pulmonale, organic mitral valve disease primarily of rheumatic origin, and PPCM, but not ischemic heart disease. This profile is consistent with epidemiologic patterns previously reported in Africa.^{14–17} For example, our findings are consistent with that of the THESUS study,¹⁵ with similar prevalences of PPCM (8% vs 7.7% in THESUS) and rheumatic heart disease (14% vs 14.3%). Although the main cardiovascular risk factors are similar to those reported in the Western world, the high proportion of cor pulmonale and organic mitral disease in our patients suggests that other preventable diseases, such as acute rheumatic fever or any chronic pulmonary disease, including tuberculosis, may contribute to the burden of CVD in Lubumbashi. Risk factors for DCM and/or PPCM may include black race, alcohol abuse, over-weight, overconsumption of salty food and clay, nutritional deficiencies, psychologic stress, and environmental pollution, which is frequently seen in most parts of the developing world, including Lubumbashi.^{18–23} The high proportion of DCM among men in our study may be explained by a combination of several factors, such as alcohol abuse and perhaps greater exposure to yet-to-be-explored environmental factors (eg, heavy metals) prevalent in poorly regulated mining areas of Lubumbashi.¹⁹

Patients presented late during their disease course and were typically younger than reported in the Western world. Also, the mortality rates were considerably higher than those previously reported in the USA,²⁴ China,²⁵ Europe,²⁶ and even in Africa.¹⁵ Aside from later presentation with more advanced disease, other challenges to improve prognosis of these patients in DRC are lack of medical coverage, limited access to surgical treatment of valvular disease, and unavailability of nonpharmacologic treatments, such as cardiac resynchronization and dialysis. The problem of limited resources is compounded by the cultural challenges of traditional or religious beliefs that drive chronically ill subjects away from modern therapies (Box 1).

The DRC ranks 176th among 187 countries in the poverty listing of the UNDP. The monthly income is 80 USD.²⁷ Importantly, while the cost of HF hospitalization for 10 days was well below 1000 USD, there is no insurance covering the cost. It is therefore not a surprise to see that so many patients were lost to follow-up. Aside from financial constraints of the patients, many other reasons account for this.¹⁵ These include lack of universal health care coverage, lack of telephone contact or inaccuracy of the telephone number provided on admission, total lack of structured organization of care, poor health literacy among the population, consultation at another facility with the hope of better care, discouragement in the face of chronic illness, moving to another city, and the absence of social workers to track down

patients. In addition, the vast majority of the population seeks help from traditional healers for worsening disease as their monetary resources shrink or because of cultural or religious beliefs causing them to distrust modern medicine.²⁸ In a context of poverty, traditions are never far below the surface. Among the Bantu, beliefs such as breaking a taboo, witchcraft, sorcery, “poisoning,” and punishment by the ancestors are easily suggested as causes of illness.²⁹ If patients or their relatives are convinced that hospital-prescribed treatment is futile, few things can persuade them to return for follow-up.⁷ Instead, they resort to the care of witch doctors, traditional healers, or pastors for deliverance or a miraculous cure.

In the DRC, as in many other African countries, HF is a critical public health concern. Given the preventable causes in some cases, such as acute rheumatic fever and tuberculosis, attention to prompt diagnosis and treatment is crucial to reducing at least some of the burden of CVD. Patient education should be provided to promote healthy lifestyles and increase awareness of readily available treatment options for cardiac disease. Health care benefits, including wider health care coverage, would also allow better access to care.

Poverty is a great barrier to access to care in Lubumbashi. In addition, the poverty of the country also limits the organization of health care and the availability of equipment, personnel, and expertise to treat heart failure. Therefore, mortality and loss to follow-up are very high.

Study Limitations

The main limitations of this study are its cross-sectional design and high rate of loss to follow-up. As a result, data on overall mortality and other outcomes are limited. Data regarding treatments following hospital discharge are also sparse, so the impact of specific therapies on clinical outcomes can not be determined. Finally, our study population was derived from a single city in DRC, and the findings may not be generalizable to other regions of the country.

Conclusion

Management of HF in DRC is challenged by factors related to socioeconomic conditions, environmental and behavioral issues, poor health literacy, and inadequate health care infrastructure. Attention to these factors will be necessary to reduce the burden of HF and improve outcomes for this condition in DRC.

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Box 1.**Challenges to Management of Heart Failure in Lubumbashi, Democratic Republic of Congo**

- Low economic status
- Lack of insurance
- No organized care by government
- Poor health literacy
- Lack of social support
- High prevalence of alcohol abuse
- Limited access to pharmacologic and nonpharmacologic therapies
- Limited surgical options for valvular disease and other conditions
- Inadequate health care infrastructure and poor communication infrastructure
- Poor adherence to therapy and follow-up
- Cultural and religious beliefs that reduce acceptance of modern therapies

Fig. 1.

Flowchart depicting study enrollment, in- and outpatient distribution, and loss to follow-up due to either death or hospital discharge at patient request. Requests for discharge were often motivated by the patient's inability to cover medical expenses and/or loss of trust in modern medicine, mostly for subjects who were chronically ill or with advanced disease.

Sociodemographic and Clinical Characteristics of Patients With Heart Failure in Lubumbashi, Democratic Republic of Congo

Table 1.

Variable	Length of Stay [†]			In-Hospital		Follow-up		All Mortality	
	All(n = 231)	LOS 10d (n = 71)	LOS < 10d (n = 73)	Alive (n = 129)	Dead (n = 30)	Alive (n = 62)	Dead (n = 33)	Alive (n = 62)	Dead (n = 63)
Age, y	56 ± 17	55 ± 18	54 ± 18	55 ± 18	56 ± 18	55 ± 16	55 ± 21	55 ± 16	55 ± 19
Male	108 (47)	40 (56)	23 (31)	57 (44)	15 (50)	26 (42)	15 (45)	26 (42)	30 (48)
No FS	78 (34)	24 (34)	28 (38)	41 (32)	14 (47)	19 (31)	12 (36)	19 (31)	26 (41)
BMI 25 kg/m ² [‡]	73 (32)	19 (27)	24 (33)	40 (31)	8 (27)	23 (37)	7 (21)	23 (37)	15 (24)
Alcohol abuse	87 (38)	31 (44)	22 (30)	47 (36)	13 (43)	23 (37)	11 (33)	23 (37)	24 (38)
eGFR < 60 mL·min ⁻¹ 1.73 m ⁻² [§]	117 (51)	38 (54)	36 (49)	59 (46)	22 (73)	35 (56)	16 (48)	35 (56)	38 (60)
AF	47 (20)	18 (25)	14 (19)	25 (19)	12 (40)	8 (13)	6 (18)	8 (13)	18 (29)
LB BB	27 (12)	14 (20)	3 (4)	15 (12)	4 (13)	7 (11)	7 (21)	7 (11)	11 (17)
LVEF, %	29 ± 15	28 ± 17	31 ± 17	29 ± 16	28 ± 19	27 ± 13	33 ± 19	27 ± 13	31 ± 19
RVSP, mm Hg	40 ± 17	38 ± 16	43 ± 18	41 ± 18	39 ± 15	41 ± 19	44 ± 19	41 ± 19	41 ± 17
DCM	110 (48)	36 (51)	31 (42)	59 (46)	14 (47)	26 (42)	15 (45)	26 (42)	29 (46)

Values are presented as mean ± SD or n (%). FS, family support; BMI, body mass index; eGFR, estimated glomerular filtration rate (Modification of Diet in Renal Disease formula); AF, atrial fibrillation; LB BB, left bundle branch block; LVEF, left ventricular ejection fraction; RVSP, right ventricular systolic pressure; DCM, dilated cardiomyopathy.

* Difference at a 2-tailed alpha level of .05.

[†]The LOS was analyzed for 144 out of 159 patients hospitalized. The dates of release for 15 patients (9 male and 6 female) were not found in the records.

[‡]The BMI could not be determined for 18 patients, for whom there were missing data on weight or height owing to the bedridden status at admission. Five patients with BMI 25 kg/m² had no date of release for determination of LOS.

[§]The eGFR was not determined in 12 patients owing to missing values of creatinine.

Table 2.

Etiologies of Heart Failure in 231 Subjects in Lubumbashi, Democratic Republic of Congo

Etiology	n	%
Dilated cardiomyopathy	110	47.6
Cor pulmonale	28	12.1
Peripartum cardiomyopathy	19	8.2
Mitral regurgitation	17	7.4
Hypertensive cardiomyopathy	10	4.3
Ischemic cardiomyopathy	9	3.9
Mitral stenosis	9	3.9
Diastolic dysfunction/RCM	8	3.5
Aortic regurgitation	7	3
Pericarditis	7	3
Pulmonary hypertension	4	1.7
Left ventricle noncompaction	2	0.9
Ebstein anomaly	1	0.4

RCM, restrictive cardiomyopathy.

Table 3.

Cost Estimates (USD) for a 10-Day Hospital Stay for Heart Failure in Lubumbashi, Democratic Republic of Congo

ITEMS	University Hospital	Private Clinic
Physician visits	94	165
Room	125	500
Prescription drugs	in	10
Electrocardiography *	20	30
Echocardiography *	60	80
Routine biochemical analysis *	100	100
Total	409	885

* Provided to our study patients free of charge.