Clinical patterns and complications of African diabetic patients: preliminary data from Kigali University Teaching Hospital, Rwanda

G J Rudasingwa, E Amendezo, and M Twagirumukiza

Abstract

Diabetes mellitus, and its complications and co-morbidities form a major component of emerging non-communicable diseases (NCDs) in developing countries where they coexist with traditional infectious diseases. The potential cost of optimum management of complications arising from diabetes and other NCDs adds an additional burden to the economy of African countries already living in poverty, with limited affordability of treatment.

We describe a prospective cross-sectional study carried out in Kigali University Teaching Hospital, Rwanda, between October 2008 and May 2010, to investigate the clinical patterns and complications profile of diabetic patients attending the Department of Internal Medicine. The study involved 294 patients (65% females, 40% of patients aged below 45 years). Co-morbidity with hypertension, overweight and dyslipidemia was found in 31%, 33%, and 28%, respectively. The mean diabetes duration was 6±6 years (mean ± SD).

Microvascular complications were common: neuropathy (53%), retinopathy (23%), and nephropathy (20%). Macrovascular complications were less frequent: cerebrovascular disease (4%), coronary artery disease (3%), and peripheral vascular disease (15%).

More efforts focused on education programmes, and early diagnosis through mass population screening, as well as the improvement of case management may help to reduce the burden of complications.

Introduction

The global rise in non-communicable diseases (NCDs) represents one of the major health and socioeconomic threats in the 21st century.[1,2] Among NCDs, diabetes mellitus remains an important component because of its prevalence and the related complications worldwide.[3] In sub-Saharan Africa, while communicable diseases such as HIV/AIDS, malaria, and tuberculosis have continued to pose great threats to the public health system, it is now apparent that NCDs such as diabetes are undoubtedly adding to the multiple burdens for people in this region.[1,4–8]

There are approximately 180 million people worldwide with diabetes.[9-11] In 2000, the prevalence of diabetes in the WHO African Region was estimated at 7 million people, of whom about 0.7 million (10%) had type 1 diabetes and 6.3 million (90%) had type 2 diabetes.[9] The figures are still increasing: in 2010, 12.1 million people were estimated to be living with diabetes in Africa, and this is projected to increase to 23.9 million by 2030.[11] Moreover, about 113 100 people died from diabetes-related causes, 561 600 were permanently disabled, and 6 458 400 experienced temporary disablement.[11] Additionally, in sub-Saharan Africa, the late diagnosis of diabetes and lack of regular monitoring of patients, coupled with inequalities in accessing care, leads to early presentations of diabetic complications.[1,12]

Diabetes exerts a heavy economic burden on society. This burden is related to health system costs incurred by society in managing the disease, indirect costs resulting from productivity losses due to patient disability and premature mortality, time spent by family members accompanying patients when seeking care, and intangible costs (psychological pain to the family and loved ones).[3]

In Rwanda, the affordability of treatment and accessibility of health facilities are still limited, for multiple reasons, including geographical, financial, and cultural beliefs. Thus, diabetic complications are likely to occur in many patients and at an early stage. Yet, there have been no prior published data on diabetes-related complications in Rwanda.

We therefore report a prospective cross-sectional study carried out in Kigali University Teaching Hospital. The general objective of this study was to describe the profile of acute and chronic complications associated with diabetes. In this study we have assessed clinical patterns and complications in a group of diabetic out- and in-patients to determine the prevalence of complications and potential risk factors.

Gatege Joseph Rudasingwa MD and Etienne Amendezo MD, Department of Internal Medicine, Kigali University Teaching Hospital, Rwanda; and
Marc Twagirumukiza MD, PhD, Department of General Practice and Primary Health Care, Ghent University, Belgium

Patients and methods

Study design, recruitment, and data collection

A cross-sectional study was carried out in Kigali University Teaching Hospital (CHUK), the largest and main referral hospital located in Kigali, the capital of Rwanda. All diabetic out- and in-patients fulfilling the inclusion criteria and attending the department of internal medicine during the period of October 2008 to May 2010 (20 months) were invited to participate in the study. Only patients who agreed to participate and gave oral consent were included in the study. For those who refused participation, no further information was collected.

Selected subjects (aged >15 years) were interviewed and examined by one of the study investigators to capture information on demographics, physical examination, and diabetes duration. Patients' records were also used to collect data on diabetes type, complications, and investigations. Body mass index (BMI) was calculated from weight and height measurements. Blood pressure was measured with the patient seated using a mercury sphygmomanometer. Due to limited resources, our laboratory could not measure patients' HbA_{1c}. Diabetes was diagnosed in accordance with international standards (World Health Organization, 1999).[13,14]

Complications assessment

The diagnosis of diabetic complications was made based on relevant present or past history of clinical findings made by the patient's attending physician. Both acute and chronic complications of diabetes were recorded. Data about acute complications (which included hyperglycaemic states, ketoacidotic or hyperosmolar, and hypoglycaemic coma) within the previous 12 months prior to enrolment in the study were collected. Chronic complications were categorised as microvascular diseases (nephropathy, retinopathy and neuropathy), macrovascular diseases (peripheral vascular disease, cerebrovascular disease and ischaemic heart disease), foot ulcers, infections, and dermatological conditions. All patients had an ophthalmoscopy to assess retinopathy, performed by one experienced ophthalmologist. For some complications (e.g. neuropathy, nephropathy), no standardised diagnostic tools were available in our study setting; therefore for those complications the diagnosis was based primarily on clinical and physical examination of the patients. Additionally the patient records were checked for known diagnosed diabetes complications. Dermatologic complications of diabetes were skin lesions diagnosed as related to diabetes. These could include necrobiosis lipoidica diabeticorum, vitiligo, psoriasis, pemphigus, cutaneous infections associated with diabetes like dermatophytosis, candidiasis, furunculosis, etc. All diabetic patients with skin lesions were sent for dermatologist review to confirm that the lesions were related to diabetes.

Data analysis and ethical approval

Data were collected and recorded under Epi-Data and analysed using PASW STATISTICS 18.0 software. The research protocol was approved and endorsed by the hospital research commission review board before data collection began.

Results

Clinical characteristics and demographics

A total of 294 patients constituted the study population, 104 (35%) were male and 190 (65%) female. Table 1 shows that the mean age was 49±17 (SD) years and the sex ratio male to female was 1:1.8. There were 70 (24%) with type 1 and 224 (76%) with type 2 diabetes. The mean diabetes duration was significantly greater in type 2 diabetes than in type 1 diabetes.

While 71% of the cohort lived in urban or semi-urban areas, only one-fifth had a fixed employment status with a salary on a regular monthly basis, and less than 30% of the total sample had received a secondary school education.

Acute complications

Analysis showed that 23% of the study participants had presented with at least one episode of hyperglycaemia, and 16% reported at least one episode of hypoglycaemic coma. Type 1 diabetes ($p<0.001$), younger age ($p<0.001$), illiteracy ($p=0.011$), new diabetes ($p=0.003$), and infection ($p=0.008$) were significantly associated with a history of hyperglycaemia, but not with hypoglycaemic experiences.

Chronic complications

Table 2 shows that of the total sample, retinopathy was found in 23%, nephropathy in 20%, peripheral neuropathy in 53%, autonomic neuropathy in 25%, cardiovascular complications in 22%, and foot ulcers in 4%. In 38% of the whole group, diabetes was associated with an infectious syndrome (HIV infection not included), whereas 4% had dermatological conditions attributable to diabetes and 23% were known to be living with HIV infection.

There was a statistical significance between the duration of diabetes and diabetic microvascular complications (retinopathy $p<0.001$, nephropathy $p=0.023$, and peripheral neuropathy $p<0.001$); but not auutonomic neuropathy ($p=0.489$) or cardiovascular complications

Table 1 Patients socio-demographic data (means ±SD)

	Total (n=294)	Type 1 diabetes (n=70)	Type 2 diabetes (n=224)	p value
Gender F:M	190:104	42:28	148:76	–
Age (years)	49±17	29±11	56±13	<0.001
Diabetes duration (years)	6±6	4±4	7±6	<0.001
Newly diagnosed diabetes	69 (23%)	26 (9%)	43 (15%)	0.002

(p=0.051). Age correlated with retinopathy (p=0.005), peripheral neuopathy (p=0.035), and cardiovascular complications (p=0.016); but not nephropathy (0.633) or autonomic neuropathy (p=0.540).

Risk factors for diabetic complications

Of the total sample, 31% had hypertension (BP>140/80 mmHg), 33% were overweight (BMI >25.0 kg/m^2), and 28% had dyslipidaemia. Eighteen percent (18%) had continued to smoke after diagnosis and 35% continued to take alcohol regularly. Hypertension was significantly associated with nephropathy (p<0.001), retinopathy (p=0.003), and cardiovascular complications (p<0.001).

Discussion

The study was the first of its type, to the authors' knowledge, to be carried out in Rwanda, and gives opportunity for further exploratory studies. The study is timely as it emphasises that diabetes must compete for political attention and financial investment.

The proportion of subjects with type 2 diabetes was high at 76%, in line with elsewhere in Africa. There has been a significant increase in type 2 diabetes since pre-1985 surveys conducted in the region. These surveys found the prevalence in sub-Saharan Africa to be typically low (1.0%), with the exception of studies in South Africa (3.6%) and the Ivory Coast (5.7%),[9,15] although many of these early studies may have underestimated the prevalence, due to the use of low sensitivity screening methods and non-standardised diagnostic criteria.[15]

Table 2 Chronic complications profile in diabetic patients

Complication	Total (n=294)	Type 1 (n=70)	Type 2 n=224)
Retinopathy	68 (23%)		
Background	20 (7%)	1 (1%)	19(6%)
Proliferative	32 (11%)	6 (2%)	32 (9%)
Maculopathy	16 (5%)	4 (1%)	12 (4%)
Cataract	15 (5%)	2 (1%)	13 (4%)
Nephropathy	60 (20%)		
Proteinuria	47 (16%)	13 (4%)	34 (12%)
Renal dysfunction	13 (4%)	2 (1%)	11 (4%)
Neuropathy	228 (78%)		
Peripheral	155 (53%)	33 (11%)	122 (42%)
Autonomic	73 (25%)	14 (5%)	59 (20%)
Cardiovascular	**66 (22%)**		
PVD	45 (15%)	12 (4%)	33 (11%)
IHD	10 (3%)	0 (0%)	10 (3%)
CVD	11 (4%)	0 (0%)	11 (4%)
Foot ulcer	13 (4%)		
Infection (all)	111 (38%)		
Skin infection	11 (4%)		

Note
PVD = peripheral vascular disease
IHD = ischaemic heart disese
CVD = cerebrovascular disease

Our study shows an important burden of diabetic complications among the study group. The mean age and diabetes duration were 49 years and 6 years, respectively. These findings are similar to elsewhere in sub-Saharan Africa. The Diabcare Africa study, carried out in six sub-Saharan African countries, found a mean age of patients of 53±16 years and a mean known duration of diabetes of 8±6 years.[1,16,17] Diabetes affects more elderly than young people in developed countries,[17,18] partly explained by the fact that the population is younger in our settings than in Western societies, where life expectancy is higher.

In the present study group there were almost twice as many females as males (190 vs 104). This could be explained by the fact that African women are, culturally, more prone to obesity and lack of physical exercise than men. Female preponderance was also reported by many other authors in Africa.[1,17,19,20] Many other factors may contribute to this apparant female excess,[21,22] including 'health-seeking behaviour', a known reason globally for females to attend chronic disease care. Moreover the workplace for males, sometime far away from their home, may have an impact on clinic attendance rates.

The mean diabetes duration was higher in type 2 patients than in type 1 diabetes patients. This finding is mostly attributable to the fact that type 1 diabetes was statistically associated with newly diagnosed diabetes. Other reasons such as type 1 diabetes-related premature death may be important.

Almost one-quarter (23%) of the total sample experienced a hyperglycaemic state in the 12-month period prior to enrolment in the study. Hyperglycaemic state history was significantly associated with newly diagnosed diabetes and illiteracy, which would support previous literature's findings that, due to poverty and lack of diabetic education among the general population, diabetic patients in low-income countries consult hospitals at a very late stage.[17,23] A report from sub-Saharan Africa by Otieno et al,[24] showed that precipitants of hyperglycaemic states were newly diagnosed diabetes, missed insulin injections, and infections. In the present study, hyperglycaemic state history was strongly associated with newly diagnosed diabetes and with the presence of infections. This finding implies that policy makers need to establish and strengthen diabetes education programmes among the population, particularly as morbidity and mortality from acute diabetic complications remains very high in sub-Saharan Africa.[24–26]

Overall, more than half of individuals included in this study suffered from at least one chronic complication attributable to diabetes. As 80% of people in Rwanda live in impoverished conditions,[27] and considering the scarcity of resources allocated to NCDs in our setting, these findings concur with other African reports that

poorly managed diabetes leads to complications.[28] Microvascular complications were found very frequently as in other African reports,[29] and at higher levels than reports from elsewhere;[3,18,30–32] however, macrovascular complications were less marked. The latter are reported to be fewer in Africa when compared with reports from Western societies and Asia.[1,20,33] However, some literature suggests that the prevalence of macrovascular complications among African diabetic patients is increasing.

When diabetes is associated with HIV/AIDS – in the present study, 23% of the total sample were known HIV-positive individuals – the management of the two conditions becomes more difficult, and the patient may be more prone to complications, as HIV infection can worsen target organ damage caused by diabetes and vice versa.[36] Diabetes care teams need to be aware of this complex situation and to establish appropriate case management systems.

Almost one-third of our total sample had hypertension, which is known to be a strong risk factor for most diabetic chronic complications in general, and for cardiovascular complications in particular.[6,16,32,33,37] Also, the present analysis showed that hypertension was strongly associated with cardiovascular complications, nephropathy, and retinopathy. Good glycaemic control, early diagnosis and treatment of hypertension in diabetic patients are appropriate interventions to reduce the burden of many chronic complications of diabetes.

Finally, it should be noted that there are some limitations to our study. We categorised our patients broadly into type 1 and type 2 diabetes, and we did not specifically look for unusual sub-types, such as malnutrition-related diabetes mellitus (MRDM) or atypical ketosis-prone diabetes.[17]

We also did not have available detailed biochemical data – for example glycated haemoglobin (HbA_{1c}), lipids, creatinine, etc. Strict and detailed criteria for complication diagnosis could also not be used, as complications were recorded retrospectively and diagnostic criteria by individual doctors may have varied. This may explain, for example, the high rate of autonomic neuropathy recorded.

Despite these shortcomings, this is the first exploratory study of diabetes-related complications in a Rwandan hospital setting. The rates we have found are high, and suggest that health policy makers should prioritise diabetes care as a major componenent of health provision in Rwanda, and elsewhere in sub-Saharan Africa.

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