Burden and pattern of micro vascular complications in type 2 diabetes in a tertiary health institution in Nigeria.

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Abstract

Introduction: Diabetes mellitus (DM) afflicts at least 5 million people in Nigeria, with more than 80% having type 2 diabetes mellitus (T2DM). Microvascular complications increase both morbidity and mortality inpatients with T2DM. The aims of this study were to report the burden of various microvascular complications in T2DM and to identify various factors associated with these complications in patients with T2DM attending the diabetes outpatients' clinic.

Methods: Ninety (90) patients with T2DM who have attended diabetes clinic for at least 3 months were recruited for this study. Detailed history, physical examination and biochemical analysis was done in each of the patients. All patients underwent a detailed standard evaluation to detect diabetic retinopathy (fundoscopy), neuropathy (10g monofilament and/or diabetes neuropathy scores), and nephropathy (microalbuminuria, macroalbuminuria, serum creatinine and estimated glomerular filtration rate).

Results: There was high prevalence of microvascular complications among patients with T2DM. Almost half of patients with T2DM had some form of microvascular complications; diabetic neuropathy being the commonest (69.6%),followed by nephropathy (54.5%) and retinopathy (48.9%). The factors associated with developing these complications were increasing age, duration of diabetes, hypertension and dyslipidaemia for nephropathy and neuropathy.

Conclusion: There is a high burden of microvascular complications in patients with type 2 diabetes. Age, male gender, hypertension, glycaemic control, BMI and duration of diabetes, and glycaemic control were factors associated with microvasular complications.

Keywords: Type 2 diabetes, microvascular complications, prevalence, risk factors, Nigeria.

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Background

Diabetes mellitus (DM) has emerged as one of the most common chronic disorders with an estimated global prevalence of 366 million in 2011 and projected to increase to 551 million in 2030[1]. The estimated prevalence of DM in sub-Saharan Africa is about 1% in rural areas, and 5-7% in urban areas, and between 8% and 13% in countries like Uganda and South Africa[2-4]. In Nigeria, the national prevalence of DM is 2.2%[5] with a higher prevalence in the urban than in the rural communities. However, studies from different parts of the countries have recorded rates of between 1% and 8%[6-10]. Morbidity and mortality in patients with type 2 diabetes mellitus (T2DM) is mainly attributed to the development of both microvascular and macrovascular complications. These microvascular complications include nephropathy, retinopathy and neuropathy. Hence, the increasing prevalence of T2DM will be followed by an epidemic of diabetes related cardiovascular disease (CVD) espe-

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cially microvascular complications. Identifying contributing factors of these diabetes complications makes it possible to control these complications and can lead to significant reduction in morbidity, mortality and health care cost.

Diabetic nephropathy is an increasingly common cause of end stage renal disease (ESRD) in many countries including Nigeria[11]; the prevalence of nephropathy in Nigerian patients with T2DM rose from 7% in 1963 to 56.5% in 1999[12-14]. The earliest clinical evidence of nephropathy is occurrence of microalbuminuria (30-300mg/day), and its presence has been shown to be associated with increased risk of cardiovascular morbidity and mortality in T2DM patients[15,16]. DM retinopathy on the other hand is the most common microvascular complications in diabetes and it may lead to blindness ultimately[17]. It may manifest as retinopathy lesions as microaneurysm, haemorrhage, cotton wool spots, hard exudates[18]. Presence of retinopathy, apart from increasing risk of vision loss, also increased cardiovascular disease by 2-3 folds[19]. Hence, this study aimed at identifying prevalence and risk factors influencing predisposition to microvascular complications in type 2 diabetic patients.

Methods

This cross - sectional study was conducted at LAUTECH Teaching Hospital, Ogbomoso. A convenient sample of ninety- two patients with T2DM aged 40 years and above were consecutively recruited from the diabetic clinic between January and May, 2013. Inclusion criteria was known patients with type 2 diabetes who had been attending the diabetes clinic for at least 3 months and willing patients. Exclusion criteria included patients with type 1 DM and pregnant women.

Patients provided written informed consent. The study was approved by the local ethical committee and conducted in accordance with the principles described in the declaration of Helsinki.

An interviewer administered questionnaire was used to collect data on the following variables from the patients: age, gender, duration of diabetes, body weight (kg), height (m), waist and hip circumferences (cm), systolic (SBP), and diastolic blood pressure (DBP), fasting plasma glucose(FPG), total cholesterol (TC), high density lipoprotein cholesterol(HDL-C), low density lipoprotein cholesterol (LDL-C), triglycerides(TG).

Patients' weight and height were measured to the nearest 0.1kg and 0.1cm with a standardised stadiometer and weighing scale, respectively[20]. BMI was calculated as weight divided by height squared (kg/m^2). Waist circumference (WC) was recorded as the smallest girth between the rib cage and the iliac crest[21]. SBP and DBP were measured in the Patients after a 5-minute rest using digital sphygmomanometer (Omron). Hypertension was defined as the need for antihypertensive therapy or untreated patients with SBP≥140mmHg and/or DBP≥90mmHg[22].

The Patients were evaluated for the presence of any these microvascular complications i.e. retinopathy, nephropathy and neuropathy, either alone or in combination. Ophthalmoscopic examination was performed by an experienced ophthalmologist by fundoscopy and direct ophthalmoscopy. Retinopathy was diagnosed by the presence of any of the following lesions: microaneurysm, blot or flame-shaped haemorrhage, hard exudates, cotton wool spots or macula oedema[23]. Nephropathy was diagnosed when serum creatinine was> 150microgram/dl, estimated glomerular filtration rate (eGFR) is < 60ml/min, and/or presence of proteinuria or microalbuminuria[24]. Neuropathy was diagnosed by history of numbness, parasthesia, tingling sensation, loss of ankle reflex or loss of light touch sensation using 10- gram monofilament[25].

Blood sample was taken for biochemical parameters after an overnight fast of 8-14hours. This was used for fasting plasma glucose (FPG) estimation by a glucose oxidase method[26]. Total cholesterol (TC), HDL-C and triglycerides by enzymatic methods, and LDL-C were calculated by using Friedwald equation[27]. Patients with untreated total cholesterol> 5.0mmol/l, TG > 1.7mmol/l and/or HDL-C <1.01mmol/l (in males) and <1.29mmol/l (in females) were considered to have dyslipidaemia[28]. Glycated haemoglobin (HbA1c) was tested by in2it®. Data was expressed as means ± SD. Statistical analysis was performed using SPSS (version 17.0 Chicago, SPSS Inc.). A Student's t- test for unpaired sample was used to compare means with standard deviations (SD), and a Chi- square to compare proportions. Statistical significance was set at $p<0.05$. Regression analyses were performed for finding factors associated with various complications. Logistic regression analysis was used to find out strength of association of risk factors with specific complications.

Results

The total study participants included equal number of males and females (46). The mean age of the participants 62.5 ± 8.6 years and the duration of diabetes was between 1 and 30 years, and median duration of 8 years. The demographic profile is shown in table 1.

Table 1: Demographic and biochemical profile of study population

Parameter	Mean ± SD
Age (years)	62.54 ± 8.62
LDL (mmol/L)	2.46 ± 1.02
TG (mmol/L)	0.74 ± 0.33
HDL (mmol/L)	1.10 ± 0.47
TC (mmol/L)	3.92 ± 1.23
BMI (kg/m2)	26.9 ± 4.40
TC/HDL	3.68 ±0.54
LDL/HDL	2.49 ± 1.21
DBP (mmHg)	83.1± 10.7
SBP (mmHg)	137.5± 18.3
Pulse pressure	54.3 ± 18.1
Uric acid (mg/dl)	0.33 ± 0.09
HbA1c (%)	9.76 ± 2.4
FPG (mmol/L)	10.2 ± 2.9

Retinopathy was seen in (45/92) 48.9% (higher in females than in males, although the difference was not statistically significant, p=0.235). Nephropathy was present in 54.3% (50/92), significantly higher in males than females (p=0.003). Neuropathy was present in 69.6% (64/92) participants giving a prevalence of 69.6%.

Nephropathy and neuropathy rates were significantly higher in males, (p=0.003) and (p=0.001) respectively. Patients with nephropathy and retinopathy had higher blood pressure and mean HbA1c, were older and had longer duration of diabetes (p=0.0002). Participants with neuropathy had higher BMI, longer duration of diabetes and higher LDL-C (p=0.003), as shown in table 2.

Table 2: **Clinical and biochemical profile of the subjects with and without micro vascular complications.**

Parameter	With (51)	Without (41)	P-value
Age (years)	62.84 ± 8.77	62.17 ± 8.5	0.003
Weight (Kg)	70.1 ± 11.2	69.9 ± 10.5	0.020
Total Cholesterol (mmol/L)	4.1 ± 1.3	3.7 ± 1.2	0.006
HDL (mmol/L)	1.1 ± 0.5	1.09 ± 0.4	0.070
eGFR (ml/min)	53.8 ± 14.8	55.6 ± 16.0	0.020
LDL(mmol/L)	2.6 ± 1.4	2.3 ± 1.0	0.002

Further analysis of patients' shows 37% of Patients had at different microvascular combinations of varying combination and 23% had all the three microvascular complications together.

On multivariate analysis, at least one of the microangiopathies were associated with older age, as shown in table 3.

Table 3: Logistic regression analyses of Potential Predictors of at least one micro vascular complication

Independent variable	Unadjusted OR(95% CI)	Adjusted OR(95% CI)	p- value
Age	1.2 (1.0-1.4)	1.2(1.0-1.5)	0.032
BMI	1.0(0.8-1.3)	0.9(0.7-1.3)	0.581
Male sex	3.1(0.3-31.4)	10.8(0.6-205.6)	0.115
Systolic blood pressure	1.0(1.0-1.1)	1.0(0.9-1.1)	0.665
Diastolic blood pressure	1.0(0.9-1.1)	1.0(0.1-1.1)	0.867

Discussion

In this hospital- based study, the prevalence of different microvascular complications of diabetes was similar to figures from other populations in Africa[29,30], but much higher than those reported by Kumar et al[31] in India. The reason for this may be due to poor control of glycaemia among our patients; only 41% of our patients had target goal of blood sugar.

In our study, 55.4% of the patients had nephropathy. This is much higher than value obtained by Alebiosu et al[34] who obtained 25%. DM nephropathy is now the leading cause of ESRD worldwide and is responsible for about 1/3 of patients who undergo dialysis[12]. In Nigeria, DM nephropathy as a cause of nephropathy is also high, representing 15–25%[11]. As previous studies [29-31], have indicated, this study also found age, hypertension, and male sex as important risk factors for DM nephropathy[35].

Retinopathy remains an important complication of diabetes mellitus. The prevalence of retinopathy among Nigerians with T2DM has been estimated to range between 20–56%[30], which is similar to the prevalence of 48.9% obtained in this study as also from a study carried out amongst Ghanaians with T2DM. This study documented that age, male sex, duration of diabetes mellitus, hypertension and poor glycaemic control has significant association with DM retinopathy.

Diabetic peripheral neuropathy is very common in T2DM patients. We found DPN in 69.6% of the study participants, which is similar to 71.1% obtained by in other studies done in Nigeria[36,37]. It is a major risk factor for development of foot ulceration, and increased morbidity and mortality. However, gender, eGFR were not associated with DPN[37]. Other studies however, have not reported a significant relation between age and the duration of diabetes on DPN[38]. Diabetic neuropathy is the most common late complication of DM, and some of the consequences include pain, falls, foot ulceration, sleep impairment, depression, and impaired quality of life[39-41].

Also, a significant percentage of our patients did not achieve target blood pressure control of 130/80mmHg. The reason for the poor blood pressure and glycaemic control are usually multifactorial. Financial constraint, lack of regular follow up visit in the clinic and late presentation before diagnosis are some of the factors affecting diabetes management in Nigeria[42]. Most patients have to pay out of pocket for their medical managements including drugs purchase, blood sugar and other laboratory testing, and at a price much higher than the cost of these drugs in other parts of the world[32]. The WHO report estimates that 90.2% of Nigerians live below poverty level of $2 per day. Thus, accessing health care is a challenge to people living with diabetes in Nigeria. Also, the high prevalence of complications may be related to the older patients recruited in this study, compared to studies with lower prevalence of complications. Our data shows that the common risk factors for any microangiopathy is old age.

Finally, our data though hospital based revealed high frequencies of microagiopathy complications in our patients. The prevalence and risk of these microagiopathic complications are old age, duration of diabetes, poor glycaemic control, hypertension and increased body mass index among other factors. These factors if controlled will probably lead to reduction in the burden of type 2 diabetes complications.

Limitations

The strength of our study is that although the sample size was modest, the study examined the profile of all microvascular complications in Nigerian patients. Due to the paucity of studies that examines all the profile

of microvascular complications together; it can serve as baseline upon which future studies can be referred. Further prospective observation study with a more robust sample size is recommended for a better result. The limitations of this study included the use of only direct ophthalmoscope in the assessment of DM retinopathy instead of retinal photography; this could have led to better detection of early retinopathy, further increasing the prevalence of retinopathy. Also, the use of biothesiometer for the detection of peripheral neuropathy would have been preferred yielding better diagnosis compared to the use of symptoms scores and microfilament. These instruments were not used for lack of availability and cost associated with the investigations.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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