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Prevalence and determinants of diabetic polyneuropathy in a sub-Saharan African referral hospital

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ABSTRACT

Background: Diabetic peripheral neuropathy is the commonest complication of diabetes mellitus, and a major cause of limb amputations. In general however, the magnitude of diabetic neuropathy in sub-Saharan Africans with diabetes has been less reliably quantified. We assessed the prevalence and determinants of diabetic polyneuropathy in hospital settings in Cameroon.

Methods: We conducted a cross-sectional survey at the Douala Laquintinie Hospital, which is one of the main reference hospital in the economic capital of Cameroon (3 million populations). Participants included all patients with type 1 (T1DM) or type 2 (T2DM) diabetes who reported to the hospital regardless of the reason, during a 5-month recruitment period. Polyneuropathy was defined as diabetic in a patient with a Diabetic Neuropathy Examination score of >3/16 and/or a monofilament score of <5/9.

Results: A total of 306 patients were recruited, including 196 women (64%) and 294 (96%) with T2DM. The mean (standard deviation) values were 59.8 (11.2) years for age and 8.4 (8.2) years for diabetes duration. Clinical signs of polyneuropathy were present in 102 (crude prevalence rate: 33.3%) patients. The polyneuropathy was symptomatic in 79/102 (77.4%) patients. Determinants of polyneuropathy were urban residence ($p = 0.02$), infection with hepatitis C virus ($p = 0.002$), infection with HIV ($p = 0.012$) and presence of albuminuria ($p = 0.0001$).

Conclusion: About one in three patients with diabetes reporting to the hospital in our setting has prevalent diabetes related polyneuropathy. This emphasizes the importance of routine implementation of therapeutic education and other measures to limit the complications.

1. Background

Diabetes is a cosmopolitan disease with escalating numbers of those affected by the condition worldwide. According to the International Diabetes Federation (IDF), the global population of individuals with diabetes will increase from 382 million in 2013 to 592 million in 2035 [1,2]. Diabetic peripheral neuropathy (DPN) is a common complication of diabetes mellitus, and may affect from 1/3rd to over 2/3rd of patients, depending upon the population characteristics, diabetes duration and diagnostic methods [3]. The prevalence of diabetic neuropathy in patients with over twenty-five years of diagnosed diabetes is estimated at 50%, and its prevalence at diabetes diagnosis is about 7%, with the progression being linear without plateau phase [4]. Although all types of peripheral nerves can be involved, it is usually sensory dominant with eventual involvement of motor nerve fibers [5].

Diabetic neuropathy (DN), which may be focal or diffuse, is diagnosed when diabetic patients complain of symptoms and/or show signs of peripheral nerve dysfunction after the exclusion of other etiologies [1,6]. Chronic sensorimotor DPN is the most common form of DN [7,8]. Furthermore, within the broad sensorimotor DPN, distal symmetrical polyneuropathy (DSP), which predisposes patients to variable pain, sensory disturbance, motor dysfunction, ulcers, and gangrene, is the most common type of diabetic neuropathy [9].

Polyneuropathy is responsible for the decline in the quality of life of diabetic patients, the occurrence of ulcerative lesions of the feet and lower limbs amputations [4]. Indeed, diabetes is the first cause of non-traumatic amputation and 50% to 60% of non-traumatic amputations are performed in diabetic patients [10].

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Evidence on the burden of diabetic neuropathy in sub-Saharan Africa is very scanty. Accordingly, we conducted this study with the aim of determining the hospital-based prevalence and predictors of diabetic polyneuropathy in an urban setting in Cameroon.

2. Research design and methods

This was a cross-sectional study conducted in the endocrinology, diabetes and obesity unit of the Douala Laquintinie Hospital (DLH). DLH is one of the reference hospitals in Douala, the economic Capital and largest city in Cameroon, with an estimated population of about three million inhabitants. The endocrinology unit of DLH also has an in-patient section with a capacity of 24 beds ran by a staff comprising 3 endocrinologists, 2 general practitioners and 12 nurses. The out-patient section functions on a daily basis (except weekends). Prior to patient inclusion, a local institutional ethical clearance as well as Cameroon National ethical approval were sought and obtained.

All adult diabetic patients (age ≥ 18 years) followed up in this unit who consented to participate in the study, which spanned the period from February to June 2013, were included in this study. All unconscious patients and those with severe hearing and/or speech impairment were excluded from the study. Data collection used a pre-tested questionnaire designed for the purpose of the study. From each consenting patient, socio-demographic as well as past medical and drug history information were collected, then the presence of symptoms suggestive of DPN was investigated using two main validated scores: the Diabetic Neuropathy Symptom (DNS) score [11], and for patients who had pain as one of the components of the DNS, the DN4 score [12] was subsequently used to determine if the pain was neuropathic in nature. The DNS score included four questions which elicit symptoms of unsteadiness in walking, pain, paresthesia and numbness, each graded either as 0 (for absence of symptom) or 1 (for presence of symptoms) for a total score of 4. A DNS score between 1 and 4, indicates the presence of symptoms relevant to DPN. The DN4 comprises 4 questions each with variable grading for a total of 10, and pain was considered neuropathic in nature for a DN4 score of ≥4/10. A thorough physical examination for each participants by a trained final year medical student, applying the criteria and grading of the Diabetic Neuropathy Examination (DNE) score [11] which contains two items relating to muscle strength, five items on reflexes and one on sensations; for a total of 8 items graded each from 0 to 2 for a total DNE score of 16. A DNE score of ≥3 was considered positive for DPN. The Semmes–Weinstein monofilament test was also used in to examine all patients. Sensitivity to 10-g monofilament (Semmes–Weinstein 5.07) consisted of applying the monofilament at each site of the plantar surface of both lower limbs: pulp of the big toe, head of the first and fifth metatarsals. On each site, three applications were done and the patient who had his eyes closed asked to answer “yes” when he/she perceived the pressure or “no” when he/she did not. The patient was also asked to indicate where he/she perceived the applied pressure (right or left foot). The rating was then one (1) point for a “yes” answer and zero (0) points for the “no” answer. The final score ranged from 0 to 9, while a score of <5/9 was considered abnormal. The results of the physical examination by the student were confirmed by a consultant neurologist in a randomly selected sub-sample of participants.

2.1. Paraclinical investigations

Recent tests results (done in the last three months) were extracted from patients file when available, or new tests were ordered: these included glycated hemoglobin, fasting blood glucose, albuminuria, serology for viral Hepatitis B, C, and HIV, CD4 count (for those with HIV infection), serum creatinine level and creatinine clearance according to the simplified MDRD (Modification of Diet in Renal Disease) equation [13].

2.2. Operational definitions

The following operational definitions were applied:

- Polyneuropathy for a diabetic patient with a DNE (Diabetic Neuropathy Examination) score of >3/16.
- Symptomatic polyneuropathy for a patient with polyneuropathy and a DNS (Diabetic Neuropathy Symptom) score of ≥1/4.
- Painful polyneuropathy for a patient with symptomatic polyneuropathy complaining of pain with DN4 score of >4/10.
- Asymptomatic polyneuropathy for a patient with polyneuropathy and a DNS (Diabetic Neuropathy symptom) score of 0/4.

2.3. Data analysis

Data analysis used the STATA Version 12 software (Stata Corporation, College Station, Texas). Group's comparison used the chi square tests and variants, after stratification of continuous variables as appropriate. Logistic regression models were used to investigate the predictors of polyneuropathy, with adjustment for potential confounders. Models were constructed separately for the outcome of diabetic polyneuropathy in the overall population, and for the outcome of diabetes-related neuropathy in the subgroup of participants free of other factors which could cause polyneuropathy. The significance level of all tests was $p \leq 0.05$.

3. Results

3.1. Characteristics of the study population

A total of 321 patients with diabetes were seen during the recruitment period. At the beginning of the study, the physical examination of almost fifty patients, randomly selected was performed by a final

Table 1
Characteristics of 306 diabetic patients screened for peripheral neuropathy.

Mean age, years (SD)	59.8 (11.2)
Age > 60 years	159 (51.9)
Females, n (%)	196 (64.1)
Living in urban area, n (%)	298 (97.7)
Median duration of diabetes, months (25th–75th percentiles)	
Type 1 diabetes	60 (24–64)
Type 2 diabetes	72 (24–144)
Type 2 diabetes, n (%)	293 (95.8)
Treatment of diabetes, n (%):	
Oral anti-diabetics	212 (69.3)
Insulin	55 (17.9)
Diet only	22 (7.2)
Not on any treatment	17 (5.6)
Profession, n (%):	
Housewives	122 (40)
Traders	61 (20)
Retired	43 (14)
Civil servants	28 (9)
Farmers	25 (8)
Drivers	17 (5.6)
Past medical history, n (%):	
High blood pressure	147 (48)
Alcohol consumption	34 (11.1)
HIV infection	26 (8.5)
Positive for anti-HCV antibodies	21 (6.9)
Positive for HBV surface antigens	13 (4.3)
History of anti-tuberculosis treatment	13 (4.3)
Tobacco consumption	10 (3.3)
Chronic renal disease	4 (1.3)

HIV: human immune deficiency virus, HCV: hepatitis C virus, HBV: hepatitis B virus, SD: standard deviation.