Factors Associated with Diabetic Foot Ulcers in Benin – City, Nigeria.

A. Eregie, A.E Edo*

SUMMARY

Background and Objectives: Diabetic foot ulcers (DFU) are the most common causes of prolonged hospitalization (associated with considerable economic costs) in persons with diabetes mellitus (DM). In resource-poor countries such as Nigeria, it becomes necessary to identify the risk/precipitating factors of DFU in order to institute the appropriate locale-specific and relevant preventive measures, hence this report.

Subjects and Methods: A prospective study of all DM persons with DFU admitted in the University of Benin Teaching Hospital, Benin City, Nigeria over a 3-year period, was carried out. Socio-demographic and clinical data were obtained from all subjects. Information on the type and duration of DM, medical co-morbidities, risk and precipitating factors of DFU and casual plasma glucose (CPG) levels on admission were documented.

Results: Thirty (61%) of the 49 eligible persons seen during this period were males. Type 2 DM was diagnosed in 37 (75.5%) persons. The mean age was 56.5 (12.9) years and mean DM duration was 8.9 (6.0) years. Twelve (24.5%) persons had hypertension, 6 (12.2%) persons had visual impairment; peripheral neuropathy and vascular disease were present in 13 (26.5%) and 3 (6.1%) persons respectively. The most commonly reported precipitating factors of DFU were puncture wounds (20.4%) and burns/scalds (14.3%); 23 (47%) persons reported no obvious precipitating factor(s). The most commonly identified risk factors for DFU were improper foot-care (38.8%) and peripheral neuropathy (26.5%). The mean CPG level on admission was 11.6 (8.0) mmol/L. A significant proportion of subjects were policemen/teachers/clergymen and farmers ($X^2 = 16.9$, $p < 0.02$).

Conclusion: Our study shows that poor DM control, male gender, improper foot-care, peripheral neuropathy and occupations which may involve prolonged standing are important factors in the development of DFU in this locale. We recommend that examination of the feet and attainment of optimal glycaemic control should be intensified by all DM care – givers, as early detection and management of identified risk factors ultimately reduces DM morbidity of mortality.

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From: Department of Medicine, University of Benin Teaching Hospital. P.M.B 1111, Benin – City, Nigeria, *Department of Medicine, College of Health Sciences, Delta State University, Abraka, Delta State, Nigeria

Correspondence: Dr. A. Eregie, terryeregie@yahoo.co.uk

INTRODUCTION

Diabetes mellitus (DM) is one of the leading causes of non-traumatic lower extremity amputations worldwide[1-4]. Persons with DM are prone to foot ulceration consequent upon interplay of factors such as peripheral sensory neuropathy, vascular disease, and foot deformity in the face of trauma, which may be imperceptible/ unintentional[5]. Globally, diabetic foot lesions constitute a major medical and socio-economic burden, contributing to DM morbidity and mortality and also prolonged hospitalisation[6-11]. Prevalence rates of DM foot lesions vary from 1.4% in the UK, to 4-10% in the US and 0.9-8.3% in Nigeria [4,9,12-14]

The economic burden of diabetic foot ulcers (DFU) in Nigeria is enormous[11,15]. Facilities for rehabilitation of diabetic amputees are scarce in our locale. It is therefore necessary to identify the risk and precipitating factors of DFU in this locale, with a view towards instituting appropriate preventive measures and ultimately, reducing DM morbidity and mortality

SUBJECTS AND METHODS

All persons admitted with DFU in the University of Benin Teaching Hospital, Benin City, Nigeria from 1st January 2002 to 31st December 2004 were recruited into the study. Data obtained include age, sex, occupation, type and duration of DM, social habits (smoking and alcohol ingestion), risk and precipitating factors of DFU. For the purposes of this study, a smoker was defined as a person who smoked (or had ever smoked) cigarettes; alcohol use was defined as the consumption of alcoholic beverages on a regular basis. Each subject had a full clinical examination to ascertain the presence of the following:

1. Hypertension: defined as a blood pressure> 140/90 mmHg, or documented use of antihypertensive therapy in a previously diagnosed person with hypertension[16].
2. Peripheral neuropathy: defined as diminished or lack of perception of touch/ pain stimuli, and loss of joint position sense and also vibration sense (assessed using a 128mHz tuning fork).
3. Peripheral vascular disease: defined as the presence of diminished or absent lower limb arterial pulsations on palpation.
4. Visual impairment: defined as diminished vision resulting from refractive errors, cataracts or diabetic retinopathy, assessed by direct fundoscopy.

The feet were assessed in all subjects and DFU was graded using Wagner[17] classification. The practice of foot care was assessed in the subjects. For this study, foot care was defined as the self-assessment of the feet for abnormalities of

the skin and nails (colour, texture and lustre) ,foot deformities; also the practice of pedicure, and the use of appropriate foot wear. The casual plasma glucose (CPG) level at presentation was documented in all subjects. Data was analyzed using Student's t- and Chi square tests as appropriate; the level of statistical significance was set at $p<0.05$.

RESULTS

A total of 49 DM persons (30 males, 19 females) were studied. Type 2 DM was diagnosed in 37 (75.5%) persons and Type 1DM in the others; in 8 (16.3%) persons, DM was diagnosed on development of DFU. The mean age was 56.5 (12.9) years, mean DM duration was 8.9 (6.0) years and mean CPG at presentation was 11.6 (7.9) mmol/L. Type 2 DM persons were significantly older, with higher mean CPG and lower mean DM duration than type 1 DM persons (see Table 1). Table 2 shows the distribution of DM persons by sex and occupation. The majority of persons were in the group of policemen/teachers/ clergymen, part-time farmers and traders. Comparison of the proportion of affected persons in the various occupations yielded a significant difference ($X^2 = 16.9$, df = 6, $p< 0.02$).

Figure 1 shows the prevalence of risk factors of DFU in this study. Improper foot-care, peripheral neuropathy and visual impairment were identified risk factors in 19 (38.8%), 13 (26.5%) and 6 (12.2%) persons respectively. In 4 (8.2%) persons, there were no identifiable risk factors. Twelve (24.5%) DM persons had hypertension, 4 (8.2%) persons had previous amputation for DFU, 2 (4%) males were smokers and only 1 (1%) male admitted alcohol use.

Figure 2 shows the frequency of occurrence of the identified precipitating factors of DFU in this study. Spontaneous blisters accounted for 46.9% of cases, puncture injuries 20.4%, burns/ scalds 14.3% and rat bites in 2% of cases.

Table 1: Characteristics of persons with diabetic foot ulcers.

Parameters	Type 1 DM (n = 12)	Type 2 DM (n = 37)	p – value
Age (years)	41.5 (8.6)	61.1 (19.3)	<0.0001
DM duration (years)	11.5 (5.5)	7.9 (6.4)	<0.04
CPG (mmol/L)	10.8 (4.8)	12.7 (8.4)	<0.04

Results in mean (SD)
CPG = Casual plasma glucose.

Table 2: Distribution of DFU persons by sex and occupation

Occupation	Sex	
	Males	Female
Farmers	4	1
Policemen, Teachers, Clergymen	7	0
Traders	4	11
Unemployed/part-time farmers	5	6
Accountant/Journalist	3	0
Artisans*	4	1
Drivers	3	0

* Artisans = Plumbers, Welders etc.
$X^2 = 16.91$, df = 6, $p < 0.02$.

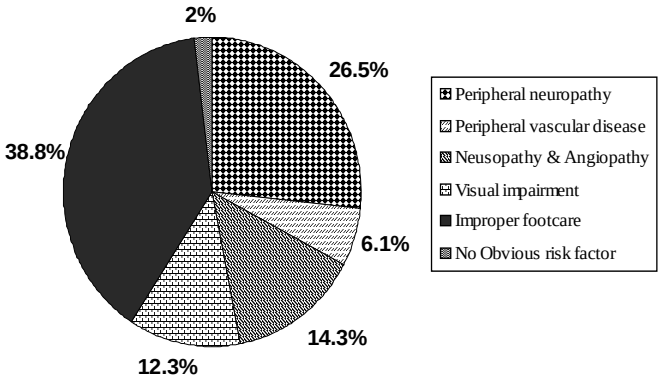

Figure 1: Prevalence of risk factors of DFU.
Footnotes
(1) Improper footcare includes walking unshod, poor pedicure and use of inappropriate footwear.
(2) Visual impairment includes refractive errors, cataracts and retinopathy.

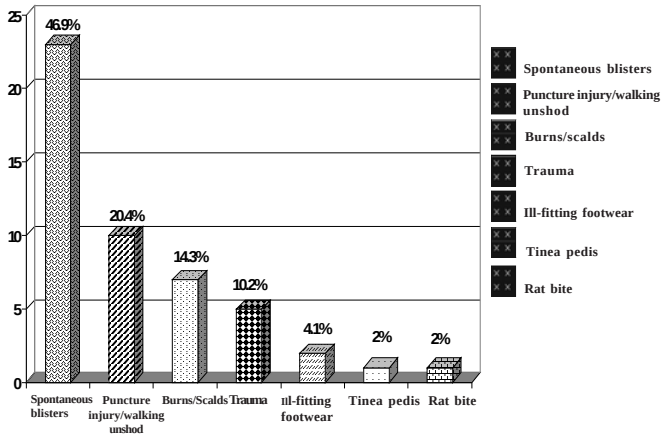

Fig. 2: Precipitating events of diabetic foot ulcers

DISCUSSION

Diabetic foot lesions are a major cause of morbidity and mortality in Nigerians with DM[9,11,14,18]. The mean age of affected persons, the slight male preponderance and the predominance of Type 2 DM in this study are all similar to previous reports[6,11,14,19]. Males with DFU tended to present at a younger age, with shorter DM duration than their female counterparts. In our locale, men (irrespective of their primary occupation) engage in farming and similar activities, a practice which may predispose them to injuries and probably contributing to the male preponderance in this study.

The majority of affected persons were partially skilled or unskilled workers, similar to previous reports[6,14,19]. The most common risk factors for foot ulceration identified in our study were improper foot-care and peripheral neuropathy. Improper foot-care encompasses walking unshod, use of inappropriate footwear and improper pedicure. This may account for the higher proportion of affected persons in this category compared with previous Nigerian studies[9,14,15]. The low prevalence of peripheral vascular disease in this study could be as a result of the non-availability of Doppler sonography for peripheral vessels in our

centre. The peripheral vessels were assessed by palpation, and early cases may have been missed. Clinically significant peripheral neuropathy can be detected by using the 128mHz tuning fork, as done in this study. The 128mHz tuning fork is also useful as a screening tool to identify at-risk patients[20,21]. However, this may be subjective, and the biosthesiometer provides a more objective assessment of vibratory perception. The non-availability of a biosthesiometer in our centre may have contributed to an unintentional under-estimation of the prevalence of peripheral sensory neuropathy in our study. Visual impairment was not as commonly seen as in previous African studies[13,22]. We believe that this may be due to the small number in our study.

Spontaneous blisters, puncture injuries/walking unshod were the most common precipitating factor in this study, similar to the report by Ogbera[23]. Unlike the reports by Dagogo – Jack[9], Akanji and Adetuyibi[14], our study showed a large number of DFU precipitated by burns/scalds. These occurred while affected persons were attempting to warm their 'numb' feet. This finding underscores the importance of appropriate health education on foot-care, which cannot be overemphasized. An interesting case was the person with DFU precipitated by rat bite. A similar case had been reported by Dagogo-Jack[9]. There is the need to ensure that education on personal hygiene and care of the environment is included in all health talks to DM persons, to avoid similar incidents in the future.

CONCLUSION

The risk and precipitating factors associated with DFU in our study are similar to previous reports, with a few exceptions. We believe that appropriate, accurate and timely health education on foot-care for all DM persons should be instituted at all levels of healthcare delivery. Also, there is the need for all tertiary health facilities in Nigeria to be equipped with the state- of- the-art equipment required for the early detection and management of the "at- risk foot" for all persons with DM. Finally, DM foot care should ideally involve a multi-disciplinary approach, with team members such as Endocrinologists, Podiatrists, Vascular/ Plastic/Orthopaedic Surgeons, Pedorthists, Diabetes Nurses etc. However, the acceptance and practice of appropriate foot care practices by the DM person is vital to the success of any comprehensive foot care programme. Therefore, we recommend that all health personnel caring for DM persons should have the necessary training in all aspects of foot care. They should also utilize the opportunity of consultations by DM persons to teach DM foot care. Ultimately, the results would be a reduced rate of lower- extremity amputations and DFU in our locale, with reduced DM morbidity and mortality.

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