

EVALUATION OF “CARE OF THE FOOT” AS A RISK FACTOR FOR DIABETIC FOOT ULCERATION: THE ROLE OF INTERNAL PHYSICIANS

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ABSTRACT

Background and Objectives: Several risk factors predispose the diabetic patient to foot ulceration, including “inadequate care of the foot”. This risk factor for foot ulceration has not been previously evaluated among Nigeria diabetic patients and is the objective of this study.

Subjects and Methods: One hundred and twenty (120) diabetic patients with and without symptoms of peripheral neuropathy receiving care at the medical outpatient department (MOPD) and the diabetic clinic of the Nnamdi Azikiwe University Teaching Hospital Nnewi were recruited consecutively as they presented. They were administered structured questionnaires to assess some variables concerning care of their feet as provided to them by their physicians.

Results: Among the 120 diabetic participants, 83(69.2%) had neuropathic symptoms (the symptomatic participants) while 37(30.8%) were asymptomatic (the asymptomatic participants). Eighty (80; 96.4%) of the symptomatic vs 36(97.3%) of the asymptomatic participants had never had their feet examined by their physician. Also, 26(31.3%) of the symptomatic vs 12(32.4%) of the asymptomatic participants had never received any form of advice on how to take special care of their feet by their physician, and 26(31.3%) of the symptomatic vs 6(16.2%) of the asymptomatic participants walked unshod most times in their immediate surroundings.

Conclusion: Physicians do not provide adequate care to the feet of their diabetic patients irrespective of the presence or absence of neuropathic symptoms, making this variable a critical risk factor for diabetic foot ulceration and amputation. Continuing medical education to health care providers emphasizing adequate “care of the foot” of the diabetic patient, will reduce avoidable loss of limbs to diabetes.

Key Words: Diabetic Foot Ulceration, Peripheral Neuropathy, United Kingdom Screening Test. (*Accepted 18 February 2008*)

INTRODUCTION

Individuals with diabetes mellitus (DM) are predisposed to foot ulceration primarily because of the presence of peripheral neuropathy (sensory, motor, autonomic) and peripheral vascular disease (macro and microangiopathy).¹ Other known risk factors for foot ulceration in DM include foot deformity (and associated high plantar pressure), previous history of foot ulceration or amputation, male gender, elderly age, long duration of hyperglycaemia/poor glycaemic control and lack of adequate care of the foot.²⁻⁵ Lack of adequate care of the foot as a risk factor for diabetic foot ulceration (DFU) may be grossly underestimated and under reported.

A survey of 1434 physicians in the United States of America focusing on how closely they adhered to the

nationally promoted and American Diabetes Association (ADA) endorsed recommendations for routine care revealed that only about 50 percent performed semi annual neurologic and foot examination.⁶ Likewise, in a major California Health Maintenance Organization (HMO) that provides care for 14,539 diabetic patients, only 6 percent had a documented foot examination within the previous year.⁷

It is recommended that clinicians examine the feet of those with DM that are at high risk for foot problems at each clinic visit^{8,9}, but such examinations reportedly occur in only about 12.3 percent of visits to diabetes specialty clinics.^{10,11}

OBJECTIVE: This study seeks to evaluate one of numerous possible risk factors for foot ulceration adequacy of care of the foot as provided by internal physicians to their diabetic patients and so determine the role of “adequacy of care of the foot” as a risk

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factor for diabetic neuropathic foot ulceration among diabetic patients without current or previous foot ulceration.

METHODOLOGY

Setting: The study was done at the Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, a 268 bed tertiary health institution in Anambra State, South Eastern Nigeria. The hospital has additional 500 beds in outposts spread within Anambra State and manned by primary care, family and community physicians. While not having a strict catchment area, most patients come from Anambra State with a population of about 3 million. Referrals also come from a large catchment area of other neighboring states in South-Eastern Nigeria including Imo, Abia, Enugu, Cross-River, Akwa-Ibom, Ebonyi, Rivers and Delta states.

Design: The study was a cross-sectional, hospital-based, descriptive study.

Subjects: Following informed consent and ethical approval, 120 diabetic participants were recruited consecutively as they presented to the medical outpatient department (MOPD) and diabetic clinic of the Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi. They included known diabetic patients (currently on treatment with oral hypoglycemic agents or insulin^{4,12}) and newly diagnosed diabetic patients as defined by the World Health Organization (WHO) 1999 Diagnostic Criteria.¹³ None of the study subjects had a current foot ulcer at the time of the study.

The study subjects were administered structured questionnaires to assess some variables concerning care of their feet as provided to them by their physicians, including- foot examination ever by their physician, advice on foot care by their physician and ambulating unshod within their immediate environment/compound. At the point of administering this questionnaire to each participant, a clinical scoring system - the United Kingdom Screening Test (UKST)¹⁴ was applied to each participant and used to screen/score for symptoms of peripheral sensory neuropathy, to objectively separate the symptomatic from the asymptomatic participants. The UKST is a two part diagnostic test comprising symptoms score and signs score and was used to determine the prevalence of peripheral neuropathy (PN) in over six thousand diabetic patients in the United Kingdom. The symptoms score component of the UKST was used to separate the study population into two groups those with symptoms of PN (the symptomatic group) and those without symptoms of PN (the asymptomatic group). This separation was necessary to properly determine if the presence or absence of neuropathic symptoms influenced physician attitude towards providing

adequate care for the diabetic foot. Since the UKST instrument is a screening instrument previously unapplied to local (Nigerian) studies involving diabetic patients, a pretest questionnaire was initially developed based on the UKST symptoms score only and administered to 40 diabetic patients with and without foot complications, recruited randomly from the study center to assess performance and applicability of this screening instrument for PN among Nigerian diabetic patients. All 40(100%) subjects gave responses easily scored using the UKST symptoms score confirming the applicability of the screening tool. The subjects of the pretest trial were excluded from the study population proper.

The symptoms of PN scored (see Table1) were the abnormal sensations felt by the patients in the feet/leg namely:

: Burning, numbness or tingling, which score 2 points

: Fatigue, aching or cramping, which score 1 point. The impact of site of discomfort, time of worst symptoms, night-time awakening and alleviating factors contributed further scores. Maximum symptoms score was 9 graded as follows:

: Normal (no PN)	0-2
: Mild PN	3-4
: Moderate PN	5-6
: Severe PN	7-9

The criteria for symptomatic PN was presence of moderate (5-6) or severe (7-9) symptom score, a criterion chosen to eliminate the risk factor of overestimation of symptomatic PN by including mild symptom scores. Mild symptoms scores may be transient and may also occur normally in the general (non-diabetic) population with increasing age.

Other background data obtained included subjects age (years), gender, blood pressure, weight (Kg) and height (meters) using stadiometer, age at first diagnosis of DM and duration of DM (years). The Body Mass Index (BMI) in Kg/m² was calculated from the weight (kg) divided by the square of the height (meters) and Waist Hip Ratio (WHR) from the waist circumference (cm) and hip circumference (cm). The waist circumference was measured from halfway (mid point) between the superior iliac crest and the lower margin of the rib cage in the mid-axillary line while the hip circumference was measured at 1/3 of the distance between the superior iliac spine and patella. Baseline fasting venous plasma glucose was estimated by the glucose oxidase method and read colorimetrically in the chemical pathology laboratory of the NAUTH Nnewi.

Statistical analysis was by SPSS (version 10) evaluating and presenting simple descriptive statistics. The mean, standard deviation and percentages of all data were derived. The Z test was used to determine the differences between the mean

ages, glycaemic control and obesity status (BMI and WHR) of the two study groups while the Chi square test was used to evaluate the difference in the gender distribution of the symptomatic and asymptomatic study groups, and to test the variables of care of the foot between the two groups. p value of = 0.05 was taken to indicate statistical significance.

RESULTS

Among the 120 diabetic participants, 83 (69.2%) had neuropathic symptoms (the symptomatic group) while 37(30.8%) were asymptomatic. Table 2 shows the age and sex distribution of the study subjects while Tables 3 shows their clinical characteristics. The age range for the symptomatic group was 40-78 years and 30-76 years for the asymptomatic group. The mean age of the symptomatic group was 60.4 9.22 years and 48.51 ± 15.35 years for the asymptomatic group. The difference in the mean ages of the two study groups was statistically significant (Z=5.26, df=118, p<0.05).

In the symptomatic group, 53(63.9%) were males while 30(36.1%) were females and in the asymptomatic group, 20(54.1%) were males compared to 17(45.9%) females. The difference in the gender distribution of the two study groups was not statistically significant ($\chi^2=1.032$, df =1, p =0.31). The majority of the symptomatic 71(85.5%) and asymptomatic 31(83.8%) participants had poor glycaemic control (plasma fasting blood sugar FBS=6.0 mmol/L) and the difference in the mean FBS for the symptomatic (12.9±5.4mmol/L) and asymptomatic (12.2±4.6mol/L) participants was not statistically significant (Z= 0.69, p = 0.495). The difference in the mean BMI of the symptomatic (23.65 ±3.33) and asymptomatic (26.27 ± 5.16) participants was statistically significant (Z=3.33, df=118, p<0.001) but the difference in the mean WHR was not (symptomatic: 0.92 ± 0.089; asymptomatic: 0.94 ±0.08; Z = 1.14, df = 118, P =0.256).

Table 4 shows the variables of care of the foot evaluated in the two study groups including foot examination by physician, advice on the foot care and use of protective foot wear in the immediate surrounding of the participant. Among the symptomatic participants, 80(96.4%) had never had their feet examined by their physician, 26(31.3%) had never received any form of advice to take special care of their feet by their physician while 26(31.3%) walked barefoot most times in their immediate environment. Among the asymptomatic participants 36(97.3%) had never had foot examination, 12(32.4%) had received no form of advice to take special care of their foot while 6(16.2%) walked unshod most times in their immediate environment. There was no statistically significant difference (χ^2

=1.99, df =2, P =0.37) between the two study groups in the variables for adequacy of care of the foot evaluated.

Table 1: The United Kingdom Screening Test (UKST): Symptom Score and Grading.

Symptom	Score			Overall
	1 point	2 points	Maximum	
1 Abnormal Sensations Felt				
- Burning, numbness or tingling	-	✓	2	
Fatigue, Aching or Cramping	✓	-	1	
2 Site of Discomfort				
- Feet or Soles	-	✓	2	
- Calves	✓	-	1	
- Elsewhere	-	-	0	
3 Time of Worst Symptoms				9
- Night only	-	✓	2	
- Both Day And Night	✓	-	1	
- Day only/ Don't Know	-	-	0	
4 Alleviating Factor				
- Walking Around	-	✓	2	
- Standing	✓	-	1	
- Sitting, Lying or No relief	-	-	0	
5 Night-Time Awakening				
- Yes	✓	-	1	
- No	-	-	0	

Grade: 0-2 (Normal) No Peripheral Neuropathy
3-4 Mild Peripheral Neuropathy
5-6 Moderate Peripheral Neuropathy
7-9 Severe Peripheral Neuropathy

Table 2: Age and Sex Distribution of Participants.

Age Group (Years)	Cases				
	Symptomatic		Asymptomatic		Total (%)
	Male (%)	Female (%)	Male (%)	Female (%)	
30-39	0(0.0)	0(0.0)	2(10.0)	11(64.7)	13(10.8)
40-49	6(11.3)	2(6.7)	7(35.0)	0(0.0)	15(12.5)
50-59	20(37.7)	14(46.7)	3(15.0)	6(35.3)	43(35.9)
60-69	14(26.4)	10(33.3)	6(30.0)	0(0.0)	30(25.0)
≥70	13(24.6)	4(13.3)	2(10.0)	0(0.0)	19(15.8)
Total	53(100.0)	30(100.0)	20(100.0)	17(100.0)	120(100.0)

Table 3: Clinical Characteristics of the Participants.

Variables	Symptomatic Group N=83	Asymptomatic Group N=37	P-Value
Gender (M:F)	53:30	20:17	0.31
Mean Age (Years)	60.4± 9.22	48.51±15.35	0.0001
Age Range (Years)	40-78	30-76	-
Mean FBS (mmol/L)	12.9±5.4	12.2±4.6	0.495
Mean BMI (kg/m ²)	23.65±3.33	26.27±5.16	0.001
Mean WHR	0.92±0.089	0.94±0.08	0.256

Table 4: “Care of the Foot” Variables.

Care of the Foot Variables	Study Population		
	Symptomatic (%) N=83	Asymptomatic (%) N=37	Total (%) N=120
No Foot Examination Ever	80 (96.4)	36 (97.3)	116 (96.7)
No Foot Advice Ever	26 (31.3)	12 (32.4)	38 (31.7)
Barefoot Most Times	26 (31.3)	6 (16.2)	32 (26.7)

DISCUSSION

Over 120 million people in the world suffer from diabetes mellitus (DM) and many have diabetes foot ulcers (DFUs), which may eventually lead to an amputation.¹⁵ The costs associated with DFUs can be tremendous and remains a major burden to both the patient and the health care system.^{16,17} Studies from Nigeria and elsewhere consistently report that the diabetes mellitus foot syndrome (DMFS) is the single most common cause of prolonged hospitalization amongst people with diabetes.^{18,19} Thus, identification of the risk factors for foot ulceration is of paramount significance in the prevention of this enormous complication of DM. Several risk factors predispose the diabetic patient to foot ulceration with peripheral neuropathy and peripheral vascular disease being major risk factors.¹ Other reported risk factors include foot deformity, previous history of foot ulceration or amputation, male gender, elderly age, poor glycaemic control and poor care of the foot.²⁻⁵ Evaluation of “adequacy of care of the foot as provided by internal physicians to their diabetic subjects” as a risk factor for foot ulceration among Nigerians living with DM is an entity that has not been previously addressed. Studies from the developed nations report that lack of adequate care of the foot is indeed a major risk factor for DFU. A survey of 1434 Physicians in the United States focusing on how closely they adhered to the nationally promoted and American Diabetes Association (ADA) endorsed recommendations for routine foot care revealed that only about 50% performed semi-annual neurologic and foot examination.⁶ Likewise, in a major California Health Maintenance Organization (HMO) that provides care for 14,539 diabetic patients, only 6% had a documented foot examination within the previous year.⁷ It is recommended that clinicians examine the feet of those with diabetes mellitus that are at high risk for foot problems at each clinic visit^{8,9} but such examinations reportedly occur in only about 12.3% of visits to diabetes specialty clinics.^{10,11} The variables of “adequacy of care of the foot as provided by physicians to their diabetic subjects” evaluated in this study were - examination of the foot ever by a physician, advice on foot care ever by a physician and usage of protective foot wear while ambulating in the immediate environment of the participants. The participants were divided into two groups- those with symptoms of peripheral neuropathy (the symptomatic group) and those without symptoms of peripheral neuropathy (the asymptomatic group). Those with symptoms of peripheral neuropathy are supposedly at higher risk for DFU and are expected to receive closer attention from their physicians considering the risk status

profile of peripheral neuropathy in causing DFU, and vice versa for those without neuropathic symptoms. The results of our study contradict these empirical expectations and show that there is gross “inadequacy in care of the foot” in both the study groups with no statistically significant difference between the two groups for the variables of “adequacy of care of the foot” evaluated.

The dismal state of inadequate care for the foot of the Nigerian diabetic patient found in our study agrees with reports from the developed nations.^{6,7,10,11}

Regarding foot examination ever by a physician, 96.4% of the symptomatic participants and 97.3% of the asymptomatic participants had never had their foot examined by a physician. 31.3% of the symptomatic participants and 32.4% of the asymptomatic participants had never received any form of advice on how to take special care of their foot from their physician. 31.3% of the symptomatic and 16.2% of the asymptomatic participants walked unshod most times in their immediate environment. Previous Nigerian studies have also reported that walking unshod is a feature of diabetic patients with foot ulceration and those without foot ulceration.^{19,20}

CONCLUSION

“Inadequate care of the foot “ of the diabetic patient by their physicians is a global problem and seemingly impacts equally diabetic patients with and without symptoms of the alarming risk factor for DFU- diabetic peripheral neuropathy. Considering the heavy financial, physical and emotional burden to the patient (and the health care system) associated with diabetic foot complications, identification of the risk factors for foot ulceration, especially preventable risk factors such as “care of the foot” remains of paramount significance in the prevention of this dreaded complication of diabetes mellitus.

Continuing education targeted at health care providers (and even receivers) to improve and sustain awareness of the need to take better care of the foot of diabetic patients is recommended to reduce avoidable loss of limbs to diabetes. Further local studies evaluating other variables of “care of the diabetic foot”- both physician and patient variables- are needed to document in greater detail, the scope and impact of this totally preventable risk factor for the diabetes mellitus foot syndrome.

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