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Contents

Original Articles

PREDICTORS OF LOWER EXTREMITY AMPUTATION AMONG PATIENTS WITH DIABETIC FOOT ULCER IN A TERTIARY HEALTH FACILITY IN NORTH CENTRAL NIGERIA

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ABSTRACT

INTRODUCTION: Diabetic foot ulcer is a complication of diabetes mellitus of great public health importance. It has the potential of leading to the dreaded sequelae of lower extremity amputation. This outcome is associated with significant morbidity and mortality, hence the need to explore its predictors among persons with diabetic foot ulcers.

METHODOLOGY: The study involved the review of the medical records of seventy (70) in-patients who had received treatment for diabetic foot ulcer at the Federal Medical Centre, Keffi, North Central Nigeria. In addition to obtaining socio-demographic and medical history, information on the Wagner grade of the ulcer, the presence of peripheral sensory neuropathy (using the 10g monofilament) and the presence of osteomyelitis (using plain X-ray of the foot) were obtained and documented. The prevalence rate of lower extremity amputation was also determined.

RESULTS: The study population comprised 52.9% males and 42.1% females. The mean age for male and female participants were 53.4±10.5 and 58.8±13.0 years respectively (t = 2.35; p = 0.061). Majority of study subjects (37.1%) had Wagner grade 2 disease. Prevalence rate of amputation was 38.6%. Among the potential predictors of lower extremity amputation analyzed (Age, sex, foot care education, duration of diabetes, cigarette smoking, walking bare feet, impaired vision, peripheral neuropathy, hypertension, previous foot ulcer, osteomyelitis), none of them demonstrated a significant association with lower extremity amputation.

CONCLUSION: The list of potential predictors of lower extremity amputation considered in this study is by no means exhaustive. More studies involving larger study populations and other potential predictors of lower extremity amputation not considered in this work (such as peripheral artery disease and glycated haemoglobin) are encouraged.

KEY WORDS: Amputation, Neuropathy, Osteomyelitis

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INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder that continues to assume an ever increasing global health significance. This is as a result of the complications associated with the condition, which is responsible for the significant morbidity and mortality seen among individuals with diabetes mellitus. The reduction in the quality of life associated with chronic complications of diabetes is expected to be a huge problem in the African continent where the prevalence of the disease is projected to almost double over the next two decades[1].

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One complication that deserves a special mention is the diabetic foot ulcer and the associated increased risk of lower extremity amputation. Diabetic foot ulcer is second to trauma as the leading cause of lower extremity amputations globally, and is estimated to account for about 85% of lower limb amputations among persons living with diabetes mellitus[2]. It is estimated that 5% of all patients with diabetes mellitus will present with a history of diabetic foot ulcer and that the lifetime risk of a diabetic developing a foot ulcer is 15%[3]. It is obvious to see why lower extremity amputation is a dreaded potential sequelae of diabetic foot ulcer. This is in view of the importance of ambulation to everyday life. There is also the risk of mortality following lower extremity amputation, which is put at 13 to 40% at 1 year follow up and 39 to 80% at 5 year follow up[4]. In addition,

the fact that one limb has suffered the fate of amputation puts the contralateral limb in danger. It is estimated that 58% of persons with diabetes have contralateral amputation 3 to 5 years after the first amputation[5]. It is therefore important to spare no effort in investigating factors associated with lower extremity amputation among patients with diabetes mellitus as this knowledge will contribute to the development of effective preventive strategies.

AIM AND OBJECTIVES

This study aims to determine the prevalence of lower extremity amputation among patients with diabetic foot ulcer accessing care at the Federal Medical Centre (FMC), Keffi, North Central Nigeria. It also seeks to determine the independent predictors of lower extremity amputation among this category of patients.

STUDY PROCEDURE

The study population comprised 70 adults aged 20 to 80 years who had been on admission with diabetic foot ulcer at FMC Keffi between April 2016 to April 2017. The necessary records of the study participants were obtained from the Medical Records Department of the hospital.

Socio-demographic and relevant medical history were documented for each participant. The findings on foot examination for the presence of sensory neuropathy using the 10g monofilament was documented, as well as the reports of plain X-ray of the foot for detection of any evidence of osteomyelitis. Each participant had his/her foot ulcer staged according to the Wagner grading of diabetic foot[6]:

Grade 0 – foot at risk
Grade 1 – superficial ulcer
Grade 2 – deep ulcer (with no bone involvement)
Grade 3 – deep ulcer with bone involvement
Grade 4 – forefoot gangrene
Grade 5 – full foot gangrene

A record was also made of all those who eventually had lower extremity amputation in the course of management of their foot ulcers.

STATISTICAL ANALYSIS

The data was entered into the Microsoft Excel spread sheet and analyzed using the Epi-Info statistical software. Quantitative variables were expressed as mean±standard deviation, and the student t-test used to determine the level of significance in the difference between means. Bivariate analysis was employed in the determination of the independent predictors of amputation in the study population. A p value of less than 0.05 was considered statistically significant

RESULTS

A total of 70 participants took part in the study. The population comprised 37 males (52.9%) and 33 females (47.1%). The mean age for male and female participants were 53.4±10.5 and 58.8±13.0 years respectively ($t = 2.35$; $p = 0.061$). Civil servants and traders constituted 21.4% of the study population, and farmers 14.3%. Eighteen study participants (25.7%) had a history of diabetes mellitus over a duration of greater than 10 years. Foot ulcers were traumatic in 48.6% of cases. At the end of the study, 38.6% of participants had lower extremity amputation.

Table 1 outlines the frequency of the different grades of foot ulcer among study participants. The majority of them (37.1%) had grade 2 disease

Table 1: Showing the antibiotic susceptibility pattern of the isolates

Wagner grade	Frequency
Grade 1	3 (4.3%)
Grade 2	26 (37.1%)
Grade 3	9 (12.9%)
Grade 4	15 (21.4%)
Grade 5	17 (24.3%)

Table 2: Clinical information of study participants

	YES	NO
Ever received diabetic foot care education?	10 (14.3%)	60 (85.7%)
Habitually walk bare feet?	17 (24.3%)	53 (75.7%)
Previous foot ulcer	8 (11.4%)	62 (88.6%)
Impaired vision	15 (21.4%)	55 (78.6%)
Cigarette smoking (presently)	5 (7.1%)	65 (92.9%)
Hypertension	37 (52.9%)	33 (47.1%)
Neuropathy	33 (47.1%)	37 (52.9%)
Osteomyelitis	13 (18.6%)	57 (81.4%)

Table 3: Independent predictors of lower extremity amputation

Predictor	OR	95% C I	P value
Age > 50 years	2.52	0.85 –7.50	0.090
No foot care education	0.5 4	0.13 – 1.42	0.532
Diabetes > 10 years	1.59	0.52 – 4.80	0.408
Male sex	1.67	0.63 – 4.43	0.298
Cigarette smoking	2.56	0.39 – 16.4	0.309
Impaired vision	0.50	0.14 – 1.79	0.285
Walking bare feet	0.26	0.06 – 1.01	0.051
Hypertension	1.19	0.45 – 3.14	0.720
Previous ulcer	0.95	0.21 – 4.34	0.947
Neuropathy	0.66	0.25 – 1.74	0.395
Osteomyelitis	1.80	0.55 – 1.52	0.965

OR = Odds Ratio; C I = Confidence Interval

DISCUSSION

Among those who took part in this study, 38.6% had lower extremity amputation. The prevalence rate of lower extremity amputation among persons with diabetic foot ulcer shows great variation depending on the part of the country or the world under consideration. Ngim et al[7] in Calabar South-south Nigeria studied 36 persons with diabetic foot ulcer and observed a prevalence of lower extremity amputation of 53%. In the study by Edo et al[8] at the University of Benin Teaching Hospital Nigeria, a larger study population was involved (61 participants), and the amputation rate was 52.2%. In that study, the majority of study participants (44.3%) had Wagner grade 4 disease, as compared to this study, where the majority of participants had grade 2 disease. In Iran, a much lower prevalence rate of 28.8% was observed by Shojaiefard et al[9] in the study population of 146 subjects with diabetic foot ulcer. Another study in India observed a prevalence of 34.4%[10] (persons with Wagner grade 5 disease were excluded from the study)

In addition to differences in study designs and the size of study populations, ethnic and racial differences can also explain the variations observed in the prevalence of lower extremity amputation in studies from different parts of the world. This was an observation made by Lavery et al[11] in a study on this subject matter among various minority ethnic populations in the United States. A similar finding was also made by the World Health Organization (WHO) in a multi-national research involving countries in North America, South America, Europe and Asia[12].

In this study, 48.6% of participants reported that their foot ulcers were of traumatic origin. The study by Ngim et al[7] found a slightly higher value of 52.7% while Edo et al8 observed a much higher value of 68%. Solomon et al[13] reports that among persons with diabetic foot ulcers in Trinidad and Tobago, 51% of them were of traumatic origin. It should be noted that individuals with neuropathic foot ulcers may not be able to ascertain whether their foot ulcer was preceded by trauma due to loss of sensation. This can influence the proportion of individuals with diabetic foot ulcer who give a history of trauma as the aetiology of their condition.

Among the participants who took part in this study, none of the following were observed to be independent predictors of lower extremity amputation: Age > 50 years, male sex, no history of foot care education, diabetes > 10 years, lmpaired vision, previous foot ulcer, habitual walking bare feet, neuropathy, hypertension, cigarette smoking and osteomyelitis. A similar finding was made by Shojaiefard et al[9] who did not find any association between age, duration of diabetes, smoking, retinopathy and the risk of lower extremity amputation among study participants with diabetic foot ulcers. On the other hand, Carlson et al[14] observed that male gender, osteomyelitis and retinopathy significantly increased the chances of amputation, precisely toe amputation and not the other forms of lower extremity amputation. Markowitz et al[15] using a case-control study design format also established an association between male gender and the risk of lower extremity amputation. A prospective study in the United States involving a much larger study population (776 participants) revealed that lower extremity amputation was more likely in the presence of neuropathy and peripheral vascular disease[16]. Lower limb vascular supply was not part of the variables considered in this study.

CONCLUSION

Lower extremity amputation is a potentially unfortunate outcome of diabetic foot ulcer. More studies involving larger study populations are encouraged to uncover factors associated with this outcome in order to facilitate measures aimed at its prevention.

CONFLICTS OF INTEREST

We have none to declare.

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