

Magnitude of limb loss attributable to diabetes mellitus in a tertiary institution in Nigeria.

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Abstract

Background: Diabetes mellitus (DM) and its complications, continues to pose enormous challenge to health and financial stability. Diabetes has remained a source of national and global economic burden. It has been observed lately that incidence of diabetic foot ulcer (DFU); one of the complications of DM, is on the increase and it is contributing hugely to financial loss, morbidity and mortality among diabetic patients. This is taking a great toll on affected individuals in terms of cost of treatment, deformities sustained, number of working/productive days lost while on admission and its attendant economic implications, and ultimately mortalities recorded. The aim was to determine the magnitude of limb loss or lower extremity amputation attributable to DM over a period of 12 months in tertiary institution and to assess the clinical profile of the patients.

METHOD: This is a retrospective study of the records of all patients that were consecutively booked for lower limb amputation and operated upon in the last 12 months at UNIOSUN Teaching Hospital, Osogbo, South-Western Nigeria. Out of these total, cases of DFU were extracted to form another study group and then studied in detail.

RESULTS; A total of 38 patients had lower limb amputation from July 2021 to May 2022. Twenty three of the total number of amputations had DFU with a huge proportion of 60.5%, followed by road traffic accident with 28.9% (n=11) Of the 23 diabetic cases, females were 15 with M:F ratio of 1:1.9. Mean age was 63±11.18 years. Mean duration of DM was 8.06±5.64 years. 78.3% had no foot care education and Doppler USS confirmed atherosclerosis in 100% of the patients. The commonest bacteria isolated was Proteus 34.8%. Length of hospital stay ranged between 6 weeks to 16 weeks. Outcome of admission was largely successful with 95.7% discharged and 4.3% mortality.

CONCLUSION: DFU contributes markedly to morbidity and mortality. Long duration of DM, presence of PAD and DPN as well as advancement in age and wound infection with proteus bacterial are observed to be risk factors associated with gangrenous DFU. However, larger studies are needed to establish these factors as predictors of amputation in patient with DFU. Outcome was majorly good as majority of the patients were discharged.

Keyword: diabetes, diabetic foot ulcer, amputation, lower limb loss, peripheral arterial disease.

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Ampleur de la perte d'un membre attribuable au diabète sucré dans une école tertiaire au Nigéria

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Résumé

Objectif de l'étude : Dernièrement, l'incidence de l'ulcère du pied diabétique (UPD) ; une complication du diabète sucré, a considérablement augmenté et contribue énormément à la morbidité et à la mortalité. L'objectif est de déterminer l'ampleur de l'amputation du membre inférieur (AAMI) attribuable au DM sur une période de 12 mois et d'évaluer le profil clinique des patients.

Méthode de l'étude: Il s'agit d'une étude rétrospective des dossiers de tous les patients diabétiques qui ont subi une LLA au cours des 12 derniers mois à l'hôpital universitaire UNIOSUN d'Osogbo.

Résultat de l'étude : Trente-huit patients ont eu un LLA de juillet 2021 à mai 2022. Vingt-trois (60,5 %) des 38 cas opérés avaient un UPD. Les femmes étaient au nombre de 15 sur 23. L'âge moyen était de $63 \pm 11,18$ ans. La durée moyenne du diabète était de $8,06 \pm 5,64$ ans. L'athérosclérose était présente à 100 %. Protée sp. était la bactérie la plus couramment isolée. La proportion totale de cas sortis était de 95,7 %.

Conclusion: L'UPD contribue de manière marquée à la perte et à la déformation des membres dans notre société.

Mots-clés : Diabète, ulcère du pied diabétique, amputation, perte du membre inférieur.

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INTRODUCTION

Diabetes mellitus (DM), a metabolic disorder characterized by hyperglycaemia has remained a global health and economic challenge. The prevalence of DM is increasing exponentially in Africa and globally. Currently, staggering figures of about 537 million people are affected globally according to International Diabetes Federation (IDF) report. (1) A meta-analysis done a few years ago put the prevalence in Nigeria as 5.7% and extrapolation from this figure will translate to about 11.2 million Nigerians suffering from this condition. (2)

Several complications are associated with improperly managed DM. Common complications of diabetes mellitus include diabetic foot ulcer, blindness, and renal impairment among others. Diabetic foot ulcer (DFU) is one of the complications of DM and usually results from a combination of macrovascular and microvascular damage. (3) Diabetic foot ulcer contributes in no small measure to morbidity and mortality in developing countries like Nigeria and sub-Saharan Africa (4). It constitutes a huge financial burden especially where hospital services and other related payments are made out-of-pocket. It also leads to financial losses from productive work days lost to a lengthy period of hospital admission. (5, 6, 7) It is a major contributor to limb deformity in form of joint deformity or amputation. (5, 6) It contributes to mortality which can be as high as 10% during admission and as much as 35-50% 3 years post-surgery. (7, 8) Diabetic foot ulcer has been an age-long problem that imposes a heavy burden on individuals and health institutions with no respite in view going by the high rate of increase in the prevalence of DM especially in low/middle-income countries. (6)

There is therefore an urgent need to evaluate the current magnitude of the contribution of DFU to limb loss in our environment in this post COVID 19 pandemic period and to study the clinical events that are common to patients with gangrenous DFU. To this end, we sought to determine the proportion of diabetic foot ulcers that resulted in amputation during the study period and observe factors or clinical profiles common to the patients studied which can serve as a guide for preventive and therapeutic measures to limit morbidity and mortality in our environment, where novel intervention for DFU is beyond the reach of many individuals who cannot afford the standard DFU management.

MATERIALS AND METHOD

It was a descriptive/retrospective study of patients who had amputation done over 12 months between July 2021 and May 2022 at UNIOSUN Teaching Hospital, Osogbo, South-western Nigeria. It is a tertiary hospital that receives patients from secondary and private healthcare facilities in Osun, Oyo, Ondo, Ekiti, and Kwara states. Ethical approval was obtained from the research and ethics committee of Osun State University. The main theatre operation record was used to determine the total number of amputations done during the study period. Following this, the details of the DM-related cases were copied and the file numbers were used to retrieve folders from the hospital records department. All adult diabetic patients who had amputation done during the study period were enlisted for the study. A structured questionnaire was used to extract demographic, clinical and other relevant information from the patients' folders. Peripheral arterial disease (PAD) was taken to be present with subjective history suggestive of PAD and Doppler USS diagnosis. Peripheral neuropathy was majorly based on subject's report in the history. Cut-off value for hypertension was according today JNC 7 or use of antihypertensives. (9) Abnormal random glucose was taken as 200mg/dl or 11.1 mmol/l. (10)

Data generated were processed using the statistical package for social sciences (IBM version 23. SPSS Inc, Chicago USA). Frequencies were expressed as percentages. Mean values were calculated for the variables measured.

RESULTS

A total of 23 patients had lower limb amputation secondary to DFU during the study period. This represented 60.5% of the total amputation carried out within 12 months. Female preponderance was observed with a F:M ratio of 1.9:1. Table 1. Elderly patients (aged 65 years and above) formed the largest proportion, and the mean age was 63.13 ± 11.18 years. Tables 1 and 2. The mean duration of DM was 8.06 ± 5.64 years. Table 2.

Clinical information showed that some established risk factors for DFU namely peripheral arterial disease (PAD) and diabetic peripheral neuropathy (DPN) were present in the cases studied. Other contributing factors to DFU in the patients are displayed in Table 3.

Laboratory investigations showed anaemia and poor glycaemic control. Table 2.

Doppler USS confirmed atherosclerosis in 100% of the patients and the commonest bacteria isolated was *Proteus* 34.8%, followed by *Staphylococcus* 14% and *Klebsiella* 13%. The left lower limb was observed to be more commonly affected and Wagner ulcer grade 4 was the most frequent.

The outcome of admission was good with 95.7% discharged and 4.3% mortality. The length of hospital stay ranged between 6 weeks to 16 weeks. Only 9 (39%) patients continued follow-up care after discharge.

DISCUSSION

Limb loss following a non-healing diabetic foot ulcer is one of the most devastating experiences that patients can have. It comes with a lot of challenges among which are psychological trauma, job loss, restriction in freedom of movement and other forms of impairment in quality of life. (11) It is therefore worrisome that many more people would experience limb loss going by the rapidly rising prevalence of DM especially in low/middle-income countries of which Nigeria is one. Without intervention, this trend will continue to have a negative impact on our society ranging from restricted social interaction, strain on relationships, loss of independence, stress on caregiver, reduced economic power and so on. Therefore, this is a topical health issue that needs urgent intervention to reduce this burden in our society.

Lower limb amputation secondary to DFU remains a major health challenge in developing countries like ours where health care services are paid for out of pocket. (12) The results from this study point to the fact that a lot has to be done to curb this menace in our society. A 3-year study carried out in Lagos University Teaching Hospital, between 1998-2000 reported 26 (42.6%) cases of lower limb amputation secondary to DFU out of a total of 61 cases of lower limb amputation carried out during the study period. (6) According to our findings, 23 DFU cases resulting in lower limb amputation - which is close to the total number seen over 3 years in the study mentioned above- were seen within a year in our facility and were responsible for more than two-thirds of the total number of amputation carried out in a year. This further corroborates the rapid rise in the incidence of DFU complicated by limb loss among DM patients. (13)

In our study, we observed that elderly patients were mostly affected. The mean age

observed in our study is similar to that reported in some foreign studies but higher in a multicenter study conducted in Nigeria. (14, 15, 16) It has been observed that wound healing tends to be slower in older people and advanced age increases the risk of peripheral arterial disease. (16, 17) Unfortunately, most elderly people have little or no economic power and limited physical strength to cater for their health and so loss of a limb will further reduce quality of life and shorten life span.

Female preponderance was observed in our study and this appears to be in tandem with what is usually seen in the larger population of DM patients. However, it is contrary to what was observed in a multiethnic study in the tropics. (18, 19)

From this study, none of the subjects seemed to have attended any health care facility where standard training and services for DM foot care offered by a podiatrist were available. It should be noted that Podiatrists are very few and not available in many health facilities including referral hospitals in Nigeria (12, 20). Majority were also not compliant with medications and clinic attendance. This is expected as many patients cannot afford the cost of DM medications and other necessary care and this still stands as a major barrier to diabetes care in Nigeria. (12, 21) Local treatment with home remedies before presentation in the hospital could contribute to the outcome of DFU. (21) Application of hot fermentation, incisions with non-sterile sharps, and the addition of potentially dangerous substances are some of the local practices that have been observed in practice. (21)

Long duration of DM was found in the patients and it has been documented that long-standing DM is a risk factor for PAD. Peripheral arterial disease was found to be present in all the subjects and it has been reported by authors to be an independent predictor of lower limb amputation in diabetic patients. (16, 18) Physiologically, adequate blood supply through patent blood vessels is necessary for the supply of oxygen, nutrients, and growth factors to aid wound healing promptly, any vascular compromise will lead to delayed wound healing and ultimately tissue necrosis/gangrene.

Another risk factor for DFU is diabetic peripheral neuropathy and it was found to be present in the study population. It is a major risk factor for DFU but has not been proven to be a significant predictor of lower limb amputation in DM patients (16, 22). The left lower limb was

more frequently involved accounting for about two-thirds of the patients studied. However in another study carried out Right lower limb was found to be more affected. (23) Wagner grades 4 and 5 were associated with limb amputation but grade 4 was commoner in our study. This is similar to a report by Edo et al. (16, 24) PAD, Wagner Grade 4 and wound infection have been reported as significant predictors of lower limb amputation in a recent study conducted among Nigerians. (16)

The mean PCV value suggested mild anaemia in the group studied. This could also potentiate existing hypoxia in the tissues at the extremities secondary to PAD. (25) The glycaemic control of many of the patients was poor. This was also observed in previous studies (16, 24). Though poor glycaemic control has not been found to independently predict amputation. (16) More than one-third had elevated blood pressure at presentation which may also be related to previously stated factors for poor glycaemic control. Hypertension has also been found to be commoner among DM patients who had major limb amputation. (18)

Proteus mirabilis was majorly found in the cultured wound specimen. This is similar to a study reported by Anyim et al in which *proteus mirabilis* was one of the major aerobes in DFU specimen of subjects though *staphylococcus aureus* was the most frequent aerobe (17.2%) cultured in that study which is close to 14% found in our study. (23) However, polymicrobial pattern is seen in many cases of DFU. (23) Wound infection was found in more than 70% of patients with DFU in the same report. (23) In this study, below-knee amputation accounted for a larger percentage of the surgeries performed. The outcome was largely good as 95.7 % of the patients were discharged and 4.3% mortality was recorded. This percentage of mortality is lower compared to 10% mortality rate that has been documented in the literature. (7) Management of these patients is successful, but it has been observed that some patients become depressed post-surgery and some others died within 3 years post-surgery (7, 8). This study revealed that only 39% continued with follow-up care with 61% having defaulted (21). This is quite worrisome and thus calls for another research in this area to find out the reasons for poor clinic attendance after having suffered some degree of setback from previous DFU. We think the challenges may be multiple ranging from financial limitation, abandonment, transportation issues, depression, and even death as previously observed in the

literature. (7, 8, 21)

CONCLUSION

In conclusion, diabetes foot ulcer has been found to be a major cause of lower limb loss especially among the elderly patients living with DM and contributing factors include peripheral arterial disease, peripheral neuropathy, poor drug compliance, wound infection, poor glycaemic control and anaemia. Therefore increased advocacy, early diagnosis of DM and regular health education and examination of the feet should be encouraged.

Limitations of the Study

1. Small sample size.
2. The study is retrospective, hence limited information was available and questionnaire for the research was filled with inferences drawn from the information documented in the patient's case files without room for further clarifications from the patients.
3. Peripheral sensory neuropathy was not objectively assessed with a standard instrument such as biothesiometer or Semmes-Weinstein monofilament.

Conflict of Interest: The authors declare that no conflicts of interest exist with regard to the publication of this paper.

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Table 1. Demographic characteristics of study group

Variable	Frequency	Percentage
Age group	N = 23	%
18-44 (young)	2	8.7
45-64 (middle aged)	9	39.1
≥65 (elderly)	12	52.2
Sex		
Male	8	34.8
Female	15	65.2
Source of referral		
Private	9	39.1
Self	14	60.9
Educational level		
No formal education	1	4.3
Primary	7	30.4
Secondary	6	26.1
Tertiary	9	39.1

Table 2. Clinical and laboratory characteristics of study group

	Mean ± SD	Minimum	Maximum
AGE	63.13±11.18	37.00	80.00
DM duration	8.06±5.64	.30	20.00
Duration of DM treatment	6.43±5.32	.00	18.00
RBS	11.79±4.89	6.50	29.60
PCV	30.26±3.60	22.00	36.00

Key: DM diabetes mellitus, RBS random blood glucose, PCV packed cell volume

Table 3. Clinical Characteristics of study population

Clinical information	Frequency	Percentage
Foot care education received		
None	18	78.3
Poor	5	21.7
Peripheral neuropathy symptoms		
Yes	23	100%
No	0	0%
PAD symptoms		
Yes	23	100%
No	0	0%
Drug compliance		
Yes	2	8.7
No	21	91.3
Dietary compliance		
Yes	21	91.3
No	2	8.7
Prior foot ulcer		
Yes	19	82.6
No	4	17.4
Foot affected		
Left	17	74
Right	6	26
Local intervention		
Yes	15	65.2
No	8	34.8
Ulcer grade		
4	16	69.6
5	7	30.4
Blood Pressure Status		
Controlled	15	65.2
Not Controlled	8	34.8
Random blood sugar		
Normal	7	30.4
Abnormal	16	69.6

Key: PAD: peripheral arterial disease