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A STUDY ON SURGICAL MANAGEMENT OF DIABETIC FOOT ULCER

Surgery

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ABSTRACT

Background: Diabetic foot ulcers (DFUs) pose a major public health problem worldwide and contribute significantly to morbidity and mortality of patients with diabetes.

Objectives: The study was aimed to outline the prevalence, pattern and treatment outcome of DFUs.

Material and Methods: This was a hospital based prospective study of all patients with diabetic foot ulcers seen in the surgical wards and at the surgical outpatient clinics of Career Institute of Medical Sciences over a one-year period from February 2017 to January 2018. All patients who presented to the surgical wards or surgical outpatient clinic with diabetic foot ulcers were consented for the study and those who met the inclusion criteria were consecutively enrolled into the study.

Results: 100 patients had foot ulcers. Of these, 85 (85%) patients were hospitalized and the remaining 15 (15%) patients were treated as outpatients. 22 were newly diagnosed diabetic patients. The majority of patients (97%) had type 2 diabetes mellitus. The majority of patients (92) were treated surgically and the remaining eight patients were treated conservatively with daily dressing and antibiotics. Most patients who were treated surgically underwent lower limb amputations in 55% of cases. A total of 48 post-operative complications were recorded of which surgical site infection was the most common complication accounting for 22.9% of cases.

Conclusion: A multidisciplinary team approach targeting at good glycaemic control, education on foot care and appropriate footwear, control of infection and early surgical intervention is required in order to reduce the morbidity and mortality associated with DFUs.

KEYWORDS

Diabetic foot ulcer, limb amputation, surgical management

Background:

Diabetic foot ulcers (DFUs) pose a major public health problem worldwide and contribute significantly to morbidity and mortality of patients with diabetes [1]. It is estimated that 15% to 20% of patients with diabetes will develop an ulcer on their foot at some point, and for many of these cases, the most appropriate treatment results in some form of surgery [2].

Diabetic foot ulcers are the most common cause of non-traumatic lower limb amputations in developing countries, and the risk of lower extremity amputation is 15 to 46 times higher in diabetics than in persons who do not have diabetes mellitus [3].

The burden of diabetic foot ulceration is heaviest in the resource-poor parts of the world where the incidence is high but sophisticated and efficient diagnostic, therapeutic and rehabilitative facilities are sparse. The challenge of management of DFUs in developing countries is that most patients with DFUs present to healthcare facilities late with advanced foot ulcers. The reasons for the late presentation include poor economic capabilities in cost shared healthcare systems, inadequate knowledge of self-care, socio-cultural reasons and poor and inadequate diabetes healthcare [4].

Aim and Objectives:

This study was intended to describe our own experience in the surgical management of DFUs in our local setting, outlining the prevalence, pattern and treatment outcome of DFUs.

Material and Methods:

This was a hospital based prospective study of all patients with diabetic foot ulcers seen in the surgical wards and at the surgical outpatient clinics of Career Institute of Medical Sciences over a one-year period from February 2017 to January 2018. All patients who presented to the surgical wards or surgical outpatient clinic with diabetic foot ulcers were consented for the study and those who met the inclusion criteria were consecutively enrolled into the study.

Patients with healed foot ulceration were excluded from the study. Identification of patients with the foot at risk for ulceration was done in the medical wards or diabetic clinics and diabetic patients who were found to have active foot ulceration were referred to the surgical wards or surgical outpatient clinics for proper surgical management.

Diabetic foot ulcer was operationally defined as a breach on the normal skin occurring as induration, ulceration or change of color on the foot for duration equal to or more than two weeks. A detailed history and physical examination was done and included the following: Patient's characteristics e.g. age, sex, area of residence, occupation, education level and presence of premorbid illness; Clinical characteristics including: duration of diabetes, types of diabetes (type I or II), duration of foot ulcer and patient's awareness of its presence, mode of treatment received, previous knowledge of foot care, previous history of healed foot ulcers, type of DFUs (neuropathic, ischemic, neuro-ischemic) and Wagner's classification; Operative characteristics included: type of operations performed and post- operative complications; Major lower limb amputation was defined as amputation at or proximal to the ankle joint whereas amputation distal to the ankle joint were termed as minor lower limb amputation. Outcome characteristics included: Length of hospital stay, mortality. Investigations including blood sugar profile, the glycated haemoglobin (HbAlc), renal functions, swabs from wound / ulcer and X-ray of foot carried out were also recorded. Assessment of glycaemic control was done by estimation of glycated haemoglobin (HbAlc). The glycated haemoglobin (HbAlc) was analyzed using the calorimetric end-point method on the IMx machine whose normal non-diabetic range is 4.4-6.4%HbAlc. The results were then reported in percentage graded as per assay test recommendation as:

HbAlc ≥ 7% good metabolic control
HbAlc 7-10% fair control
HbAlc ≤10% poor metabolic control

The diagnosis of surgical site infection was based on careful clinical examination (purulent discharge from the wound + signs of inflammation) and identification of micro-organisms from the area of the operative wound suspected of being infected.

The DFUs were graded according to Wagner's classification [5]. In order to describe the type of foot ulcers, both feet were examined for the presence or absence of peripheral sensation or pulses (dorsalis pedis and posterior tibial arterial pulses). Foot ulcers were categorized as ischemic when peripheral pulses were absent but the sensation was intact, neuropathic when sensation was absent but the peripheral pulses were intact and neuroischemic when both sensation and peripheral pulses were absent.

Data collection and Statistical analysis

Data were collected using a designed questionnaire. The questionnaire was pre-tested before use to a small sample of 10 diabetic patients to determine whether the respondents have any difficulty in understanding the questionnaire and whether there are ambiguous or biased questions. Data collected were analyzed using SPSS computer

software 17.0. Data were expressed in form of proportions and frequency tables for categorical variables. Means and standard deviation were used to summarize continuous variables. The test statistics used included student's t test and Chi squared test. The student's t test was used to test for differences between quantitative variables and Chi squared test was used to test for associations and comparisons of proportions. Significance was defined as a p-value of less than 0.05.

Results:

100 patients had foot ulcers. Of these, 85 (85%) patients were hospitalized and the remaining 15 (15%) patients were treated as outpatients. Sixty-five patients were males and females were thirty-five with the male to female ratio of 2:1. Their mean age was 54.32 ± 16.24 years (ranged from 21to 72 years. The modal age group was 51-60 years. The majority of patients (70%) came from the rural areas located a considerable distance and most of them (60%) had either primary or no formal education. Smoking habits and alcohol use was reported in 32% and 45% of patients respectively. 10% had family history of diabetes mellitus (Table 1).

Patients characteristics	No. of patients	Percentage %
Age in years		
<40	05	05
41-50	35	35
51-60	45	45
>60	15	15
Sex		
Male	65	65
Female	35	35
Area of residence		
Rural	70	70
Urban	30	30
Education		
No formal education	27	27
Primary education	33	33
Secondary education	30	30
Tertiary education	10	10
Pre morbid illness		
Present	12	12
Absent	88	88
Smoking		
Present	32	32
Absent	68	68
Alcohol		
Present	45	45
Absent	55	55
Family history of Diabetes		
Present	10	10
Absent	90	90

Table 1: Socio demographic characteristics of patients Of the total 100 patients, 22 were newly diagnosed diabetic patients. The majority of patients (97%) had type 2 diabetes mellitus. The median duration of diabetes was 8 years while the median duration of foot ulcers was 18 weeks. The majority of patients (70%) presented between four weeks and 52 weeks of onset of an ulcer (median = 12 weeks). Five patients had previous history of foot ulcers and 93% had previous amputations. Seventy-one (71%) ulcers were on the right lower limb while (22%) were on the left. 7% patients had ulcers on both feet. (Table 2)

Clinical characteristics	Frequency	Percentage %
Duration of Diabetes in years		
Newly diagnosed	22	22
<1	10	10
1-5	30	30
>5	38	38
Duration of DFUs in weeks		
<4	10	10
4-52	70	70
>52	20	20
Type of Diabetes Mellitus		
Type 1	03	03
Type 2	97	97
Previous history of DFU		
Yes	05	05
No	95	95
Previous history of amputation		
Yes	93	93
No	07	07
Anatomical site		
Forefoot	73	73
Midfoot	02	02
Hindfoot	10	10
Whole foot	15	15
Foot affected		
Right	71	71
Left	22	22
Both	07	07
Type of ulcer		
Neuropathic	70	70
Ischemic	20	20
Neuro-ischemic	07	07
Unclassified	03	03
Wagner's classification		
Stage 0	0	0
Stage 1	15	15
Stage 2	18	18
Stage 3	30	30
Stage 4	32	32
Stage 5	05	05

Table 2: Clinical characteristics

The majority of patients (92) were treated surgically and the remaining eight patients were treated conservatively with daily dressing and antibiotics. Most patients who were treated surgically underwent lower limb amputations in 55% of cases (Table 3). On stratification by severity of ulcers, patients with gangrenous DFU (Wagner score ≥ 4) were significantly more likely to have limb amputation than those with non-gangrenous DFU (Wagner score < 4) (P = 0.015).

Type of operation	Frequency	Percentage %
Debridement	**27**	**29.3**
Lower limb amputation	**55**	**59.7**
Minor amputation		
• Toe/Rye's amputation	25	45.45
Major amputation		
• Syme's amputation	05	9.0
• Below knee amputation	20	36.36
• Above knee amputation	05	9.0
Skin grafting	**05**	**5.4**
Incision and drainage	**03**	**3.2**
Sequestrectomy	**02**	**2.1**

Table 3: Type of operations performed (N=92)

A total of 48 post-operative complications were recorded of which surgical site infection was the most common complication accounting for 22.9% of cases (Table 4). Complication rate was significantly high in patients who had major lower limb amputation than patients who had minor lower limb amputation (42.2% versus 16.7%) (P = 0.006)

Complication	Frequency	Percentage %
Surgical site infection	11	22.9
Revision amputation	10	20.8
Stump gangrene	06	12.5
Wound dehiscence	06	12.5
Phantom pain	04	8.3
Diabetic coma	04	8.3
Wound hematoma	03	6.25
Skin grafting failure	02	4.1
Anemia	02	4.1

Table 4: Post operative complications (N=48)

Discussion:

In this review, the prevalence of diabetic foot ulcers amongst diabetic patients at Career Institute of Medical Sciences was 3.2% which is comparable to studies in Kenya and South Africa [5,13]. Studies in Netherlands and Iran found high prevalence of 20.0% and 20.4% respectively [6,9]. These differences in prevalence may be a reflection of regional variations in prevalence of diabetes mellitus and the local

operating risk factors of diabetic foot ulcer disease. High prevalence of DFUs in developing countries like Tanzania is due to illiteracy, poor socioeconomic status, bare-foot walking and inadequate facilities for diabetes care.

In our study, males were more affected than females with a male to female ratio of 1.2:1 which is in agreement with other studies [2,5,14]. Male predominance may be attributed to their smoking habits which were recorded in 35.3% of cases (all of them were males). Smoking is a contributory factor as a result of vascular wall thickening, reduction in blood circulation and ischemic changes in the affected neurons [15]. The resultant effect is also loss of sensation and increased predisposition to injuries.

The mean age of the patients was 54.32 years which is comparable to other studies done elsewhere [2,5,14]. Morbach et al [16] compared foot disease in Germany, India and Tanzania and found that German patients were significantly older (70.5 years) compared with those from Tanzania (51.4 years) and India (56.4 years). These studies were conducted in different centers that offer diabetes care of different qualities. This comparable mean age may suggest certain time-dependent risk factors in the evolution and course of diabetic foot ulcer disease which are common to diabetes in whatever environment. Age of onset of diabetes is also different in continents.

In this study, the median duration of diabetes is in keeping with other studies [5,10,17]. Morbach et al [16] found a significantly long mean duration of diabetes among German (14.0 ± 10.8 years) and Indian (11.7 ± 7.1 years) patients than among Tanzanian patients (5.1 ±.4.8 years). This finding may imply the differences in the quality of diabetes care where German and Indian patients, on average have longer duration of diabetes exposure before they develop foot ulcers. It is possible that better diabetes care that they receive delays the onset of foot ulcer disease.

The majority of patients in the present study presented to the surgical department between four weeks and 52 weeks (median of 18 weeks) of onset of an ulcer. Similar observation was also reported by other studies [2,5,14]. Late presentation in our patients may be attributed to low socioeconomic status, poverty, lack of diabetes education (regarding the importance of general foot care, the significance of diabetes and its complications), unrecognized foot trauma from walking barefoot and lack of access to medical care. Other contributing factors for late presentation include attempts at home surgery, trust in faith healers and undetected diabetes.

The rate of lower limb amputations in our study was 56.7% which is higher than rates reported in other studies [2,10,18,19-21]. This high amputation rate in our study could be attributed to the late presentation and severity of the disease on presentation. It is clearly evident from our study that more than half of our patients presented with high Wagner's grade (≥ 4) which resulted in the high rate of amputation. In this study, patients who had major lower limb amputation had significantly high complication rate than patients who underwent minor lower limb amputation.

Conclusion:

Diabetic foot ulceration constitutes a major source of morbidity and mortality among patients with diabetes mellitus at our centre and is the leading cause of non-traumatic lower limb amputation. A multidisciplinary team approach targeting at good glycaemic control, education on foot care and appropriate footware, control of infection and early surgical intervention is required in order to reduce the morbidity and mortality associated with DFUs.

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Limitations:

As it is a single centre study with a relatively small study population, results cannot be generalized to the entire population

References:

1. Robert S, Yoram R, Micha R: Diabetic Foot Ulcers: Principles of Assessment and Treatment. IMAJ 2001, 3:59-62.
2. Rooh-Ul-Muqim , Griffin S, Ahamed M: Evaluation and management of diabetic foot according to Wagner's Classification, A study of 100 cases. J Ayub Med Coll Abbottabad 2003, 15(3):39-42.
3. Sarkar PK, Ballantyne S: Management of leg ulcers. Postgrad Med J 2000, 76:674-82.
4. Nyamu PN, Otieno CF, Amayo EO, Mcligeyo SO: Risk factors and prevalence of diabetic foot ulcers at Kenyatta National Hospital, Nairobi. East African Medical Journal 2003, 80(1):36-43.
5. Wagner FW Jr: The diabetic foot. Orthopaediatrics 1987, 10:163-172.
6. Bouter KP, Storm AJ, de Grost RR, Uitslager R, Erkelena DW, Diepersloot RJ: The diabetic foot in Dutch hospitals: epidemiological features and clinical outcome. Eur J Med 1993, 2:215-221.
7. Ogbera AO, Fasanmade O, Ohwovoriole AE, Adediran O: An assessment of the disease burden of foot ulcers in patients with diabetes mellitus attending a teaching hospital in Lagos, Nigeria. Int J Low Extrem Wounds 2006, 5:244-249.
8. Unachukwu C, Babatunde S, Ihekwaba AE: Diabetes, hand and/or foot ulcers: a cross-sectional hospital-based study in Port Harcourt, Nigeria. Diabetes Res Clin Pract 2007, 75:148-152.
9. Fard AS, Esmaeizadeh M, Larijani B: Assessment and treatment of diabetic foot ulcer. Int J Clin Pract 2007, 61:1931-1938.
10. Abbas ZG, Lutale JK, Morbach S, Archibald LK: Clinical outcome of diabetes patients hospitalized with foot ulcers, Dar es Salaam, Tanzania. Diabetic Medicine 2002, 19(7):575-579.
11. Abbas ZG, Archibald LK: Challenges for management of the diabetic foot in Africa: doing more with less. Int Wound J 2007, 4(4):305-13.
12. Wagner FW Jr: The diabetic foot. Orthopaediatrics 1987, 10:163-172.
13. Levitt NS, Bradshaw D, Zwarenstein MF, Bawa AA, Maphumdos M: Audit of public sector primary diabetes care in Cape Town, South Africa; high prevalence of complications, uncontrolled hyperglycemia and hypertension. Diabetes Med 1997, 14:1073-1077.
14. Doumi A: Diabetic Septic Foot in El Obeid, Western Sudan. Sudan journal of Medical Sciences 2007, 2(2):119-121.
15. Viswanathan V: The diabetic foot: perspectives from Chennai, South Africa. Int J Low Extrem Wounds 2007, 6:34-36.
16. Morbach S, Lutale JK, Viswanathan V, Mollenberg J, Ochs HR, Rajashekar S, Ramachandran A, Abbas ZG: Regional differences in risk factors and clinical presentation of diabetic foot lesions. Diabetic Medicine 2004, 21(1):91-5.
17. Akanji AO, Adetuyidi A: The pattern of foot lesions in Nigerian diabetic patients. West Afr J Med 1990, 9:1-5.
18. Alnour AM, Aamir AH, Alguili EI: Diabetic Septic Foot in Omdurman Teaching Hospital. Sudan journal of Medical Sciences 2009, 4(2):129-132.
19. Al-Ebous AD, Hiasat B, Sarayrah M: Management of diabetic foot in a Jordanian hospital. East Mediterranean Health Journal 2005, 11(3):490-493.
20. Sano D, Tieno H, Drabo Y, Sanou A: Management of the diabetic foot, apropos of 42 cases at the Ougadougou University Hospital Center. Dakar Med J 1998, 43:10-113.
21. Benotmane A, Mohammedi F, Ayad F: Diabetic foot lesions: etiologic and prognostic factors. Diabetes Metab 2000, 26:113-117.