Clinical Profile and Outcome of Patients with Diabetes Mellitus Foot Ulcer in Gusau, Northwestern Nigeria

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ABSTRACT

Diabetes Mellitus foot ulcer (DMFU) is a worrisome chronic complication of diabetes mellitus. This study aimed to evaluate the clinical profile and outcome of patients with DMFU in our setting. This was a 3-year retrospective descriptive study of patients managed with DMFU at two tertiary health facilities in Gusau. Relevant information from the files was extracted such as socio-demographics, duration of Diabetes and ulcer, risk factors and causes of DMFU, Wagner grading, random plasma Glucose at presentation, packed cell volume, duration of hospital stay and outcomes. The data was analyzed using SPSS version 20.0 statistical software. One hundred and nineteen case notes were retrieved. They consisted of 45(37.8%) males and 74(62.2%) females. Their mean age was 56.0±12.8years. The mean duration of Diabetes and foot ulcers before presentation were 4.8±4.29years and 4.02±4.6weeks respectively. The ulcer healed normally in 71(59.6%) patients, 25(21%) had amputations and 15(12.6%) left against medical advice. The overall mortality rate was 6.7% [males 5(62.5%), females 3(37.5%), p < 0.001]. Predictors of ulcer healing were early presentation, female gender and packed cell volume greater than 24% at presentation. The mean duration of admission was 5.4±4.2weeks. Forty-one (43%) patients were on admission for more than 4 weeks. DMFU is a cause of prolonged hospital admission, amputations and mortality in our setting. Sustained health education on foot care will go a long way in taming the tide.

Keywords: Profile, Diabetes mellitus foot ulcer, Outcome

INTRODUCTION:

Diabetes Mellitus is a multisystemic disease with varying acute and chronic complications. One of the worrisome chronic complications is diabetes mellitus foot disease.[1] The diabetes mellitus foot syndrome (DMFS) presents as a combination of neuropathy and peripheral vascular disease that may lead to ulceration and gangrene in a patient with Diabetes Mellitus.[2] Diabetes mellitus foot ulcer (DMFU) is a breach in the continuity of the skin epithelium involving its full thickness or beyond in a person living with Diabetes Mellitus. Neuropathy is the commonest risk factor of DMFU as it causes insensitivity in the feet, reduces proprioception, causes wasting of small muscles of the foot, leads to alteration of normal arches of the foot and peripheral autonomic neuropathy all of which predispose patients with Diabetes Mellitus to trivial foot injuries and subsequent infections.[3]

The prevalence of DMFU is around 5-10% in people living with Diabetes Mellitus A person living with Diabetes Mellitus has about 25% lifetime risk of developing a foot ulcer.[4]

The International Diabetes Federation (IDF) estimated that 40-60 million people globally are living with DMFU. Amputation in people with Diabetes Mellitus is 10 to 20 times more common than in those without Diabetes Mellitus and a lower limb is lost every 30 seconds as a consequence of Diabetes Mellitus globally.[5]

World health organization estimated that more than half of all non-traumatic lower-limb amputations worldwide are due to DMFU.[6] It accounts for over 72% of lower limb amputation in Spain[7] and leads to 73,000 amputations annually in the United States of America.[8] DMFU accounts for up to 20% of Diabetes Mellitus related hospital admissions and leads to prolonged hospital stay and enormous financial burden.[9,10,11]

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A person with DMFU has 2.5 fold increased risk of death compared to other people living with Diabetes Mellitus [12] and the risk of mortality following amputation of DMFU is up to 50% at 2 years which is higher than mortalities of some cancers.[13] Despite the bleak picture of DMFU, 50% of the cases can be prevented by health education and effective identification.[14]

We aimed to determine the clinical profile and outcomes of patients with DMFU in Gusau. To our knowledge, this is the first study of DMFU in Gusau, North-Western Nigeria. This will greatly help in determining peculiarities in our setting and bridge the gap in the aspects of prevention and management.

METHODOLOGY

This was a retrospective descriptive study conducted at the two tertiary health centres in Gusau, North-Western Nigeria. The case files of patients managed with DMFU at Federal Medical Centre Gusau and Ahmad Sani Yariman Bakura Specialist Hospital Gusau from 1st January 2017-31st December 2019 were retrieved. To be included in the study, an individual must have documented history or diagnosis of Diabetes Mellitus at the time of admission and admitted into the adult medical or surgical wards of these hospitals with foot disease. Those excluded were those with foot ulcers in the absence of Diabetes Mellitus.

Relevant information from the files was extracted by a Medical Officer such as Age, Sex, Occupation, duration of diabetes, duration of ulcer, risk factors and causes of Diabetic foot, Wagner grading, random plasma glucose at presentation, Packed cell volume, duration of hospital stay and outcomes such as ulcer healing, amputation, leaving against medical advice (LAMA), discharges or death.

Being a retrospective study, some of our limitations include the inability to determine the glycated haemoglobin of the patients which is a gold standard for glycaemic control, lack of complete microbiological studies of the ulcer, lack of Doppler ultrasound scan and inability to determine the exact reasons why some patients left against medical advice.

The data was analyzed using SPSS version 20.0 statistical software. Frequency distribution tables were constructed and comparison of association between proportions was determined with Chi-square (X^2). Continuous data were presented as means and compared with student's t-test. P-values <0.05 was considered significant at 95% confidence level.

RESULTS

One hundred and nineteen case notes of patients managed for DMFU were retrieved for the study period. They consisted of 45(37.8%) males and 74(62.2%) females. Their mean age was 56±12.8 years; males 57.7±12.7 and females 54.3±12.9; p= 0.12. The mean duration of Diabetes Mellitus was 4.8±4.29 years. Seventeen (14%) patients were diagnosed with Diabetes Mellitus after developing DMFU.

The duration of DMFU before presentation ranged from a day to 20 weeks with a mean of 4.02±4.6 weeks. Ninety-four (79%) patients presented within 4 weeks of developing the ulcer, while the remaining presented after 4 weeks.

The documented risk factors were peripheral neuropathy 65(55%), peripheral arterial disease 39(33%) and visual impairment in 11(9%). The causes of the DMFU identified are shown in Figure 1.

The Wagner grading of the DMFU at presentation is shown in Table 1. Sixty-three (52%) of the patients presented with Wagner grade III and IV; 27 (60%) males, 36(49%) females.

The mean random plasma Glucose at presentation was 18.69 mmol/L. One hundred and one (85%) patients had random plasma Glucose greater than 10mmol/L. Fifty-four (45%) patients had anaemia and 18(15%) of them were transfused with blood.

Figure 2 shows clinical outcome of the patients. Ninety- six (81%) patients were discharged [71 (74%) following normal healing, 25(26%) following amputation].

Fifteen (12.6%) patients left against medical advice (LAMA); 10(67%) males and 5(33%) females; p= 0.001. Eight patients (6.7%) died during admission; 5 males (62.5%) and 3 females (37.5%); p= 0.001.

The mean duration of admission was 5.4(±4.2) weeks. Fifty-five (57%) patients were discharged within a month, while 41(43%) were on admission for more than 4 weeks. Figure 3 shows the duration of hospital stay.

Twenty-five (21%) patients had amputations. The types of amputations done were trans-femoral in 18(72%) patients, trans-tibial in 3(12%) and disarticulation of toes in 4(16%) of the patients.

Predictors of ulcer healing were female gender, early presentation and packed cell volume greater than 24% (Table 2).

Table 1: Wagner grading

Grade	Description	Ma les(%)	Females(%)	Total(%)
0	Foot at risk with deformity or Callosities	0(0)	0(0)	0(0)
I	Superficial ulceration	4(9)	5(7)	9(8)
II	Deep Ulcer to tendons, ligaments or deep fascia	14(31)	33(44)	47(40)
III	Presence of Abscess or Osteomyelitis	12(27)	16(22)	28(23)
IV	Distal gangrene involving toes.	15(33)	20(27)	35(29)
V	Extensive gangrene	0(0)	0	0(0)
		45(100)	74(100)	119(100)

$X^2 = 1.2$ p= 0.3

Table 2: Predictors of ulcer healing

Predictor	DMFU-Healed Normally n=71 (%)	DMFU- Amputation+ Not Healed n=48 (%)	X^2	P-value
Gender				
Males	20(28)	25(52)	12	0.001
Females	51(72)	23(48)		
Duration of ulcer				
< 4 weeks	61(86)	33(69)	8.3	0.004
>4 weeks	10(14)	15(31)		
Wagner Grade				
I	9(13)	0(0)		
II	46(65)	1(1)	140	0.001
III	16(22)	12(25)		
IV	0(0)	35(74)		
RPG at presentation				
< 10mmol/L	10(14)	8(17)	0.8	0.3
>10mmol/L	61(86)	40(73)		
Anaemia (PCV)				
< 24%	4(6)	14(29)	18	0.001
>24%	67(94)	34(71)		

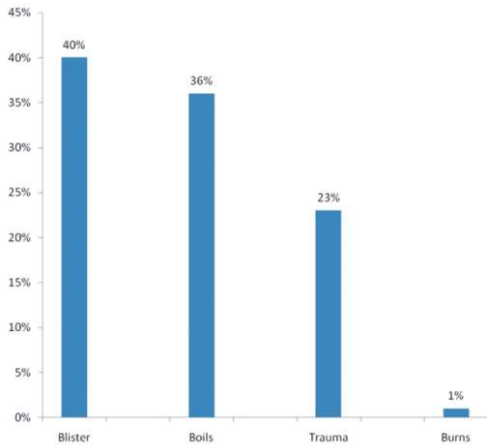

Figure 1: Causes of DMFU.

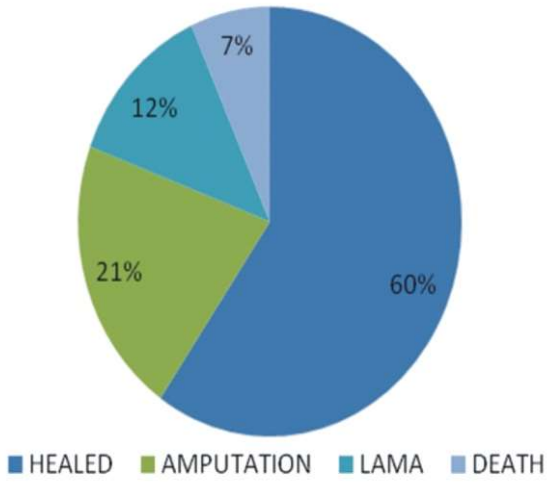

Figure 2: Outcome of DMFU

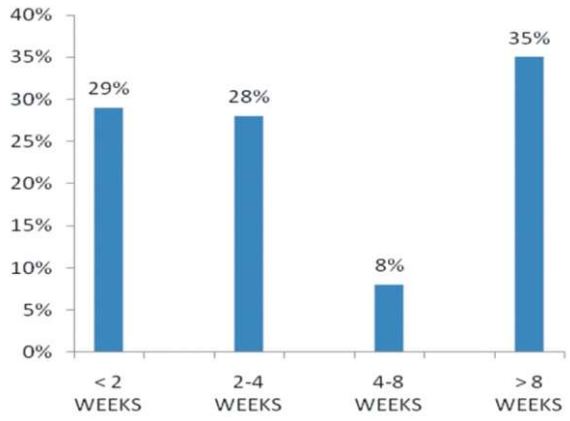

Figure 3: Duration of hospital stay

DISCUSSION

More females were admitted with DMFU in this study which is in keeping with the findings of Odusan *et al.* and Anumah *et al.* - they reported higher female admissions with DMFU of 78.9% and 52.4% in Lagos and Abuja respectively.[15,16] The mean age of our patients was 56 years which is similar to that of Anumah *et al.* whose patients had a mean age of 54.3 years, however, the mean age of patients of Odusan *et al.* was 61.1 years.[16,15]

The preponderance of women may be due to their health-seeking behaviour or the fact that the males who are mostly breadwinners in our society decline admission unless critical and manage their DMFU on an outpatient basis. A study has shown that males have a higher prevalence and severe neuropathy which is a major risk of DMFU compared to female's.[17] The higher prevalence of neuropathy in males is thought to be as a result of height difference between the genders, as males are generally taller and neuropathy affects longer nerve fibres, also, males have more occupational risks such as farming that predispose them to foot injuries.

Our finding that 21% of patients presented 4 weeks after onset of DMFU is similar to the findings of Akaa *et al.* - they reported that 19.6% of their patients with DMFU presented with more than 28 days history of foot ulcer.[18] The late presentation could be due to the trial of native and herbal medications and financial constraints. Late presentation is known to be associated with poor outcome as a result of sepsis.[19]

Aetiological and risk factors in this study were similar to findings from other studies.[16,20] Spontaneous blisters and abscesses were the commonest aetiologies while peripheral neuropathy was the major risk factor. The abscesses indicate an infection which usually occurs secondary to a breach in the skin.[14] Patient education on foot care and the need to visit the hospital immediately they observe a lesion in the foot will go a long way in halting the progression of DMFU and in preventing amputation.[14]

In this study 40% of our subjects presented with Wagner grade II DMFU which is similar to the finding of Jawad *et al.* in India who reported that 34.5% of their patients presented with grade II DMFU.[21] Sixty-three percent (63%) of our patients presented with Wagner grade II-III DMFU, similar to the finding of Anumah et al *et al.* that reported

66%.[16] Presentation with Wagner grade I-III DMFU gives a more favourable outcome than Wagner grade IV-V which often necessitates amputation.[22]

Majority of the patients with DMFU in this study had poor glycaemic control at presentation which could be due to wound infection and sepsis. This is similar to the finding of Salman *et al.* in Saudi Arabia who reported that only 5.6% of their patients with DMFU had good glycaemic control at presentation.[23] The poor glycaemic control seen in patients with wound infection and sepsis is due to the release of cytokines and anti-insulin hormones such as catecholamines which subsequently leads to glycolysis and lipolysis in the muscles and liver and resultant hyperglycaemia.[24]

The 45% prevalence of anaemia observed in this study agrees with the finding of Wright *et al.*, they reported a prevalence of 51.9% in their patients.[25] Gezawa *et al.* also found anaemia in 53.6% of their patients with DMFU and it was also found to significantly predict poor wound healing, amputation and risk of death.[26] The associations with anaemia from their study were nephropathy, osteomyelitis and foot gangrene.

The rate of amputation in this study is lower than that reported from Ibadan and Makurdi, 26.1% and 30.1% respectively, but higher than from Abuja which was 12.7%.[27,18,26] The difference may be attributed to the Wagner grade of the DMFU at presentation.

The 72% choice of trans-femoral amputation compared to other forms of amputation in our patients is higher than the 47.4% reported from Sokoto.[28] Tans-femoral amputation is safer when the extent of vascular compromise is extensive or not ascertained but leads to more challenges in prosthesis compared to trans-tibial amputation.[29] The higher rate of trans-femoral amputations in our patients may be due to late presentation, limited access and high cost of Doppler ultrasound scan that ascertain the extent of good blood supply. Amputation done at sites with impaired blood supply leads to delay in wound healing and may warrant amputation at a proximal site.

The mean duration of hospital stay in this study was about 5 weeks, which was similar to 35 and 38 days reported from Makurdi and Calabar respectively.[18,30] It was, however, shorter than that reported at Ibadan (52.9 days).[27]

Fifteen (12.6%) of our patients left against medical advice mostly due to financial constraints or failure to consent for surgery, this finding is similar to 13.7% reported from Abuja.[16] More males were observed to leave against medical advice because as breadwinners they have to source for their medications and means of livelihood for their families, therefore they could not endure prolonged stay in hospital.

The mortality rate of about 7% in our study is similar to that of Anumah *et al.* who reported 8.7% but lower than that from some centres[16,18,27] The mortality was higher among males (62.5%) in our study, similar to the 62.8% mortality rate among males reported from Australia.[31] The higher mortality rate among males may be explained by late presentation of males compared to their female counterparts.

CONCLUSION

DMFU is a cause of prolonged hospital admissions, amputations and mortalities in our patients with Diabetes Mellitus. Predictors of ulcer healing were early presentation, female gender and packed cell volume >24% at presentation. Sustained health education on foot care will go a long way in taming the tide.

REFERENCES

1. Tseng CL, Sambamoorthi U, Helmer D. The association between mental health functioning and non-traumatic lower extremity amputations in veterans with diabetes. Gen Hosp Psychiatry 2007;29:537-46.
2. Jeffcoate WJ, Macfarlane RM, Fletcher EM. The description and classification of diabetic foot lesions. Diabetic Medicine 1993;10:676-9.
3. Bakker K, Apelqvist J, Lipsky BA, Van Netten JJ. International Working

Group on Diabetic Foot. The 2015 IWGDF guidance document on prevention and management of foot problems in diabetes: development of an evidence-based global consensus, Diabetes Metab Res Rev 2016;32:2-6.

4. Richard JL, Schuldiner S. Epidemiology of diabetic foot problems. Internal Medicine Journal 2008;29:222-30.
5. International diabetes federation. IDF Diabetes Atlas, 8th ed. Brussels, Belgium 2017.
6. World Health Organisation/ International diabetes federation, screening for type 2 diabetes. World Health Organisation, Geneva, Switzerland 2003.
7. Almaraz MC, Gonzalez- Romero S, Bravo M, Caballero FF, Palomo MJ, Vallejo R, *et al.* Incidence of lower-limb amputations in individuals with and without diabetes mellitus in Andalusia(Spain) from 1998-2006. Diabetes Res Clin. Pract 2012;95:399-405.
8. Centre for disease control and prevention. National Diabetes Statistics Report: Estimates of Diabetes and its burden in the united states, 2014, Atlanta, GA: US Department of Health and Human Services 2014.
9. Yazdanpanah L, Nasiri M, Adarshi S. Literature review on the management of diabetic foot ulcer. World J Diabetes 2015;6:37-53.
10. Ugwu E, Adeleye O, Gezawa I, Okpe I, Enamino M, Ezeani I. Burden of diabetic foot ulcer in Nigeria: Current evidence from the multicentre evaluation of diabetic foot ulceration in Nigeria. World J Diabetes 2019;10:200-11.
11. Algebra AO, Fasanmade O, Ohwovoriole AE, Adediran O. An assessment of the disease burden of foot ulcers in patients with diabetes attending a teaching hospital in Lagos, Nigeria. Int J Low Extrem Wounds 2006;4:244-9
12. Walsh JW, Hoffstad OJ, Sullivan MO. Association of diabetic foot ulcer and death in a population-based cohort from the United Kingdom. Diabet Med 2016;33:1493-9.
13. Brownrigg JR, Apelqvist J, Bakker K, Schaper NC, Hinchliffe RJ. Evidence-based management of PAD and Diabetic foot. Euro J Vasc and EndovascSurg, 2013.45:673-81.
14. Andrew JMB. The diabetic foot. Medicine 2014;43:33-7.
15. Odusan O, Amoran OE, Salami O. Prevalence and pattern of Diabetic foot ulcers among adults with Diabetes mellitus in a secondary health facility in Lagos, Nigeria. Annals of Health research 2017;3:98-104.
16. Anumah FO, Mshelia RR, Abubakar A, Sough T, Asudo F, Jamda MA *et al.* Management outcome of Diabetic foot ulcer in a teaching hospital in Abuja. The Journal of Diabetic foot complication 2017;9:15-20.
17. Dinh T, Veves A. The influence of gender as a risk factor in diabetic foot ulceration. Wounds 2008;20:127-31.
18. Akaa PD, Ahachi NC, Kortor NJ, Mue DD, Elachi CI, Ogiator M, *et al.* Diabetic foot ulcers: Epidemiology, management modalities and outcome at Benue state university teaching hospital Makurdi. JAMMR 2017; 22:1-12.
19. Chris M, Elisabetta L, Benjamin B, Julien V, Raju A, Claas L *et al.* Delayed referral of patients with diabetic foot ulcers across Europe: Patterns between primary care and specialized units. J wound care 2018;27:3.
20. Raimi TH, Fasanmade OA. Precipitating factors for Diabetes foot ulcer in Nigerian Tertiary Hospital. European Journal of Biology and Medical Science Research 2018;6:21-8.

21. Jawad MA, Imran AK, Vinay VS, Najnin K, Zahiruddin QS. Evaluation of diabetic foot according to Wagner classification in a rural teaching hospital. British Journal of Diabetes and vascular disease 20011;11:74
22. Ugwu E, Adeleye O, Gezawa I, Okpe I, Enamino M, Ezeani I. Predictors of lower extremity amputation in patients with diabetic foot ulcer: findings from MEDFUN, a multi-centre observational study. J foot Ankle Res 2019;12:34.
23. Salman YG, Hamdi A, Nehal AM, Khulood YF, Bashaer AA, Hadeel HA. The correlation of fasting glucose levels with severity of diabetic foot ulcer and the outcome of treatment strategies. Journal of Biomedical Research 2018;2-9.
24. Remick DG. Pathophysiology of sepsis. Am J Pathol 2007; 170:1435-44.
25. Wright JA, Oddy MJ, Richards T. Presence and Characterisation of Anaemia in Diabetic foot ulceration. Hindawi publishing corporation 2014; Article ID 104214.
26. Gezawa ID, Ugwu ET, Ezeani I, Adeleye O, Okpe I, Enamino M. Anaemia in patients with Diabetic foot ulcer and its impact on disease outcome among Nigerians: Report of the MEDFUN study. PloS one 2019. https://doi.org/10.1371.
27. Adeleye JO. Diabetes foot disease: the perspective of a Nigerian tertiary care centre. PractDiabInt 2005; 22:211-4.
28. Oborien M, Agbo SP, Ajiboye LO. Risk factors for Amputation in a patient with diabetic foot disease in Sokoto, Nigeria. Health 2018;10:645-53.
29. Bernard OK, Shraddha R. Prosthetic Rehabilitation in the Lower Limb. Indian J Plast Surg 2019;52:134-43.
30. Akaninyene AO, Victor AU, Okon ES, Ofem EE, Henry OO, Patric NM. "Profile, Bacteriology and Risk factors for foot ulcers among diabetes in a tertiary health centre in Calabar, Nigeria", Ulcers, vol.2013, ArticleID820468,6pages,2013. http://dx.doi.org/10.1155/2013/820468.
31. Jeyereman K, Berhane T, Hamilton M, Chandra AP, Falhammar H. Mortality in patients with diabetic foot ulcer: a retrospective study of 513 cases from a single centre in Northern Territory of Australia. BMC Endocr Disord2019; 19-21. Doi10.1186/s12902-018-0327-2.