Original Research Article

Prevalence of diabetic foot ulcers and assessment of foot care knowledge and practice among patients attending diabetic clinic of a tertiary hospital of eastern India

Satabdi Mitra[1]*, Kunal Kanti Majumdar[1], Sushanta Bhanja[2]

[1]Department of Community Medicine, KPC Medical College and Hospital, West Bengal, India
[2]Department of Pediatrics, Jagannath Gupta Institute of Medical Sciences and Hospital, West Bengal, India

*Correspondence:
Dr. Satabdi Mitra,
E-mail: stbdimtr111@gmail.com

ABSTRACT

Background: Diabetic foot ulcer (DFU) is a dreaded complication holding huge health and socio-economic impacts and negative impacts on quality of life of individual, community and society as a whole yet carrying scope of preventive potential. The objectives were to find out the prevalence of diabetic foot ulcers and to assess gap in knowledge, foot care practices and their determinants.
Methods: A cross-sectional study was conducted over three months among 310 diabetic outpatients of a medical college of an eastern Indian state. Data were collected with a validated questionnaire containing socio-demographics, clinical and behavioral factors, foot care knowledge and practice and SINBAD score was used for assessing diabetic ulcers.
Results: Out of 310 participants, 44 (14.2%) had diabetic foot ulcer and 1/5th of them had SINBAD score ≥3 indicating severity. Knowledge level was poor among 245 (79.0%) and healthy foot habits were among only 70 (22.6%). Addiction, diabetes for ≥5 years, any associated non-communicable diseases, irregular treatment and follow-up care, unhealthy foot condition, improper foot wear, poor knowledge of the disease and unhealthy foot habits had significant association with occurrence of foot ulcers.
Conclusions: Generation of awareness can bring about prevention of development of foot ulceration among diabetic patients and henceforth can avert risk of adverse consequences of it.

Keywords: Diabetic foot ulcer, Foot habits, Non-communicable diseases, Quality of life

INTRODUCTION

The prevalence of diabetes has risen to epidemic proportions all over the world.[1] The condition is presently afflicting 194 million people worldwide and is estimated to rapidly increase to 333 million people in 2025 as a consequence of longer life expectancy, sedentary lifestyle, changing dietary patterns and so on.[2]

This rise in prevalence of DM is likely to bring a concomitant increase in its complications among diabetic patients. One important and complication of DM affecting lower extremities is diabetic foot ulcer (DFU). It is defined as any ulceration, necrosis, gangrene, or full thickness skin defect occurring distal to the ankle in a diabetic patient.[3] DFU constitutes an increasing public health problem and are a leading cause of admission, amputation, resultant adverse effects on living condition, relationship status and quality of life and premature mortality among diabetic patients.[4] The prevalence of diabetic foot ulcer (DFU) ranged between 1.0% and 4.1% in the United States (US), 4.6% in Kenya, 15% in India and 20.4% in Netherlands.[3,5] Hospital-based studies demonstrated that the prevalence of limb ulceration were between 11.7% and 19.1% among individuals with diabetes in Nigeria.[6]

In addition to causing pain and morbidity, foot lesions in diabetic patients also have substantial negative economic consequences, beside the direct costs of foot complications, there are also indirect costs relating to loss of productivity, individual patients' and family costs and loss of health related quality of life.[7] The lifetime risk of a person with diabetes developing a foot ulcer could be as high as 15%, and it is believed that every 30 seconds a lower limb is lost somewhere in the world as a consequence of diabetes.[8]

People with diabetes are prone to develop foot ulcer, amputation and other lower extremity clinical abnormalities if they do not have good knowledge of foot care practice.[9] Therefore, increasing the knowledge, awareness and self-care of the foot among diabetic patients have found to be cost effective ways of preventing DM foot ulceration especially in low income economy characterized by inadequate healthcare facilities and lack of skilled healthcare personnel.[10] There are very few studies on knowledge and practice of foot care among diabetic patients in India. Yet in this field there is lack of exploration in this part of the country.[11] Therefore, this study was conducted to estimate prevalence of diabetic foot ulcers and to assess the knowledge, foot care practices, gap and their determinants in these aspects among patients with diabetes mellitus attending diabetes clinic of this tertiary care center situated in an eastern state if India.

METHODS

Study type and design

It was a descriptive with cross-sectional design.

Study settings

The study was conducted among the patients attending Diabetes clinic run by a medical college of West Bengal. The clinic was started in 2016, runs one fixed day per week under the department of Internal medicine. On an average, monthly 100-150 patients primarily visit the clinic every month. The clinic is staffed by a faculty in charge, a senior resident, junior residents, and staff nurses. Basic laboratory services like blood sugar testing, lipid profile, liver function test, renal function test, urine routine examination and ECG are available within the hospital premises.

Study population

The study population consisted of patients diagnosed with diabetes mellitus.

Inclusion criteria

All adult diabetic patients attending the diabetes clinic of the hospital were considered as study population.

Exclusion criteria

Patients having cognitive impairment/hearing problem. Patients having ulcers due to some other causes were excluded.

Study duration

Study was carried out for a period of 3 months from July to September, 2022.

Sample size and sampling

Using the formula as mentioned $N=Z^2 \times p \times q/d^2$ [N= sample size, p= prevalence of diabetic foot ulcer was found as 20.5%[11]. The q= (1−p), Z= standard normal deviation usually set at 1.96 which correspond to the 95% confidence interval. d= degree of accuracy desired usually set at 0.05]. Non-response rate has been assumed as 10%. The calculated and rounded off minimum required sample size was 277. Patients attending the diabetes clinic satisfying the criteria were recruited after obtaining written informed consent and total 310 patients participated in the study.

Study tools and data collection procedures

The data were collected in pre-designed, pre-tested semi-structured questionnaire containing socio-demographic, clinical profile and behavioral factors of the patients designed by the investigators and pre-tested in a nearby setting among 30 (approximately 10% of sample size) diabetic people without including in study proper. The questionnaire was validated for language and content by respective subject matter experts. The SINBAD scoring system was used for diabetic foot ulcer assessment.[12] The questionnaire consisted of 10 questions on knowledge regarding foot care and current self-foot care practices and correct response to each question was assigned one mark and incorrect response was given zero marks. SINBAD is classification system for diabetic foot ulcer comprising of site, ischemia, neuropathy, bacterial infection, and depth with maximum possible score of six. A score ≥3 is considered a severe ulceration. The national diabetes foot care audit (NHS Digital, 2019) utilizes the SINBAD score in purpose of reviewing care of the patients.

Statistical analysis

The data were collected in and double-entered, validated and analyzed using SPSS version 22.0. Descriptive analysis was performed in the form of mean and SD (for continuous variables) or frequency and proportions (for categorical variables). The association of socio-economic, demographic and clinical factors with foot care scores was assessed using multivariable analysis using adjusted odds ratio. A p value <0.05 was considered statistically significant. A subgroup analysis was done with patients with diabetic foot ulcer and their SINBAD scoring was

done to assess severity of the condition for prognostic reasons.

Ethics

Ethical clearance from institute ethics committee and informed consent from all study participants was obtained. Regarding information confidentiality anonymity was maintained.

RESULTS

Baseline information

Out of total 310 study participants, majority (57.7%) were males, age was 34±7.02 years (mean±SD) overall. As the study setting was in a metropolitan city 96.1% were urban residents. Majority (97.1%) of them reside with family members which can assure their care level like as, regular medication, check-ups. Substantially high number of participants (52.6%) confessed on continuing addiction specially smoking and 28 (9.0%) were found to be alcoholic too (Table 1).

Table 1: Baseline characteristics of the participants (n=310).

Variables	Mean±SD	
Age	44±7.02 years	
Sex	**Male N (%)**	**Female N (%)**
	179 (57.7)	131 (42.3)
Residence	Urban	Rural
	298 (96.1)	12 (3.9)
Religion	Hindu	Others
	201 (64.8)	109 (35.2)
Educational status	Just literate and primary	Secondary and above
	142 (45.8)	168 (54.2)
Occupation	Service	Business and others
	52 (16.8)	258 (83.2)
Living status	With partner and/or family members	Living alone
	301 (97.1)	9 (2.9)
Current addiction	Present	Absent
	163 (52.6)	147 (47.4)

Diabetes related information

Regarding diabetes related information of the study participants, more than 2/3rd (60.7%) was having DM for more than five years being at risk of development of complications. Most of the patients (60.9%) were on oral hypoglycaemic agents (OHA) alone. 84.5% stated that they undergo follow-up care regularly though various diabetic check-ups like eye examination, renal function testing etc. was lacking among them. 59.4% were found to suffer from various co-morbidities as hypertension,

neuropathy, kidney problems and so on. It was alarming that 68.7% were found to be obese and on informal discussion revealed not to do any physical exercise daily. More than ½ (56.8%) had documented well controlled blood sugar with current medication. On clinical examination, majority (76.8%) were found to have unhealthy foot skin, with tuning fork of 128 Hz vibration sensation loss among 57.4% and 87.4% callus formation was found (Table 2).

Table 2: Diabetes related characteristics of the participants (n=310).

Duration of DM	<5 years N (%)	122 (39.3)
	≥5 years N (%)	188 (60.7)
Current treatment status	On OHA	189 (60.9)
	On Insulin only	10 (3.3%)
	On OHA+Insulin	111 (35.8)
Follow-up care	Regular	262 (84.5)
	Irregular	48 (15.5)
Type of co-morbidity	Hypertension only	77 (63.5)
	Neuropathy only	34 (27.1)
	Kidney disease only	13 (10.9)
	Combined co-morbidities	92 (59.4)
Body mass index (BMI)	<25 kg/m^2	97 (31.3)
	≥25 kg/m^2	213 (68.7)
Blood glucose level with current treatment	Well controlled	176 (56.8)
	Poorly controlled	134 (43.2)
H/o diabetic foot ulcer in past	Yes	23 (7.4)
	No	287 (92.6)
Condition of foot skin	Smooth, moist	72 (23.2)
	Dry, cracks present	238 (76.8)
Sensory loss to vibration	Yes	178 (57.4)
	No	132 (42.6)
Callus formation	Absent	39 (12.6)
	Present	271 (87.4)

Knowledge related to DM and foot self-care practice

It was found that none of the study participants could tell purposes of taking foot care, 32 (10.3%) could state two or three risk factors of foot problems among diabetics. Overall knowledge of participants regarding inspecting, washing, drying feet, moisturizing dry skin, caring for toenail, proper footwear and healthy foot habits were grossly found to be low. One hundred and forty-two (45.8%) of the patients stated that they do not check toes and feet on daily basis, 95 (30.6%) wash feet everyday with warm water and mild soap, 65 (20.9%) have habit of moisturizing foot skin with oil or lotion, proper toenail care, i.e. trimming nails, not cutting nails up to corners was among only 77 (24.8%). Nearly 2/3rd of the respondents, 184 (59.3%) neither use well fitting, adjusted shoes nor use socks.

Prevalence of diabetic foot ulcer

Among the total 310 DM patients, 44 (14.2%) were examined to have diabetic foot ulcer among them 9

(20.5%) scored ≥3 in SINBAD scoring indicating severe form of ulcers.

Table 3: Correlates of foot ulcers among diabetes patients (n=310).

Variables	Category	DFU		Sig.	AOR	95% C.I. for AOR	
		Yes (%)	No (%)			Lower	Upper
Age (years)	<44	8 (18.2)	108 (40.6)	*	1.00	*	*
	≥44	36 (81.8)	158 (59.4)	0.11	2.88	1.91	5.7
Sex	Female	11 (25.0)	120 (45.1)	*	1.00	*	*
	Male	33 (75.0)	146 (54.9)	0.10	1.03	0.06	2.71
Educational status	Secondary and above	21 (47.7)	147 (55.3)	*	1.00	*	*
	Just literate and primary	23 (52.3)	119 (44.7)	0.07	1.76	0.99	4.77
Addiction	Absent	10 (22.7)	153 (57.5)	*	1.00	*	*
	Present	34 (77.3)	113 (42.5)	0.03	2.17	1.85	7.32
Duration of DM (years)	<5	15 (34.1)	107 (40.2)	*	1.00	*	*
	≥5	29 (65.9)	159 (59.8)	0.05	4.31	1.97	7.90
Co-morbidity	Absent	7 (15.9)	87 (32.7)	*	1.00	*	*
	Present	37 (84.1)	179 (67.3)	0.03	2.45	1.45	6.86
BMI (kg/m²)	<25	13 (29.5)	84 (31.6)	*	1.00	*	*
	≥25	31 (70.5)	182 (68.4)	0.08	1.95	0.09	2.46
Regular treatment and follow up	Yes	14 (31.8)	248 (93.2)	*	1.00	*	*
	No	30 (68.2)	18 (6.8)	<0.001	2.92	1.83	4.16
Condition of foot	Healthy	3 (6.8)	69 (25.9)	*	1.00	*	*
	Unhealthy	41 (93.2)	197 (74.1)	<0.001	3.23	1.48	7.63
Usage of proper foot wear	Yes	6 (13.6)	120 (45.1)	*	1.00	*	*
	No	38 (86.4)	146 (54.9)	0.02	4.47	1.26	8..09
Knowledge on DM	Good	9 (20.5)	56 (21.1)	*	1.00	*	*
	Poor	35 (79.5)	210 (78.9)	0.01	3.67	2.01	5.35
Healthy foot habits	Present	4 (9.1)	66 (24.8)	*	1.00	*	*
	Absent	40 (90.9)	200 (75.2)	<0.001	2.56	1.78	4.09

Influencing factors for diabetic foot ulcer

Among the various independent variables, presence of addiction in any form, duration of diabetes more than five years, any associated non-communicable diseases, irregular treatment and follow-up care, unhealthy foot condition, non-usage of proper foot wear, poor knowledge of the disease and unhealthy foot habits have significant association with occurrence of foot ulcers (Table 3).

DISCUSSION

Diabetic foot ulcer imposes a negative impact on health, economy and quality of life of individual, family, community and country as a whole. But the condition and its consequences are preventable through insights and knowledge on contributing factors as well as timely interventions.

As in the current study the mean age of the participants was found closer to study by Regas et al, Deribe et al but

somewhat lower than Singh et al.[13-15] Likewise in this study male preponderance was noted by Tamilselvan et al, Regas et al but females were more in study by Mutonga et al.[11,13,16] Distribution of participants following religion was different in various studies. Educational status influences level of awareness, understanding and practice. As in current study it has been supported by Chiwanga et al, Mariam et al but Deribe et al from Ethiopia found more DFU among their higher educated patients.[14,17,18] Living status in terms of availability of caregivers in present study has similarity with study by Regas et al, Shahi et al, Marium et al.[13,18,19] Current study found smoking and/or alcoholism to be an important predictor for DFU and worsening of disease itself. Findings in the current study in this have supports from studies by Chiwanga et al, AlAyed et al, Assaad-Khalil et al.[17,20,21]

Literatures show that longer a person remains diabetic higher the negative consequences affecting various organ systems including lower extremities. This finding of the study has been supported by Yazdanpanah et al from Iran, O'Shea et al from New Zealand, Regas from Ethiopia,

Gadepalli et al from India.[13,22,24] In accordance with current study Tamilselvan et al, Deribe et al, Mariam et al, found various co-morbidities like as, hypertension, obesity, neuropathy, kidney disease etc. which increased risk of DFU manifold.[11,14,18] Self-care practice has tremendous role in predicting prognosis, and prevention of ulceration among diabetics. Findings of current study in this have been supported by Marium et al,[18] Atosona et al, Nongmaithem et al, Kumhar et al.[18,25-27]

Prevalence of DFU as found in the present study is similar to Regas et al, Deribe et al, Chiwanga et al, Shahi et al but it was higher than AlAyed et al from Jordan, Assaad-Khalil et al.[13,14,17,19-21] On the other hand Amogne et al, Ogbera et al showed much higher prevalence of DFU than current study.[28,29] For ulcer severity, as in current study where 1/5th was found severe was in accordance to studies by Amogne et al, Bakri et al.[28,30] Regarding the influencing factors for diabetic foot ulcers, the current study has similarities with studies by Regas et al, Marium et al, Deribe et al, Shahi et al.[13,14,18,19]

This study had some limitations like as, in-depth assessment of ulcers by their clinical characteristic, microbiological examination, antibiotic sensitivity etc. was not done. The study was conducted in only one setting and that too for just three months. A future study with prospective design may be beneficial for follow up of the patients.

CONCLUSION

The prevalence of foot ulcer was 14.2% among diabetic patients attending the study setting. There is definite role of measures targeted towards modifiable risk factors like current addiction, maintaining regularity in treatment and follow up, healthy foot habits like wearing appropriate foot wear, self-examination of feet and toes regularly, and identification and timely intervention at pre-ulcerative stage. Awareness generation on these is much needed by educating the patients, family members and health care service providers.

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