Original Article

Diabetic Foot Care: Knowledge and Practice – A Cross-sectional Study from a Tertiary Care Hospital in Southern India

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Abstract

Background: Diabetes mellitus is one of the major problems in health systems and a global public health threat and diabetic foot ulcers and lower extremity amputations are common, complex, costly, and disabling complications of diabetes. Poor foot care knowledge and practices are important risk factors for foot-related problems among diabetic people. **Aims:** The aim of the study is to assess the knowledge about foot care, foot care practices, the prevalence and risk factors of diabetic foot and foot-related complications in adult diabetic patients. **Settings and Design:** The cross-sectional study was conducted in 204 consecutive diabetic patients attending the outpatient department of a tertiary care hospital. **Methods:** A questionnaire including demographic details, knowledge questionnaire, attitude, and awareness for foot problems based on the Nottingham Assessment of Functional Foot Care Revised 2015 questionnaire was administered. This was followed by a foot examination for various aspects related to foot care and risk stratification. **Statistical Analysis Used:** Descriptive analysis with frequency distribution for knowledge and practice scores, univariate analysis, and multiple logistic regressions to find significant variables associated with good foot care knowledge and practice scores. **Results:** About 30.39% had good knowledge score. Rural background (adjusted odds ratio [OR]: 1.98, 95% confidence interval [CI]: 1.08–3.65), poor education status (adjusted OR: 4.63, 95% CI: 1.04–20.54), poor glycemic control (adjusted OR: 1.46, 95% CI: 0.83–2.58), and previous history of foot ulcer (adjusted OR: 3.05, 95% CI: 1.42–6.65) were significantly associated with poor knowledge on foot care. **Conclusion:** Our study shows that knowledge and practice of foot care of diabetic patients are still substandard. Poor communication between patients and nurses/physicians, rural background, poor education, and poor glycemic control were significant barriers of foot care. Policymakers should initiate foot care education programs throughout the regional state for increasing awareness about proper foot care practice in diabetic patients to reduce the incidence of complications.

Keywords: Diabetes mellitus, foot care knowledge, foot care practices

Introduction

India is the "diabetes capital" of the world, with more than 75 million people with diabetes.[1,2] The incidence of foot ulcers among people with diabetes varies from 8% to 17%.[3] Diabetic foot ulcer is one of the most common complications of diabetes and it is because of microvascular and neuropathic complications [Figure 1]. People with poor knowledge and practice regarding diabetic foot care are known to have a higher incidence of diabetic foot ulcers that cause severe disability and hospitalization.[4] Proper control of blood glucose prevents the development of microvascular complications. Furthermore, the practice of diabetic foot care, including daily foot examination and use of appropriate footwear, is considered important in its early detection and prevention of complications.[5] Of all complications of diabetes, diabetic foot-related complications are the most preventable ones. Poor knowledge of foot care and poor foot care practices were identified as important risk factors for foot problems in diabetes. Thus, this study thus aims to determine the awareness, practices of foot care, and prevalence of diabetic foot and foot-related complications in adult diabetic patients attending medicine outpatient department (OPD).

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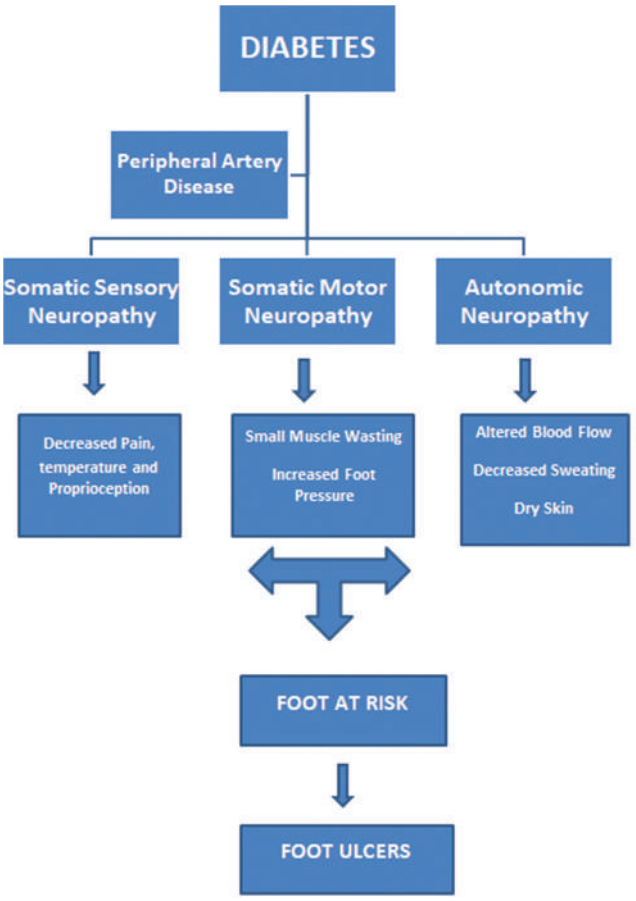

Figure 1: Pathways that lead to diabetic foot

Methods

Study period

The cross-sectional study was conducted for 15 months, over the period from April 2018 to July 2019.

Study settings

The setting of the study is a tertiary care center. The study was conducted in the Outpatient Department of Departments of General Medicine at Christian Medical Hospital, Vellore, India.

Study population

All patients diagnosed with diabetes mellitus and attending the outpatient clinics of the General Medicine department were included in the study. Patients with gestational diabetes and patient on glucocorticoids were excluded from the study.

Aims and objectives

- To determine the awareness and practices of foot care in adult diabetic patients attending medicine OPD
- To assess the knowledge about foot care in adult diabetic patients
- To assess the prevalence of diabetic foot and foot-related complications.

Sample size and sampling

The sample size was calculated to be 204, with relative precision (%) of 20, expected proportion of knowledge is 0.32, with desired confidence level (1-alpha) % of 95.

Data variables and data collection procedures

All eligible patients, after written informed consent, were administered a questionnaire by the principal investigator which had 16 self-administered "yes or no" questions regarding knowledge of foot care, attitude, and awareness of methods used to screen for foot problems and whether such methods are practiced by them. This questionnaire was based on the Nottingham Assessment of Functional Foot Care Revised 2015 questionnaire.

This was followed by a foot examination done by the principal investigator for various aspects related to foot care and risk stratification, including assessment of peripheral neuropathy by use of the following: (1) Semmes–Weinstein monofilament 2 g (purple) and 10 g (orange) at ten sites. The inability to feel a 10 g monofilament at 4 of 10 sites indicates a loss of protective sensation, (2) Biothesiometer – this is used for quantitative sensory testing and a recording of more than 15 mV indicates a mild neuropathy, >25 mV a moderate neuropathy, and a voltage of >40 mV if there is a severe neuropathy, (3) Pin–prick sensation, (4) vibration sense using a 128 Hz tuning fork, and (5) ankle jerks. The peripheral arterial disease was assessed by examining peripheral pulses and calculating the ankle-brachial pressure index. Foot inspection for calluses, deformities such as hammer toe, claw toe, mallet toe, ulcers, discoloration, and fissures was done. Intrinsic foot muscle strength was tested using a paper–grip test.

This was followed by education by the diabetic foot care nurse stationed at the medicine outpatient department on importance and aspects of foot self-examination and preventive care.

Statistical analysis

The data were collected and double-entered, validated, and analyzed using EpiData version 3.1 for entry and version 2.2.2.182 for analysis (EpiData Association, Odense, Denmark). Data were analyzed using descriptive statistics such as mean and standard deviation for the continuous variables and for the categorical variables, frequencies, and percentages. The knowledge score was calculated and summary measure was reported. The decision of choosing independent *t*-test, Mann–Whitney *U*-test, or Kruskal–Wallis test is done on the basis of the assumption of normality which was assessed by plotting QQ plot and histogram along with the Shapiro–Wilk test of significance for normality. Then, this knowledge score was categorized (scores: <8 low and >8 high) groups). The data were entered in EpiData version 3.1 (EpiData Association Odense, Denmark) and were analyzed using R software. Pearson's Chi-square test or Fisher's exact test was used to test the categorical data to evaluate if the relationship between them arose by chance. The value is significant based on the *P* value within the significant range of less than or equal to 0.05.

Results

Of the study population, 50% (102/204) consisted of women. 50.1% (103/204) were from rural areas. The mean age of the participants was 50 years (standard deviation [SD] + 10). Of the study participants, 10.3% (21/204) had not received any formal education, 8.8% (18/204) had primary school education, and 33.8% (69/204) were graduates. Homemakers accounted for 43% (88/204) of the study participants, unskilled workers 2.9% (6/204), and professional workers 28.4% (58/204). The demographic details of the subjects are shown in Table 1.

The disease was diagnosed within the past 5 years for 46.6% (95/204) of the study participants. Of the study participants, 58.3% (119/204) were only on oral antidiabetic drugs, 15.7% (32/204) on insulin, 13.7% (28/204) on diabetic diet and exercise, and the rest were on a combination of OHAs and insulin. Poor glycemic control (postprandial sugar >180 mg/dl or HbA1C >7.2 mmol) was noticed in 55.1% (113/204) of the participants. Of all the study participants, 25.5% (52/204) had a history of foot ulcer. The details regarding the disease and treatment are shown in Table 2.

Of the study participants, 34.8% (71/204) knew that calluses and fissures could lead to foot ulcers in diabetes, 79.4% (162/204) knew that they should not walk barefoot, 46.1% (94/204) knew that people with diabetes should use special shoes, and 88.7% (181/204) knew that they should not smoke as it could worsen a diabetic foot. Numbness of feet was reported in about 28%. Only about 10% had been prescribed protective footwear like microcellular rubber before and most were compliant with its use (18/21, i.e., 86%). Reported rates of physician advice regarding foot care and examination for at-risk feet were abysmal at 30% and 20% only. Despite poor rates of physician counseling reported practice of wearing any kind of footwear both indoors and outdoors were nearly 65%, washing feet daily was reported in nearly 90%. Self-inspection of feet and correct technique of cutting nails were reported in nearly 40%. The salient responses regarding the knowledge and practices regarding foot care are shown in Table 3.

The physical assessment results of diabetic foot are highlighted in Table 4.

The total possible maximum score for assessing knowledge, attitude, and practice was 16. The mean score obtained by the participants was 6.60 (SD 2.653). Among the participants, 30.39% (62/204) had a score of ≥ 8 (i.e., ≥50%), indicating good knowledge, attitude, and practice.

The multiple logistic regression analysis showed that after adjusting for other variables, rural background (odds ratio [OR]: 1.98, 95% confidence interval [CI]: 1.08–3.65), poor education status (OR: 5.08, 95% CI: 1.33–26.04), poor glycemic control (OR: 1.93, 95% CI: 1.03–3.60), and previous history of foot ulcer (OR: 3.05, 95% CI: 1.42–5.53) were significantly associated with poor knowledge on foot care. The results are shown in Table 5.

Table 1: Demographic characteristics of the study population (*n*=204)

Variables	*n* (%)
Sex	
Male	102 (50.0)
Female	102 (50.0)
Address	
Rural	103 (50.0)
Urban	101 (50.0)
Occupation	
Unemployed	11 (5.4)
Unskilled	6 (2.9)
Semiskilled	30 (14.7)
Housewife	88 (43.1)
Professional	58 (28.4)
Retired	11 (5.4)
Education	
Nil	21 (10.3)
Up to 5th grade	18 (8.8)
6th–10th grade	54 (26.5)
11th and 12th grade	42 (20.6)
Graduate	69 (33.8)
Age, mean (SD)	50 (10)
Height, mean (SD)	160 (7)
Weight, mean (SD)	66 (11)
HbA1c, mean (SD)	7.7 (1.6)

SD: Standard deviation, HbA1c: Hemoglobin A1c

Table 2: Details regarding disease and treatment among study population (*n*=204)

Variables	*n* (%)
Duration of illness (years)	
<5	95 (46.6)
>5	109 (53.4)
Medications	
Only on diabetic diet and exercise	28 (13.7)
Oral antidiabetic drugs	119 (58.3)
Insulin	32 (15.7)
Combinations of OADs and insulin	25 (12.3)
Glycemic control	
Good control	91 (44.6)
Poor control	113 (55.4)
Have or had foot ulcer	
Yes	52 (25.5)
No	152 (74.5)

OADs: Oral antidiabetic agents

Discussion

We concluded from our study that rural background (OR: 1.98, 95% CI: 1.08–3.65), poor education status (OR: 5.08, 95% CI: 1.33–26.04), poor glycemic control (OR: 1.93, 95% CI: 1.03–3.60), and previous history of foot ulcer (OR: 3.05, 95% CI: 1.42–5.53) were significantly associated with poor knowledge on foot care. A similar study done on 212 diabetes patients attending the outpatient department in a Secondary Care Rural

Table 3: Frequencies of answers in knowledge, attitude, and practice questionnaire

	Yes, *n* (%)	No, *n* (%)
Knowledge		
Are you aware that calluses and fissures can lead to foot ulcers in diabetes?	71 (34.8)	133 (65.2)
Do you know that you should not walk barefoot	162 (79.4)	42 (20.6)
Do you know that if people with diabetes can develop an ulcer, they should use special shoes?	94 (46.1)	110 (53.9)
Do you know that you should not smoke	181 (88.7)	23 (11.3)
Attitude		
Do you have numbness of your foot	58 (28.4)	146 (71.6)
Have you ever been prescribed any special footwear	21 (10.3)	183 (89.7)
If yes, do you wear the special footwear everyday	18 (8.8)	186 (91.2)
Has your treating physician ever discussed foot care with you	64 (31.4)	140 (68.6)
Have your feet been ever examined for diabetes-related complications	37 (18.1)	167 (81.9)
Practice		
Do you self-inspect your foot daily and look for any new red spots/cuts/swelling/blisters?	79 38.7)	125 (61.3)
Do you wash your feet daily?	182 (89.2)	22 (10.8)
Do you trim your toenail straight and file edges?	82 (40.2)	122 (59.8)
Do you wear shoes/slippers both indoors and outdoors?	132 (64.7)	72 (35.3)
Do you protect and keep your feet away from too hot/too cold temperature?	137 (67.2)	67 (32.8)
Do you use talcum powder to keep the skin between your toes dry to prevent infection?	12 (5.9)	192 (94.1)
Do you use oil on your feet daily	17 (8.3)	187 (91.7)

Hospital in Southern India showed that about 75% had good knowledge scores and 67% had good foot care practice score. They also showed that male gender, poor education status, and lesser duration of diabetes were significantly associated with poor knowledge of foot care.[6]

A community-based, cross-sectional study among 400 patients with type 2 diabetes, majority of them belonging to the upper middle class in Rural Sullia, Karnataka, showed that only 24.25% of them had good knowledge toward diabetic foot with poor self-care practices.[7] A study done in rural health center, in Puducherry, India, with 103 diabetes patients showed that only 54% were aware that diabetes could lead to decreased foot sensation and foot ulcers and 19.4% had a satisfactory awareness about good practice and it was concluded that foot care education for diabetics in a primary care setting can improve their foot care practice.[8] The risk of diabetic foot ulcer was found to be higher in patients of rural areas than in urban diabetic patients.[9] In a prospective study from North India, it was reported that patients with diabetes from rural areas were more prone to foot ulcers (70.10%) than those living in urban areas (29.90%).[10]

Table 4: Physical assessment revealed the following results

	n (%)
Appearance of feet	
Normal	46 (22.2)
Deformities	2 (1)
Dry skin callus	135 (66)
Infection	2 (1)
Fissure	15 (7.4)
Ulceration	
Absent	111 (54.4)
At risk	90 (44.1)
Superficial ulceration	4 (2)
Ankle reflexes	
Present	115 (56.4)
Reinforcement	74 (36.3)
Absent	15 (7.4)
Vibration perception at great toe	
Present	131 (64.2)
Decreased	67 (32.8)
Absent	6 (2.9)
Monofilament	
Normal	119 (58.3)
Reduced	82 (40.2)
Absent	3 (1.5)
Vibration sensation with biothesiometer (mv)	
<25	169 (82.8)
>25–<40	28 (13.7)
>40	7 (3.4)
Pinprick	
Present	194 (95.1)
Decreased	9 (4.4)
Absent	1 (0.5)
Ankle brachial index	
0.9–1.2	193 (94.6)
0.6–0.9	11 (5.4)
Muscle strength	
Normal	203 (99.5)
Reduced	1 (0.5)
Peripheral pulses	
Present	203 (99.5)
Absent	1 (0.5)

Poor knowledge was also found to be associated with poor glycemic control, which could be attributed to lesser number of visits to the health-care facility, which would have exposed them to more patient education regarding foot care. Previous history of foot ulcer was found to be associated with poor knowledge and similar findings were reported in previous other studies.[11]

Another cross-sectional study in a Tertiary Care Hospital in northern India with 400 diabetic patients concluded that only 50 of 400 patients (12.5%) had received previous foot care advice from health-care professionals and the mean foot care score was 5 of a maximum of 14, which was poor.[12]

Table 5: Individual factors and their association with poor and good knowledge, attitude, and practice scores

	Poor knowledge	Good knowledge	*P*	OR (95% CI)
Address				
Rural	79	24	0.026	1.98 (1.08–3.65)
Urban	63	38		
Sex				
Male	65	37	0.068	0.57 (0.31–1.04)
Female	77	25		
Occupation				
Unemployed and semiskilled	41	17	0.83	1.07 (0.55–2.09)
Others	101	45		
Duration of illness (years)				
<5	72	23	0.073	1.74 (0.94–3.21)
>5	70	39		
Education				
Illiterate	19	2	0.019	5.08 (1.33–26.04)
Schooling and graduate	113	70		
Medication				
OADs	103	44	0.818	1.08 (0.55–2.09)
Insulin + OAD	39	18		
Glycemic control				
Good	68	20	0.038	1.93 (1.03–3.60)
Poor	74	42		
Have or had foot ulcer				
Yes	42	10	0.003	3.05 (1.42–5.53)
No	88	64		

OR: Odds ratio, CI: Confidence interval, OADs: Oral antidiabetic agents

In a study done in three tertiary centers of Saurashtra, assessing the knowledge, attitudes, and practice of type 2 diabetes among patients concluded that the two main aspects of diabetes care, foot care checking, and self-care motivation were ignored by most of the treating physicians.[13]

There are various deficiencies in the practices regarding foot care identified from this study. 20.6% of the study population did not know that they should not walk barefoot and 35.3% do not wear shoes/slippers both indoors and outdoors. In most rural Indian households, walking barefoot indoor is an age-old cultural practice. In a study done in a diabetic clinic in Mumbai, only 45% of patients with diabetes were found to walk barefoot indoors.[14] There lies the importance of proper education regarding various aspects of foot care. In this study, it was also found that poor educational status was associated with poor knowledge. A hospital-based study done in Chennai also showed similar results.[15]

This study highlights few areas of knowledge and practice of foot care which is deficient in the study population with diabetes. We can use these findings to guide a health education program on foot care for diabetic people. More emphasis should be put on these deficient areas during health education. In this study, few sociodemographic factors have been identified which were significantly associated with poor knowledge of foot care. Better foot care practice can be achieved by better foot care knowledge in diabetic patients, and our study showed a significant association between them as the incidence of fissures ($P = 0.009$) was significantly associated with poor knowledge of foot care.

Our study shows the importance of increasing awareness about proper foot care practice in diabetic patients to reduce the incidence of complications. This can be achieved by educating the patient about self-foot care and other important practices. This should be done by treating physicians who have a major role in this education.

The strengths of the study are an adequate sample size and the use of a good instrument for the physical assessment of diabetic feet. The study has few limitations. This is an outpatient clinic-based study in a tertiary care center and the level of knowledge and practices do not reflect the same in the community.

Conclusion

We found that better foot care practice can be achieved by better foot care knowledge in diabetic patients. Hence, there should be more emphasis on improving the care of feet in diabetic patients. Doctors should spare some time for patients for discussing various aspects of foot care and search for complications. Specific attention should be given on patients with rural background, poor education status, poor glycemic control, and patients with a previous history of foot ulcer. Education about foot care must be imparted by every clinician, or else trained nurses can be used. Special attention should be

given to systematic foot examination. Directed education and teaching regarding the proper care of the cracked foot, fissures, and calluses should be provided during the visit.

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Conflicts of interest

There are no conflicts of interest.

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