

CHARACTERISTICS OF DIABETIC FOOT LESION IN TYPE-2 DIABETIC PATIENTS OF NORTH KARNATAKA

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ABSTRACT

India has the highest number of patients affected by diabetes mellitus. Patients with diabetes are at high risk of developing foot lesion that can develop into non-healing wound. Few studies have reported that type-2 diabetes mellitus patient have a lifetime risk of developing diabetic foot ulcer. Thus aim of this study was to evaluate the characteristics of diabetic foot lesion in patients of type-2 diabetes of north Karnataka. It is a prospective study conducted on patients admitted in department of surgery and orthopedics at Al Ameen Medical College & Hospital Bijapur for a period of 6 months. The demographic data, diabetic foot history, bacteriological pattern and associated risk factors, treatment and patient offloading were evaluated. Demographics and physical characteristics were: 68% patients with history of type II diabetes mellitus presenting with foot lesion were males, among them 36% patients had peripheral neuropathy and 30% had peripheral artery disease (PAD). Diabetic foot lesion characteristics are 30% of lesions were located on dorsum aspect and 24% on toes, 40% University of Texas (UT) wound Grade of 1B (wound involving tendon, capsule or bone), 30% with Grade 1C (ischemia) and 16% with Grade 3B (osteomyelitis). Bacteriological pattern showed 42% of gram negative anaerobes with grade-2 (50%) and grade-3(44%) infection under PEDIS system of classification. Majority underwent conservative (22%) management; few underwent disarticulation (26%) or major amputation with no mortality rate during study period. Diabetic foot lesion occurs more commonly in middle and old age group patients having male predominance. Smoking, chewing tobacco and alcohol consumption are the associated risk factors predisposing to PAD and neuropathy leading to foot lesion.

KEYWORDS: North Karnataka, type 2 diabetes mellitus, risk factors, diabetic foot lesion.

INTRODUCTION

India has ranked first in the list of ten nations most affected with diabetes (1, 2). Around 15% of diabetic patients got affected with diabetic foot lesion during their lifetime (2), this can be associated with poor diabetic control, barefoot walking and lack of education which will complicate diabetes mellitus (3). Despite the efforts of conservative therapy, there will always be a percentage of foot lesions that necessitates hospitalization. In general, the development of diabetic foot lesion is mainly related to local trauma, neuropathy and deformity (4, 5). In India neuropathy (13%-78%), microangiopathy (16%-53%) and diabetic foot lesion are the common complications of diabetes mellitus (6, 7) leading to disability, morbidity and mortality in the patients. Thus the objective of this study was to evaluate the characteristics of diabetic foot lesion in patients of type-2 diabetes of north Karnataka.

MATERIAL & METHODS:

Study Area: Department of surgery and department of orthopedics Al Ameen Medical College & Hospital Bijapur, Karnataka. This hospital serves as a general hospital, teaching hospital and a research centre, it is not considered as a diabetic foot care clinic, though patients with various diabetic complications are referred to this hospital to take care of.

Study Duration: 6 months

Sample Size: 50

Study Design: Prospective study, the data was collected from those patients admitted in the department of surgery and orthopedics Al Ameen Medical College & Hospital Bijapur with history of type II diabetes mellitus presenting with foot lesion during study period.

Sample Population: 50 patients with history of type II diabetes mellitus presenting with foot lesion admitted

in the department of surgery and orthopedics Al Ameen Medical College & Hospital Bijapur

Inclusion criteria: All adult patients with history of type II diabetes mellitus presenting with foot lesion admitted in the department of surgery and orthopedics Al Ameen Medical College & Hospital Bijapur.

Exclusion criteria: Type II diabetic patients with severe systemic illness, foot lesion such as cellulitis, blisters, osteomyelitis and gangrene of lower limb occurring due to causes other than diabetes mellitus were excluded from the study.

Ethical Clearance: Entire study was approved by Institutional Ethical Committee which follows the guideline of Indian council of medical research (ICMR) for principles on ethical considerations involving human participants 2017(8).

Study Interventions: Diabetic foot lesion is a general term used to designate lesion that occurs in diabetic patient's foot, an anatomical area below malleoli (9). Diabetic foot lesion patients were admitted with progressive infection, septicemia, gangrenous tissue requiring amputation and those in need of complex wound care. The intention was to optimize the limb salvage rate and healing time by combining medical treatment, surgical management and limited lower limb amputation surgery if needed. On admission patient's initial random blood sample for blood glucose level was collected and analyzed. Immediate measures were taken to control hyperglycemia using insulin or oral hypoglycemic drugs and they were advised to take complete bed rest. Foot lesions with ulceration were treated conservatively by debridement and dressing, while those lesions with abscess collection were incised and drained, specimens of foot lesions after decontamination and debridement followed by curettage were collected for culture and antimicrobial susceptibility testing. Patients with diabetic foot lesion associated with the peripheral arterial disease were diagnosed using Doppler ultrasonography, radiological examination of the affected foot was taken to discover bone abnormalities and osteomyelitis. Diabetic foot patients were graded under the PEDIS grade of classification for infection, according to the PEDIS classification grades of infection were defined as, Grade 1: No symptoms or signs, Grade 2: Infection of skin/subcutaneous tissues only, Grade 3: Extensive erythema deeper (>2cm) than skin/ subcutaneous tissue and Grade 4: Systemic inflammatory response syndrome(4-26) (10). The University of Texas Diabetic Wound Classification System was used to classify diabetic foot ulcers in a simple grading system according to this ulcer is graded as; 1B- Infected superficial wound not involving tendon capsule or bone; 1C- Surgical

wound with ischemia; 3B- Infected wound penetrating to bone or joint; 2D- Infected and ischemic penetrating wound to tendon or capsule (4-28) (11).

Data Collection: Data was collected using a structured and pre-texted questionnaire via face to face interview and direct observation of the patient. The questionnaire was prepared in the local language to keep its consistency. Junior resident and senior resident doctors were involved in the data collection process and the following information was collected: Demographic data, diabetic history, laboratory results, diabetic foot investigation for ulcer severity, presence of infection, peripheral neuropathy, peripheral arterial disease, microbiological profile, treatment modality, observed outcome including length of hospital stay (patient offloading) and inpatient hospital mortality.

Statistical Analysis: After the collection of data within the stipulated period it was reviewed thoroughly and checked manually for its completeness. The data was collected in such a way that it could provide epidemiological information. Grouped mean \pm standard deviation was calculated using SPSS software version 13. The data was summarized and then presented in the form of diagrams, tables and pie chart as appropriate.

RESULTS

50 adult diabetic patients with diabetic foot lesion which were included in the study within a stipulated period of 6 months were analyzed and the following results were obtained. Demographics and patient characteristics (Table 1) shows 34(67%) patients were male and 16(33%) were female (Fig.01), with a mean age of 53.1 ± 12.38 (Mean \pm SD) with male and female ratio of 1.3:1 belonging to urban area (70%) and having government job (36%) or merchants, this shows prevalence of diabetic foot lesion is common among male patients. Almost 68% of the patients had a history of trauma precipitating foot lesion located at the dorsum of foot (30%) with history of diabetes (<5yrs) showing associated co-morbidities such as neuropathy (36%) and hypertension (56%) (Table 2 & 3). Local foot lesions in this study were more likely to affect the plantar aspect of foot and toe that were treated conservatively (22%) with topical antibiotics and dressing after debridement and drainage, few underwent disarticulation (26%) or major amputation; there was no mortality during study period. Diabetic foot lesion grading was done based on University of Texas classification of diabetic foot wound in which grade 1B and 1C predominate in our study (Table 4). The infection status of each ulcer was graded using the PEDIS system of classification with the type of infected foot ulcer belonging to Grade 2(50%) and Grade 3(44%) (Table 5).

Variables	Total participants (%)
AGE	
21-30	01 (02%)
31-40	08 (16%)
41-50	10 (20%)
51-60	18(36%)
61-70	10 (20%)
71-80	02 (04%)
>81	01(02%)
Sex	
Male	34(68%)
Female	16(32 %)
Marital Status	
Married	38 (76%)
Widowed	09 (18%)
Single	03 (06%)
Occupation	
Farmer	11 (22%)
Housewife	08 (16%)
Govt. employed	18 (36%)
Merchant	13 (26%)
Residence	
Urban	35 (75%)
Rural	15 (30%)

Table 1: Socio-demographic Characteristics of the Sample (n=50)

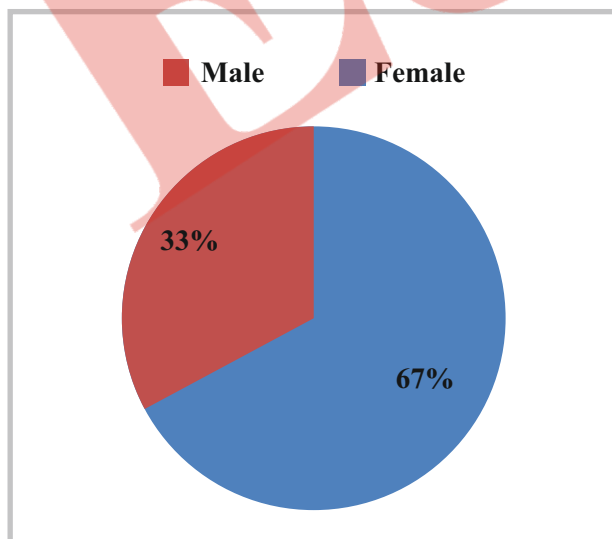


Fig 1: Sex Distribution

Characteristics	Total participants (n=50)
Anatomical region	
Dorsum	15(30%)
Toes	12(24%)
Sole - heal	03(06%)
- Forefoot	06(12%)
2 nd and 3 rd web space	02(04%)
Complete foot	01(02%)
Corsum of toes	06(12%)
Lateral aspect of foot	05(10%)

Table 2: Primary Ulcer Characteristics of the Sample

Factors	Numbers (%)
History of trauma present	34 (68%)
Neuropathy	18 (36%)
Hypertension	28 (56%)
Hyperlipidemia	38 (76%)
History of healed ulcer	13(26%)
Claudication	15(30%)
Smoking- smokers	36(72%)
-Nonsmokers	14(28%)
Angina	08(16%)
Duration of diabetes mellitus	
On the day of admission	06(12%)
< 05years	27(54%)
06-10 years	10 (20%)
11-15 yrs	06(12%)
>16yrs	01(02%)

Table 3: Medical History and Risk Factors (n=50)

Grade/DepthN=50					
Stages/ Comorbidities N=50		0 pre-or post- ulcerative lesion completely epithelialised	1 Superficial wound not involving tendon, capsule or bone	2 Wound penetrating to tendon or capsule	3 Wound penetrating to bone or joint
	A	n=0	n=0	n=0	n=0
	B with infection	n=04 (8%)	n=20 (40%)	n=0	n=08 (16%)
	C with ischaemia	n=0	n=15 (30%)	n=0	n=0
	D with infection and ischaemia	n=0	n=0	n=03 (06%)	n=0

Table 4 Primary Ulcer Grade/depth According to the University of Texas Classification for Diabetic Foot wounds

Grades of infection	Number (%)
Grade 1 No symptoms or signs	00(00%)
Grade 2 Inflammation of skin/ subcutaneous tissue only	25 (50%)
Grade 3 Extensive Erythema deeper (>2cm) than skin/ Subcutaneous tissue	22(44%)
Grade 4 Systemic inflammatory response syndrome	03(06%)

Table 5: PEDIS Classification Grades of Infection (n=50)

Bacteriological pattern: A total of 70 specimens were collected from diabetic foot lesion for culture and antimicrobial susceptibility testing which showed 42% positive culture for anaerobic gram-negative bacilli which include pseudomonas aeruginosa, polymicrobial, E.coli, Klebsiella and Proteus (Fig.02).

Patient management and outcome: All 50 patients with diabetic foot lesion received insulin or oral hypoglycemic agents to keep diabetes under control, parenteral or oral antibiotics were given to control infection, local foot lesions were treated conservatively (22%) with topical antibiotics and dressing after debridement and drainage (72%). Other treatment modalities include split-skin grafting of patient, who underwent wide excision and few underwent disarticulation (26%) or major amputation (10%) (Fig.03). All the patients were advised on foot care including appropriate selection of footwear and importance of regular follow up after discharge.

Patient Offloading: The mean length of stay per admission for diabetic foot lesion was 42days (range

from 21 to 42 days) with age group ranging from 20 to 40 years. There were no deaths during the period of study. The ulcer healed satisfactorily (95%) but required outpatient wound care (Fig.04).

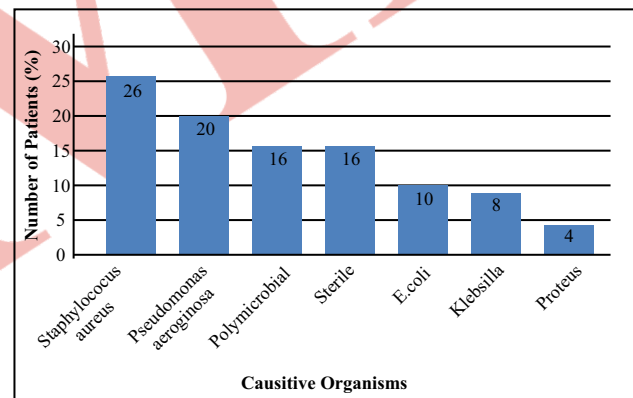


Fig 2: Bacteriological Pattern

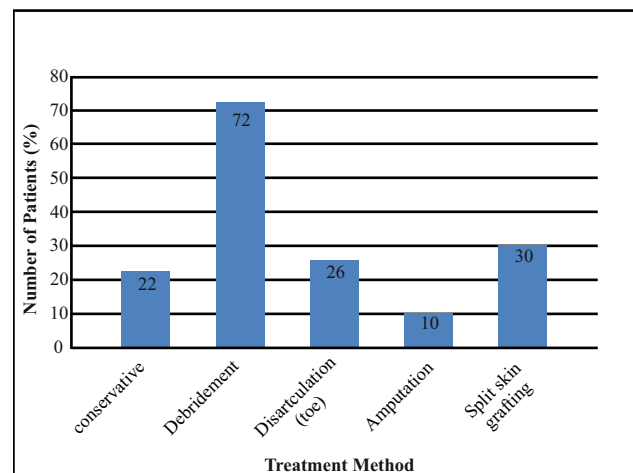


Fig 3: Patient Management and Outcome

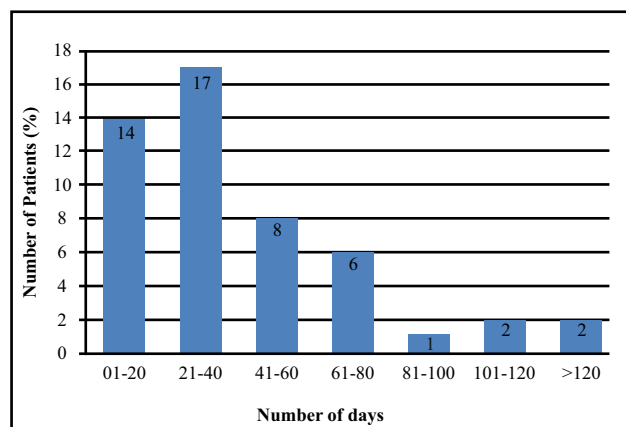


Fig 2: Bacteriological Pattern

DISCUSSION

This is a prospective study conducted on 50 patients with a history of type II diabetes mellitus presenting with foot lesion admitted in the department of surgery and orthopedics Al Ameen Medical College & Hospital Bijapur. Diabetic foot lesion is a serious and expensive complication with considerable mortality which affects the diabetic patient during their lifetime. Diabetes is a syndrome of metabolic, vascular and neuropathic components that are interrelated (6, 7). It is seen that the prevalence of risk in diabetic foot lesion is higher in India (12) compared to the global prevalence of risk up to 40%-70%. Meanwhile, the current prevalence of diabetic foot lesion is 12% compared to the global prevalence of 1.4%-5.9% (13). The present study reveals that males are affected more than females with a mean age of 53yrs and patients hailing from urban areas are affected more than rural places, this finding contradicts with other studies which show rural predominance (14). This may be due to sedentary & stressful lifestyle leading to poor glycemic control even under treatment along with patient's bad habits such as smoking, chewing tobacco and alcohol consumption which is more common in this region all these conditions are the strongly associated risk factors (15,16) for the development of peripheral artery disease (17, 9) leading to diabetic foot lesion. In another study, it was shown that pressure due to ill-fitted shoes or repeated trauma from tight shoes can be a triggering factor which compromises local blood supply at the microvascular level predisposing the patient to foot lesion (13). In our study, we have observed a positive association of age, duration of diabetes and risk factors (bad habits) with diabetic foot lesion. More than 50% of the patients had a history of diabetes of <5 year's duration presenting with foot lesion. Boyko et al (16) in the Seattle Diabetic Foot Study found the mean duration of diabetes to be 1.2 years compared to 4.9 years in our

study. In our report, the infection was present invariably in nearly all patients and Gram-negative bacteria were the most commonly isolated microorganism, which is in accordance to previous bacteriologic study from another tertiary care hospital in India (18). It was observed that the mean duration of stay in the hospital for diabetic foot patient was 41.08 days which is comparable with studies conducted in England (19), Tanzania (20) and Nigeria (21) the mean duration of hospital stay was 22.2 days, 36.2 days and 60.3 days respectively. This variation from study to study might be related to differences in clinical practices, the severity of illness and the availability of supportive care in their hospital.

CONCLUSION

Diabetic foot lesion is more common in middle and old age group with male predominance (male: female ratio of 1.3: 1). Most of the patients were hailing from an urban background with a history of smoking, chewing tobacco and alcohol consumption. The severity of foot lesion, treatment modality and hospital stay was directly proportional to poor glycemic control and associated risk factors. The need or intention of this study was to optimize the healing time and limb salvage rate by combining medical and surgical management.

Limitations of the study

- This study is limited by the evaluation of patients with diabetes only. There is also a need to consider other factors such as HbA1c, a specific cause of foot lesions due to foot deformities such as clawed toe, foot pathologies such as fissures and callositi.
- Duration of foot lesion was generally self-reported which is a limitation and unreliable for determining ulcer duration.
- The sample size with which the study was undertaken might have not found any significant relationship from the data.
- There might be recall bias or reporting bias regarding the contributing factors, such as alcohol use or exercise frequency. Further, the nature of the study does not confirm the definitive cause and effect relation.

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