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DETECTION OF HIGH RISK FOOT IN DIABETIC PATIENTS ATTENDING DIABETIC CLINIC

Medicine

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ABSTRACT

Background: Diabetes and the diabetic foot ulcer (DFU) have made their mark in society, with the prevalence of diabetes being four times higher than all cancers combined. Infected DFU is a major cause of prolonged hospital admission and contributes over 90% of non traumatic lower limb amputations (LLAs), which is more than a million amputations/year. As a result, subjects with DFU maintain poorer quality of life, with higher baseline depression rate, and 5-year mortality rates of up to 74% .

Objectives: The study mainly aimed at making foot care and clinical examination of foot an integral part of diabetes care in patients attending diabetic clinic and also to identify High risk foot in diabetic patients attending diabetic clinic.

Material and Methods: Present study was a cross sectional hospital based study which was done at Promhex Amrapali Hospital, Greater Noida from January 2017 – June 2017 (6months). A total of 180 patients with diabetes attending the clinic were enrolled in the study. A clinical assessment of vascular and neuropathic compromise was done by a Semmes-Weinstein 10 g monofilament, VPT- Biothesiometer for Vibration senses and Ankle Brachial Index (ABI) by using hand held doppler.

Results: This study shows that significant number of diabetic patients (15.8%) coming to Promhex Amrapali Hospital, diabetic follow up clinic have (Diabetic Foot Ulcer) DFUs. Diabetic foot ulcer was observed among 32 (17.7%) diabetic patients. The mean age of the study population was 50.72±13.39 years. 47.2% of the patients had presence of peripheral vascular disease which is almost half of the study population. The amputation rates were higher in neuro-ischaemic group (46%).

Conclusion: The prevalence of diabetic foot ulcer among diabetic patients in Promhex hospital was 15.8%. From our study we also confirm that peripheral neuropathy is the predominant factor for foot ulceration as the insensate foot is prone for undue trauma. The coexistence of peripheral vascular disease worsens the morbidity and mortality of the diabetic foot syndrome.

KEYWORDS

Diabetes Foot Ulcer, Lower Limb Amputations, Biothesiometer, Ankle Brachial Index.

Introduction:

Diabetes, considered as a disease of developed countries, is one of the endocrine disorders that reached epidemic proportions worldwide[1]. The metabolic deregulation associated with diabetes mellitus (DM) cause's secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system[2].

International Diabetes Federation (IDF) estimates that South east asian (SEA) countries have about 78 million patients of diabetes with an additional 42.2 million pre diabetes patients. This figure is estimated to rise to 140 million diabetic patients by year 2040. Eighty five (85%) percent of these cases are in India. IDF recognizes rapid urbanization and increased life expectancy in this region as two major factors leading to exponential rise in prevalence of diabetes[3]. Asian Indian phenotype is characterized by higher waist circumference, higher levels of total and visceral fat, hyper insulinemia, insulin resistance, and a greater predisposition to diabetes as compared with white Caucasians of comparable body-mass index (BMI)[4].

Lots of complications are associated with DM. Those complications arise chiefly from the disruption of the vascular system which can result in inadequate circulation to the peripheral body. This places the foot at higher risk of ulceration and infection[5].

As the incidence of diabetes mellitus is increasing globally, increase in complications is also unquestionable. Overall all 15% of individuals with diabetes mellitus will have foot ulcer during their lifetime and the annual incidence is 2-3%[6,7]. Diabetic foot ulcer is becoming major concern of diabetic patients and those who treat them from quality of life, social and economical stand point[8].

Diabetes and the diabetic foot ulcer (DFU) have made their mark in society, with the prevalence of diabetes being four times higher than all cancers combined [9]. Increased life expectancies have contributed significantly to this exponential rise, with diabetes now contributing to 9% of global mortality, equating to 4 million deaths per year[10,11]. DFU occurs as a diabetic complication and involves a multifactorial pathogenesis including peripheral neuropathy as the primary causal factor, together with variable contribution from peripheral vascular disease (PVD), repetitive trauma, and superimposing foot infection[12,13]. Infected DFU is a major cause of prolonged hospital admission and contributes over 90% of non traumatic lower limb amputations (LLAs) [14,15], which is more than a million amputations/year [16-18].

Diabetic foot problems are common throughout the world, resulting in major economic consequences for the patients, their families, and society [19].The lifetime risk of a person with diabetes developing a foot ulcer could be as high as 25% [20] and it is believed that every 30 seconds a lower limb is lost somewhere in the world as a consequence of diabetes [21].The burden of diabetic foot disease is set to increase in the future since the contributory factors to foot disease, such as peripheral neuropathy and vascular disease, are present in more than 10% of people at the time of diagnosis of type 2 diabetes [22] and the first year after diagnosis of diabetes is a period of danger for foot ulcers and amputations [23] . Provision of a foot-care service can be associated with a reduction in amputations in diabetic patients [24].When Paul Brand was asked to make a recommendation on reducing amputations in diabetes

to a US Department of Health conference, most listeners were surprised to hear that his key recommendation was a national campaign to encourage health-care professionals to remove patients' shoes and socks and examine the feet. Unfortunately, however, this simple advice is ignored in most of the prescriptions in many countries. Identification of the at-risk foot does not require any expensive equipment: a tuning fork, pin, tendon hammer, and a 10-g monofilament should suffice for the detection of at risk foot. Education and more frequent follow-up should be focused on those with at-risk feet [19].

The progressive rise of diabetes is likely to pose a significant burden on future society leading to an associated increase in diabetic amputations [25,26]. Despite previous alert to the importance of early detection and management, prevention practices remain poor, with inconsistent patient follow-up and management compliance [27,28]. As a result, subjects with DFU maintain poorer quality of life, with higher baseline depression rate, and 5-year mortality rates of up to 74% [29]. Existing studies have identified Indigenous ethnicity and presence of micro vascular complications as contributing factors to poor DFU outcomes; however there is currently limited Indian evidence supporting this [30].

Aim and Objectives:

1) To make foot care and clinical examination of foot an integral part of diabetes care in patients attending diabetic clinic.
2) To identify High risk foot in diabetic patients attending diabetic clinic.
3) To assess peripheral neuropathy in diabetic patients.
4) To assess for peripheral vascular disease in diabetic patients
5) To assess glycemic status of all diabetic patients and to assess its relation with diabetic foot disease.

Material and Methods:

Present study was a cross sectional hospital based study which was done at Promhex Amrapali Hospital, Greater Noida from January 2017 – June 2017 (6months). A total of 180 patients with diabetes attending the clinic were enrolled in the study. A detailed history was taken in all the patients regarding duration of diabetes, treatment taken and any complications as per the predefined proforma. A detailed clinical examination including anthropometric measurements i.e height, weight, BMI was recorded. A detailed general and systemic examination was performed. A detailed clinical examination of foot was also carried out with attention to any deformity, corn, calluses, local temperature, edema, discoloration, decreased hair growth, pulses ex. dorsalis pedis and posterior tibial pulse. A clinical assessment of vascular and neuropathic compromise was done by a Semmes-Weinstein 10 g monofilament, VPT- Biothesiometer for Vibration senses and Ankle Brachial Index (ABI) by using hand held doppler.

The sample size was calculated as per the formula

$$n = \frac{2(Z\alpha+Z1-\beta)2\sigma2}{\Delta2}$$

The sample size calculated was 163 patients

Study population comprised of patients with a confirmed diagnosis of DM type 1 or 2 as per ADA Criteria [31]. The data was analyzed using SPSS version 12. We analyzed and identified what percentage of patients attending the diabetes clinic had a normal foot at presentation, diabetic foot ulcers with peripheral neuropathy, with peripheral vascular disease, or both. The data was represented in mean. The correlation between glycemic status and diabetic foot was also sought using Chi Square and appropriate statistical tests.

Result and Observations:

180 diabetic patients were involved in the study of prevalence and factors influencing diabetic foot ulcer with the response rate one hundred percent. Diabetic foot ulcer was observed among 32 (17.7%) diabetic patients. The mean age of the study population was 50.72±13.39 years. With regard to gender distribution 100 (55.5% were male. Considering place of residence 50 (27%) was from rural area. One hundred twenty nine (69.4%) were married. Corresponding to educational status 60(33.3%) have secondary education. Regarding age classification 28.8% were 48-57 years. Almost 33.3 percent of study populations were employs meaning they have paying job either from governmental or nongovernmental organizations.

Table 1: Socio demographic profile of diabetic patients

Variables	Diabetes patients				P value
	Without foot ulcer		With foot ulcer		
	No.	%	No.	%	
Sex of patient					
Male	100	55.5	15	8.3	**0.443**
Female	55	30.5	10	5.5	
Residence					
Urban	110	61.1	12	6.6	**0.001**
Rural	50	27.7	08	4.4	
Educational status					
Illiterate	30	16.6	15	8.3	**0.012**
Primary	50	27.7	05	2.7	
Secondary	60	33.3	05	2.7	
Above secondary	15	8.3	00	0.0	
Marital status					
Married	125	69.4	25	13.8	**0.097**
Unmarried	15	8.3	03	1.6	
Divorced	10	5.5	02	1.1	
Age interval in years					
18-27	05	2.7	00	0.0	**0.038**
28-37	05	2.7	00	0.0	
38-47	38	21.1	05	2.7	
48-57	52	28.8	25	13.8	
58-67	20	11.1	10	5.5	
68-77	15	8.3	05	2.7	
Occupation					
Serviced employee	60	33.3	10	5.5	**0.002**
Farmer	25	13.8	15	8.3	
Merchant	20	11.1	02	1.1	
Laborer	10	5.5	00	0.0	
Housewife	05	2.7	03	1.6	
Others	20	11.1	00	0.0	

Concerning knowledge about diabetes, 120 (66.6%) of client have good knowledge about diabetes. Diabetic foot self care practice was observed among 119(55.1%) of clients. Pertaining to attitude towards diabetic foot self care 96(44.4%) have favorable attitude. Considering body mass index majority of the study population lie within the range of 24.5-29.9 kg/m2 that indicates they are overweight. Looking to the blood pressure, majority of the study population 120 (66.6%) has systolic blood pressure less than 139 mmhg. With regard to diastolic blood pressure 45(24.4%) of the study population have DBP greater than 90 mmhg. Regarding fasting blood glucose level, the mean fasting blood glucose level among diabetic patients with foot ulcer is 177.97 mg/dl which is higher than those diabetic clients without diabetic foot ulcer.

Table 2: Risk factor profile of diabetic patients

Variables	Diabetes patients				P value
	Without foot ulcer		With foot ulcer		
	No.	%	No.	%	
Type of co morbidity					
Hypertension	65	36.1	15	8.3	**0.003**
Kidney disease	15	8.3	05	2.7	
Neuropathy	20	11.1	10	5.5	
Hypertension and Kidney disease	10	5.5	05	2.7	
Others	05	2.7	00	0.0	
None	20	11.1	10	5.5	
Knowledge about Diabetes					
Good knowledge	80	44.4	40	22.2	**0.81**
Poor knowledge	40	22.2	20	11.1	
BMI (kg/m2)					
16-24.5	15	8.3	05	2.7	**0.003**
25-29.5	105	58.0	20	11.1	
≥30	20	11.1	15	8.3	
Systolic blood pressure mm Hg					
<140	110	61.1	10	5.5	**0.01**
≥140	40	22.2	20	11.1	
Diastolic blood pressure mm Hg					
<90	130	72.2	05	2.7	**0.024**
≥90	30	16.1	15	8.3	
Duration of Diabetes in years					
<10	95	52.7	10	5.5	**0.001**
≥10	55	30.5	20	11.1	

Among the study population 41.6% were diabetic for more than 9 years and above. Regarding to foot skin texture 32.2% have dry and cracked

skin. Concerning to smoking status 13(7.2%) of the study populations were smokers. Among the study population 115(63.8%) have chronic health problem or co- morbidity other than diabetes. Regarding use of ill fitting shoes majority of respondents use shoes that doesn`t fit their foot well. Sensation to vibration (often the first sense to be lost in peripheral neuropathy) using a relatively low-pitched tuning fork of 128 Hz was detected in 52 (28.3%) of the study population. Majority, 130 (72.2%) of the study population has callus (Table 3).

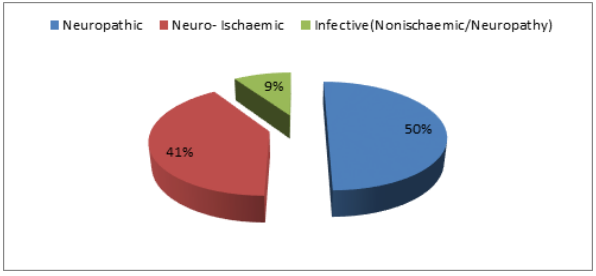
Table 3: Risk factor profile of Diabetic patients for developing foot ulcer

Variables	Diabetes patients				P value
	Without foot ulcer		With foot ulcer		
	No.	%	No.	%	
Foot skin texture					
Smooth and moist	100	55.5	20	11.1	**0.005**
Dry and/cracked	30	16.1	30	16.1	
Sensory loss to vibration					
Absent	98	54.4	30	16.1	**0.001**
Present	22	12.2	30	16.1	
Use of ill fitting shoes					
Absent	120	66.6	20	11.1	**0.015**
Present	25	13.8	15	8.3	
Callus of the feet					
Absent	110	61.1	20	11.1	**0.004**
Present	20	11.1	30	16.1	
Mean FBS in mg/dl					
	131.62±32.08	177±35.45			

Table 4: Distribution of Score According To Ankle Brachial Pressure Index (ABPI)

ABPI	Number of patients	Percentage
1.1-1	95	52.7
0.9 to 0.6	65	36.1
≤0.45	20	11.1

Figure 1: Percentage distribution of patients according to ABPI

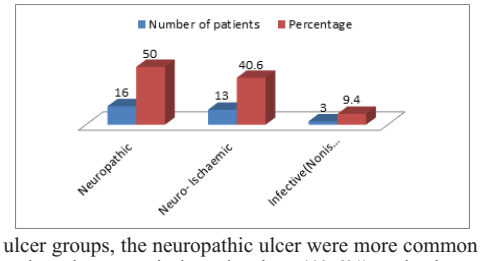


47.2% of the patients had presence of peripheral vascular disease which is almost half of the study population. Out of which 18 had stenosis in peripheral arteries, 3 had complete occlusion and 2 had both stenosis and occlusion of peripheral arteries. 36.1% of patients had ABPI reading 0.9 to 0.6 and 11.1% had ABPI ≤ 0.45.

Table 5: Distribution of Score Categorized In Ulcer Groups

Categories	Number of patients	Percentage
Neuropathic	16	50
Neuro- Ischaemic	13	40.6
Infective(Nonischaemic/Neuropathy)	03	9.4

Figure 2: Distribution of patients according to type of ulcer



In the ulcer groups, the neuropathic ulcer were more common (50%) compared to the neuro-ischaemic ulcer (40.6%) and others (9.4%) which indicates that substantial amount of population suffer both neuropathic and peripheral vascular problems.

Table 6: Distribution of Patients Undergone Amputation

Categories	Minor amputation*	Major amputation **	Total amputation
Neuropathic (n=16)	2(12.5%)	-	12.5
Neuro-ischaemic(n=13)	4 (30.7%)	2 (15.3%)	46
Infection (Nonischaemic/Neuropathic)(n=3)	1 (33.3%)	-	33.3

*Toe amputation ** Forefoot, BK AK amputation

In analyzing the outcome of these patients in the above three groups, the amputation rates were higher in neuro-ischaemic group (46%) when compared to other two groups which signifies that most of the patients undergoing amputation are predominantly due to combination of neuropathy, ischaemia and infection.

Table 7: Distribution of Outcome of the Patients

Categories	Healed *	Unhealed**	Mortality ***
Neuropathic(n=16)	14 (87.5%)	2(12.5%)	-
Neuro-ischaemic(n-13)	10 (77%)	2 (15%)	1 (8%)
Infection (Non ischaemic/ Neuropathic)(n=3)	2(67%)	1 (33%)	-

*within a period of 6 months either by full primary healing or by SSG
**healing time more than 6 months period going for further surgeries
***patient dead due to complication of the wounds

The outcome of the patients with diabetic foot ulcers, treated surgically were assessed depending on the wound healing time. The healing rate were better in the neuropathic group (87.5%) compared to neuro-ischaemic group (77%) which signifies that the presence of neuropathy increase the chance of foot ulceration and the presence of ischemia worsens the presentation and which further affects the outcome of the ulcer.

Discussion:

This study shows that significant number of diabetic patients (15.8%) coming to Promhex Amrapali Hospital, diabetic follow up clinic have (Diabetic Foot Ulcer) DFUs. According to standard books this prevalence is within the reference range. The possible explanation for this high prevalence of DFU among diabetic patients of Promhex might be related to diabetic foot self care practice, health seeking behavior and diabetes related knowledge of patients. Besides significant number of patients were coming from far rural areas which are far away from the hospitals catchment area. Besides our study`s result flashed the need to do lots of job to prevent diabetic foot ulcer. Previous studies in different areas have reported the prevalence of DFUs in the range of 4.6-11.9% among diabetic patients[2,32,33]. The difference might be due to variation in sample size, study population, study area or it may be explanation of socio cultural variation of the study participants. In spite of that, this study finding was comparable with the study conducted in North India[34] and Nigeria[35].

The occurrence of DFUs mostly in males and middle aged subjects has been reported by several researchers[36-38]. Those figures have slight variation with the present finding. This may be reflection of regional variation in the prevalence of diabetes mellitus and locally operating factors like socio demographic and socio cultural variables. This study found, 8.3% of males and 5.5% of females with a mean age of 50.72±13.39 years having DFUs and this is consistent with the findings of previous works[37,39]. The variation of DFU related to sex and age, might be reflection of variation in societal role between male and females in southern Ethiopia, typically in the study area, males spent most of their time outside homes doing jobs that need more energy compared to women. The increase in DFUs among diabetic patients, particularly in our study area, is worrying situation for individual families as males are the backbone and the sole earning members of the family, particularly in south Ethiopian population.

This study which is aimed to assess the prevalence and factors affecting diabetic foot ulcer found that 32.1% of diabetic patients with foot ulcer were from rural and the remaining 67.9% were from urban area. This was in contrast to recent study conducted in India that found high prevalence of foot ulcer among diabetic patients from rural area[40]. The association between residence and diabetic foot ulcer may be due to the fact that individuals in rural areas of Ethiopia particularly in the study area often spent most of their time in farm area or outdoors.

These people are commonly subject to rodent bites, especially bites to the feet of patients with diabetes can lead to ulceration due to poor healing.

The odds in favor of DFU for overweight diabetic patients were four times more likely as compared to diabetic patients who were not overweight. Body weight and body mass index were emerged as an influential factors for developing diabetic foot ulcer, with higher risk associated with greater weight and increased body mass index[35]. One potential mechanism for this association might be higher foot pressure in heavier and those with higher BMI subjects.

Long duration of diabetes, even after controlling for age, was a statistically significant finding in several studies[40,41]. This crossectional study also found that the odds in favor of having diabetic foot ulcer is increased by 8 times higher in those who were diabetic for more than 10 years as compared to those whose duration of diabetes is less than 9 years which is comparable with previous studies[40,42,43]. The possible explanation might be the fact that diabetic patients for long time were presumed to be at more risk due to the development of long term diabetic complications such as peripheral vascular disease (PVD), neuropathy, nephropathy and retinopathy which could lead to the occurrence of foot ulcer in the diabetic patients.

This cross sectional study identified use of ill fitting shoes as an influential factor for the development of diabetic foot ulcer which is in line with study conducted in black line hospital, Ethiopia[44]. This increased risk among those who uses ill fitting shoes might be related to high chance and frequency of foot injury which may result in subsequent ulceration.

Conclusion:

The prevalence of diabetic foot ulcer among diabetic patients in Promhex hospital was 15.8%. This study con-firm that foot ulcers in diabetes result from multiple influential factors. Significant influential factors were rural residence, mean arterial blood pressure, Comorbidity, occupation and duration of diabetes.

From our study we also confirm that peripheral neuropathy is the predominant factor for foot ulceration as the insensate foot is prone for undue trauma. The coexistence of peripheral vascular disease worsens the morbidity and mortality of the diabetic foot syndrome. Peripheral vascular disease further increases the amputation rates and reduces the healing time.

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Limitations of Study:

As it was a single centre hospital based study with a relatively small study population, results cannot be generalized to the entire population.

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