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Predisposing Factors of Diabetic Foot Amputation among the Diabetic Patients in a Tertiary Care Hospital

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Abstract

Background and Aim: Diabetic patients have a 15 to 20 time's higher risk of amputation than non-diabetic patients. In literature, many factors have been mentioned which affect diabetic foot prevalence and its treatment among diabetic patients. Present study was directed to recognize those factors. Identification of those factors would help to bring down the financial burden over patients and healthcare centers.

Material and Methods: Present cross-sectional study was conducted among the diabetic (diabetes type II) patients who came with problems relevant with diabetic foot in the surgical outpatient department of tertiary care institute of India for the duration of 6 months. Three hundred Patients were categorized into two categories based on the treatment advised to them. One category of patients was treated through amputation whereas, other category of patients was treated with antibiotics and wound dressings. A self-structured questionnaire was built to collect the required data from patients. Chi-square was applied to identify any association.

Results: From the total of 300 patients 78 (26%) were advised amputation, whereas, 22 (74%) patients were managed conservatively. The correlation between diabetic foot amputation and various factors which included gender, socioeconomic status, diet modification, blood sugar monitoring, life style, therapy type, smoking (p=0.02), ischemic heart disease, peripheral neuropathy and peripheral arterial disease (p=0.001) was statistically significant.

Conclusion: The incidence of foot amputation was high among the patients who had male gender, lower educational status, lower socioeconomic status, longer duration of diabetes, no diet change, no proper blood sugar monitoring, sedentary type of life style, inadequate therapy, poor compliance with treatment, history of smoking, hypertension, ischemic heart disease, stroke, peripheral neuropathy, and peripheral arterial disease and these factors were correlated with incidence of diabetic foot amputation significantly except duration of diabetes.

Key Words: Cross-sectional study, Diabetic foot amputation, Peripheral neuropathy, Socioeconomic status

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Introduction

The prevalence of diabetes for all age-groups worldwide is estimated to be 2.8% in 2000 and which is likely to rise to 4.4% by the year 2030. The total number of persons affected by diabetes is also projected to rise from 171 million in 2000 to 366 million by 2030.[1] Approximately 20% of all diabetics who enter the hospital are admitted for the foot problems.[2] The most common components in the causal pathway leading to limbloss include peripheral neuropathy, ulceration, infection, and peripheral vascular disease. Annual incidence of foot ulcers is 1% to 4% and prevalence 5% to 10% in patients with diabetes [3]

Diabetes mellitus has multiple chronic complications. These complications impact almost every system of human body. There are two types of complications including microvascular complications and macrovascular complications. Microvascular complication included retinopathy, nephropathy and neuropathy, whereas, macrovascular complications involved ischemic heart disease, cerebrovascular disease, and peripheral arterial disease.[4,5] Along with these aforementioned complications, one of the very lethal complications of diabetes mellitus is diabetic foot. Diabetic foot indicates an area of necrosis and gangrene distal to ankle joint.[6] The causative agents for diabetic food consisted of peripheral neuropathy, peripheral arterial disease, and infection.[7] Approximately 90% of non-traumatic lower limb amputations which is caused by diabetic foot only and thus it also leaves people physically paralyzed as well.[8],[9,10]

Diabetic foot ulcers and amputation are acute health and socioeconomic problems that negatively affect the quality of life of patients and impose a high economic burden on the patients and society.[11] Of patients with foot ulcers, 20% to 50% eventually undergo amputation.[12-14] Diabetic patients have a 15 to 20 times higher risk of amputation than non-diabetic patients.[15,16] Amputation is a multifactorial complication in diabetic patients. Older age, being male, and the duration of disease have been reported to be risk factors for amputation. In various studies, the incidence of amputation in diabetic patients has been reported to range from 5.2% to 39.4%.[18,19] People with diabetic foot get managed, either in conservative manner via wound dressing and antibiotics, or through amputation of affected foot.[20] In literature, many factors have been mentioned which affect diabetic foot prevalence and its treatment among diabetic patients. These factors included gender, educational status, socioeconomic status, duration of diabetes, diet modification, blood sugar monitoring, life style, type of therapy, compliance with treatment, smoking, hypertension, ischemic heart disease, stroke, peripheral arterial disease, and peripheral neuropathy[21-23]. Present study was directed to recognize those factors. Identification of those factors would help to bring down the financial burden over patients and healthcare centers.

Material and Methods

Present cross-sectional study was conducted among the diabetic (diabetes type II) patients who came with problems relevant with diabetic foot in the surgical outpatient department of tertiary care institute of India for the duration of 6 months. Study sample size was calculated through WHO sample size calculator and it was 300 with confidence interval of 95%. Only those patients who were willing to participate and who had no trauma history were recruited while patients who had history of any trauma and were not willing to participate were excluded from study. . Patients were categorized into two categories based on the treatment advised to them. One category of patients was treated through amputation whereas, other category of patients was treated with antibiotics and wound dressings. A self-structured questionnaire was built to collect the required data from patients. Questionnaire had two components. First was related to the demographic information of the participants. In second part of questionnaire, data regarding the duration of diabetes, diet modification according to diabetes chart, life style, type of therapy for diabetes, compliance with therapy, daily blood sugar monitoring, smoking history, hypertension, stroke history, and ischemic heart disease history was collected. Physical examination was also performed of each patient to check for peripheral neuropathy and peripheral arterial disease. Patients were considered to have to peripheral neuropathy, if the vibration sensation was reduced or absent in the foot and it was assessed by

a tuning fork of 252 Hz, while patients with absent pulses of posterior tibialis and dorsalis pedis in lower limbs were considered to have peripheral arterial disease.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Out of 300 participants 180 (60%) were males while 120 (40%) were females. The means of age and duration of diabetes for study population were 58.10 years with SD of ±10.20 years and 13.22 years with SD of ±6.90 years respectively. The percentage of patients who had been advised amputation of foot was 26%, whereas, patients who had been advised conservative treatment for diabetic foot were 74%.

In comparison to non-amputation group of patients, the amputation group of patients had more patients with male gender, lower educational status, lower socioeconomic status, longer duration of diabetes, no diet modification, no blood sugar monitoring, sedentary life style, oral hypoglycemic agent as therapy of choice for diabetes, poor treatment compliance, history of smoking, and peripheral arterial disease.

Table 1: Association of study variables with diabetic foot amputation

Variable	N=300		Diabetic patients' groups N (%)		P value
		Number Percentage (%)	Amputation N (%)	Non-amputation N (%)	
Gender			78 (26)	222 (74)	
	Male	180 (60)	55 (70.51)	120 (54.05)	
	Female	120 (40)	23 (29.48)	102 (45.94)	0.002*
Socioeconomic status	Lower class	170 (56.6)	58 (74.35)	106 (47.74)	0.001*
	Middle class	130 (43.3)	14 (17.94)	116 (52.25)	
Duration of diabetes	Longer	168 (56)	42 (53.84)	125 (56.30)	
	Shorter	132 (44)	36 (46.15)	97 (43.69)	0.09
Diet modification	Yes	125 (41.66)	25 (32.05)	95 (42.79)	
	No	175 (58.33)	53 (67.94)	127 (57.20)	0.05*
Blood sugar monitoring	Yes	60 (20)	22 (28.20)	40 (18.01)	
	No	240 (80)	56 (71.79)	182 (81.98)	0.0006*
Life style	Active	90 (30)	18 (23.07)	70 (31.53)	0.001*
	Sedentary	210 (70)	60 (76.92)	152 (68.4)	
Type of therapy	Insulin	70 (23.3)	20 (25.64)	50 (22.52)	0.003*
	Oral hypoglycemic agent	200 (66.6)	42 (53.84)	160 (72.07)	
	Both	30 (10)	16 (20.51)	12 (5.4)	

* indicates statistically significance at p≤0.05

Discussion

Diabetes could be very devastating when its complications occur. It has multiple and deadly

complications that involve every major system of the body. Along with aforementioned complications it could lead to a very destructive change among the diabetic patients with poor diabetes control in the form of diabetic foot. Inappropriate care of diabetic foot can bring further problems in the life of diabetic patients when poor diabetic foot care leads to its amputation. It all shows that how deadly diabetes could be when it goes beyond proper control. The diabetic foot could be managed conservatively with proper wound dressing and antibiotics. But when the tissues of diabetic foot get infected and necrosed then only option we left with is foot amputation.19 The incidence of the diabetic foot amputation among the diabetic population of our study was high 26%. Little lower incidence (22.50%) of diabetic foot amputation has been noted in a study that was also conducted among Pakistani population.19 In a study at China 21.50% amputation has been noted as well.20

Almost all factors that are related to diabetes management including diet modification, blood sugar monitoring, life style, type of therapy, and compliance with therapy were associated with amputation of diabetic foot significantly except the duration of diabetes. No change in diet, irregular blood sugar monitoring, sedentary life style, oral hypoglycemic agents, and poor compliance were associated with higher incidence of diabetic foot amputation. Similar findings have been noted in other studies that were conducted in various countries.[19,21-25] Stone et al [26] the duration from the time of diagnosis until the first event of amputation was 11 years. In the study by Armstrong et al the duration was 14 years, and by Muller et al, it was 8 years and in present study, it was 7 years. In our study, mean duration of diabetes mellitus is less than the other studies may be because our patients had lack of knowledge regarding the diabetes control and foot care.

We observed that history of comorbidities which comprised of smoking; hypertension, ischemic heart disease, and stroke were strongly involved in the rise of foot amputation incidence among diabetic patients. Relationship between smoking and diabetic foot amputation has also been noted in a study of China.[27] Likewise, the association between cardiovascular system related diseases hypertension and ischemic heart disease and amputation of diabetic foot, is also established in literature.[19,28]

Diabetic complications including peripheral neuropathy and peripheral arterial disease that occur in the advance stage of the diabetes were also noted as factors that predispose to the foot amputation to the diabetic patients with diabetic foot. Amputation incidence could be higher among diabetic patients with peripheral vascular disease, as this disease brings obstruction in the flow of the blood to the peripheries which lead to gangrenous changes in the limbs and consequently amputation of limbs becomes the only treatment for diabetic foot. Moulik et al had reported the incidence of peripheral neuropathy in as much as 61% of diabetic patients. In a study by Boyko and associates, 60% of the patients who developed diabetic foot ulcer had neuropathy. Pecoraro and colleagues indicated that peripheral vascular disease and infection were significantly associated with an increased prevalence of lower-extremity amputation. Additionally, infection, gangrene, and ischemia were the most common component causes of lower-extremity amputation.[29,30]

Conclusion

The incidence of foot amputation was high among the patients who had male gender, lower educational status, lower socioeconomic status, longer duration of diabetes, no diet change, no proper blood sugar monitoring, sedentary type of life style, inadequate therapy, poor compliance with treatment, history of smoking, hypertension, ischemic heart disease, stroke, peripheral neuropathy, and peripheral arterial disease and these factors were correlated with incidence of diabetic foot amputation significantly except duration of diabetes. So, by controlling the controllable factors we could prevent the foot amputation among diabetic patients. Raising awareness about the lethal complications of diabetic foot and educating the patient regarding the foot hygiene, use of well fitted closed foot wear, early access to healthcare system and satisfactory rehabilitation might help in reducing the risk of amputations.

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