Original Article

Frequency of Lower Limb Amputations in Diabetic Foot Disease at Public Sector Hospital

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ABSTRACT

Objective: The aim of this study is to determine the frequency of minor and major amputations in diabetic foot disease patients at different Wagner's grades of severity and correlate it with the glycemic control.

Study Design: Prospective descriptive study

Place and Duration of Study: This study was conducted at the Department of Orthopaedic Surgery Peoples University of Medical & Health Sciences (PUMHS) Nawabshah from January 2015 to December 2017.

Materials and Methods: Total number of 120 patients of diabetic foot disease were included in this study. According to the Wagner's classification these patients were divided into six grades. Each patient's glycemic control was monitored byHbA1c level, fasting blood sugar level, and random blood sugar level. Patients were admitted at medical department and operated at Orthopaedics operation theatre and the outcome of lower limb amputations were determined.

Results: In Wagner's grade-0, there was no any patient,in Wagner's grade-I, 12(10%) patients, in Wagner's grade-II, 26 (21.6%) patients, in Wagner's grade-III, 28 (23.3%) patients, in Wagner's grade-IV, 36 (30%) patients, andin Wagner's grade-V18(15%) patients were included. Out of 120 patients 74 (61.6%) patients were male.50.88 ± 11.06 years was the mean age of the patients. There was history of Diabetes Mellitus of 9 years or longer in 80 (66.7%) patients.NIDDM was found in 112 (93.3%) patients. The most common organism isolated from wounds was Staphylococcus aureus. In grade-I only 2(16.6%) patients underwent minor amputation, while 6 (23.7%) in grade-II, 16 (57.14%) in grade-III, and 16 (44.44%) in grade-IV underwent minor amputation. In grade-III, 6 (21.42%), in grade-IV, 20 (55.55%) and in grade V, all 18 (100%) underwent major amputations. The most common performed procedure was below-the-knee amputation. There were 40 (33.3%) overall frequency of minor amputations and 44 (36.3%) overall frequency of major amputations. There was higher percentage of minor and major amputations in patients with poor glycemic control (p-value = 0.001).

Conclusion: This study concluded that the frequency of amputations in lower limb increases withpoor glycemic control and higher Wagner's grades of diabetic foot disease patients.

Key Words: Diabetic foot, Amputation, Wagner's grading

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INTRODUCTION

Diabetic foot disease affects about 15% of the diabetic pateitns. Multiple risk factors have been implicated[1,2]. Neuropathy, peripheral vascular disease, limited joint mobility, cigarette smoking, hyperglycemia and reduced resistance to infections, all play a role in the development of foot pathology in diabetic pateints[3-6]. Once established ulcerations, infection and gangrene may provoke an irreversible cascade of events, culminating in limb loss. Lower extremity amputation in diabetic patients is associated with high postoperative mortality and a high rate of secondary amputation[7,8]. Foot problems are the major cause of hospital bed occupancy by diabetic patients[9]. Hyperglycemia is one of the major risk factor in diabetic foot disease patients underwent amputations. Good glycemiccontrol is crucial in preventing diabetic foot compliations[10-12].

The objectives of this study were to determinethe frequency of minor and major amputation in diabetic foot patients at different grades of Wager's classification and to correlate these with glycemic control of the patients.

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MATERIALS AND METHODS

This was an descriptive study conducted from January 2015 to December 2017 at the Department of Orthopedic Surgery Peoples University of Medical & Health Science (PUMHS) Nawabshah. It included all the patients with diabetic foot disease admitted on the

medical ward. Patients with previous major amputations due to diabetic foot disease and those with cause other than diabetes were excluded from the study. A detailed history was taken from each patientintended to obtain the information regarding the general bio data of the patients, cigarette smoking, history of foot problems, its duration, any treatment taken for it and the response about the foot care practice, blood sugar control and any other co-morbid condition like hypertension, ischemic heart disease, renal or vision problem. General and systemic examination was performed. Detailed examinationof involved feet were done to determine the nature of the lesion, extent and vascularity of the limb as well as its motor and sensory supply. Glycosylated hemoglobin (HbA1c), fasting blood sugar (FBS) level, and random blood sugar (RBS) level were performed in each patientselected for the study. These levels were used to determine the previous blood sugar control and for comparison of treatment results. The other investigations performed included complete blood picture, erythrocyte sedimentation rate (ESR), urine analysis, urea, creatinine, electrolytes, lipid profile, pus from wound for culture and sensitivity.

X-rays of the involved feet and chest and ECG were carried out necessary. Color Doppler ultrasound was used to determine the patency of the vessels in the involve limb.

According to Wagner's classification the patients were then distributed into six grades of severity as follows.

Grade-O: No ulcer, intact skin, high risk foot due to bony deformities.

Grade-I: Superficial ulcer with exposed subcutaneous tissues.

Grade-II: Deep extension of ulcer into soft tissues.

Grade-III: Ulceration with abscess formation or osteomyelitis

Grade-IV: Gangrene of toes of forefoot.

Grade-V: Gangrene of entire foot.

Each patient was managed according to the grade of the disease. Previous medications were stopped and patients were placed on the sliding scale of regular insulin at start and during the surgical procedures. It was then converted to fix dose of 70/30 mixed insulin. Blood sugar levels were monitored daily, in patients with grade-I disease the ulcer was debrided off dry scale or callosity and wound was dressed. Repeated dressings were then done till the ulcer healed. In grade-II ulcer patients wound debridement was done under ankle block or spinal anesthesia. In infected lesions, antibiotics were given accordingly to the culture and sensitivity results. As the wound become aseptic, total contact cast was applied for two weeks, weight bearing was not allowed in patients with heel ulcer. At two weeks, a window was made in the cast at ulcer site and dressings were then changed through it. As the ulcer healed, the patients were advised to wear soft cushion shoes and keep foot hygiene. Antibiotics were given to all the patients in grade-III and above extensive debridement and curettage was done for osteomyelitis lesions under spinal or general anesthesia. Many patients needed repeated debridement and dressings. EUSOL solution was used for dressings in these patients. Large skin affected was covered with split thickness skin graft. Where indicated, minor (amputation of a toe or forefoot) or major (amputation of whole foot or leg) amputation were performed. In some patients, multiple level amputations were needed. The disease outcome in each patient was determined. Data was collected and analyses on SPSS package. Chi-square test of significance was applied to compare disease outcome with the baseline reading of FBS, RBS an HbA1c levels to find out the influence of blood sugar control on the diseaseoutcome at $p<0.05$ level of significance.

RESULTS

Out of 120 patients selected for study 74 (61.6%) were males and 46 (38.3%) were females.50.88 ± 11.06 years was the mean age of the patients. 92 (76.66%) patients were more than 40 years of age. 112 (93.3%) patients were of non-insulin dependent diabetes mellitus (NIDDM) against 8 (6.6%) insulin dependent diabetes mellitus (IDMM) patients. There was history of Diabetes Mellitus of 9 years or longer in 80 (66.7%)patients(Table-I), 70 (58.3%) were smokers. In 84 (70%) patients, baseline FBS more than 120mg/dl and RBS > 180mg/dl were found while in 96 (80%) patients HbA1c values higher than 9% were found, indicating poor glycemic control. The most frequent site for ulceration was the base of big toe on the planter aspect and the heel. Debridement alone was successful in 36 (30%) patients who were fitted with TCC responded well. The ulcers in 2 patients out of 12 in grade-I and 6 out of 26 in grade-II extended deeply and resulted in toe and ray amputations.

Patients with osteomyelitis (grade-III) had poor outcomes. In only 6 out of 28 patients, the lesion was eradicated without any amputation though extensive debridement and curettage. S. aurous was cultured in 75% cases. 16 patients in this group needed minor amputation while 6 ended up in below-the-knee amputation.

There were 36 (30%) patients in Wagner's grade-IV and 18 (15%) patients in Wagner's grade-V at presentation which needed minor and major amputations at different levels (Table-II). 16 patients needed split thickness skin grafts for wound coverage. The ray (whole toe) amputation was the most frequently done 18 of 40 minor and below-the-knee 28 of 44 was major amputation. The overall frequency of minor amputation was 33.3% and major amputation was 36.3% (Table-2).

Table No. I: Type and duration of diabetes mellitus.

Type of diabetes mellitus	**No. of Cases (n=120)**	**Duration of DM**	**Percentage**	**95% Confidence Interval**
IDDM*	8 (6.66%)	<10 Years 10 – 20 Years > 20 Years	0 (0%) 2 (3.3%) 2 (3.3%)	2.15 – 15.3
NIDDM*	112 (93.4%)	<8 Years 8 – 12 Years > 12 Years	20 (33.3%) 30 (50%) 6 (10%)	84.6 – 97.8
*IDDM = insulin dependent diabetes mellitus; *NIDDM = non - insulin dependent diabetes mellitus				

Table No. 2: Disease out come with reference to grade severity and management.

Grade	**Total No. of Patients (n=120)**	**Healed Without Amputation**	**Minor Amputation**	**Major Amputation**
Grade-0	0 (0%)	0	0	0
Grade-I	12 (10%	10 (8.3%)	Ray amp. = 2	0
Grade -II	26 (21.6%)	20 (16.6%)	Toe amp. = 4 Ray amp. = 2	0 0
Grade-III	28 (23.3%)	6 (5%)	Toe amp. = 2 Ray amp. = 6 Lisferanc = 8	Blow knee = 6
Grade-IV	36 (30%)	0 (0%)	Toe = 4 Ray = 8 Lisferanc = 4	Chopart = 4 Below knee = 16
Grade-V	18 (15%)	0	0	Below knee = 6 Above knee = 6 Knee Dis. = 4 Hip Dis. = 2
Overall	120 (100%)	36 (30%, 9.5% Cl 19.4-42.2)	40 (33.3%, 95% Cl 22.3-45.9)	44 (36.3%, 95% Cl, 25.2-49.3)
Key = amp. amputation; dis. = destruction				

Table No. 3: Correlation between the glycemic control and the frequency of amputations.

Glycemic Level (Mg/dl)	**No of cases**	**Healed without amputation**	**Minor amputation**	**Major amputation**	**P=Value**
FBS* >120 RBS* > 180	84 (70%)	12 (14.3%)	28 (33.3%)	44 (52.3%)	P=0.005**
FBS* >120 RBS* > 180	36 (30%)	24 (66.7%)	12 (33.3%)	0	P=0.001**
HbA1c* 6 – 8%	24 (20%)	20 (83.3%)	4 (16.7%)	-	P=0.001**
9 – 12%	60 (56.6%)	12 (17.6%)	30 (44.1%)	26 (38.2%)	P=0.001**
> 12%	28 (23.3%)	4 (14.3%)	6 (21.4%)	18 (64.2%)	P=0.13
*FBS=Fasting blood sugar, RBS = random blood sugar HbA1c=glycosylated hemoglobin; **statistically significant					

When the treatment results were compared with the baseline value of FBS, RBS and HbA1c level (Table-III), it was found that outcome of 84 (70%) patients with baseline FBS>120mg% and RBS>180mg%, 28 (33.3%) patients underwent minor and 44 (52.3%) major amputations (P = 0.001). similarly out of 96 (80%) patients with HbA1c level 9% or more, 80 (83.33%) patients underwent some sort of amputation (P = 0.001). The diabetic foot lesion in 24 of 36 patients with controlled blood sugar levels healed without any amputation.

DISCUSSION

Lower extremity amputation is a common disabling complication occurring in diabetes mellitus, it is

associated with high mortality with survival after lower extremity amputation being less than 50% at 3 years[13].

Most patients in the study were males, above 40 years of the age and with diabetes duration longer than 9 years. Male gender and duration of diabetes more than 10 years are known risk factor for lower limb amputation in diabetes[14]. Majority of the lower limb amputations are associated with NIDDM. The reason may be the greater prevalence of NIDDM in older people with associated other risk factors such as atherosclerosis, reduced immunity and longer duration of the disease.

The treatment results in the present series are comparable to national and international studies. In a study conducted in Scotland, there were 55.8% first lower limb amputations. Out of these, 29 (55.8%) were major and 23 (44.2%) were minor. Below-the-knee amputation was done in 24 (46.2%) and Ray amputation in 21 (40.4%) patients[15]. Similarly, in a study in Nauru, the incidence of first lower extremity amputation was 8.1/1000 person-year. Out of 46 patients who underwent amputation, 18 had single minor, 18 had single major 7 had major and minor amputation and 3 had more than one major amputation. The were no amputation among individuals with baseline fasting plasma glucose less than 7.8mmo/1, irrespective of diabetic duration. Comparable frequencies of different amputation have been reported in a study by Khan et al. where debridement alone was sufficient in 42 (62%) patients, ray amputation in 12%, metatarsal amputations in 6%, Syme's amputation in 3%, below the knee amputation in 14% and above the knee in 3%. S. aureus was cultured from wounds in 80% cases[16]. Below-the-knee is the most frequently performed amputation. This level offers most promise of rehabilitation compared with above the knee amputation, the success rate of prosthetic rehabilitation for the former is 60 to 66%[17].

Several studies proved the importance of good blood sugar control for the prevention of lower limb amputation in diabetic people. In a study conducted by Jamilet al.[18]all the patients who underwent major amputation had uncontrolled diabetes mellitus at presentation, while the lesion in the rest of the patients, who had controlled blood sugar, either healed without any amputation or with minor amputation. The diabetic control and complication trail (DCCT) is a land mark multicenter trial designed to test the preposition that the complication of diabetes mellitus are related to evolution of plasma glucose concentration. A strong association of hyperglycemia with amputation risk is consistently found in multiple studies in Prima[19], Oklahoma[20], Indians and whites from Wisconsin[21] and in California[22]. Significant reduction in incidence of amputation has been achieved through effective diabetic education and awareness program addressing self-care and foot-care behavior[23-25].

CONCLUSION

This study concluded that the frequency of amputations in lower limb increases with poor glycemic control and higher Wagner's grades of diabetic foot disease patients. To help patients and physicians to prevent foot complications and improved diabetes care, health care facilities should institute a standard diabetic education and awareness programme addressing self-care and foot-care behavior.

Author's Contribution:

Concept & Design of Study:	Zahoor Illahi Soomro
Drafting:	Abdul Aziz Sahito
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