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Research Article

**ROLE OF HEALTH EDUCATION IN DECREASING THE
CASES OF DIABETIC FOOT**

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Abstract:

Objectives: Despite of the awareness of LEA in Pakistan, many factors are needed to be educated. This study carries the goal of defining all those factors which a diabetic foot ulcer leading to LEA at a Lahore General Hospital.

Methodology: Our research tends to define grades, features, and risks for LEA and DFU selecting subject size of 214 diabetic patients between February 2012 to November 2017 at Lahore General Hospital.

Results: Among those patients, 7.9% (17) patients had 1st grade, 62.1% (133) had 2nd grade and 29.9% (64) had 3rd grade ulceration, patients who were healed completely without LEA was 72.43% (155) while the number of patients who underwent LEA was 27.5% (59). Grade of ulceration held a great association with the risk of LEA at UT staging, increasing age, and presentation (p Value equals to 0.001). Female patients suffering from FU had relatively higher P value of 0.0001(BMI), P=0.03(diastolic), P=0.002(systolic), P=0.03(total cholesterol) and blood pressure.

Conclusion: We concluded at presentation that grade and severity of foot ulceration determine the outcome of ulceration. Although a significant number of patients who had foot ulceration of an underlying Neuro-ischemic Aetiology, most of them healed. Gender differences had different risk effects among neuropathic ulceration patients.

Key Words: Lower Extremity Amputation (LEA), Diabetic Foot Ulceration (DFU) Risk Factors (RF), Lower Limb Amputations (LLA), Foot Ulceration (FU), Multivariate Logistic Regression (MLR), Confidence Interval (CI).

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INTRODUCTION:

There is approx. 15% possibility of patients suffering from diabetes that DFU may affect them. This is one of the most common antecedents of the LLA. The outcome of DFU is closely related to the severity of ulceration. Important RF for ulceration preceded by amputation include severity of neuropathy, existence of peripheral vascular disease, concomitant infection and structural foot deformity. The LEA occurs 10 to 30 times more frequently among patients with diabetes compared to those with no diabetes and 70% of LLA occur in diabetic patients, among which 85% follow the FU [1].

Record shows incidents of LEA among diabetic patients (25.80/1000/year) compared to non-diabetic patients (1.10/1000/year). However, occurrence of LEA is different across the world. In United States of America, the occurrence rate of LEA among diabetic patients is 0.86% (8.6/1000) per year. In Pakistan, even though a comparable prevailing campaign of DFU is held, the rate of amputation was recorded 21%. Some reports calculated this rate up to 48%. Due to this high rate of LEA, suggestion of many factors has been made like lack of education about diabetes, unhygienic conditions, poor socio-economic status and delayed consultancy to secondary/tertiary care units [2]. Our study was purposed to define RF which determine the outcome of DFU leading to LEA in Lahore tertiary care unit in Pakistan.

METHODOLOGY:

Our study included patients (diabetic) having FU who attended a Lahore General Hospital from February 2012 to November 2017. Patients who could not follow up/completed treatment were excluded. The clinic of diabetic foot includes a consultant diabetologists, trained in diabetic foot associates of diabetology, orthoptist and chiropodist, and a surgeon greatly interested in diabetic foot. The variables which have been recorded in our research regarding each patient on their first visit were age, gender, duration/type of diabetes, duration and cause of ulceration, previous history and treatment regarding their FU, symptoms/signs of FU and their economic status. The detection of Proteinuria was carried out using combur-10 strip and confirmed by microalbuminuria/mitral test or one-day estimation of urinary protein. Measurement of glycosylated hemoglobin or HbA1c was taken to assess glycemic control where our scale for "Good glycemic control" was HbA1c less than 6.5%, "Fair glycemic control" ranged from 6.6% to 7.5% and "Poor glycemic control" was more than 7.5%. Due to the non-availability of HbA1c at some points, we assessed the glycemic control through levels of fasting and

Random Plasma Glucose (FPG/RPG): Good FPG < 120 milligram per dl, Fair 121-140 milligram per dl, and Poor > 140 milligram per dl. Whereas Good RPG < 160 milligram per dl, Fair 160-180 milligram per dl, and Poor > 180 milligram per dl.

Each patient was assessed for the definition of patency and grade (Good/Diminished/Absent) on the basis of vascular status using palpation of femoral (manual), dorsalis pedis, popliteal & posterior tibial arteries.

Neuropathic data was quantified to calculate vibration sensation. A tuning fork of 128 HTZ and a monofilament of 10 grams was applied perpendicular in direction to planter area of 1st toe. After that, to the 1st, 3rd & 5th metatarsal heads, dorsum of foot and finally to the plantar aspect of the heel carefully keeping any callus tissues, wound/corn site and denoting grades among Normal/Diminished/Absent. Reflexes of knee & ankle were recorded and graded as Normal/Diminished/Absent [3]. Through radiological examination and penetrating bone, Osteomyelitis determination was recorded. The level of severity of ulceration was classified with the help of Texas Classification System. Photographs were taken of FU for record at initial and each stage though out the study. Results key in case any part of lower limb is lost defines were recorded as: No LEA means the loss of any part from the lower limb (No LEA) defined as 'major' (Amputation is in proximity to tarso-metatarsal joint) or 'minor' (distal the tarso-metatarsal joint).

Research analysis checked our collected data with the software SPSS (v10.0) and gender differences were assessed by using the sample T test (independent). CI and odds ratios were also recorded for those variables (independent) which were related with every resulted variable. Variables having 'p' value less than 0.05 were used in the model of multivariate.

RESULTS:

Total subjects/patients were 214 where males were 63.5% (136). Average duration of possessing diabetes among them was 16.26 ± 6.81 years. Table-1 shows parameters regarding biochemical and physical. Record shows that an increased number of subjects held a poor glycemic control during presentation having the mean of HbA1c as: 10.03 ± 2.69 . Only 2.8% (6) patients were lost due to 'cardiovascular' events. Patients who were presented with FU possessed gender differences. Females subjects were recorded with higher P value of 0.0001(BMI), $P=0.03$ (diastolic), $P=0.002$ (systolic), $P=0.03$ (total cholesterol) and blood pressure.

According to the UT grading system, 7.9% (17) patients had 1st grade, 62.1% (133) had 2nd grade and 29.9% (64) had 3rd grade ulceration. According to the type of FU, patients with neuropathic ulcer were 44%, non-ischemic ulceration patients with

55.6% and less than 1% were recorded with pure ischemic ulcer. However, the number of patients who were healed completely without LEA was 72.43% (155) while the number of patients who underwent LEA was 27.5% (59) Table-II shows:

Table – I: Physical/biochemical parameters with mean & standard

Parameters	Male Mean \pm SD (n=136)	Female Mean \pm SD (n=76)	P value
Age (years)	53.64 \pm 10.38	51.29 \pm 9.77	0.108
Body Mass Index (kg/m ²)	25.01 \pm 4.41	28.48 \pm 5.44	0.000
Duration of diabetes (years)	16.26 \pm 6.91	16.30 \pm 6.65	0.963
Systolic Blood Pressure (mmHg)	128.39 \pm 20.84	138.14 \pm 23.24	0.002
Diastolic Blood Pressure (mmHg)	78.86 \pm 10.94	82.47 \pm 12.80	0.032
Serum Creatinine (mg/dl)	1.17 \pm 0.38	1.09 \pm 0.59	0.220
Fasting plasma glucose (mg/dl)	193.42 \pm 86.43	182.18 \pm 76.65	0.409
Random plasma glucose (mg/dl)	247.08 \pm 86.63	234.18 \pm 78.87	0.314
HbA1c (%)	10.13 \pm 2.67	9.77 \pm 2.47	0.451
Serum Cholesterol (mg/dl)	183.67 \pm 38.36	198.65 \pm 42.34	0.034
Serum Triglycerides (mg/dl)	145.55 \pm 80.07	168.15 \pm 73.52	0.099
Serum LDL (mg/dl)	116.01 \pm 34.39	123.76 \pm 34.00	0.241
Serum HDL (mg/dl)	39.18 \pm 7.70	39.28 \pm 7.46	0.942

Table – II: FU and amputations Records of University of Texas grades/stages*

Outcome	n= 214 (%)
No LEA	155(72.43)
Toe amputation	35(16.35)
Trans metatarsal amputation	2 (0.93)
Below knee amputation	13(6.07)
Above knee amputation	9(4.20)

Table – III: Outcome of patients (n=214)

Grade 1	Stages	Superficial wound not involving tendon, capsule or bone					P-value
		No. of Patients (n)	No. amputation	(%)	Amputation	(%)	
None	Stage A	1	1	100.0	0	0	0.001
Infection	Stage B	9	8	88.8	1	11.1	
Ischemia	Stage C	1	1	100.0	0	0	
Both	Stage D	6	5	83.3	1	16.6	
Grade 2			Wound penetrating to tendon				
None	Stage A	0	0	0	0	0	0.001
Infection	Stage B	60	52	86.6	8	13.3	
Ischemia	Stage C	1	0	0	1	100.0	
Both	Stage D	72	54	75.0	18	25.0	
Grade 3			Wound penetrating to bone or joint				
None	Stage A	0	0	0	0	0	0.001
Infection	Stage B	21	15	71.4	6	28.5	
Ischemia	Stage C	1	0	0	1	100.0	
Both	Stage D	42	19	45.2	23	54.7	

In accordance to the development rate of (P equals to 0.001), we collected 3rd grade 50.7% ulceration, 2nd grade 45.7%, and 1st grade 3.4%. A high development in LEA was recorded in 'D' stage of UT ulceration severity as compared to 'A' stage for 1st, 2nd and 3rd grade ulceration (P = 0.001). Site wise distribution of amputation is shown in Table-III. A number of 16.3% (35) patients processed under toe amputation.

Table-IV contains details of univariate factors related to LEA for DFU include age, sex, history of FU, grade of ulceration, and history of admission. The model of multivariate logistic regression shows that amputation was independently associated with increase in age, stage of ulceration and hospital admission (Table-V).

Table – IV: Analyzed factors of univariate associated with LEA

Variables	No LEA(n=155) n(%)	LEA(n=59) n(%)	Odds Ratio (95% Confidence Interval)
Age (years)*	51.69±10.0	55.81±10.20	1.04(1.01-1.08)
Gender			
Female	62 (28.97)	16 (7.47)	1.79(0.9281-3.46)
Male	93 (43.45)	43 (20.09)	
Duration of Diabetes (years)			
<10	30 (14.21)	10 (4.73)	
10-15	44 (20.85)	10 (4.73)	0.68(0.25 -1.84)
16-20	47 (22.27)	14 (6.63)	0.89(0.35 -2.27)
>20	34 (16.11)	22 (10.42)	1.94(0.79 - 4.75)
LDL (mg/dl)			
<130	58 (50.87)	21 (18.42)	
≥130	25 (21.92)	10 (8.77)	1.11(0.46-2.68)

Fasting Blood Sugar (mg/dl)			
<126	37 (22.83)	9 (5.55)	
≥126	84 (51.85)	32 (19.75)	1.57(0.68-3.61)
Random Blood Sugar (mg/dl)			
<200	47 (25)	18 (9.57)	
≥200	91 (48.40)	32 (17.02)	0.92(0.47- 1.81)
HBA1c (%)			
≤7.5	17 (12.59)	4 (2.96)	
>7.5	80 (59.25)	34 (25.18)	1.80(0.56-5.76)
HTN			
No	57 (27.27)	21 (10.04)	
Yes	95 (45.45)	36 (17.22)	1.03 (0.55- 1.93)
Protienurea			
No	147 (69.33)	50 (23.58)	
Yes	8 (3.77)	7 (3.30)	2.57(0.88 – 7.45)
History of foot ulcer			
No	87 (42.43)	21(10.24)	
Yes	64 (31.21)	33 (16.09)	2.14(1.13 – 4.03)
Hospital Admission			
No	76 (35.84)	8 (3.77)	
Yes	79 (37.26)	49 (23.11)	5.89(2.62-13.26)
Type of Ulcer			
Neuropathic	77 (37.74)	16 (7.84)	
Neuro-ischemic/ischemic	75 (36.76)	36 (17.64)	2.31(1.18 – 4.51)

Table – V: Model of multivariate showing factors associated with DFU patients' amputation

Factor	OR	CI (95%)
Age	1.04	1.01-1.07
Hospital Admission		
No		
Yes	5.89	2.57 -13.49
UT Stage		
Stage B		
Stage C&D	2.35	1.15 – 4.79

With the increasing age for each 1 year, amputation odds also increased by 1.04 (95% CI for AOR: 1.01-1.07). Comparing to non-imputes, odds of amputee's admission at hospital increased 5.9 times (95% CI for AOR: 2.57-13.49). Similarly, patients with amputations were classified higher (2.35 times) in higher UT stage comparing to non-amputees (95% CI for AOR: 1.15-4.78). Goodness of fit demonstrated with 'P' Value=0.56.

DISCUSSION:

DFU is one of the most frequent reason of being hospitalized among patients with diabetes. LEA is very frightening and expensive result of FU [4]. Our research presented patients with advance staged FU having and high rate of amputation [5]. Other studies showed that male subjects had a higher chance of being processed under LEA than female subjects. Although neuropathy was not associated independently with LEA but ischemia and neuropathy patients had a higher chance of undergoing LEA [6]. MLR analysis showed that hospital admission and age were independently

associated with LEA [7]. A high number of patients who were presented suffering from an advanced grade/stage of ulceration clearly reflected loop holes of Health care system of Pakistan among all three types (Primary, Secondary, and Tertiary) care units [8]. The problem is further aggravated by attempts of home surgery, undetected diabetes and trust in faith-healers. Moreover, improper use of antibiotics and using sterile instruments increases the growth of multi-resistant-organism which necessitates doctor consultancy [9].

Such lamentable outcomes show low priority for

spending on health care (2.9% or Rs. 260/US\$ 4.33) of the monthly average household expenditures of Rs. 8965/ US\$149.41. The same analysis has been reported for 8 countries with only 2% - 5% spent on health [10]. Our findings lack the association between poor glycemic control and LEA. Our research confirms that DFU in Pakistan leads to a high amputation rate [11]. This study holds the only major deficiency of not being a population based rather it only represents those patients who underwent treatment of a tertiary care unit [12]. However, reports of stage/severity of FU with follow up helped us being accurate. In time reporting and treatment of ulceration can add up to health and mortality [13]. This is achievable with promoting awareness among patients and health care professionals by providing education through foot care programs. Patients must be advised with effective foot care awareness to decrease diabetic foot complication, especially in countries still developing.

CONCLUSION:

We concluded at presentation that grade and severity of FU determine the outcome of ulceration. Although a significant number of patients who had FU of an underlying Neuro-ischemic Aetiology, most of them healed. Difference in gender had significant risk factors difference for neuropathic ulceration.

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