

ORIGINAL ARTICLE

Frequency of Chronic Kidney Disease in Type 2 Diabetic Patients Presenting with Diabetic Foot Ulcer

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ABSTRACT

Background: Recent evidence states that about a quarter of all diabetic patients will experience an ulcer on foot at some point in their lifetime and 15-25% of these will require foot amputation. In the present study, we aimed to evaluate the incidence of chronic kidney disease (CKD) in Type 2 diabetes mellitus (T2DM) patients presenting with Diabetic foot ulcer.

Methods: The present study was carried out at Jinnah Postgraduate Medical Center (JPMC), Sindh from February-August 2017. Over 100 Type 2 - DM patients, aged between 35-60 years who presented with diabetic foot ulcer took part in this study. Data was collected and documented in pre-approved pro-forma, subsequently, entered and analyzed via SPSS version 19. Chi-square was applied to test any significant difference between the categories with a p-value of ≤ 0.05 considered as significant.

Results: The mean serum creatinine (mg/dl) value was reported to be 1.17 ± 0.45 . Frequency of CKD in Type 2 - DM patients presenting with diabetic foot ulcer was 31%. Male gender was affected more from CKD. Frequency distribution of chronic kidney disease among duration of DM groups 10-15 years = 35.5% and >15 years = 64.5%. The characteristics of HbA1c (g/dl) of study population was 8.34 ± 0.59 .

Conclusion: Occurrence of CKD in Type 2 - DM patients presenting with diabetic foot ulcer was much higher as compared to national and international studies. Therefore, special attention should be given on regular screening of diabetic patients with a complaint of a foot ulcer.

Keywords: Type 2 Diabetes Mellitus; Diabetic Foot Ulcer; Albuminuria; Chronic Kidney Disease; Nephropathy; Neuropathy.

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INTRODUCTION

Over 120 million people are affected by diabetes mellitus, globally. This number is feared to be increased to 370 million in the next 10 years or so^{1,2}. Pakistan has 12 million Type 2 DM patients (10% of the entire world burden) which, the World Health Organization - WHO, estimated to hit 16 million populations by the year 2030³⁻⁵.

One of the direst complications of diabetes is the irreversible damage and multi-organ failure. In

contrast to Type 1 diabetes, which presents with apid onset of symptoms, the T2DM patients often remain asymptomatic for many years with a gradual disease progression leading to chronic complications like retinopathy, nephropathy, foot ulcers risking leg amputation and autonomic neuropathies^{6,7}.

According to the WHO, a foot ulcer in diabetes is defined as the deep tissue infection or destruction along with neurological and vascular deficits in the affected limb⁸. The American Diabetes Association

(ADA) and other studies have reported that 15% to 25% of patients with diabetes present with the complaint of foot infection at one point in the course of disease^{6,9}. A quarter of these will require an amputation. In the US, almost 70% of all lower leg amputations are carried out on diabetics. Diabetic to non-diabetic risk of leg amputation is 25 times¹⁰. In Pakistan, 15% of diabetics suffer from complications involving foot⁶.

Foot-related issues in diabetic patients are encountered more frequently with a concomitant nephrological disease, and the incidence of amputation is higher in these subjects than the diabetic population without nephrological disease^{11,12}. In contrast, even though foot complications are more frequently developed in diabetic patients with nephrotic disease, they are not less likely to cure than are those in diabetic patients without kidney disease¹³. Another study, from the United Kingdom reported a substantial correlation between the severity of CKD and foot ulcers in diabetes¹⁴. Studies have documented that 60-80% of cases presenting with diabetic foot ulcers had CKD^{11,15}.

In a recent study, it was found that 28% of patients having type 2 diabetes who presented with diabetic foot ulcer had chronic kidney disease of 3rd stage (diagnosed as having 24 hours urinary creatinine clearance of <60 mL/min)¹⁶. Diabetic nephrological disease and foot ulcers are two serious complications of diabetes resulting in augmentation of morbidity and mortality^{17,18}. Early recognition and proper management of risk factor may prevent amputations^{19,20}. The current study was undertaken with the aim to screen for CKD in diabetic patients with the complaint of a foot ulcer.

METHODS

The present study was a cross-sectional, observational study that was conducted at the Medical OPD of Diabetic Clinic of Medical Ward-7, Jinnah Postgraduate Medical Center, and Karachi from February 2017 to August 2017. After attaining the ethical approval from the Institutional Review Board (IRB) and written consent form signed by the participants, data was collected from 100 type 2 diabetes mellitus patients of both genders, aged between 35-60 years who presented with a complaint of a diabetic foot ulcer.

As per the inclusion criteria of the study, patients having minimum ten-year disease history and the HbA1C value greater than 7.0 g/dL were included in the study. A patient was diagnosed as a case of Diabetic foot ulcer when the wound was greater than 1 cm in length, width and depth with shiny, warm, red and dry surrounding skin. A patient was diagnosed as a case of Chronic kidney disease when he met the following criteria; clinical features of puffiness of the face and periorbital edema in the morning for a period of three months at least and a urinary creatinine clearance of less than 60

mL/min (in 24 hours).

Type 1 DM patients, diagnosed cases of CKD or on hemodialysis and those having other comorbid illnesses leading to CKD, such as hypertension, systemic lupus erythromatosis, decompensated CLD and heart failure, those taking NSAIDS for > 3 months were excluded from the study. A detailed history was recorded from each participant about the presenting complaint, history of the illness, duration, severity, past medical and surgical procedures, family history and socioeconomic status was recorded as per history taking protocol. Physical examination especially of the affected foot or lower limb was done thoroughly. 24-hour urine was collected through the standardized procedure and sent to the lab for the measurement of 24 hours urinary creatinine clearance. Data were collected on a pre-approved proforma. The Pro-forma was reviewed and approved by a number of consultants and specialists. Data were entered and analyzed into SPSS version 21 expressing continuous variables as mean ± Standard deviation while the categorical data as frequencies and percentages. Chi-square was applied to test any significant difference between the categories with a p-value of ≤0.05 considered as significant.

RESULTS

A total of hundred diagnosed cases of Type 2 - DM patients, having diabetic foot ulcer were enrolled in the present study. The mean age of patients was found to be 50.70 ± 5.45 years with a range of 30 years. Other baseline descriptive results on variables like disease duration, HbA1C, serum creatinine and 24 hours urinary creatinine clearance are given in Table 1 and 2.

Table 1: Descriptive demographic of participants.

Characteristic	Mean	Standard deviation (±)	Minimum	Maximum
Age of Patient (Years)	50.70	5.45	35	60
Duration of T2DM (Yrs)	14.50	2.23	10	18
HbA1C(g/dL)	8.34	0.59	7.80	9.90
Serum Creatinine (mg/dl)	1.17	0.45	0.60	2.10
24 Hours Urinary Creatinine Clearance (mL/min)	79.72	32.49	16	120

Table 2: Clinical statistics of participants.

Characteristics	Frequency	Percentage(%)
Puffiness of the face	51	51
Periorbital Edema	54	54
24 Hours urinary creatinine clearance		
	Frequency	Percentage(%)
>90 ml/min (Stage I)	48	48
60-89 ml/min (Stage	21	21
30-59 ml/min (stage III CKD)	20	20
15-29 ml/min (Stage IV CKD)	11	11
Puffiness of the face	51	51

Table 2 depicts that 51% and 54% patients presented with puffiness of the face and periorbital Edema respectively. Grading of kidney function (Grade I through IV, based on 24 hours urinary creatinine clearance) with which patients presented is given in Table 2. Most of the patients (61%) were of age group 51-60 years while males were predominant compared to females (63% versus 37%). The main objective variable of this study was percentage distribution of chronic kidney disease among T2DM patients having diabetic foot ulcer and it was found to be 31% (Figure1).

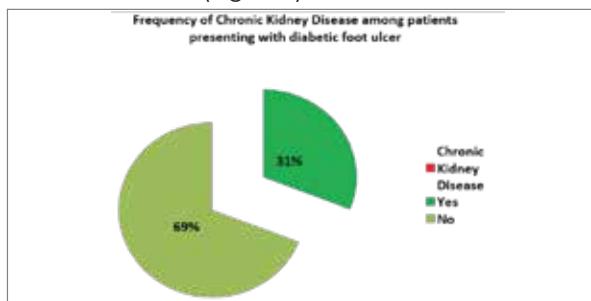


Figure 1: Frequency of chronic kidney disease among patients presenting with diabetic foot ulcer (n=100).

Upon applying univariate analysis following stratification, it was found that age was a statistically significant effect modifier as; patients of younger age 35-50 years had lesser frequency i.e. 9.70% (3) compared to elder age group of 51-60 years i.e. 90.3% (28) with a p-value of 0.001.

Table 3 shows that male gender (p-value = 0.015), rural residents (p-value = 0.03), and those having more than 15 years of disease duration (p-value = 0.004) had higher prevalence of CKD when presented with diabetic foot ulcer. Finally, with the increasing severity of grade of 24 hours urinary creatinine clearance from grade I to grade III; the prevalence of CKD also increased from zero to 65% however; reduced to 35% in grade IV patients (Table 3, Figure 2).

Table 3: Distribution CKD among patients presenting with diabetic foot ulcer as different variable categories.

Variable	CKD Patients with Foot ulcer	CKD Patients Without Foot ulcer	Total	p-value
Gender				
Female	13 (41.9%)	24 (34.8%)	37	0.015
Male	18 (58.1%)	45 (65.2%)	63	
Residence				
Rural	22 (71.0%)	27 (39.1%)	49	0.03
Urban	9 (29.0%)	42 (60.9%)	51	
Disease Duration				
10-15 years	11 (35.5%)	46 (66.7%)	57	0.004
> 15 years	20 (64.5%)	23 (33.3%)	43	
24 Hours urinary creatinine clearance				
>90 ml/min (Stage I)	0 (0.0%)	48 (69.6%)	48	N/A
60-89 ml/min (Stage II)	0 (0.0%)	21 (30.4%)	21	
30-59 ml/min (stage III CKD)	20 (64.5%)	0 (0.0%)	20	
15-29 ml/min (Stage IV CKD)	11 (35.5%)	0 (0.0%)	11	

p-value = <0.05 is considered to be statistically significant

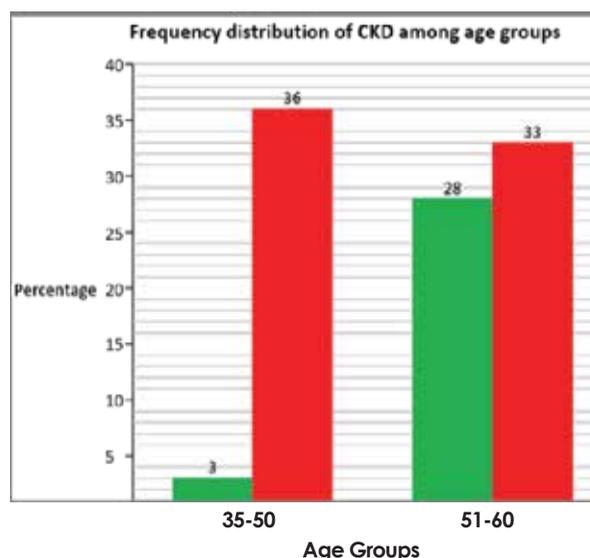


Figure 2: Distribution chronic kidney disease among patients presenting with diabetic foot ulcer as age categories.

DISCUSSION

A foot ulcer in diabetes is a frequently encountered problem. Recent data reported the incidence rate of foot ulcers to be as high as 25%⁸. It is a frequent cause of hospitalization and lower-limb amputations (85%) in patients with Type 2 diabetes mellitus. In contrast, diabetic nephropathy is becoming a frequent disorder, especially in diabetic population the prevalence is about 30%²¹. Very little is known regarding the potential relationship between these two major complications of diabetes.

The current study reported that nearly one third (31%) of T2DM, patients who presented with a foot ulcer had a concomitant kidney disease. A similar study by Margolis et al. found that as much as 33% type II diabetics with a lower limb ulcer had CKD¹⁴. In a retrospective cohort study, it was noted that of 4007 patients of T2DM, 532 patients (13.7%) had foot ulcer and in them, there was a significant correlation of having CKD with a p-value of <0.01²². These facts show the different populations of T2DM have different rates of CKD with diabetic foot ulcer²³.

Taking account of 24 hours urinary creatinine clearance rate; we categorized patients in four stages i.e. Stage I-IV of renal dysfunction. In our study, no patients belonged to Stage I or Stage II of renal dysfunction. Two-third of patients presenting with stage III and one-third of patients presenting with stage IV renal dysfunction had CKD. Other studies also identified that advanced CKD stages had more prevalence of diabetic foot (p-value <0.005). One study reported the probability of foot amputation in patients under dialysis, increases tenfold as compared to those without CKD⁹. Margolis and colleagues analyzed data from individuals with diabetes and their findings are in agreement with

current study results rectifying the strong correlation between the severity of CKD and the foot ulcer¹⁴.

Generally there is no gender difference in prevalence of T2DM however; male gender was affected more with CKD in presence of diabetic foot ulcer compared to females- as found in the current study and this mimics other studies findings too^{8,24,25}. In the current study, frequency distribution of chronic kidney disease between residences rural was 22 (71%), urban 9 (29%).

In a study conducted in Egypt, the age of such patients was between 15-65 years but elder age patients suffered more from CKD8. Likewise in the current study, the patients of elder age 51-60 years had much higher frequency of CKD (90.3%) compared to the patients of age 35-50 years (9.7%). This trend was mostly identical in other studies- the reason of which may be extent of vascular damage, which is caused, with the prolonging duration of disease. In a study, the duration of diabetes mellitus in Egyptian population was (8.28 ± 9.34) and in Sudanese population it was (11.62 ± 10.99) with significant difference diabetic foot (p- value = 0.0001)²⁶. In our study, percentage distribution of duration of diabetes mellitus of study population was 14.5 ± 2.23 (10-15 years=35.5% and >15 years=64.5%). Some of the independent factors, resulting in kidney damage may include comorbid conditions like hypertension, cardiovascular disease, hyperuricemia and economic status. However, these were beyond the scope of the present study^{10,12,27,28}.

Diabetic foot when accompanied with CKD not only limits the mobility; also affects the psychology and behavior of diabetics negatively; thus lowering the quality of life. Although; it was limited scope study with smaller sample size and one point data collection yet; it has come up with some significant findings and puts light on a very critical and important issue of care of diabetic patients.

CONCLUSION

The frequency of chronic kidney disease in T2DM patients presenting with foot ulcer was found high in our setup, who were not previously diagnosed as CKD patients. Therefore, we recommend that all patients with diabetic foot ulcer should be screened to know the actual burden of CKD in our population.

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CONFLICT OF INTEREST

There was no conflict of interest among the authors.

ETHICS APPROVAL

The study approval was obtained from the Ethics Review Committee of the Jinnah Postgraduate Medical Center.

PARTICIPANT'S CONSENT

Verbal and written informed consent was obtained from all patients.

AUTHORS' CONTRIBUTIONS

All the authors were contributed equally in the research write-up.

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