ORIGINAL ARTICLE

Frequency of Diabetic Nephropathy in Type 2 Diabetic Patients Using Spot Urine ACR and Its Associated Risk Factors

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ABSTRACT

Objective: To determine the frequency of diabetic nephropathy in type 2 diabetic patients using spot urine ACR ratio and identify its associated risk factors.

Study Design: Descriptive, cross-sectional study.

Place and Duration of Study: This research was carried out at the Department of Medicine, Muhammad Teaching Hospital (MTH) Peshawar, Pakistan from February 01, 2023, to July 31, 2023.

Methods: A total of 150 patients having type 2 diabetes mellitus were investigated. The sample size was calculated with a WHO sample size calculator using a reference study with a 10.8% prevalence of diabetic nephropathy in individuals with type 2 diabetes mellitus; confidence
interval = 95% and the margin of error was 5%.

Results: With an SD ± 5.146, the mean age was 49 years old. There were 87 (58%) females and 63 (42%) males present. Out of 150 individuals, the spot urine ACR was analyzed. Of these, 47 (31%) had microalbuminuria (less than 300 mg/m) while, 28 patients (19%) had macroalbuminuria (more than 300 mg/m), whereas end-stage renal disease was found in 6 (4%) with GFR < 30 ml/m -1.73 m2. A study was conducted on 150 individuals to determine the status of diabetic nephropathy. Of these, 81 (54%) had diabetic nephropathy and 69 (46%) did not.

Conclusion: Using the spot urine ACR ratio, our study suggests that 46% of type-2 diabetic patients had diabetic nephropathy. The incidence was 24% in people with diabetes for 5–10 years and 26% in patients with diabetes for 11–15 years. Patients with diabetes for 16 to 20 years had a 50% incidence. In conclusion, those with diabetes for a longer period are at a much greater risk of diabetic nephropathy.

Keywords: *Albuminuria, ESRD, Hyperglycemia, Hypertension, Nephropathy, Protienuria.*

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Introduction

Diabetic nephropathy is the leading cause of end-stage renal disease globally. The conventional definition of diabetic nephropathy is the existence of proteinuria greater than 0.5 grams per 24 hours.[1] It is a clinical condition defined by high vascular blood pressure, gradual reduction in the glomerular filtration rate (GFR) along chronic albuminuria.[2] Kidney complication was identified as a prevalent consequence of diabetes mellitus by 1950, and proteinuria as an entity was first identified in DM in the late 18th century. In terms of mortality and morbidity, it is also among the most important long-term problems for individuals with diabetes mellitus.[2]

The data analysis from 1985 to 2010 showed that the prevalence of diabetes mellitus globally has increased rapidly, from an estimated 30 million cases in 1985 to 285 million in 2010.[3] According to the International Diabetes Federation (IDF), there were around 387 million diabetic patients all over the world in 2014, and by 2035, that number is expected to increase to 592 million.[4] Half of diabetes patients in South East Asia go undiagnosed.[4] Type 2 diabetes mellitus is becoming very common nowadays most likely as a result of obesity, sedentary lifestyles, lack of exercise, industrialization, and population aging. The International Diabetes Federation (IDF) reports that the estimated occurrence of diabetes mellitus in Pakistan is 6.8% based on data from 2014 and that complications associated with diabetes account for 87547.56 deaths annually.[4] Based on WHO figures, 101,145 individuals in Pakistan are receiving dialysis for end-stage renal disease (ESRD) caused by diabetes mellitus.[5]

The UK Prospective Diabetes Study (UKPDS) reports state that, although micro-albuminuria in DM type-2 patients was reported in 2.0% every year, in the next ten years of diagnosis it was 25%. Five to twenty percent of people with diabetes type-2 have proteinuria.[1]

Al-Rubeaan K et al. discovered that the occurrence of type-2 diabetes in Saudi Arabia was 10.8%, with 1.2% of cases being microalbuminuria, 8.1% being macro albuminuria, and 1.5% being end-stage renal disease[6]. Diabetes duration and age were significant risk factors, as reported by 3.7% in 25–44 years old patients with diabetes less than 5 years to 21.8 % in patients having age more than 65 years with diagnosed diabetes of more than 15 years.[6]

The prevalence of macroalbuminuria was 5.1% and microalbuminuria was found to be 26.5% in patients with DM type-2 in the Chennai Urban-Rural Epidemiology Study (CURES) conducted in India[7]. The same study reported that advancing age, disease duration, higher HbA1C, and abnormal lipid profile were the most important risk factors for diabetic nephropathy.[7]

A study conducted in Pakistan revealed that 56.2% of people had diabetic nephropathy. Another study conducted in Karachi found that 34% of type 2 diabetics had microalbuminuria.[8,9] Significant correlations were also established between microalbuminuria and risk factors such as increasing age, diabetes duration, gender, cigarette smoking, high blood pressure, deranged lipid profile, and high random and/or fasting blood glucose levels. According to a local study conducted in Swat, 29.5% of people have microalbuminuria. Microalbuminuria was present in 35.9% of patients with poor glycemic control and 10% of patients with adequate glycemic control, respectively.[10]

No research has been done so far in Peshawar for the past ten years, and this is the reason behind carrying out this research. A larger sample size will be used in this local study to ensure accurate data. Keeping in view the high prevalence of type 2 diabetes mellitus in Peshawar and limited awareness for screening of diabetic nephropathy among patients, this will have a significant impact and will reduce gaps in existing literature, particularly using spot urine ACR as a screening tool. Furthermore, as individuals with diabetic nephropathy have an increased risk of ESRD, thus detection as early as possible and timely treatments are very necessary and will decrease the burden of the disease.

Methods

This research work was carried out at the Department of Medicine, Muhammad Teaching Hospital Peshawar, Pakistan from February 01, 2023, to July 31, 2023. By using a descriptive cross-sectional study design**,** 150 patients were selected with the WHO formula for sample size calculation referenced with a study having diabetic nephropathy prevalence of 10.8% in type-2 diabetes mellitus (95% confidence level and a margin of error was 5%).[6] All patients were followed up and results were noted. Consecutive-non-probability sampling was employed.

Inclusion Criteria

1. Diagnosed diabetes mellitus type-2 patients (as defined in operational definition).
2. Both genders
3. Patients between 18 and 65.

Exclusion Criteria

1. Patients with nephropathy
2. Patients with congestive heart failure
3. Patients with urinary tract infection
4. Patients running high-grade fever, or who had performed rigorous exercise on that day

The above-mentioned circumstances act as confounders and, if present, would skew the study's findings.

This research was conducted after taking ethical approval from the Ethical Research Committee of the institution Muhammad Teaching Hospital Peshawar, Pakistan on dated: 24th January 2023 vide letter no: MTH/EC/124/2023. Data was obtained from diagnosed type 2 diabetes mellitus patients who visited the hospital. Patients were chosen according to the inclusion criteria; and gave their informed written consent. Patients (between the ages of 18 and 65) underwent a thorough clinical examination and history. To quantify the HbA1c level and determine the urinary albumin-creatinine ratio, spot urine was collected. Every investigation was carried out by the same biochemist in the laboratory.

Following measurement of the spot urine albumin-creatinine ratio in these individuals with confirmed type-2 diabetes mellitus, total number of cases were used to compute the frequency of diabetic nephropathy. Every bit of information was entered into a proforma created only for this purpose. Exclusion standards were strictly adhered to in order to reduce study bias and confounders.

The latest version of the statistical program SPSS-24 was used to store and analyze data. In the form of frequencies and percentages, qualitative characteristics such as age, gender, duration of diabetes, and microalbuminuria were displayed. In order to observe how the condition changed with age, gender, and length of diabetes, diabetic nephropathy was stratified. These outcomes were all displayed as tables.

Results

The age-wise distribution of 150 patients as shown revealed that 12% (18) were 25-35 years old, 20% (30) were 36-45 years old, 33% (50) were 46-55 years old, and 35% (52) were 56-65 years old. With SD ± 5.146, the mean age was 49 years old. (Table-1).

Table no. 2 shows the gender distribution of the study sample; 42% (63) were men and 56% (87) were women. (Table-2).

A study of 150 individuals' diabetes duration shows that 36 (24%) had the disease for five to ten years, 39 (26%) for eleven to fifteen years, and 75 (50%) for sixteen to twenty years. With an SD ± 8.23, the mean time of diabetes was 15 years. (Table-3).

The analysis of spot-urine ACR in the participating 150 patients shows that 31% (47) showed micro-albuminuria (30-300 mg/m), whereas 19% (28) had macro-albuminuria (>300 mg/m), and 4% (6) had ESRD (GFR < 30 ml/m -1.73 m2). (Table-4).

Among 150 patients it was analyzed that 54% (81) had diabetic nephropathy whereas, 46% (69) did not have the complication. (Table-5).

Table-1: Age-Wise Distribution (n=150)

Age (years)	Frequency	Percentage (%)
25-35	18	12
36-45	30	20
46-55	50	33
56-65	52	35
Total	150	100

Table-2: Gender-Wise Distribution (n=150)

Gender	Frequency	Percentage(%)
Men	63	42
Women	87	58
Total	150	100

Table-3: Diabetes Duration (n=150)

Duration	Frequency	Percentage (%)
5-10 years	36	24
11-15 years	39	26
16-20 years	75	50
Total	150	100

Table-4: Spot Urine ACR (n=150)

Sport Urine ACR	Range	Frequency	Percentage
Microalbuminuria	30-300 mg/m	47	31
Macro albuminuria	>300 mg/m	28	19
ESRD	GFR < 30ml/m -1.73m^2	6	4
Total		81	100

Table-5: Diabetic Nephropathy (n=150)

Diabetic Nephropathy	Frequency	Percentage (%)
Present	69	46
Not present	81	54
Total	150	100

Discussion

The conventional definition of diabetic nephropathy, which is the primary cause of ESRD globally, is the presence of proteinuria greater than 0.5 gm every 24 hours.[11] Prolonged albuminuria, a gradual reduction in the GFR, and hypertension are the hallmarks of this clinical condition.[12] In the late 1700s, proteinuria was identified as a common complication of diabetes mellitus (DM). By 1950, kidney damage was estimated to affect up to 50% of individuals with DM who had had the condition for more than 20 years.[13] In terms of death and morbidity, it is also among the most serious long-term consequences for diabetic patients.[13]

According to the reports of the UK-Prospective Diabetes Study (UKPDS), the occurrence of microalbuminuria in patients with type 2 diabetes was 2.0% every year, and the load was 25% in the next ten years following diagnosis. Five to twenty percent of people with DM type 2 have proteinuria.[14] Al-Rubeaan K et al. discovered that the occurrence of DM type 2 in Saudi Arabia was 10.8%, with 1.2% of cases being micro-albuminuria, 8.1% being macro-albuminuria, and 1.5% being ESRD.[15] Diabetes duration and advancing age were significant risk factors, ranging from 3.7% in patients 25–44 years old with diabetes of ≥5 years duration to 21.8% in those patients who were 65 years and above with diabetes of 15 or more years duration.[15]

The prevalence of macroalbuminuria was 5.1% and microalbuminuria was found to be 26.5% in patients with DM type 2 in the Chennai Urban-Rural Epidemiology Study (CURES) conducted in India.[16] The most important and common risk factors for the development of diabetic nephropathy in patients were advanced age, high HbA1C, high inflammatory markers, serum ferritin, total duration of diabetes after diagnosis, and high serum triglycerides.[17] A High uric acid levels affects liver enzymes and have direct association with metabolic syndrome and diabetes mellitus.[18] Another study conducted showed that there was a strong correlation between micro-albuminuria and ischemic heart disease, increasing age, the length or duration of the diabetes, gender (male), cigarette smoking, raised blood pressure, high serum triglycerides, high fasting and random blood sugar readings.[19]

According to a local study conducted in, 29.5% of people have microalbuminuria. Microalbuminuria was present in 35.9% of patients with poor glycemic control and has direct association with heart failure and left ventricular dysfunction.[20]

A different study carried out produced similar results, reporting diabetic nephropathy of 42.5% (95% C.I: 38.83% - 46.15%) in their study. There was no statistically significant variation in the prevalence within the two-polyclinic catchment region. Male prevalence was much higher (51.6%) than female prevalence (36.5%). A preliminary examination of the risk factors revealed a strong correlation between male gender, lower literacy rates, long-term diabetes mellitus type-2, high blood pressure, high HbA1C, retinopathy, family history of diabetic nephropathy, neuropathy, and serum hypertriglyceridemia. A multivariate study revealed that gender (male), lower literacy rate, prolonged diabetes, a positive family history of diabetic nephropathy, and high glycated hemoglobin were independent risk factors.[21]

In addition, we found that diabetes patients had higher levels of microalbuminuria in our investigation. Microalbuminuria and uncontrolled glucose levels showed a positive correlation, in line with a prior study.[22] Additionally, we found that the ratio of urine albumin to creatinine and urine microalbuminuria were early and sensitive markers of renal impairment. It's interesting to note that there were positive connections with serum creatinine levels, urine micro-albuminuria, and urine ACR, all of which were consistent with other populations.[23] These also apply to patients in the area who have type-2 diabetes, which is likely a sign of early nephropathy.

The study fails to consider the clinical perspective, neglecting the quality of life, patient-reported outcomes, or caregiver burden. Other limitations include no comparison group such as a non-diabetic control group.

Conclusion

Our study suggests that 46% of type 2 diabetic patients had diabetic nephropathy using the spot urine ACR ratio. The incidence was 24% in people with diabetes for 5–10 years and 26% in patients with diabetes for 11–15 years. Patients with diabetes for 16 to 20 years had a 50% incidence. In conclusion, those with diabetes for a longer period have a higher risk of diabetic nephropathy.

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Authors Contribution

AU: Idea conception, manuscript writing and proofreading
SAZK: Data analysis, results and interpretation, manuscript writing and proofreading
MA: Study designing, data analysis, results and interpretation
MSK: Data analysis, results and interpretation
SU: Data collection
RFS: Data collection