



DIABETIC NEPHROPATHY IN QUETTA CITY: A CROSS-SECTIONAL HOSPITAL BASED STUDY.

Shahzadi Sanam¹, Sabeena Rizwan^{2*}, Irum Javid^{2*}, Sobia Munir², Farida Behlil¹, Zille Huma³, Farrukh Bashir², Fazeela Mandokhail².

¹Department of Chemistry, Sardar Bahadur Khan Women's University, Quetta-87300, Pakistan
²Department of Biochemistry, Sardar Bahadur Khan Women's University, Quetta-87300, Pakistan
³Department of Zoology, Sardar Bahadur Khan Women's University, Quetta-87300, Pakistan:

***Corresponding Author:-** Sabeena Rizwan, Irum Javid

*Email:-irum.javid@sbkwu.edu.pk Email:-sabeenarizwan81@gmail.com

Abstract:

Diabetic renal damage is a severe complication of Diabetes mellitus. It occurs in around 20-40% of the patients with diabetes. This study aims to investigate the prevalence and related risk factors of renal damage among the diabetic patients in Quetta city. It was a hospital based cross-sectional study conducted in different government and private hospitals of Quetta city. Blood and urine analysis were executed in Balochistan Institute of Nephro-Urology Center Quetta(BINUQ) with hospital's prior approval. 100 patients from both genders were selected that were above 15 years of age. Values of fasting blood glucose (FBG), serum Creatinine, Albuminuria, Basal Metabolic Index (BMI), and glomerular filtration rate (GFR) were obtained along with complete sociodemographic profile. FBG values were determined through GOD-POD method using micro lab 300 auto analyzer. Serum creatinine was estimated through Jaffe's colorimetric method by using ADVIA 1800 Chemistry System, Siemens, Germany. GFR calculations were interpreted using Cockcroft-Gault equation. Urine samples were analyzed by using Multistix Reagent strips for the determination of albuminuria. The data was examined by using Statistical package for social science (SPSS) software (IBM SPSS Statistics 22). A noticeable percentage of diabetic renal damage was detected among the diabetic patients in Quetta city. 63% patients were found to have different stages of renal damage. Results of FBG 172 ± 24 mg/dL exposed poor glycemic control among the patients. Blood samples revealed a significant amount of creatinine 2.4 ± 2.4 mg/dl. Mean GFR values were 53 ± 30 mL/min/ $1.73m^2$. Albuminuria results indicated that 33% patients had microalbuminuria and 26% had Macroalbuminuria. This study indicated an inverse significant correlation between eGFR and duration of diabetes mellitus ($r = -0.370^{**}$). Fasting blood glucose, smoking, and physical inactivity displayed a reverse correlation with eGFR (-0.010) (-0.117) (-0.218*) respectively. There was not a significant relationship between eGFR and BMI. Both males and females exhibited diabetic renal damage. These findings pointed out a crucial requirement to develop strategies for the prevention and proper management of Diabetes Mellitus to minimize the increasing burden and prevalence of diabetic renal damage.

Keywords; Diabetes mellitus, Fasting blood glucose, Albuminuria, Basal Metabolic Index, Glomerular Filtration Rate.

Introduction:

Diabetic nephropathy DN is one of the threatening complexities of diabetes mellitus causing illness and death in patients suffering from diabetes mellitus (Samsu, 2021) and also a prominent reason of end-stage renal disease (ESRD). Persistent and slowly progressive proteinuria is a characteristic of DN and diabetic renal failure (Zhuo *et al.*, 2013). Within the first 10 to 20 years following the development of diabetes, average prevalence of diabetic nephropathy is extensive (3% annually). Usually, small blood capillaries in the kidney, eyes, and nerves can get infected after 10 to 15 years. It is predicted that up to 40% of diabetic patients would experience renal failure (Sulaiman, 2019).

A global estimate of 415 million people between the ages of 20 to 79 are thought to have different complications of diabetes worldwide. In middle-class and low-income regions, type 2 diabetes is predicted to be the seventh most common causes of death (Hussein *et al.*, 2023).

A decrease in the kidney function contributes to microalbuminuria which in turn initiates the progression of microalbuminuria into proteinuria, leading to diabetic nephropathy and renal failure (Yacoub *et al.*, 2010).

One of the major cause of renal damage is diabetes. The two main indicators of renal damage are decline in glomerular filtration rate and presence of albuminuria (Joshi *et al.*, 2023).

This illness originates from a change in kidney structure, causing a reduction in glomerular filtration rate (GFR) of less than 60 mL/min per 1.73 m² in excess of three months. As a result, a decline is seen in the capability of kidney to remove waste from blood and perform other biological tasks (Akpore *et al.*, 2022).

A diabetic patient may experience obesity, edema (swelling in legs and ankles), weakness in morning, excess amount of urination in night times, hypertension and anemia as signs and symptoms of renal damage (Hussain *et al.*, 2021).

The findings of International Diabetes Federation indicated that diabetes affected approximately 26.7% of Pakistani adults in 2022. This alarming figure is already high and is gradually increasing every day. It is also believed that a large number of people remained unidentified, which would ultimately increase the true prevalence as well as the threat of complications from not receiving a proper treatment (Azeem *et al.*, 2022).

This study aims to investigate the prevalence of renal damage among the patients with diabetes mellitus in Quetta city, to figure out risk factors and providing information to reduce complications leading to better health outcomes.

Methods:

Quetta being the capital city of Balochistan Province is the only urban city in the Balochistan. Due to this it falls in the category of major cities of Pakistan and the largest city in Balochistan. Across the nation, Quetta is a city with most ethnic diversity. Pashtuns and Balochs make up the majority population followed by Brahui, Punjabi, Hazaras and Muhajirs.

From 1st Nov 2022 to 1st March 2022, sample size consisting of 100 diabetic patients, of both genders above 15 years of age, participated in this hospital based cross-sectional study. The current study was formally approved by Advance Studies and Research Board (ASRB) of the SBK Women's University Quetta, Pakistan, and verbal consent was obtained from all participants in the study.

Patients from different Government and Private hospital were selected by using random and purposive sampling method. Nevertheless, diabetic patients who had a history of renal transplant, unwilling and expecting mothers were excluded from the study. The sample examinations were cautiously carried out in Balochistan Institute of Nephro-Urology Center Quetta (BINUQ) with the hospital's prior approval.

Questionnaire:

A semi-structured questionnaire was developed for the collection of data. It comprised of queries related to socio demographic profile and medical history. Furthermore, other related information and medical reports were carefully examined. Prior to data collection, patients' consent was obtained to ensure the validity of data gathered.

Anthropometric measures:

Anthropometric measurements were executed on all patients under the supervision of trained staff. Weight and height were recorded by standard device and tools for every patient after the removal of heavy attires and foot ware. BMI calculations were done by using the formula as weight in kilograms and divided by height in square meters (Ji *et al.*, 2019).

Blood and urine analysis:

Venous blood samples were collected from each patient for the determination of serum creatinine levels and fasting blood glucose (FBG) levels. For the estimation of FBG, the sample was obtained after a minimum of 8 hours of fast. FBG test was carried out on micro lab 300 automated analyzer by using GOD-POD method (Zain, 2014). Serum Creatinine test was estimated through Jaffe's colorimetric method by using ADVIA 1800 Chemistry System, Siemens, Germany (Liu *et al.*, 2012). GFR calculation were arranged through Cockcroft-Gault equation and results were adjusted for female patients by multiplying the values with 0.85 (Amer, 2020).

Patients' urine samples were collected to monitor albumin levels in urine. Urine samples were analyzed by suing Multistix Reagent strips for the determination of albuminuria (Zacharias *et al.*, 2012).

As albuminuria is categorized into three levels according to American diabetes association. Normalalbuminuria is a category where a trace amount of albumin (<29 mg/dL) is present in urine. Albumin levels greater than 29-299mg/dL are considered as microalbuminuria and levels above 300mg/dL are known as Macroalbuminuria. The patients were characterized according to the severity of albumin levels in urine.

Statistical Analysis:

The data was analyzed through SPSS software 22. The findings were demonstrated using descriptive analysis technique. Frequencies and percentage of the responses were displayed and correlation technique was employed to identify the relationship.

Results:**Demographic and Clinical Characteristics:**

A total of 100 patients were examined during November to March. A majority (94%) were diagnosed with Type 2 diabetes, only 6% had Type 1 diabetes. 65% patients were female and 35% were male. 56 % were on insulin and 44 % were on oral agents for the management of diabetes. 39% were having a family history of diabetes and only 18 % patients had a positive history of renal failure. Higher illiteracy rates (54%) were observed with a majority (42%) of fair economic status (Table 1). The mean BMI was 26.2, mean age was 49.9 years, and the mean duration of diabetes was 9.2 years (Table3). 30% patients were actively engaged in smoking, and only 34% patients were physically active (Table 2). Average value of FBG was 172.24 mg/dL, mean value of creatinine in blood was 2.4 mg/dl, and the average eGFR was 53.184 mL/min/1.73m² according to Cockcroft-Gault equation (Table 4).

Table: 1 Socio demographic characteristics of patients

Type of diabetes	Percentage
DM1	6
DM2	94
Gender	
Male	35
Female	65
Drug of DM	
Insulin	56
Oral agent	44

Family history with DM	
Present	39
Absent	61
Family history with renal damage	
Present	18
Absent	82
Educational Level	
Illiterate	54
Primary	14
Middle	15
Matric	11
Intermediate	6
Economic status	
Poor	20
Fair	42
Good	38

Table 2: Behavioural Characteristics of Patients

Smoking status	Percentage
Current	30
Never	45
Stopped	25
Physical activity	
Yes	34
No	66

Table:3 Anthropometric measurements

Duration of DM	Percentage	(Mean ± SD)
< 5 years	17	9.28 ± 4.2
6 to 10 years	55	
>10 years	28	
Body Mass Index		
Under weight	4	26.32 ± 4.70
Normal weight	37	
Over weight	43	
Obese	16	
Age of Patients		
18 – 40	14	49.94 ± 10.65
41 – 55	62	
55+	24	

Table:4 Clinical Parameters

Clinical Parameters	Mean
Creatinine mg/dl	2.402
eGFR, mL/min/1.73m ²	53.184
Fasting Blood Glucose mg/dL	172.24

Prevalence of renal damage:

Table:5 Prevalence of renal damage by stage and gender

Stages of Renal Damage	Male %	Female %	Total %
Stage 3a	8	13	21
Stage 3b	7	13	20
Stage 4	1	8	9
Stage 5	7	6	13
Total Number of Cases	23	40	63

The current hospital based study revealed that among the total number of patients, 63% patients exhibited different stages of renal damage. A slight to moderate reduction of GFR was seen among the 21% patients in stage 3a, in which 13% females and 8% males were present. In stage 3b, 20% patients were found to have moderately to severely reduced GFR with 8% males and 13% females. A severe reduction of GFR was found in 9% patients possessing 4th stage, where 8% females and 1% male were present. Last (5th) stage known as ESRD had 6% female and 7% male patients with a total percentage of 13.

Prevalence of Albuminuria:

In urine analysis results, it was observed that in 3a stage of renal damage, out of 21% patients, 7% had Normalalbuminuria, 10% had microalbuminuria and 4% patients had Macroalbuminuria. In 3b stage, 7% patients had Normalalbuminuria, 10% were found to have microalbuminuria and 4% patients had Macroalbuminuria making up a total of 20% patients in this stage. Among the 9% patients of stage 4, 2% patients had Normalalbuminuria, 3% patients had microalbuminuria and 4% patients had Macroalbuminuria. In 5th stage, only 1% patients were found to have Normalalbuminuria, 2% patients had microalbuminuria and 10% patients had Macroalbuminuria with a total of 13% patients in this stage. The results further clarified that 16% patients had Normalalbuminuria, 25% patients had microalbuminuria and 22% patients had Macroalbuminuria out of total patients distributed across different stages of diabetic kidney disease.

Table:6 Prevalence of albuminuria and the stages of renal damage

Albuminuria				
Stages of DKD	Normalalbuminuria <30mg/L %	Microalbuminuria 30-300mg/L %	Macroalbuminuria >300mg/L %	Total Percentage
Stage 3a	7	10	4	21
Stage 3b	6	10	4	20
Stage 4	2	3	4	9
Stage 5	1	2	10	13
Total	16	25	22	63

Correlation among parameters:

Table:7 Correlation among different Parameters

	Age	Gender	Duration of DM	Physical Activity	Smoking	Creatinine mg/dl	FBG mg/dl	Albuminuria	eGFR mL/min	BMI
Age	-									
Gender	-.327**	-								
Duration of DM	.465**	-.286**	-							
Physical Activity	.118	-.217*	.217*	-						

Smoking	.014	-.041	.084	-.036	-				
Creatinine mg/dl	.114	-.176	.329**	.228*	.169	-			
FBG mg/dl	.002	-.072	.106	-.047	.047	-.036	-		
Albuminuria	.028	.041	.120	.016	-.035	.388**	-.022	-	
eGFR mL/min	-.098	.026	-.370**	-.218*	-.117	-.660**	-.010	-.164	-
BMI	-.118	.386**	-.302**	-.070	-.024	-.116	-.016	-.065	.132

**p< 0.01

*p< 0.05

Table 7 revealed the correlation among different parameters. The current study characterized an inverse significant correlation between eGFR and duration of diabetes mellitus where ($r = -.370^{**}$, $p < 0.01$). Fasting blood glucose, smoking, and physical inactivity showed a reverse correlation with eGFR ($r = -.010$) ($r = -.117$) ($r = -.218^*$, $p < 0.05$) respectively. There was not a significant relationship between eGFR and BMI.

Discussion:

The current study shows new observed findings regarding the diabetic nephropathy and aims to find out the prevalence of renal damage among the patients with diabetes mellitus in Quetta city. A total of 100 patients with diabetes were the part of this study and the prevalence of renal damage was different in each stage. Majority of the patients (21%) and (20%) were in 3a stage and in 3b stage respectively, 9% patients had 4th stage and 13% patients had end stage renal disease by calculating the values through Cockcroft-Gault method. The current findings are similar to the results of a previous study conducted in Egypt, where 16.6% were in 3a stage of renal damage, 16.6% patients had 3b stage, 6.6% patients exhibited 4th stage of renal damage, and 2.6% patients were having 5th stage of renal damage (Elhefnawy & Elsayed, 2019). Similarly another study conducted in Ethiopia shows identical results, in which the prevalence of kidney damage using MDRD equation characterized that 26% patients had 3a stage, 14% patients were in 3b stage, 6 patients were in 4th stage and only one patients were found to have ESRD (Alemu *et al.*, 2020).

Furthermore, among all the categories and stages of GFR, the current study reveals a high percentage of females. This high prevalence is similar to the previous study where females were dominantly high in prevalence than man (Lin *et al.*, 2021). Another study shows the same results too, where advance renal damage was found in females along with diabetes (Yu *et al.*, 2012). Although the current study has a small percentage of male patients. Yet a noticeable percentage of male patients had different stages of renal damage. This high percentage is similar to the previous findings where males were less than females, still an obvious percentage and high prevalence of diabetic nephropathy was seen in males (Bamashmoos & Ganem, 2013).

In addition, the results of the current study highlighted a high percentage and high values of mean serum creatinine levels (2.402 mg/dl) in the blood samples of diabetic patients. These results were similar with a previous investigation, where a prominently high mean values ($2.24 \pm SD 0.34$) were recorded among the patients of diabetes. (Shahid & Mahboob, 2006). Likewise, another study reveals an extremely high mean values of serum creatinine in diabetic patients. This study reveals a significant high amount of mean serum creatinine values ($4.6 \pm SD 1.18$ mg/dl) among the diabetic patients (Mittal *et al.*, 2010). Additionally, the current study revealed that out of total patients of diabetic nephropathy, 25% patients had microalbuminuria and 22% patients had Macroalbuminuria. These results were similar to a former study in which 21.2% were found to have microalbuminuria and 12.4% patients had Macroalbuminuria, among the patients with diabetes (Bamashmoos & Ganem, 2013). Likewise, another study conducted in Southern Nigeria found the results of albuminuria with a slight distinction,

where the dipstick result showed that 60.3% patients were found with normoalbuminuria, 31.8% had Microalbuminuria and 7.9% patients Macroalbuminuria (Wachukwu et al., 2015).

Conclusion:

Diabetic nephropathy or diabetic renal damage is a long term complication of diabetes mellitus and it aggregates with time reaching to an alarming situation. We need to be more conscious and proficient to understand this issue. As its progression to irreversible stages and renal failure requires renal transplant or dialysis, that is highly expensive and challenging approach. Through proper management and awareness its progression can be reduced. Diabetic renal damage can be delayed if it is diagnosed at early stages and treated properly with appropriate medications and care.

Current study revealed that around 63% diabetic patients had renal damage with an irreversible and severe decline in GFR. Both genders were highly susceptible to this issue. Probability of this complication was more common among the patients with type 2 diabetes mellitus. Duration of diabetes mellitus, smoking, lack of physical activity and poor glycemic control were identified as main risk factors and correlated with declined GFR. Albumin served as an early marker of diabetic renal damage, which was aggravated by inadequate glycemic control.

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