e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(11); 240-244

Original Research Article

Evaluation of Glycaemic Status and Diabetic Kidney Disease among Patients with Type 2 Diabetes: A Cross-Sectional Analytical Study

Shubham Jain[1], Birata Debbarma[2], Devdas Rai[3]

[1]Department of Medicine, Indraprastha Apollo Hospital, Sarita Vihar, New Delhi, India
[2]Department of Medicine, Tripura Medical College and Dr. BRAM Teaching Hopsital, Agartala, Tripura, India
[3]Department of Medicine, A. J. Institute of Medical Sciences, Manguluru, Karnataka, India

Received: 14-09-2023 / Revised: 17-10-2023 / Accepted: 26-11-2023
Corresponding Author: Shubham Jain
Conflict of interest: Nil

Abstract

Background: Diabetic kidney disease is a major risk factor for microvascular and macrovascular complications in diabetes patients but recently, fewer studies have correlated glycaemic status and diabetes kidney disease in south Indian population.

Objective: To evaluate the relation between glycaemic status and diabetes kidney disease in type 2 diabetes mellitus (T2DM).

Methods: This was a Cross-sectional analytical study among T2DM patients. Poor glycaemic status was defined as a serum value of glycosylated haemoglobin A1C (HbA1C) ≥ 7%. Albuminuria was defined as albumin values > 30 mg/dl in the first morning urine.

Results: 100 cases of Type 2 DM patients comprises 75% males. The prevalence of diabetes kidney disease was 60%. The prevalence of microalbuminuria in groups with poor glycaemic status was 46% and adequate glycaemic status was 40% only. The findings were statistically significant between poor glycaemic status and albuminuria(Microalbuminuria, Mean FBS 201.33 mg/dl, 95% CI 185.6-216.9, Macrolbumininuria, mean FBS 219.6 mg/dl, 95% CI 180.8-258.4).

Conclusion: The prevalence of poor glycaemic status and Diabetes Kidney disease was high among T2DM patients.

Keywords: Diabetes Kidney Disease, Glycaemic Status, T2DM Diabetes Mellitus, Albuminuria, Microalbuminuria.

Introduction

The prevalence of T2DM in 2017 was 451 million cases worldwide, and according to the estimate of the International Diabetes Federation for the year 2045, this figure will rise to 693 million people. Around the world, almost 50% of T2DM cases have not yet been diagnosed. There were 451 million cases of Type 2 diabetes cases worldwide as of 2017 The IDF(International Diabetes Federation) had predicted that by the year 2045, the cases will raise to 693 million. [1] Diabetes kidney disease(DKD) is the most common cause of CKD in general population in India leading to increased morbidity and mortality in diabetes patients. DKD is characterised by both type 1 and type 2 diabetes as the presence of persisting severely elevated albuminuria of >300 mg/24 h (or >200 mg/min), or an albumin-to-creatinine ratio (ACR) of >300 mg/g, confirmed in at least 2 of 3 samples, with concurrent presence of diabetic retinopathy and absence of signs of other forms of renal disease. [2] The appearance of microalbuminuria has been considered as the earliest marker of DKD. [3] Among Diabetes patients, 20 to 40% of diabetes patient including type 1 and Type 2 diabetes would develop DKD. [4,5] In this stage of DKD, if not treated properly around 30% of patients with Type 1 diabetes and 10-40% of those with type 2 diabetes will subsequently develop CKD. In other words, every third patient with diabetes has the risk of developing CKD. For many years, several new biomarkers were discovered to detect early kidney impairment and to improve the outcome by initiating early treatment, but all of them were found to be cost-effective or prognostic significance in routine clinical care of these patients. [6]Therefore, in current clinical practice, the urinary microalbuminuria or albumin–creatinine ratio (UACR) and estimated glomerular filtration rate (eGFR) are two biomarkers that are still commonly used in diagnosing DKD. Several studies have confirmed that only measurement of eGFR value using serum creatinine is useful only when urinary eGFR is less than 60ml mL/min/1.73 m^2 by that time, about 50% renal function is thought to be lost.

[7] Although almost a decade back, there were several studies which had advocated poor glycaemic control has been associated with albuminuria and while intensive glucose control reduced the risk of microalbuminuria, but recent studies on evaluation of glycaemic status and microalbuminuria are very few in India in spite of fast changes in demographic profile including food habits and life style because of industrialisation in this country. Recently, ADA 2023 [8] guidelines also had relaxed on strict glycaemic control in those diabetes patients who are living alone and in elderly population.

With this view, this study is aimed to evaluate the correlation between the glycaemic status and microalbuminuria in type 2 diabetes so that proper glucose monitoring level can be estimated in these population of this part of country.

Methodology:

The study was a hospital based, cross-sectional study, conducted for a period of one year from October 2016 to September 2017, carried out on 100 patients diagnosed with type 2 diabetes mellitus and admitted to AJ institute of medical sciences & research centre(AJIMS), Mangaluru. All the type 2 diabetic patients hospitalized at AJ institute of medical sciences & research centre, Mangaluru who were18 yrs and above were included in the study. Who were having type 1diabetes mellitus, alcoholics, fever, UTI(urinary tract infections), arthritis, acute myocardial infarction, recent major surgery/major trauma, hypertensive, recent (6 months) intervention with ACE inhibitors/ARB and those on chemotherapeutic agents (anti-neoplastic drugs)were excluded from the study. A pre-structured proforma was used to collect the data on Detailed history was taken from the patients about the fever, chest pain, breathlessness, lifestyle, history of chronic disease, current medications including anti diabetic drugs (oral agents or Insulin), anti-hypertensive agents, uricosuric drugs and chemotherapeutic agents. Measurement of Fasting, post prandial sugar levels, HBA1C levels were done with prior consent from patients. Urinary albumin excretion was assessed by urinary albumin: creatinine ratio in spot sample. The patients were divided into the following groups according to the degree of albuminuria as follows: normal: <30mg/day, microalbuminuria: 30-300mg/day and macroalbuminuria: >300mg/day.8The serum uric acid normal range is 3-7 mg/dl in male whereas it's 2.5-6 mg/dl in female. [9]

Statistical analysis. Collected data from the study population were entered into Microsoft Excel 2016 and Epi Info 7. Descriptive data were expressed as frequency, percentage, Chi-square test, Fisher Exact and 't' test were applied whenever applicable. The collected data were analysed using the software graph pad, $p<0.05$ was considered to be statistically significant and $p<0.001$ was considered to be statistically highly significant.

Results:

This study was a cross-sectional analytical study conducted for a period of 1 year from October 2016 to September 2017, where 100 patients diagnosed as type 2 DM admitted in AJIMS were included for the study. In our study, 46 out of 100 patients had a positive microalbuminuria and 14% have showed macroalbuminuria.

Table 1: Mean and S.D of FBS (mg/dl) In The Study Group

	N	Mean (FBS)	Std. Deviation	95% Confidence Interval for Mean		ANOVA F	P
				Lower Bound	Upper Bound		
Microalbuminuria (DKD)	46	201.33	69.94	185.66	216.99	3.265	.042**(S)**
Macroalbuminuria (DKD)	14	219.64	67.21	180.84	258.45		
Normal	40	140.29	45.95	97.79	182.78		

As represented in the table, the mean FBS level in patients with Microalbuminuria was 201.33 ± 69.94 mg/dl, with Macroalbuminuria was 219.64 ±67.21 mg/dl, and with Normal Albuminuria was 140.29 ± 45.99 mg/dl with a Significant P value.

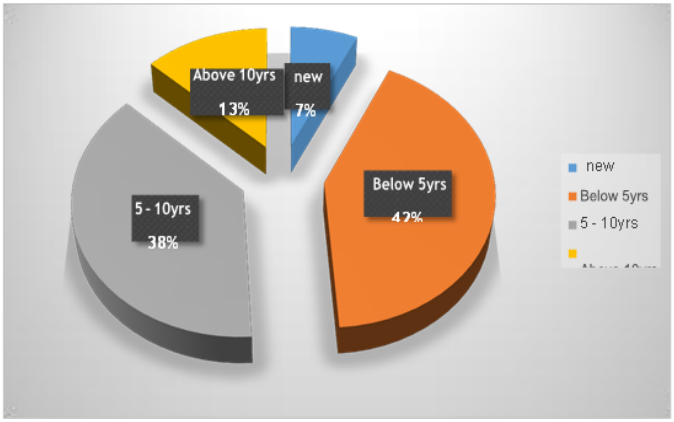

Figure 1: Duration of T2DM In The Study Group

Table 2: Multiple Comparisons of FBS

Bonferroni
Dependent Variable: FBS

Diabetes Kidney Disease		Mean Difference	Std. Error	p	
Microalbuminuria	Macroalbuminuria	-18.314	19.814	1.000	HS
	Normal	61.043	26.946	0.037	HS
Macroalbuminuria	Normal	79.357	31.630	0.041	S

On doing multiple comparisons among FBS and Proteinuria, the results showed significant P value in all the groups.

Table 3: Glycated Haemoglobin (HBA1C) and Proteinuria(DKD):-

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		ANOVA F	p
				Lower Bound	Upper Bound		
Microalbuminuria (DKD)	46	9.37	2.02	8.92	9.82	15.376	0.000 **(HS)**
Macroalbuminuria (DKD)	14	11.39	1.48	10.54	12.25		
Normal	40	6.59	0.63	6.00	7.17		

As represented in the table, the mean HbA1c levels in diabetic patients with Microalbuminuria is 9.37 ± 2.02%, in Macroalbuminuria patients is 11.39 ±1.48%, and in Normal Albuminuria patients is 6.59 ± 0.63%. As represented in the table, there was a statistically significant increase in the mean HbA1c values in patients with Proteinuria (Microalbuminuria and Macroalbuminuria).

Table 4: Multiple Comparisons of HbA1C Multiple Comparisons

Bonferroni
Dependent Variable: HbA1C

Diabetes Kidney Disease		Mean Difference	Std. Error	p	
Microalbuminuria	Macroalbuminuria	-2.0220	0.5503	0.001	HS
	Normal	2.7852	0.7484	0.001	HS
Macroalbuminuria	Normal	4.8071	0.8785	0.000	HS

On doing multiple comparisons among HbA1C and Proteinuria, the results showed highly significant P value in all the group.

Discussion

In patients with Type 2 Diabetes, Microalbuminuria is associated with a twofold to fourfold increase in the risk of death. Microalbuminuria being a well-known early predictor of Diabetes kidney disease and is due to increased vascular permeability as well as endothelial damage.[10]

This study have found that the prevalence of DKD is 60% in our set up(Table-1). In our study, 66% of the study population was above 50 years of age, as in study by Chin-Hsiao Tseng [10]where the mean age of T2DM was 62.8 ± 10.8 years, and in a study by Baihui Xu et. al, [11,12] the mean age was 61.11 ± 10.01 years.

In this study, the mean duration of diabetes mellitus in diabetic patients with Microalbuminuria was 9.70 ± 4.66 years and in Diabetic patients with Normoalbuminuria was 3.56 ± 2.31 yrs(Figure-1). The duration of Diabetes Mellitus was significantly higher in diabetic patients with Microalbuminuria when compared to diabetic patients with Normal Albuminuria in our study.

Our findings are comparable with the study done by Jiji Inassi et. al, [13] who have proposed that duration of DM is probably the strongest predictor for the development of DKD. Studies have also shown that for every 5-year increase in the duration of Diabetes Mellitus, the risk of DKD increases. A good statistically significant correlation was found between the prevalence of DKD and the duration of diabetes that was consistent with findings of other studies. Huraibet al. in Saudi Arabia, [14] Varghese et al., [15] and Mather et al, [16] reported a significant correlation between Microalbuminuria and the duration of diabetes.

The above findings show that Duration of Diabetes is one of the important risk factor which causes renal impairment which is evident by increased incidence of DKD. Duration of Diabetes has significant contribution for the development DKD by prolonged exposure to hyperglycemia-induced advanced glycosylation, end products accumulation as seen in study by N.K. Chowta et, al.[17]

In our study, there was a significant increase in mean value of FBS and HbA1C in patients with

Microalbuminuria as compared with patients with Normal Albuminuria. The mean FBS level in Microalbuminuria group was 201.33 ± 69.94 mg/dl in comparison with Normal Albuminuria was 140.29 ± 45.99mg/dl. The mean HbA1c levels in Diabetic patients with Microalbuminuria was 9.37 ± 2.02%, and in Normal Albuminuria patients was 6.59 ± 0.63%.

The level of glycemic status appears to be the most important influencing transition from Normoalbuminuria to Microalbuminuria. Our findings were consistent with previous studies done by N.K. Chowta et.al.[17]

Studies have also shown that in patients with Type 2 DM, every 1% increase in HbA1c would result in an increase in the microvascular complications by 37%. [18]

HbA1c is also shown to have a special affinity for oxygen thereby causes tissue anoxia and plays a role in causation of micro and macroangiopathy. The interaction of advanced glycation end products and their receptors have been implicated as mediators of micro vascular permeability, ischemia & angiogenesis. [19]

Limitation: It was a hospital based cross sectional study which may not be representative to other parts of country. Further study with larger sample in different regions may be conducted.

Conclusion:

Based on the results of present study, we concluded that Poor Glycemic status and microalbuminuria were directly proportional to the incidence of DKD in Type 2 Diabetic patients. In addition, the diagnosis of DKD is dependent on urinary albumin excretion(UACR) along with clinical assessment. Measurement of UACR also recommended in guidelines but not yet fully adopted universally in diabetes care. Some new biomarkers have been found to be promising, but till date not yet fully validated in clinical practice.

Funding: No funding sources

Ethical approval: The study was approved by the Institutional Ethics Committee

References

1. Cho NH, Shaw JE, Karuranga S, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract. 2018; 138:271-81.
2. Parving HH, Mauer M, Fioretto P, et al. Diabetic nephropathy. In: Brenner B, ed. Brenner and Rector's The Kidney. Vol. 1. Philadelphia, PA: Elsevier; 2012:1411–1454.
3. Fiseha T. Urinary biomarkers for early diabetic nephropathy in type 2 diabetic patients. Biomark Res. 2015 Jul 4; 3:16.
4. Stanton R. Clinical challenges in diagnosis and management of diabetic kidney disease. *Am JKidney Dis* 2014; 63(2, Suppl. 2): S3–S21.
5. Persson F and Rossing P. Diagnosis of diabetic kidney disease: state of the art and future perspective. *Kidney Int Suppl* 2018; 8: 2–7.
6. Frederik Persson, Peter Rossing; Diagnosis of diabetic kidney disease: state of the art and future perspective kidney International Supplements (2018) 8, 2–7.
7. January 2023 | volume 46 | supplement 1 https: //diabetesjournals.org/care/issue/46/Supplement_1.
8. de Boer IH, Gao X, Cleary PA, et al. Albuminuria changes and cardiovascular and renal outcomes in type 1 diabetes: the DCCT/EDIC Study. Clin J Am Soc Nephrol. 2016; 11:1969–1977.
9. De Oliveira EP, Burini RC. High plasma uric acid concentration: causes and consequences. Diabetol Metab Syndr. 2012; 4:12.
10. Weir MR. Microalbuminuria in type 2 diabetics: an important, overlooked cardiovascular risk factor. J Clin Hypertens (Greenwich). 2004 Mar;6(3):134-41.
11. Baihui Xu, Jichao Sun, Xinru Deng, et.al. Low Serum Magnesium Level Is Associated with Microalbuminuria in Chinese Diabetic Patients. International Journal of Endocrinology vol. 2013.
12. Chin-Hsiao Tseng, "Correlation of uric acid and urimnary albumin excretion rate in patients with type 2 diabetes mellitus in Taiwan", Kidney International, vol. 68 (2005), pp. 796-801.
13. Jiji Inassi et, al. "Role of duration of Diabetes In The Development of Nephropathy in Type-2 Diabetic patients". National Journal of Research, 2014.
14. Huraib S, Abu-Aisha H, Sulimani RA, Famuyiwa FO, Al-Wakeel J, Askar A, et al. The pattern of diabetic nephropathy among Saudi patients with NIDDM. Ann Saudi Med. 1995; 15:120–4.
15. Varghese A, Deepa R, Rema M, Mohan V. Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetes center in southern India. Postgrad Med J. 2001; 77:399–402.
16. Mather HM, Chaturvedi N, Kehely AM. Comparison of prevalence and risk factors for microalbuminuria in south Asians and European with type 2 diabetes mellitus. Diabetes Med. 1998; 15:672–7.
17. N.K. Chowta, P. Pant, and M.N. Chowta. "Microalbuminuria in DM: Association with age, sex, weight and creatinine clearance. Indian Journal of Nephrology, 2009, April, 19(2); 53-56.

18. Singh R, Barden A, Mori T, Beilin L. Advanced glycation end products: A review. Diabetologia 2001; 44; 129-146.

19. Baynes JW, Thorpe SR. Role of oxidative stress in diabetic complications. A new perspective on an old paradigm. Diabetes 1999; 48:1-9