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Original Article

Correlation between urinary microalbumin and glycated hemoglobin in type 2 diabetes

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Abstract

The chronic metabolic disorder diabetes mellitus is a fast-growing global problem with huge social, health, and economic consequences. Nephropathy is one of the tricky situations of type 2 diabetes mellitus that may well lead to end-stage renal disease. Persistent microalbuminuria is the best predictor of a high risk of developing diabetic nephropathy. This study was done on fifty type 2 diabetes patients attending Chettinad Hospital and Research Institute, Kodambakkam: age and sex-matched cross-sectional study. A number of 50 type 2 DM with the age groups 40–70 years without complications were taken as cases, and 50 healthy subjects of comparable age were taken as controls in the study. The study was conducted among 100 study subjects who were type 2 diabetes individuals. The scatter plot shows the correlation between all study subjects' urinary microalbumin and glycated hemoglobin values. The correlation between urinary microalbumin and glycated hemoglobin is strongly correlated. The association between urinary microalbumin and glycated hemoglobin in type 2 DM is strongly correlated. Urinary microalbumin levels are much higher in people who have (Poor Glycemic Control).

Keywords: diabetes mellitus, nephropathy, metabolic disorder.

Introduction

In recent decades, type 2 diabetes mellitus (DM) has become more prevalent worldwide. Since a large number of people are expected to be affected by this disease in the next decade, it is fast becoming an epidemic in some countries due to the aging population, which will add to the burden already borne by healthcare providers, especially in countries with poorer health [1]. Long-term diabetes mellitus often leads to diabetic nephropathy. Diabetic kidney disease is a frequent outcome of DM that has been around for a long time. The development of diabetic nephropathy has a spectacular increase in M&M among patients with DM [2]. The renal disorder is one of the snags of type 2 DM that may perhaps result in incurable kidney disorders. Insistent MAU is the best prognosticator of elevated risk of diabetic kidney disease [3]. A specific combination of micro-vascular diseases and neuropathies with diabetes, and the association of these two complications with the duration of diabetes, suggests that they are related to hyperglycemia or coexisting metabolic disorders [4]. Glycated hemoglobin is sometimes referred to as HbA1c. This is a product of the body's glucose (sugar) binding to your red blood cells. Because the body cannot adequately use the sugar, more binds to the blood cells and accumulates in the blood. The term "glycation" should describe non-enzymatic processes, whereas "glycosylation" would describe reactions catalyzed by enzymes. Proteins, lipids, or DNA can ingest glucose or other carbs through a process known as glycation, which is non-enzymatic, unchangeable, and concentration-dependent. Glycated substances can then be treated further to provide advanced products from glycation. (AGEs). On the other hand, glycosylation is a post-translational mechanism involving enzymes catalyzing carbohydrate inclusion in proteins or lipids [5]. People with diabetes have an optimum HbA1c level of

48mmol/mol (6.5%) or below [6]. Microalbuminuria is characterized as an atypical rise in albumin excretion rate between 30 to 299 mg/g creatinine. The phrase was coined in the early 1980s when technological breakthroughs enabled the detection of minute but unusual rises in albumin in the urine of individuals with diabetes and other diseases—hence the term "microalbuminuria" [7]. Microalbuminuria, the earliest stage of progressive diabetic renal impairment, is the simplest and most sensitive predictive indicator for assessing the probability of overt nephropathy in diabetes. The underlying risk factors for microalbuminuria are raised blood pressure and poor glycemic management. According to several research, diabetes duration, male sex, and pre-existing retinopathy are key indicators of risk for microalbuminuria [8]. Microalbuminuria is, therefore, a crucial signal of danger for both the physician and the patient, and if overlooked, it can result in permanent kidney damage [9]. The significance of microalbuminuria as a resourceful predictor of advanced renal disease and cardiovascular events was then recognized by several potential studies, mainly among diabetic patients and hypertensive patients [10].

Material and methods

This study was done on type 2 diabetes patients coming to Chettinad Hospital and Research Institute, Kodambakkam. Age and sex-matched cross-sectional study. This study was conducted only after getting approval from the institutional ethical committee. In this study, the total sample size is 100. Among them, fifty patients with type 2 DM were taken as cases, and fifty healthy subjects were taken as controls, with the age group between 40–70 years taken as controls and participated in the study. Inclusion criteria – known cases of type 2 diabetes mellitus patients visiting Chettinad Academy and Research Institute interested in participating are included in the study. Exclusion criteria – Type 1 DM, pregnant and lactating mothers, diabetes with complications, and diabetic nephropathy were excluded from the study. HbA1C is estimated through the HPLC method using the completed data entered into an MS Excel worksheet. Urinary microalbumin is estimated using the Beckman Coulter method, and collected data of study subjects were analyzed with IBM SPSS (Statistical Package Social Service) version 29.0.

Results and discussion

The total sample size in this study is 100. Fifty patients with type 2 DM were taken as cases, and fifty healthy subjects were taken as controls. The mean age of the cases and controls is 54.48±6.74 and 55.52±7.69, respectively.

The study revealed a positive connection between urine microalbumin and glycated hemoglobin in type 2 DM. The current studies find that people with diabetes with poor metabolic control are more prone to kidney injury and consequently have higher microalbumin levels. Microalbumin levels are observed to be greater in the case study than in the control study, and this variance is significant in statistical terms (P 0.001). A similar study was conducted by Kare *et al*. The average age at diabetes diagnosis in the research sample was 8 years, with most patients aged 6 to 10. Microalbuminuria and glycemic control show a significant linear relationship with diabetes duration in type 2 diabetics. (p 0.05). Microalbuminuria is also connected with an increase in glycosylated hemoglobin levels.

The proportion of cases of microalbuminuria in diabetic patients has been determined to be high, and as an evolving country, adjoining is a critical requirement for Microalbuminuria and HbA1c testing to be investigated in equally those with recently analyzed and previously determined type 2DM patients as an early indicator of renal risk factor (Table 1) [2]. Kundu *et al*. discovered that the patients' urinary microalbumin

Table 1: Descriptive statistics for study participants.

Descriptive statistics				
Parameter	**Case study (n=50)** **Mean±SD**	**Control study (n=50)** **Mean±SD**	**T-value**	**P-value**
Age	54.48±6.74	55.52±7.69		
FBS mg/dL	165.98±53.52	109.7±22.82	-.035	<.001*
PPBS mg/dL	237.18±82.24	116.42±24.39	.027	<.001*

Table 1: Continued.

Descriptive statistics				
Parameter	**Case study (n=50) Mean±SD**	**Control study (n=50) Mean±SD**	**T-value**	**P-value**
HbA1c%	8.752±1.63	5.751±0.37	.005	<.001*
BUN mg/dL	10.08±3.79	10.14±4.20	.059	.940
Serum CR mg/dL	2.9584±14.43	1.139±1.34	-.061	.377
TC mg/dL	180.88±39.17	189.92±36.73	.042	.237
TGL mg/dL	134.58±59.77	123.5±67.58	.306	.387
HDL mg/dL	39.84±7.86	44.74±9.63	-.037	.006
LDL mg/dL	111.96±36.86	120.54±29.33	-.027	.201
VLDL mg/dL	26.88±11.92	24.64±13.47	.303	.381
Total protein g/dL	7.568±0.42	7.362±1.05	.333	.203
ALB g/dL	3.942±0.37	3.994±0.47	.074	.544
Globulin g/dL	3.626±0.46	3.712±1.45	.249	.692
Bilirubin total mg/dL	0.6038±0.32	0.61296±0.32	-.107	.889
Bilirubin direct mg/dL	0.15516±0.08	0.1284±0.05	-.131	.053
AST mg/dL	24.54±23.04	22.1±9.15	.293	.488
ALT U/L	41.7±31.07	34.82±20.56	.199	.195
ALP U/L	77.34±20.65	81.08±25.06	.104	.417
Gamma GT U/L	48.26±46.83	31.82±19.36	.351	.025
Urinary microalbumin	123.386±73.01	16.242±38.37	1	.02*
BMI kg/m²	25.91841±0.98	26.9055±0.92	1	1*

Note: * – P<0.05 – significant.

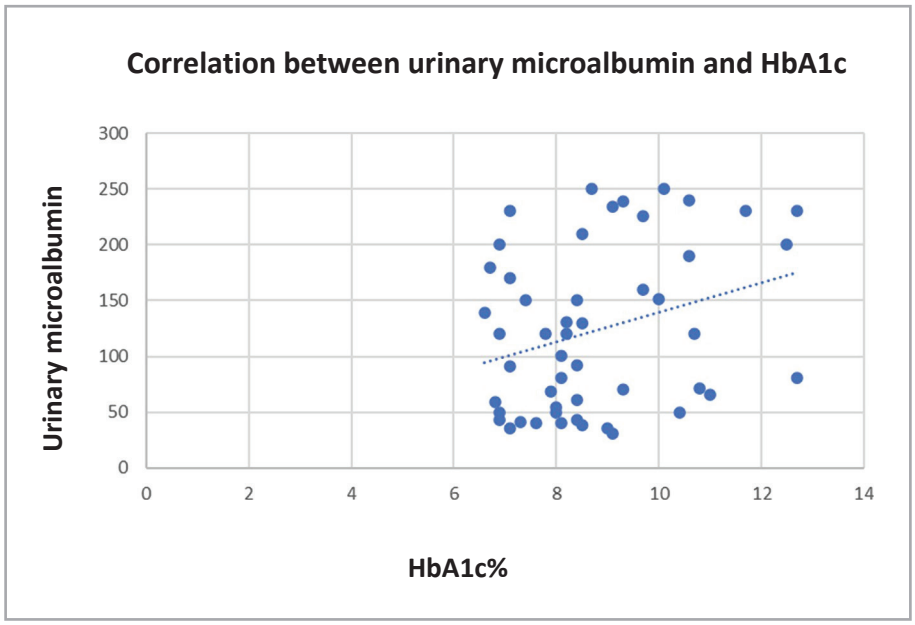

Figure 1: Correlation between urinary microalbumin and HbA1C.

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and HbA1c levels were suggestively developed. Microalbumin levels were discovered to be directly related to the duration of DM and HbA1c. People with poor glycemic control have considerably greater urinary microalbumin levels. Furthermore, as the duration of diabetes increases, urine microalbumin levels rise, indicating higher-speed urinary microalbumin detection (Figure 1) [3]. According to research, urinary microalbumin levels correlate with well-known risk factors like age and poor glycemic management (HbA1C). According to this study, females had a higher mean value of microalbumin than males. According to this study, if adequate glycemic control is maintained in the early phases of DM, the risks of microalbuminuria are reduced. Some studies have found larger kidneys in people with diabetes who have been diagnosed for less than two years. This observation is consistent with numerous others. The current study demonstrated no significant link between microalbumin levels and patient ages, consistent with earlier research. The current study demonstrated a statistically substantial link between the prevalence of microalbuminuria and the length of diabetes, which is dependable with previous research findings. Research on regression analysis and diabetes duration has revealed that diabetes duration is a powerful prognosticator of the expansion of abnormal albuminuria in type 2 DM. Our conclusions also suggest that diabetes duration is a strong prophet of higher microalbumin excretion. FBG and PPBG levels are greater in type 2 DM, and the variance is statistically substantial (P 0.001). People with poor glycemic control have significantly greater urinary microalbumin levels, as well as the duration of the DM (Diabetes mellitus). Elevate urinary microalbumin also rises and brings several complications in life, so people with long-term and short-term diabetes mellitus should take care of their health to lead good lifestyles. To maintain glycemic control and a healthy lifestyle, some dietary recommendations such as whole grain, green leafy vegetables, less carbohydrate foods, moderate protein, and high fiber food are recommended for controlling DM. They also restrict salt, sweets, beverages with sugar, and red meat. It can help maintain glycemic control and promote a healthy lifestyle.

Conclusion

The association between urinary microalbumin and glycated hemoglobin in type 2 DM shows a strong correlation. Weakened glycemic control is related to substantial rises in (urinary microalbumin) levels, indicating that monitoring microalbuminuria levels in the early stages of diabetes might help avoid and minimize the Scientific and economic hardship of ancillary difficulties in developing countries.

Conflict of interest

The authors declare no conflict of interest.

Ethics approval

The approval for this study was obtained from the Institutional Human Ethics Committee – Chettinad Academy of Research and Education(CARE IHEC II) (approval ID: IHEC-I/1394/22).

Consent to participate

Written informed consent was obtained from all the participants.

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