Int J Biol Med Res. 2012; 3(2): 1724-1726

BioMedSciDirect Publications

Contents lists available at BioMedSciDirect Publications

International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com

Original article

Evaluation of Glycated hemoglobin and Microalbuminuria as early risk markers of Nephropathy in Type 2 Diabetes Mellitus

Naveen. P[a], Kannan. N [b], Vamseedhar Annam [b*], Bhanu Prakash. G [c], Aravind Kumar. R[c]

[a]Assistant Professor, [b]Associate Professor, [c]Tutor, Department of Physiology, *Department of Pathology, Melmaruvathur Adhiparasakthi Institute of Medical Sciences & Research [MAPIMS],Melmaruvathur – 603319, Tamil Nadu, India*

ARTICLE INFO

Keywords:
Microalbuminuria
HbA1c
Nephropathy
Diabetes

ABSTRACT

Aims: 1. To evaluate microalbuminuria and HbA1c as early risk markers of nephropathy in Type 2 Diabetes Mellitus. 2. To correlate microalbuminuria and HbA1c with duration of Diabetes Mellitus. Materials and Methods: The present cross-sectional study included randomly selected Uncontrolled Type 2DM [n=50], Controlled Type 2DM [n=50] and healthy controls [n=50]. Informed consent of each patient and healthy controls were taken. Complete clinical details, general physical and systemic examinations were recorded. The fasting venous blood was obtained for glycated hemoglobin and serum creatinine, while their morning urine sample was obtained for detection of microalbuminuria. Statistical analysis was done using SPSS version 16.0. One-Way ANOVA was performed. All p-values <0.05 were considered as statistically significant. Results: The mean glycated hemoglobin, microal buminuria and serum creatinine were the highest in Uncontrolled DM [(8.01±0.83), (121±49.89), (2.18±1.12)] when compared with Controlled DM [(6.49±0.37), (47.14±39.15), 0.85±0.32] respectively. Microalbuminuria and glycated hemoglobin had a significant correlation with duration of diabetes (p<0.0001). Conclusions: The present study identifies that the risk of microalbuminuria increases with poor glycemic control. Persistent increase in glycated haemoglobin and microalbuminuria may be considered as risk markers in Diabetic Nephropathy. Therefore, regular screening for microalbuminuria and HbA1c estimation can help in clinical management to prevent complications.

© Copyright 2010 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685. All rights reserved.

1. Introduction

Type 2 Diabetes Mellitus [Type 2DM] is a non-autoimmune, complex, heterogeneous and polygenic metabolic disease condition in which the body fails to produce enough insulin, characterized by abnormal glucose homeostasis [1]. Patients with Type 2DM often have a long asymptomatic period of hyperglycaemia and many have complications at the time of diagnosis [2]. Diabetic Nephropathy is a common consequence of long standing diabetes mellitus. Its pathogenesis appears to involve complex interactions between genetic and environmental factors [3]. The patho-physiologic basis for elevated urinary albumin excretion entails the binding of glucose to proteins resulting in excessive protein glycosylation with the build up of advanced glycated end products. This leads to deposition of advanced glycated end products on the glomerulus resulting in renal and glomerular hypertrophy, mesangial matrix accumulation and thickening of glomerular basement membrane. This abnormality permits the leakage of low molecular weight proteins [albumin] [4]. This is the stage of microalbuminuria (Incipient Nephropathy) which could be reversible with good glycemic control. However, with persistent microalbuminuria, further leakage of protein in urine will result in overt diabetic nephropathy. Increased level of microalbuminuria is associated with increased risk of progressive kidney disease leading towards end stage renal disease and cardiovascular morbidity and mortality in diabetic patients as reported in an earlier study [5]. The present study was carried out to evaluate microalbuminuria in relation to HbA1c and duration of diabetes. Microalbuminuria and glycated hemoglobin were measured as risk markers of renal damage and glycemic control respectively.

* Corresponding Author : Dr. Vamseedhar Annam M.D., D.C.P.
Associate Professor, Department of Pathology
MAPIMS, Melmaruvathur, Kancheepuram,
Tamil Nadu.
E-mail: vamseedhar_a @ yahoo.com.

©Copyright 2010 BioMedSciDirect Publications. All rights reserved.

2.Materials and Methods

The present cross-sectional study was conducted from January 2008 to December 2011 in two tertiary health centers located at Kolar, Karnataka and Melmaruvathur, Tamil Nadu respectively. The study included subjects with a known history of Type 2DM and age above 45years [based on the screening recommendation by American Diabetes Association (ADA)] [6]. The study had 3 groups: Group A consisted of patients on default antidiabetic treatment [Uncontrolled DM (n=50)], Group B comprised of patients on regular antidiabetic treatment [Controlled DM (n=50)] and Group C included age-matched healthy controls (n=50). Diabetic patients suffering from any other medical problems were excluded from the study.

Purposive random sampling technique was used for data collection. All the patients and healthy controls gave informed written consent after due explanation. Ethical clearance was obtained from the ethical committee. A structured questionnaire regarding the demographic data such as age, sex, duration of diabetes, complete clinical details with general physical and systemic examinations were recorded for each patient. Venous blood samples were collected after 12 hours fasting into two test tubes; with no anticoagulant for serum creatinine, and with Ethylene Diamine Tetra Acetic Acid for HbA1c. Serum creatinine was analysed by alkaline picrate, Jaffe's Method (Biocon Kit). HbA1c was estimated by using glycated hemoglobin reagent kit (Recombigen laboratories Pvt. Ltd, India) and analysed by Spectrophotometer. Twenty four hour urine sample was collected in a container (without preservative) for analysis of albumin. Microalbuminuria was estimated by ion-exchange high-performance liquid chromatography (HPLC).

The statistical analysis was done by using SPSS version 16.0. One Way ANOVA method was applied to observe association of microalbuminuria with HbA1c and duration of diabetes. P value <0.05 was considered as statistically significant.

3.Results

Among the 100 Type 2DM patients studied [controlled and uncontrolled groups], 45% had a family history of diabetes and Male:Female ratio was 1.17:1. In Table.1, the glycemic control of Group A, Group B and Group C were compared between diabetic patients and healthy controls with serum creatinine levels [The recommended reference level for glycated hemoglobin was by American Diabetes Association]7. Microalbuminuria was compared between controlled and uncontrolled diabetic patients in Table 2. Based on Table.1 and Table.2, the Microalbuminuria increased significantly with poor glycemic control and correlated with elevated serum creatinine levels indicating renal damage ($p<0.0001$).

The parameter of the studied groups according to duration of diabetes was summarized in Table.3. In Type 2DM patients, Microalbuminuria and glycemic control have shown a significant linear correlation with duration of diabetes ($p<0.0001$).

Table-1: Comparison of HbA1c with Serum creatinine levels between Group A, Group B and Group C.

Parameters	Group A (n=50)	Group B (n=50)	Group C (n=50)
HbA1c (%)	8.01±0.83	6.94±0.37	4.93±0.33
Serum Creatinine	2.18±1.12	0.85±0.32	0.51±0.1
HbA1c: F ratio – 392.41, df - 2, p value < 0.0001 (significant). Serum Creatinine: F ratio – 65.19, df - 2, p value < 0.0001 (significant).			

Table-2: Comparison of microalbuminuria between Group A and Group B.

Parameters	Group A (n=50)	Group B (n=50)
Microalbuminuria	121±49.89	47.14±39.15
Microalbuminuria: F ratio – 67.82, df - 1, p value < 0.0001 (significant). In Group C – Microalbuminuria was not seen.		

Table.3: Duration of Type 2DM with Microalbuminuria and HbA1c.

Duration of Diabetes	HbA1c (%)	Microalbuminuria (mg/24hrUrine)
<5years [n=35]	7.34±0.26	23.6±6.53
5-10years [n=35]	7.92±0.39	95.67±33.71
>10years [n=30]	8.97±0.85	164.33±51.46

F ratio – 408.50, df – 2, p value < 0.0001 (significant).

4. Discussion:

Diabetes Mellitus has become a major health problem in India. It has been estimated that the burden of Type 2DM for India is projected to increase to 87 million in 2030. The impacts of Type 2DM are considerable: as a lifelong disease, it increases morbidity and mortality and decreases the quality of life. At the same time, the disease and its complications cause a heavy economic burden for diabetic patients themselves, their families and society [7,8]. In our study, 45% patients had family history of diabetes showing that Type 2DM has a strong genetic component. Usually the patients are asymptomatic until complications become obvious and among those affected one-third will eventually have progressive deterioration of renal function.

The present study was conducted on 100 diabetic patients [controlled and uncontrolled groups]. The serum glucose is a continuous variable, rising and falling about two-fold throughout the day in people without diabetes, and up to some 10-folds in people with diabetes [9]. Hence, the higher mean value of glycated hemoglobin in uncontrolled diabetes was expected in view of increase in microalbuminuria levels. This is based on the previous fact that HbA1c can provide an accurate and reliable method to routinely assess the relative level of diabetes control [10].

Also, the level of mean blood glucose, effectiveness of treatment and risk of development of possible long term chronic complications are typically associated with suboptimal or poor glycemic control in uncontrolled Diabatic [8]. This finding was

supported by the present study, which showed that elevated levels of microalbuminuria and serum creatinine levels were seen in patients with poor glycemic control. We also observed that there is relative risk reduction, when the mean HbA1c levels were 6.94% [Table.2]. This was substantiated by the reduction in the levels of microalbuminuria and serum creatinine levels in controlled diabetics.

From the foregoing, it is obvious that good glycemic control is the key to preventing and/or forestalling microalbuminuria and subsequently, diabetic nephropathy amongst other chronic complications of DM. Also in our study, we observed increase in the levels of HbA1c and microalbuminuria with increase in the duration of the disease. The possible reason could be that during long course of disease, the patient might have default treatment. Therefore regular screening for microalbuminuria for every 2-3 months in addition to continuous HbA1c estimation are important tools in the management of DM.

5. Conclusion

Being a developing country; there is a dire need that microalbuminuria and HbA1c testing should be done in both, newly diagnosed as well as already diagnosed Type 2DM patients as an early marker of renal risk factor. Hence, patients and health care givers should give very high priority to improving glycemic control sufficiently to maintain blood glucose. If this is achieved, the number of patients with microalbuminuria will decline substantially and in turn lower the numbers in which overt macroalbuminuria and end stage renal disease develop.

Acknowledgements

We thank Department of Physiology, Clinical Pathology and Medicine, Sri Devaraj Urs Medical College, Kolar, Karnataka for supporting our research work.

6. References

[1] Report of the expert committee on the diagnosis and classification of diabetes mellitus. Diabetes Care.2003;26 (Suppl 1):5-20.

[2] Satchell S, Tooke JF. What is the mechanism of microalbuminuria in diabetes: a role for the glomerular endothelium? Diabetologia 2008;51:714–725.

[3] Powers A C. Diabetes Mellitus. In: Jameson JL. (editor) Harrison's Endocrinology. 1st ed. New York: McGraw-Hill;2006.303–304.

[4] Mason RM, Wahab NA. Extracellular matrix metabolism in diabetic nephropathy. J Am Soc Nephrol 2003;14:1358-1373.

[5] Vergouwe Y, Soedamah-Muthu SS, Zgibor J, Chaturvedi N, Forsblom C, Snell-Bergeon JK, et al. Progression to microalbuminuria in type 1 diabetes: development and validation of a prediction rule. Diabetologia 2010;53:254-262.

[6] American Diabetes Association. Testing in Asymptomatic Patients. Diabetes Care 2011;34(Suppl 1):13-14.

[7] American Diabetes Association. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 2011;34(Suppl 1):62-69.

[8] Ramachandran A, Snehalatha C. Current scenario of diabetes in India. J Diabetes 2009;1(1):18-28.

[9] Saudek CD, Kalyani RR, Derr RL. Assessment of Glycemia in Diabetes Mellitus: Hemoglobin A1c. J Assoc Physicians India 2005;53:299–304.

[10] Genuth S. Insight from the diabetes control and complications trial/epidemiology of diabetes interventions and complications study on the use of intensive glycemic treatment to reduce the risk of complications of type 1 diabetes. Endocr Pract 2006;12:34-41.

© Copyright 2010 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685.
All rights reserved.