International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Association of Microalbuminuria in Type 2 Diabetes Mellitus with Obesity and Dyslipidemia

Suma K R[1*], Srinath S[1**], Ganesh Shetty[2**]

[1]Professor, [2]Resident,
[*]Dept. of General Medicine, [**]Dept. of General Surgery
Sri Siddartha Medical College, Tumkur, Karnataka, India.

Corresponding Author: Suma K R

Received: 03/09/2015 *Revised: 10/10/2015* *Accepted: 16/11/2015*

ABSTRACT

Background and objectives: Diabetic nephropathy is a dreaded complication of type2 diabetes mellitus. However in the early stages, also known as incipient nephropathy, it can be detected by the presence of microalbuminuria. The present epidemic of diabetes is significantly fuelled by the growing problem of overweight and morbid obesity. The aim of our study was to know the occurrence of microalbuminuria in patients with type 2 diabetes mellitus and to note its associations with obesity and lipid abnormalities.
Methodology: This study was undertaken in our institution from October 2012 to April 2014. A total of 100 type 2 diabetes mellitus patients satisfying the inclusion criteria were randomly selected for the study. All patients were evaluated in detail along with the testing of microalbuminuria by calculating albumin- creatinine ratio of spot urine sample**.**
Results: The overall occurrence of microalbuminuria was 31%. The occurrence of microalbuminuria showed a significant increase in patients with higher waist circumference and body mass index. There was no significant association of microalbuminuria with abnormalities in lipid profile.
Interpretation and conclusions: The occurrence of microalbuminuria in type 2 diabetic patients in this study was significantly influenced by abdominal obesity and body mass index of the patients. During the initial evaluation and also during follow up visits, particular attention must be given for recording of waist circumference and body mass index, and the importance of weight control has to be stressed as it will help in better glycemic control and reduction in progression to nephropathy.

Key words: type 2 diabetes mellitus, microalbuminuria, waist circumference, body mass index, lipid profile, HbA1c.

INTRODUCTION

Diabetes Mellitus (DM) has emerged as the major public health problem in India. Genetic predisposition combined with changes in lifestyle, associated with urbanization and globalization contributes to this rapid rise of diabetes in India. Moreover type2 diabetes in India occurs a decade earlier than the western population, thus affecting the productive youth of this country**.** [1-3]

The present epidemic of diabetes is significantly fuelled by the growing problem of overweight and morbid obesity. Excessive truncal adiposity is very well correlated with the risk for diabetes, hypertension and cardiovascular disease. The changing lifestyle, lack of physical activity and increasing stress are some of

the important contributing risk factors. [4] The typical dyslipidemia of type 2 DM is characterized by several quantitative and quantitative lipoprotein abnormalities. The most commonly seen lipid abnormalities are elevation of both fasting and post prandial triglyceride levels, low high density lipoprotein (HDL) cholesterol levels and an increase in small dense low density lipoprotein (LDL) levels. [5]

The real burden of the disease is due to its micro and macro vascular complications which lead to increased mortality and morbidity. Type 2 diabetes mellitus is the leading cause of end stage renal disease (ESRD). Asian Indians have shown an increased tendency towards development of end stage diabetic nephropathy. The early marker for diabetic nephropathy is microalbuminuria, which is also a risk factor for cardio vascular disease. [6]

Microalbuminuria is also associated with an increased prevalence of arterial hypertension, proliferative retinopathy and peripheral neuropathy. The development of microalbuminuria precedes the development of overt diabetic nephropathy by 10 to 15 years. Thus it is an important warning sign for both the physician and the patient, which if ignored can lead to irreversible renal damage. [7]

So the aim of this study was to assess the occurrence of microalbuminuria in patients with type 2 diabetes mellitus and find out its association with waist circumference, body mass index and lipid profile.

MATERIALS AND METHODS

The study was conducted at Sri Siddhartha medical college hospital from October 2012 to April 2014. 100 patients over the age of 40 years, diagnosed of type 2 diabetes (according to ADA criteria [8]) were selected by systematic random sampling. Type 1 diabetes, patients with macroalbuminuria or overt nephropathy, congestive cardiac failure, urinary tract infection, hematuria, patients confined to bed for more than 2 weeks, pregnant patients and patients with hypertension of more than 160/100 mm hg were excluded from study. A detailed history regarding onset and duration of diabetes, modality of treatment and the drugs and dosage, and also regularity of treatment was noted. Waist circumference, body mass index (weight [kg]/height [mtr] ^{2}) was measured for all patients. A detailed clinical examination was done to note the presence of other complications of diabetes. Apart from the routine investigations, fasting lipid profile, fasting and post prandial blood sugar, blood urea, serum creatinine, HbA1c, urine routine/ culture, ophthalmological evaluation for diabetic retinopathy, electrocardiogram were done.

Estimation of microalbuminuria: Spot urine sample was collected from the patients and was tested for albuminuria by Microalbumin-turbilatex technique and the same sample was used to estimate urine creatinine by semi auto analyzer calorimetry. The diagnosis of microalbuminuria was done by calculating albumin creatinine ratio (ACR) of the spot urine sample. An albumin creatinine ratio of 30-300mcg/mg of creatinine from a spot urine collection was taken as presence of microalbuminuria, which has been shown to have a sensitivity of 83% and specificity of 100%. [9,10]

Statistical analysis was done using mean, standard deviation and chi square test.

RESULTS

Out of the 100 patients in the study, 56 were males, and 44 were females. 29 patients were in the age group of 40-50years, 30 in 51-60years, 27 in 61-70years, 14 in >70years age group. The mean age of the patients was 59.01+/-11.62 years. The mean duration of the disease was 5.88+/-4.56 years. Total number of patients who were on treatment with oral hypoglycemic agents (OHAs)

were 79, 13 were on insulin, and 8 were on both OHAs and insulin. A total of 31 patients tested positive for microalbuminuria, and 69 tested negative. Out of these 31 patients, 18 were male and 13 were female. The age distribution is shown in table 1.

Table 1: Age distribution of patients with microalbuminuria

Clinical variables	Microalbuminuria			P value
	Absent (n=69)	Present (n=31)	Total	
Age in years				
• 40-50	22(31.9%)	7(22.6%)	29	0.117
• 51-60	21(30.4%)	9(29%)	30	
• 61-70	14(20.3%)	13(41.9%)	27	
• >70	12(17.4%)	2(6.5%)	14	
TOTAL	69(100%)	31(100%)	100	

Number of patients with waist circumference of (females <80 cms and males <90 cms) were 62, and with waist circumference of (females >80 cms and male >90 cms) were 38, Mean of waist circumference measurement is 85.05±9.86. 22 patients were with BMI less than 19, 51 patients were with BMI 19-25, 27 patients were with BMI more than 25. Mean of BMI distribution of patients is 22.64±5.40.

The association of waist circumference with occurrence of microalbuminuria is shown in table 2. Among 62 cases with waist circumference less than 80 cms in females and less than 90 cms in males, 8 cases were positive for microalbuminuria (i.e. 12.9%). Among 38 cases with waist circumference more than 80 cms in females and more than 90 cms in males, 23 cases were positive for microalbuminuria (i.e.60.52%).This study showed significant increase in microalbuminuria in patients with higher waist circumference. P value strongly suggestive of significance (<0.001).

The association of BMI with occurrence of microalbuminuria is shown in table 3. 27 patients had a BMI of less than 19kg/m^2 and out of them 3 patients were positive for microalbuminuria (i.e.11.1%). 46 patients had a BMI between 19kg/m^2 and 25 kg/m^2 and out of them 13 patients were positive for microalbuminuria (i.e.28.26%). 27 patients had a BMI of above 25 kg/m^2 and out of them 15 patients were positive for microalbuminuria (i.e.55.55%), showing that the occurrence of microalbuminuria is significantly associated with BMI, as the BMI increased, number of microalbuminuria positive cases also increased showing strongly significant p value (0.002).

21 patients had Total cholesterol greater than 200 mg/dl and among them 4 patients were positive for microalbuminuria. 39 patients had Triglycerides greater than 150 mg/dl and among them 14 patients were positive for microalbuminuria. 84 patients had LDL greater than 100 mg/dl and among them 27 patients were positive for microalbuminuria. 100 patients had HDL lesser than 50 mg/dl and among them 31 patients were positive for microalbuminuria. The association of microalbuminuria with the lipid parameters is shown in table 4. Occurrence of microalbuminuria is not significantly associated with the abnormal lipid parameters.

Table 2: Association of waist circumference with the Occurrence of microalbuminuria

waist circumference in cms	microalbuminuria		Total	P value
	Absent (n=69)	Present (n=31)		
• Female <80, Male <90	54(87.1%)	8(12.9%)	62(100%)	<0.001**
• Female>80, Male>90	15(39.48%)	23(60.52%)	38(100%)	
Total	69	31	100	

Table 3: Association of BMI with the Occurrence of microalbuminuria

BMI (kg/m^2)	Microalbuminuria		Total	P value
	Absent(n=69)	Present(n=31)		
• <19	24(88.9%)	3(11.1%)	27(100%)	0.002
• 19-25.0	33(71.4%)	13(28.6%)	46(100%)	
• >25.0	12(44.45%)	15(55.55%)	27(100%)	
Total	69	31	100	

Table 4: Association of Lipid parameters with the occurrence of Micro albuminuria

Lipid parameters	Microalbuminuria			P value
	Absent(n=69)	Present(n=31)	Total	
T.Cholesterol (>200 mg/dl)	17(24.6%)	4(12.9%)	21	0.183
Triglycerides (>150 mg/dl)	25(64%)	14(36%)	39	0.397
LDL (>100 mg/dl)	57(68%)	27(32%)	84	0.571
HDL (<50 mg/dl)	69(69%)	31(31%)	100	0.557

The association of HbA1c with occurrence of microalbuminuria is shown in table 5.

Table 5: The association of HbA1c with occurrence of microalbuminuria

HbA1c	Microalbuminuria			P value
	Absent(n=69)	Present(n=31)	Total	
<7	28(40.6%)	1(3.2%)	29	<0.001**
7-8	38(55.1%)	17(54.8%)	55	
>8	3(4.3%)	13(41.9%)	16	
Total	69(100%)	31(100%)	100	

With increasing values of HbA1c, or poor glycemic control, the percentage of patients with microalbuminuria also significantly increased ($p<0.001$).

The mean pattern of other laboratory parameters is shown in table6.

Table 6: Mean pattern of other laboratory parameters

Variables	Microalbuminuria (Mean ± SD)		P value
	Absent(n=69)	Present(n=31)	
Glucose parameter			
• FBS (mg/dl)	174.32±36.95	188.90±52.04	0.113
• PPBS (mg/dl)	249.33±50.06	270.97±63.67	0.070
• HbA1C	7.12±0.46	7.87±0.57	<0.001**
Renal Parameters			
• Blood urea(mg/dl)	24.98±4.80	29.73±10.07	0.784
• S Creatinine (mg/dl)	1.09±0.15	1.10±0.19	0.764

DISCUSSION

The percentage of patients with microalbuminuria in the present study was 31%, which is similar to the previous studies. A study by Unnikrishnan R et al in south Indian population showed 26.9% of patients with microalbuminuria, and another study by Patel et al had 28.65 % of the patients with microalbuminuria. The slightly higher percentage in this study is probably due to the fact that most patients were on irregular treatment. [11, 12]

A study of association of microalbuminuria with the insulin resistance syndrome, independent of hypertension and type 2 diabetes in the Korean population showed that, subjects with microalbuminuria had a higher body mass index (BMI), waist-to-hip circumference ratio, and were independent factors associated with the presence of microalbuminuria. [13] In another study, Identifying patients with type 2 diabetes at high risk of microalbuminuria: results of the DEMAND study, showed that, abdominal obesity, elevated blood pressure levels and low HDL cholesterol levels substantially increase the risk of microalbuminuria. [14] Chowta et al in his study Microalbuminuria in diabetes mellitus: Association with age, sex, weight, and creatinine clearance, concluded that there is no effect of BMI and sex on the prevalence of microalbuminuria. [15] A study done by Ruilope LM et al, Metcalf P et al Mokdad et al study reported that increase in BMI increased the frequency of microalbuminuria. [16-18] Present study brought out a significant association of microalbuminuria with body mass index of more than 25kg/m2 as 48% of patients were positive for microalbuminuria. The possible explanation for this could be due to the fact that, increasing body mass index is a reflection of insulin resistance which in turn leads to endothelial dysfunction and microalbuminuria.

Kramer H, Reboussin D showed that abdominal obesity was associated with

microalbuminuria in with type 2 diabetes patients. [19] Present study showed statistically significant increase in microalbuminuria with increase in waist circumference, among patients with waist circumference of (female >80cms and male >90cms), 74.2% of patients were positive for microalbuminuria. Possible reasons for this may be that patients with higher BMI were also in the higher waist circumference group. This may explain the similar associations noted in this study between microalbuminuria and BMI and waist circumference.

Varghese A et al , Lu B et al, Liu JE et al study showed the absence of significant difference in triglyceride and total cholesterol values between microalbuminuric and normoalbuminuric patients, which is similar to that of present study, which found no statistical significance between the microalbuminuric and normoalbuminuric patients . [20-22]

As in previous studies, the frequency of occurrence of microalbuminuria was strongly associated with the rising HbA1c values. In this study, only 3.4% of the patients with HbA1c<7% had microalbuminuria, whereas, 81.25% of the patients with HbA1c >8% had microalbuminuria. Studies by Gupta et al and John et al also reported that incidence of microalbuminuria increased with increasing HbA1c values, suggesting that poor glycemic control is directly associated with the development of microalbuminuria which heralds the onset of diabetic nephropathy. [23,24]

CONCLUSION

It can be concluded that microalbuminuria is an important early sign of diabetic nephropathy. Abdominal obesity, reflected by the waist circumference and overweight type 2 diabetics has higher likelihood of developing microalbuminuria. Therefore its recognition and early weight control measures may help in retarding the progression to overt nephropathy. Good glycemic control is associated with lesser occurrence of microalbuminuria and therefore nephropathy. Since direct causal relationship between the variables cannot be established from this study due to small sample size, further large scale studies are needed, but till now enough evidence is there to say that weight control should be an integral part of diabetes management as it is associated with better glycemic control and therefore lesser number of complications.

REFERENCES

1. Ramachandran A. Epidemiology of diabetes in India: three decades of research. Gupta S B, Medicine update. Mumbai; API: 2005.p.177
2. Sircee R, Shaw J, Zimmet P. Diabetes and impaired glucose tolerance in India. Diabetes Atlas. Gan D Ed. International Diabetes Federation, Belgium, 2006; 15:103
3. Nagakami T, Qlao Q, Carstensen B, Hu G, Balkau B, Johnson BK. The DECODEDECODA study group. Age, body mass index and type 2 diabetes-association modified by ethnicity. Diabetologia 2003; 46:1063-1070.
4. Yash Pal Munjal. Prevention of Diabetes Mellitus, section 9, chapter 21, API Textbook of Medicine, 9th edition, The Association of Physicians of India,2012: 393 -396.
5. Tina J Chahil, Henry N Ginsberg, Diabetic Dyslipidemia. Endocrinology and Metabolism Clinics, North America, Elsevier, Saunders, Vol 35, Issue 3. (September 2006).491-510.
6. Kanakamani J, Ammini A, Gupta N et al. Prevalence of microalbuminuria among patients with type 2 diabetes mellitus- a hospital based study from North India. Diabetes Technology and Therapeutics 2010;12(2):161-166.
7. Fauci A S, Kasper D L, Braunwald E, Hauser S L, Jameson J L et al. Diabetes mellitus. Osler W, editor. Harrison's principles of internal medicine.17th ed, New York; McGraw Hill; 2008: 2275-2304.

8. American Diabetes Association: Standards of medical care in diabetes-2010. Position statement. Diabetes Care; Jan 2010; vol 33, sup 1 (s11-s61).
9. Cavanaugh K L. Diabetes management issues for patients with chronic kidney disease. Clinical diabetes. 2007; 25(3): 90-97.
10. Justesen T I, Damm P, Petersen H I A, Ekbom P, Mathiesen E R. Albumin – creatinine ratio in random urine samples might replace 24 hour urine collections in screening for micro- and macroalbuminuria in pregnant women with type 1 diabetes. Diabetes care, 2006; 29(4): 924-925.
11. Unnikrishnan R, Rema M, Pradeepa R, Deepa M. Prevalence and risk factors for diabetic nephropathy in an urban south Indian population. Diabetes Care. 2007; 30:2019-24.
12. Patel K L, Mhetras S B, Varthakavi P K, Merchant P C, Nihalani K D, Microalbuminuria in non insulin dependent diabetes mellitus. J of Assoc of Physic of India, 1999; 47(5):596-601
13. Kim Y L, Kim C H , Choi C H, Chung y e, Lee M S, et al. Microalbuminuria is associated with the insulin resistance syndrome independent of hypertension and type 2 diabetes mellitus in Korean population. Diabetes Res Clin Pract. 2001 May; 52(2):145-52.
14. Rossi MC1, Nicolucci A, Pellegrini F, Comaschi M, Ceriello A, Cucinotta D, Giorda C, Valentini U, Vespasiani G, De Cosmo S. Identifying patients with type 2 diabetes at high risk of microalbuminuria: results of the DEMAND (Developing Education on Microalbuminuria for Awareness of reNal and cardiovascular risk in Diabetes) Study. Nephrol Dial Transplant. 2008 Apr;23(4):1278-84. Epub 2007 Nov 26 .
15. Chowta NK, Pant P, Chowta MN. Microalbuminuria in diabetes mellitus: Association with age, sex, weight, and creatinine clearance. Indian J Nephrol. 2009;19:53–6.
16. Ruilope LM, Segura J. Predictors of the evolution of microalbuminuria. Hypertension. 2006;48:832–3.
17. Metcalf P, Baker J, Scott A, Wild C, Scragg R, Dryson E. Albuminuria in people at least 40 years old: Effect of obesity, hypertension, and hyperlipidemia. Clin Chem. 1992;38: 1802–8.
18. Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS, *et al.* Prevalence of obesity, diabetes, and obesity related health risk factors, 2001. JAMA 2003; 289:76–9.
19. Kramer H,Reboussin D,Bertoni AG."Obesity and Albuminuria Among Adults With Type 2 Diabetes". Diabetes Care. 2009 May; 32(5): 851–853.
20. Varghese A, Deepa R, Rema M, Mohan V. Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetes centre in Southern India. Postgrad Med J 2001; 77: 399-402
21. Lu B, Wen J, Song XY et al. High prevalence of albuminuria in population based patients diagnosed with type-2 diabetes in the Shanghai downtown. Diabetes Res Clin Pract 2007;75: 184-9
22. Liu JE, Robbin DC, Bella JN et al. Association of albuminuria with systolic and diastolic left ventricular dysfunction in type 2 diabetes. The strong heart study. J Amer Coll Cardiol 2003; 41: 2022-8.
23. Gupta DK, Verma LK, Khosla PK, *et al*. The prevalence of microalbuminuria in diabetes: a study from north India. Diabetes Res Clin Pract 1991;12:125–8.
24. John L, Rao P S, Kanagasabapathy A S. Prevalence of diabetic nephropathy in non insulin dependent diabetes. Indian J Med Res 1991; 94: 24-29.

How to cite this article: Suma KR, Srinath S, Shetty G. Association of microalbuminuria in type 2 diabetes mellitus with obesity and dyslipidemia. Int J Health Sci Res. 2015; 5(12):21-26.

****