Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Association of Microalbuminuria with Intimal Medial Thickness of the Superficial Femoral Artery in Type 2 Diabetes Mellitus.

Pashaura Singh Sandhu[1], Shalinderpal Singh[2], S.B. Nayyar[3], N.S. Neki[4], Riputapan Singh Sandhu[5]

[1]Assistant professor, Dept of medicine, Government Medical College, Amritsar, 143001, India.
[2]Assistant professor, Dept. of Medicine, SGRDIMSAR, Amritsar, 143501, India.
[3]Professor, Dept. of Medicine, SGRDIMSAR, Amritsar, 143501, India.
[4]Professor, Dept. of Medicine, Govt. Medical College/Guru Nanak Dev Hospital, Amritsar, India.
[5]Medical intern, Govt. Medical College/Guru Nanak Dev Hospital, Amritsar, India.

ABSTRACT

Background: Microalbuminuria is an early, less expensive and easily available parameter of detecting microvascular angiopathy of kidneys in diabetic patients and angiopathy may also involve retinal, coronary, cerebral and peripheral vessels in these patients. The present study was done to find the association of microalbuminuria with intimal medial thickness of the superficial femoral artery in type 2 diabetes mellitus. **Methods:** The study included two groups of 100 individuals each. Group 1 having type 2 diabetes mellitus and group 2 non-diabetic control persons. Statistical analysis was done by standard statistical methods. It revealed significant association of microalbuminuria with intimal medial thickness of superficial femoral artery in type 2 diabetes mellitus. **Results:** Mean age of group 1(diabetic) was 50.73±SD8.48 years. Mean age of group 2(non-diabetic) was 49.57±SD 7.677 years. Majority of patients were in age group 40-50 years in both group 1 and group 2. Mean microalbuminuria in group 1 (diabetic), was 214.74±71.174 and that in group 2 (non diabetic), was 41.500±23.837. Difference in mean microalbuminuria, in both groups was highly significant ($p<0.001$). Mean intimal media thickness (IMT) of superficial femoral artery(SFA) in group 1 (diabetic), patients was 0.0836±0.0167 cm and that of group 2 (non diabetic), was 0.059 ± 0.00464 cm. Difference in mean IMT of SFA, in both groups was highly significant($p<0.001$). **Conclusion:** There is highly significant correlation between microalbuminuria and intimal-medial thickness (IMT) of superficial femoral artery (SFA) in type 2 diabetes mellitus.

Keywords: Microalbuminuria; Diabetes mellitus; Intimal medial thickness.

INTRODUCTION

Diabetes mellitus is a heterogeneous group of metabolic disorders characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action or both.[1] The worldwide prevalence of diabetes mellitus has risen dramatically over the past two decades from an estimated 30 million cases in 1985 to 177 million in 2000. Based on current trends >360 million individuals will have diabetes by the year 2030.[2] Albumin is a major constituent of proteins excreted in urine. Microalbuminuria is defined as 30-300 mg albumin in a 24-hr urine collection or 30-300 ug albumin/mg creatinine in a spot collection (preferred method).[2] Microalbuminuria is the first manifestation of injury to the glomerular filtration barrier and predicts the development of overt nephropathy. Various studies have suggested the increased mortality in diabetic patients with raised urinary albumin excretion rate (AER), so called macroalbuminuria.[3]

Name & Address of Corresponding Author
Dr N S Neki
Professor,
Dept. of Medicine,
Govt. Medical College/Guru Nanak Dev Hospital,
Amritsar, India.
E mail: drneki123@gmail.com

Hence, early detection of microalbuminuria is of great significance in planning treatment and evaluating prognosis of individual cases of type 2 diabetes mellitus.[4] Using microalbuminuria as an index of atherosclerotic macrovascular angiopathy, adverse changes in the lower limb arterial structure predisposing to critical limb Ischemia can be detected early with Doppler ultrasonographic scanning in order to decrease gangrene and amputation in type 2 diabetes mellitus.

MATERIALS AND METHODS

It was randomized open study carried out in the outpatient department as well as indoor of Guru Nanak Dev Hospital attached to Government Medical College, Amritsar in the age group of 40-65 years. The Study group consisted of two groups; group 1 of 100 individuals of type 2 diabetes of more than 5 years duration and group 2 of 100 non-diabetic individuals in the same range of 40-65 years. Those excluded from the study were, patients having type I diabetes mellitus, patients with any evidence of arteritis or connective tissue disease, physiological and abnormal stress, exercise, high altitude hypoxia and myocardial ischaemia as these can cause microalbuminuria and evidence of ketonuria.

Detailed history including the duration of diabetes was taken and thorough general and systemic

examination was done. Microalbuminuria was measured by Micro Protein Kit (Pyrogallol Red method). First morning mid-stream urine was collected in a sterile container and used for determining microalbuminuria sample.[5] Blood glucose was measured by glucose oxidase method.[6] Intimal medial thickness **(**IMT) of the superficial femoral artery (SFA) was determined by using a high resolution B-mode ultrasonography system ENVISOR (Philips) version C0.1 having an electrical linear transducer mid frequency of 7.5 mHZ in the department of Radio-diagnosis, Govt. Medical College Amritsar. In the morning fasting blood samples were taken for plasma glucose, lipidogram (serum cholesterol, HDL, LDL and triglycerides), Hb, TLC, DLC, urine examination, USG abdomen was done to rule out secondary hypertension.

RESULTS

The data generated from study was analyzed according to standard statistical methods. In the study group patients were between ages of 40-65 years. Type 2 diabetes patients were put in group 1 and non diabetes in group 2 as shown in [Table 1].

Table 1: Group Statistics.

	Group	N	Mean	Std. Deviation	Std. Error Mean
Age	1	100	50.73	8.480	.848
	2	100	49.57	7.677	.768
Weight	1	100	73.11	10.259	1.026
	2	100	71.94	6.262	.626
Height	1	100	165.78	9.458	.946
	2	100	168.23	5.889	.589
BMI	1	100	26.6522	2.47045	.24705
	2	100	25.3916	1.74942	.17494
FBG	1	100	161.23	32.963	3.296
	2	100	102.12	15.884	1.588
SBP	1	100	140.44	16.117	1.612
	2	100	123.48	11.216	1.122
DBP	1	100	83.24	8.248	.825
	2	100	76.60	9.617	.962
STG	1	100	162.22	47.459	4.746
	2	100	138.50	35.452	3.545
HDL	1	100	41.44	5.233	.523
	2	100	47.12	11.524	1.152
LDL	1	100	121.92	26.923	2.692
	2	100	103.49	29.153	2.915
SCL	1	100	196.31	29.493	2.949
	2	100	178.76	31.508	3.151
Microalbuminuria	1	100	214.740	71.1744	7.1174
	2	100	41.500	23.8372	2.3837
IMT	1	100	.083640	.0167178	.0016718
	2	100	.055950	.0046414	.0004641

[Table 1] showing the statistical data of type 2 Diabetes mellitus in group 1 and 2.

BMI: Body mass index; FBS: Fasting blood glucose; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; STG: Serum triglyceride; HDL: High density lipoprotein; LDL: Low density lipoprotein; SCL; Serum cholesterol; IMT: Intimal media thickness.

Mean age of group 1(diabetic) was 50.73$\pm$SD8.48 years. Mean age of group 2(non-diabetic) was 49.57$\pm$SD 7.677 years. Majority of patients were in age group 40-50 years in both group 1 and group 2. Mean microalbuminuria in group 1 (diabetic), was 214.74$\pm$71.174 and that in group 2 (non diabetic),was 41.500$\pm$23.837. Difference in mean microalbuminuria, in both groups was highly significant ($p<0.001$). Mean intimal media thickness (IMT) of superficial femoral artery(SFA) in group 1 (diabetic), patients was 0.0836$\pm$0.0167 cm and that of group 2 (non diabetic), was 0.059 $\pm$ 0.00464 cm. Difference in mean IMT of SFA, in both groups was highly significant($p<0.001$) as shown in Figure 1.

In group 1(diabetic group),microalbuminuria showed a highly significant correlation with age ($r=0.834$, $p<0.001$),BMI($r=0.413$, $p<0.01$) SBP($r=0.925$, $p<0.001$), DBP($r=0.459$, $p<0.001$),

LDL-C(r=0.406, p<0.001), HDL-C(r=-0.362, p<0.001), triglycerides (r=0.378, p<0.001)and correlation was significant with FBG(r=0.312, p<0.05) In group 2 (non-diabetic) correlation of microalbuminuria was non significant with age (r=0.017, p>0.05), BMI(r=0.081, p>0.05), FBG(r=0.067, p>0.05), SBP(r=0.066, p>0.05) DBP (r=0.084, p>0.05), HDL(r=0.205, p>0.05), triglyceride (r=0.191, p>0.05) but it was significant with LDL-C(r=0.282), p<0.05).

While correlating IMT of SFA, in group 1(diabetic), it showed a highly significant correlation with age (r=0.918, p<0.001),BMI(r=0.367, p<0.01) SBP (r=0.941, p<0.001), DBP(r=0.441, p<0.001), LDL-C(r=0.418, p<0.001),HDL-C(r=-0.312, p>0.001), triglyceride (r=0.444, p<0.001) and correlation was significant with fasting blood glucose (FBG)(r=0.311, p<0.05) In group 2(non-diabetic) correlation of IMT of SFA was non significant with age(r=-0.041, p>0.05), BMI(r=0.017, p>0.05), FBG(r=0.061, p>0.05), SBP(r=0.018, p>0.05) DBP(r=0.034, p>0.05), HDL-C(r=0.098, p>0.05), triglyceride (r=0.073, p>0.05) but it was significant with LDL-C(r=0.282), p<0.05).

While correlating mean IMT with different range of microalbuminuria in group A, 13% patients had microalbuminuria in range of 51-100 mg/24 hrs and had mean femoral artery IMT 0.060 cm. Similarly, 9% subjects having 101-150 mg/24 hrs microalbuminuria had mean IMT of 0.0692 cm, 151-200 mg (11%) had mean IMT of 0.0736 cm, 201-250 mg (23%) had mean IMT of 0.0838 cm and 251-300 mg (38%) had mean IMT of 0.099 cm. In group B, patients having 24 hrs albuminuria in range of 0-50 mg (83%) had mean IMT of 0.0558 cm, those in range of 51-100 mg (12%) have IMT of 0.0560 cm and those in range of 101-150 (5%) have mean IMT of 0.0574 cm. Thus there was positive correlation between IMT of superficial femoral artery with microalbuminuria and it was statistically significant (p<.001).

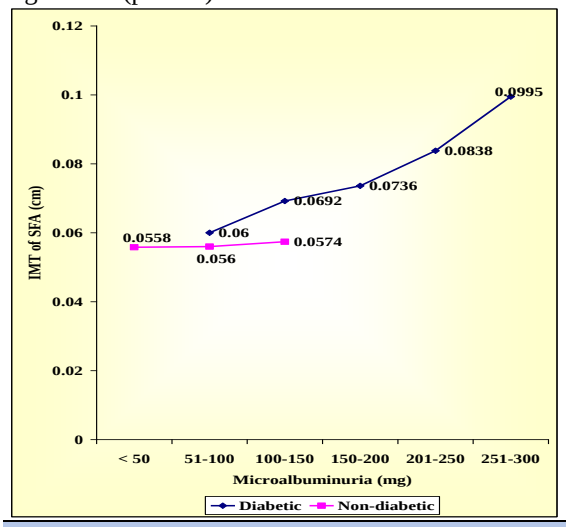

Figure 1: Showing correlation of microalbuminuria (mg) with intimal medial thickness (cm) in diabetic and non-diabetic groups.

DISCUSSION

Diabetes is one of the most prevalent diseases world-wide. It affects almost all organs of the body, in turn increasing the prevalence of chronic renal failure and other micro and macrovascular complications. [7] The superficial femoral artery (SFA) at the level of bifurcation from the femoral artery is the medium sized artery most susceptible to atherosclerosis leading to critical limb ischaemia. An accurate and sensitive marker for measuring lower limb macroangiopathic atherosclerosis is by assessing the intimal medial thickness (IMT) of SFA.[8] Urine microalbuminuria has proved to be valuable marker for early microangiopathic atherosclerotic changes in type 2 diabetes mellitus.[2]

In the present study, mean intimal medial thickness(IMT) of SFA (0.0836+0.0167cm) was more in the group 1 (diabetic) as compared to group 2 (non diabetic) (0.0559±0.0046cm) which is statistically highly significant (p<0.001). The results of the present study are in concordance with the study by David N et al in which IMT of SFA in diabetic patients was 0.078±0.021 cm and in non-diabetics was 0.065±0.016 cm and the observation was statistically highly significant (p<0.001).[9] In the present study, mean microalbuminuria is 214.74±71.174 mg in the group 1 (diabetic) and 41.50±23.82 mg in group 2 (non diabetic) and the difference is statistically highly significant (p<0.001). In a study by David N et al, the microalbuminuria was 111±34 mg in diabetics and 29±70 mg in non diabetics and the difference was statistically significant.[9]

In group 1(diabetic group) ,microalbuminuria showed a highly significant correlation with age, BMI, SBP, DBP, LDL-C, HDL-C, serum triglycerides and correlation was significant with FBG. In group 2(non-diabetic) correlation of microalbuminuria was non-significant with age, BMI, FBG, SBP, DBP, HDL, triglyceride but it was significant with LDL-C. Hoorn study by Marc M. H. also revealed significant correlation of microalbuminuria with age, SBP, DBP, LDL-C, HDL-C, serum triglycerides.[10] David N et al also showed highly significant correlation between microalbuminuria and BMI, FBG, HDL, serum triglycerides (p<0.0001) in their study.[9]

While correlating IMT of SFA, in group 1(diabetic), it showed a highly significant correlation with age, BMI, SBP, DBP, LDLC, HDL-C, triglycerides and correlation was significant with FBG. In group 2(non-diabetic) correlation of IMT of SFA was non-significant with age, BMI, FBG, SBP, DBP, HDL-C, triglycerides but it was significant with LDL-C. Similar results in diabetic patients were shown in the study by Vineeth K et al which documented statistically highly significant association of IMT of SFA with microalbuminuria, age, SBP and atherogenic index but not with DBP.[11]

1. Microalbuminuria was significantly higher in diabetic group ($p<0.001$) as compared to non-diabetic group ($p<0.001$).
2. Microalbuminuria had highly significant ($p<0.001$) correlation with age, systolic blood pressure (SBP), diastolic blood pressure (DBP), LDL-C, HDL-C and serum triglycerides. Correlation was significant ($p<0.05$) with fasting blood glucose (FBG) but was non-significant with gender ($p>0.05$).
3. Intimal-medial thickness (IMT) of superficial femoral artery (SFA) was highly significant in diabetic group as compare to non-diabetic group ($p<0.001$).
4. Intimal-medial thickness (IMT) of superficial femoral artery (SFA) had highly significant ($p<0.001$) correlation with age, BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), LDL-C, HDL-C and serum triglycerides. Correlation was significant ($p<0.05$) with fasting blood glucose (FBG) but was non-significant with gender ($p>0.05$).
5. Microalbuminuria had highly significant correlation ($p<0.001$) with Intimal-medial thickness (IMT) of superficial femoral artery (SFA) and the relationship was positive.
6. Microalbuminuria of >150 mg/day was associated with progressive increase in intimal-medial (IMT) of superficial femoral artery (SFA).

CONCLUSION

There is highly significant ($p<0.001$) correlation between microalbuminuria and intimal-medial thickness (IMT) of superficial femoral artery (SFA) in type 2 diabetes mellitus. This correlation is more positive and progressive with microalbuminuria of >150 mg/day thereby signifying increased cardiovascular risk in type 2 diabetes mellitus patients with microalbuminuria >150 mg/day.

REFERENCES

1. Bennett PH, Knowler WC. In: Kahn CR, Weir GC, King GL, Jacobson AM, Moses AC, Smith RJ, editors. Joslin's Diabetes Mellitus. 14th ed. New Delhi: Wolters Kluwer Company; 2011. 331.
2. Power AC. Diabetes mellitus. In: Fauci A, Braunwald E, Kasper DL, Houser SL, Longo DL, Jameson JL, editors. Harrison's Principle of Internal Medicine. 17th ed. New york: McGraw Hill Company; 2008. 2275-304.
3. Lewis JB, Neilson EG. Glomerular diseases. In: Fauci A, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson, JL, editors. Harrison's Principle of Internal Medicine. 17th ed. New York: McGraw Hill Company; 2008.1782-96.
4. Karralliedde J, Viberti G. Microalbuminuria and cardiovascular risk. Am. J. Hypert. 2004; 17: 986-93.
5. Mogensen CE, Damsguard EM, Froland A, Nielsen S. Microalbuminuria in NIDDM. Clin Nephro. 1992; 38: 528-38.
6. Mogensen CE, Chachati A. Microalbuminuria an early marker of renal involvement in diabetes. Uraemia Invest. 1984-86; 9: 85-95.
7. Bennett PH, Knowler WC. In: Kahn CR, Weir GC, King GL, Jacobson AM, Moses AC, Smith RJ, editors. Joslin's Diabetes Mellitus. 14th ed. New Delhi: Wolters Kluwer Company; 2011: 350-51.
8. Diehm C, Kareem S, Lawall H. Epidemiology of peripheral arterial disease. Vas. 2004; 33: 183-89.
9. David N,George D,Keven GR,Mohamed ZA, Nicholas B,Alica J, et al. A Cross-Sectional Study of the Effects of Type 2 Diabetes and other Cardiovascular Risk Factors on Structure and Function of Nonstenotic Arteries of the Lower Limb. Diabetes Care. 2003; 26:199-205.
10. Hermans MM, Henry R, Dekker JM, Kooman JP, Kostense PJ, Nijpels G et al. Estimated glomerular filtration rate and urinary albumin excretion are independently associated with greater arterial stiffness: the Hoorn Study. J Am Soc Nephrol. 2007;18:1942-52.
11. Sukrithan VK, Desai SC, Naik D, Roopkala MS, Kumar P. Association of microalbuminuria with intimal medial thickness of the superficial femoral artery in type 2 diabetes mellitus. Ramaiah Medical College, Bangalore; RSSD. 2009:12-103.

How to cite this article: Sandhu PS, Singh SP, Nayyar SB, Neki NS, Sandhu RS. Association of Microalbuminuria with Intimal Medial Thickness of the Superficial Femoral Artery in Type 2 Diabetes Mellitus. Ann. Int. Med. Den. Res. 2016;2(3):52-5.

Source of Support: Nil, **Conflict of Interest:** None declared