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Original Research Article

Correlation between Microalbuminuria and Coronary Artery Diseases (CAD) In Type-2 Diabetes Mellitus, a Study in a Tertiary Care Hospital in Western India

Pawan Kumar Gangwal[1], Vivek Gupta[2], Kusum Khoiwal[3], Ranjita Bansal[4]

[1,2]Assistant Professor, Department of General Medicine, National Institute of Medical Sciences and Research, Jaipur Rajasthan

[3,4]Senior Demonstrator, Department of Pathology, Sawai Man Singh Medical College, Jaipur Rajasthan

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Corresponding author: Dr. Ranjita Bansal

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Abstract:

Introduction: Diabetes mellitus, a multi-systemic metabolic disorder, is one of the leading causes of mortality and morbidity worldwide. Coronary heart disease is the main cause of premature death in type-2 diabetes. Early diagnosis of Microalbuminuria with a direct correlation with intima-medial thickening will predict the degree of atherosclerosis, as atherosclerosis is the major cause of mortality and morbidity in these patients.

Aim & Objective: To determine the correlation between Microalbuminuria and Coronary Artery Disease (CAD) in type -2 Diabetes Mellitus patients. To study statistical significance of various parameters in our study population.

Materials & Methods: The present study include total three hundred patients in the Department of Medicine, National Institute of Medical Science and Research, Jaipur, Rajasthan a tertiary care hospital from June 2022 to May 2023. Biochemical and clinical risk factors assessed for Diabetes Mallitus and coronary artery disease. Microalbuminuria is defined as excretion of albumin in urine in the range of 20 to 200µg/min. (30-300mg/day).

Results: Case group are Type -2 Diabetes Mellitus with Microalbuminuria and control group are Type 2 Diabetes Mellitus without Microalbuminuria. The mean age in the case and control group for males were 58.01 and 58.10 years respectively, while for females the values were 57.66 and 56.55 years respectively. The mean age±SD of all subjects of the case and control group were 57.9±8.18 and 57.39±7.75 years respectively. There is a significant association between Age and CAD in both case and control group (x2=33.64, P <0.001 HS). CAD+ patients are Highly Significant higher (P<.001) in more than 50 years age group in comparison to less than 50 years age group (x^2= 23.66 P <0.001 HS). In >50 year age group CAD patients are highly Significant higher in case group in comparison to control (x^2 = 29.84 P <0.001). CAD + Cases are Highly Significantly higher in males in comparison to females (x^2=41.45, P<0.001 HS). CAD in males are Highly Significantly higher in case group in comparison to control. (x^2=35.67 P <0.001). In case group 90.65% of male and in control group 50% male had CAD. In case group 46.15% of female and in control group 28.81% of female had CAD.

Conclusions: There is an association between age and CAD in both microalbuminuric and nonmicroalbuminuric Diabetes Mellitus patients but more in microalbuminuric Diabetes Mellitus case. Risk of CAD is higher in both sexes in microalbuminuric Diabetes Mellitus subjects as compared to nonmicroalbuminuric Diabetes Mellitus patients. Microalbuminuria showed a positive correlation with coronary artery disease (CAD) in type -2 Diabetes Mellitus subjects. In type -2 Diabetes Mellitus an association of Microalbuminuria had a more significant association with CAD as compared to subjects of type 2 Diabetes Mellitus without Microalbuminuria.

Keywords: Coronary Artery Disease [CAD], Microalbuminuria [MA], Albumin/Creatinine Ratio (A/C Ratio).

Introduction

Diabetes mellitus, a multi-systemic metabolic disorder, is one of the leading causes of mortality and morbidity worldwide **[1]**. India has the maximum number of diabetes patients in the world. This increase is reaching massive proportions and is mainly related to changes in lifestyle and increasing obesity. However, the real problem posed by diabetes is that condition brings with it a train of chronic complications including accelerated atherosclerosis and disease of the eye, foot and kidney - each of which is costly to manage and can be devastating for the patient. These complications can be largely prevented, but only if the diagnosis is made early. Compared with their

non-diabetic counterparts, clinically significant coronary heart disease is over two times more common in diabetic patients. Coronary heart disease is the main cause of premature death in type-2 diabetes.

Diabetes mellitus is one of the major modifiable risk factor for atherosclerosis. Most of the diabetics die of atherosclerosis and its complications. Insulin resistance and diabetic dyslipidemia aggravated the pathogenesis of atherosclerosis in type-2 Diabetes Mellitus [2].

Albuminuria is the excretion of albumin in the urine. Normally the amount of albumin in urine is less than 30 mg./24 hrs. When the amount of albumin excreted in urine between 30 to 300 mg./24 hrs it is known as Microalbuminuria. Microalbuminuria is the earliest laboratory evidence of nephropathy and occurs 5-8 years before the onset of overt proteinuria in Diabetes Mellitus. An early morning urine specimen is more convenient than a 24 hours collection. The upper limit of normal is regarded as a urine albumin: creatinine ratio of 2.5 mg./mmol in men and 3.5 mg./mmol in women. A positive result should be repeated once or twice in the next month and if it is borderline a full 24 hours urine collection will give a more definitive result.

Since an early diagnosis of Microalbuminuria with a direct correlation with intima-medial thickening will predict the degree of atherosclerosis, which has set in, as atherosclerosis is the major cause of mortality and morbidity in these patients [3].

We planned this study to correlate microalbuminuria with CAD in patients of type -2 Diabetes Mellitus, as it can be used as a simple tool for early diagnosis of CAD.

Aims & Objectives: To determine the correlation between Microalbuminuria and Coronary Artery Disease (CAD) in type -2 Diabetes Mellitus patients. To study statistical significance of various parameters in our study population.

Materials & Methods: The present study was conducted in the Department of Medicine, National Institute of Medical Science and Research, Jaipur, Rajasthan a tertiary care hospital from June 2022 to May 2023. Total number of 300 patients was enrolled attending the Medical & Cardiology OPD as well as admitted in various medical & cardiology wards.

Inclusion Criteria: The patients of type-2 Diabetes Mellitus between 40-70 years of age fulfilling ADA (2006) criteria: Random plasma glucose concentration 11.10 mmol/L (200 mg/dl) accompanied by classic symptoms of Diabetes Mellitus polyuria polydipsia, weight loss or Fasting plasma glucose≥ 07.00 mmol/L (126 mg/dl) or Two-hour plasma glucose≥ 11.10 mmol/L (200 mg/dl) during an oral glucose tolerance test[14]. **Exclusion Criteria:** Significant hepatic and renal disease with overt proteinuria, Pregnancy, Malignancies, Hypothyroidism, and Hyperthyroidism, Patients taking beta-blockers, thiazide diuretics, corticosteroids and hypolipidemic drugs were excluded.

Microalbuminuria Micral test was used for the detection of microalbuminuria. Albumin excretion increases after exercise or physical activity. It is therefore recommended to use urine that has been produced at rest i.e. the first morning urine sample was collected after rising. Urinary albumin concentration was assessed in a morning spot urine sample. Overnight Albumin Creatinine Ratio (ACR) correlates well with albumin excretion rate, and ACR measured in a single untimed urine specimen has been shown to be an effective means for identifying diabetic patients who are at risk of developing overt nephropathy [17]. An overnight ACR >2 mg/mmol predicts an albumin excertion rate 30 µg/min with a high sensitivity and specificity.

Results: On analysing the data collected from case sheets of these patients the following results were observed:

Table 1: Age & Sex Distribution Type 2 Diabetes Mellitus

Age Group (years)	Case (with Microalbuminuria)			Control (without Microalbuminuria)		
	M	F	Total	M	F	Total
40-45	9 (8.41%)	4 (6.15%)	13	0 (0%)	4(6.78%)	4
46-50	26 (24.30%)	4(6.15%)	30	13(18.84%)	9(15.25%)	22
51-55	9(8.41%)	20 (30.77%)	29	17(24.64%)	16(27.12%)	33
56-60	13(12.15%)	17 (26.15%)	30	9(13.04%)	4(6.78%)	13
61-65	26 (24.30%)	9 (13.85%)	35	13(18.84%)	17(28.81%)	30
>65	26 (24.30%)	9(13.85%)	35	17(24.64%)	9(15.25%)	26
Total	107	65	172	69	59	128

In our study group of cases (Type -2 Diabetes Mellitus with Microalbuminuria) - There were 25 males and 15 females while among the control group i.e. (Type 2 Diabetes Mellitus without Microalbuminuria) - There were 16 males and 14 females. The mean age in the case and control group for males were 58.01 and 58.10 years respectively, while for females the values were 57.66 and 56.55 years respectively. The mean age±SD of all subjects of the case and control group were 57.9±8.18 and 57.39±7.75 years respectively.

Table 2: Age & CAD Distribution Type 2 Diabetes Mellitus

Age Group (years)	Case (with Microalbuminuria)		Control (without Microalbuminuria)	
	CAD + ve	CAD-ve	CAD + ve	CAD-ve
40-45	5(3.94%)	9(20.00%)	0(0.00%)	13(17.11%)
46-50	14(11.02%)	16(35.56%)	7(13.46%)	18(23.68%)
51-55	24(18.90%)	5(11.11%)	9(17.31%)	13(17.11%)
56-60	26(20.47%)	6(13.33%)	8(15.38%)	12(15.79%)
61-65	24(18.90%)	9(20.00%)	12(23.08%)	12(15.79%)
>65	34((26.77%)	0(0.00%)	16(30.77%)	8(10.54%)
Total	127	45	52	76

P value is highly significant (P < .001) for both case and control group i.e. there is a significant association between Age and CAD in both case and control group (x2=33.64, P <0.001 HS). It is also observed that CAD+ patients are Highly Significant higher (P<.001) in more than 50 years age group in comparison to less than 50 years age group (x^2= 23.66 P <0.001 HS). In >50 year age group CAD patients are highly Significant higher in case group in comparsion to control (x^2 = 29.84 P <0.001)

Table 3: Sex & CAD Distribution Type 2 Diabetes Mellitus

Sex	Case (with Microalbuminuria)		Control (without Microalbuminuria)	
	CAD+ve	CAD-ve	CAD+ve	CAD-ve
Male	**97 (76.38%)**	**10 (22.22%)**	**35 (67.31%)**	**34 (44.74%)**
Female	**30 (23.62%)**	**35 (77.78%)**	**17 (32.69%)**	**42 (55.26%)**
Total	**127**	**45**	**52**	**76**

It is observed that CAD + Cases are Highly Significantly higher in males in comparison to females (x^2=41.45, P<0.001 HS). It is observed that CAD are cases in males are Highly Significantly higher in case group in comparsion to control. (x^2=35.67 P <0.001). In case group 90.65% of male and in control group 50% male had CAD. In case group 46.15% of female and in control group 28.81% of female had CAD.

Discussion

This study was done to evaluate any relationship between macroangiopathy (CAD) and microangiopathy (Microalbuminuria) in type-2 Diabetes Mellitus patients. Apart from CAD, which is macrovascular complication of Diabetes Mellitus, microvascular complication of Diabetes Mellitus is Diabetic nephropathy whose earliest indicator is Microalbuminuria.

An early diagnosis of Microalbuminuria in type -2 Diabetes Mellitus and it's correlation with CAD will help in predicting the future outcome in these patients as CAD is the main cause of premature death in type -2 Diabetes Mellitus patients.

A study by Young, 2004 et al., has proposed that Microalbuminuria is a novel atherosclerotic risk factor in patients with type -2 Diabetes Mellitus and predicts the future cardiovascular events [18]. Study by Brown AF, Saliba D et al., have proposed that older individuals with diabetes have higher rate of premature death, functional disability and coexisting illness such as hypertension, CAD and stroke then those without Diabetes Mellitus[1].. In our study significant association was found between age and CAD in both microalbuminuric and nonmicroalbuminuric Diabetes Mellitus subjects but microalbuminuric diabetic cases had more strong association between age and CAD.

Multiple Risk Factors Intervention (MRFIT) study by Ronalo CB, Janet HJ, et. Al., also suggested that men with diabetes had an absolute risk of CAD more than 3-times higher than that of females [16].. Also in our study males had higher risk of CAD as compared to females in both cases and control group but in the case group the risk of CAD is higher in both sexes as compared to control group i.e. microalbuminuric has higher risk of CAD in males as compared to females and this risk is more in both the sexes as compared to nonmicroalbuminuric patients. There are several explanations to association between Microalbuminuria and CAD and some of these may operate simultaneously. Endothelial dysfunction has been proposed as a common link between Microalbuminuria and CAD as suggested by Young, Chyun DA, et al [18]. Diabetes subjects with Microalbuminuria have more adverse risk profile such as higher ambulatory blood pressure and dyslipidaemia as suggested by Vnitini et al. [17].

Thus the relation between Microalbuminuria and CAD might be explained by adverse changes in cardiovascular risk factors with microalbuminuric type -2 Diabetes Mellitus subjects.

Summary & Conclusion

The study was undertaken to determine the Microalbuminuria in type -2 Diabetes Mellitus cases and to access CAD in type -2 Diabetes. There is an association between age and CAD in both

microalbuminuric and nonmicroalbuminuric Diabetes Mellitus patients but more in microalbuminuric Diabetes Mellitus case. Risk of CAD is higher in both sexes in microalbuminuric Diabetes Mellitus subjects as compared to nonmicroalbuminuric Diabetes Mellitus patients. Microalbuminuria showed a positive correlation with coronary artery disease (CAD) in type -2 Diabetes Mellitus subjects. In type -2 Diabetes Mellitus an association of Microalbuminuria had a more significant association with CAD as compared to subjects of type 2 Diabetes Mellitus without Microalbuminuria when the other parameters remained the same.

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