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A Study of the Pairing Between Microalbuminuria and Silent Myocardial Ischemia in Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Diabetes Mellitus is the metabolic disorder, which is characterized by hyperglycaemia, it is caused by abnormality in insulin secretion or insulin action or both. To study the correlation between micro albuminuria and myocardial ischemia asymptomatic type 2 diabetic patients. It is an Observational and descriptive study. It's conducted from Jan 2023 to Dec 2023 at KPC Hospital, 1F, Raja Subodh Chandra Mullick Road. 100 micro albuminuria and silent myocardial ischemia in patients with type 2 diabetes mellitus patients. The present study contains 35 (70%) patients taking oral hypoglycaemic agents and 15 (30%) patients taking both insulin and oral hypoglycaemic agents. This below table shows, more number of patients (30 i.e., 60%) were having diabetes 6 to 9 years of duration, followed by 13 patients (26%) with the duration of more than 9 years, next 7 patients (14%) with duration less than 6 years and only 5 patients (10%) between 16-20 years. In the present study out of 50 patients 32 patients (64%) became positive, 18 patients (36%) were negative. The current study showed that abnormal MPI findings are significantly more common in diabetic patients with micro albuminuria. With respect to low cost and availability of urine Alb detection tests, it might be as a biomarker for prediction of SMI in daibetic population. About 13 patients with diabetes duration more than 10 years, Treadmill test was positive in all 13 patients (100%).

INTRODUCTION

Diabetes Mellitus is the metabolic disorder, which is characterized by hyperglycemia, it is caused by abnormality in insulin secretion or insulin action or both. It is also associated with other biochemical disturbances and the presence of progressive tissue damage with micro and macro vascular complications. Diabetes is one of the leading cause of end stage renal disease and major cause of non-traumatic amputations, accounts for 30% of the preventable blindness and leading cause of cardiovascular mortality[1].

Coronary Artery disease (CAD) is the important cause of death in patients with type 2 diabetes and is most of the time asymptomatic because of silent myocardial ischemia. CAD is multifactorial in etiology and it has several important risk factors, in which diabetes is important modifiable risk factor.

Data from "FRAMINGHAM HEART STUDY" demonstrated that increased and poor prognosis of cardiac disease in diabetes. Mortality related to cardiac vascular disease is two times more common in diabetic men and four times common in diabetic women than their non-diabetic counterparts.

CAD is the important cause of morbidity and mortality in diabetic patients and often manifests itself silently and prematurely. The classical cardiovascular risk factor is hyperglycaemia and clinical evidence also demonstrate that the hyperglycaemia in diabetes is well correlated with risk and severity of micro and macro vascular complications. Clinical evidence also suggests that improving hyperglycaemia reduce the risk of complications. The deadly triangle of coronary artery diseases, cerebrovascular diseases and peripheral vascular diseases is the major cause of morbidity and mortality in diabetic patients.

"INTERHEART"-study shows 10% of the population attributable risk for first episode of MI. High risk of asymptomatic coronary artery disease in type 2 DM. Micro albuminuria is one of the important predictor of endothelial dysfunction in Patients with type 2 diabetes. Endothelial dysfunction leads to coronary artery disease. Asymptomatic myocardial ischemia is common in asymptomatic NIDDM patients but is more common in those with micro albuminuria[2]. So micro albuminuria is an important predictor for development silent myocardial ischemia.

Exercise electrocardiography can identify myocardial ischemia in asymptomatic type 2 diabetes patients. Exercise Stress treadmill test is a widely available and is cost effective, so it can be useful to identify asymptomatic myocardial ischemia in patients with type 2 diabetes. So this study was designed to correlate micro albuminuria with silent myocardial ischemia in patients with type 2 diabetes mellitus.

MATERIALS AND METHODS

Study Design/Experiment Design: Observational and descriptive study.

Place of Study: KPC Hospital, 1F, Raja Subodh Chandra Mullick Road, Jadavpur, Kolkata 700032, W.B., India.

Period of Study: Jan 2023 to Dec 2023.

Study Population: The 50 outpatients of asymptomatic type diabetic patients without clinical or ECG evidence of CAD attending, diabetology OPD. microalbuminuria and silent myocardial ischemia in patients with type 2 diabetes mellitus patients.

Sample Size/Design: 100 microalbuminuria and silent myocardial ischemia in patients with type 2 diabetes mellitus patients.

Inclusion Criteria:

- All patients with diagnosed as type 2 DM as per ADA guidelines
- Age 30-60 years (both male and female sex)
- All patients have microalbuminuria with type 2 DM
- Patients without clinical or ECG evidence of CAD
- Patients who are willing to voluntarily participate in this study after informed consent
- Patients without previous history of hypertension

Exclusion Criteria:

- Patients who have active chest pain or any previous of IHD or its treatment
- Previous history of hypertension
- Type 1 diabetes or any other types Diabetes Mellitus like MODY, LADA
- Thyroid disorders
- Patients with nephrotic syndrome
- Any acute illness like UTI
- Those who have ECG abnormality
- Patients with contraindications for treadmill stress test
- Patients who are all on angiotensin converting enzyme inhibitors
- Patients on angiotensin receptor blockers,
- Pregnant woman

RESULT AND DISCUSSIONS

In our study, 40 (40.0%) patients had 18.5-24.9 BMI, 46 (46.0%) patients had 25-29.9 BMI and 14 (14.0%) patients had >30 BMI. The value of z is 4.9377. The value of p is <0.00001. The result is significant at $p<0.05$. In above table showed that the mean BMI of patients was 25.8±3.1 (Table 1).

In our study, 70 (70.0%) patients were Oral hypoglycemic agent and 30 (30.0%) patients were Oral

hypoglycemic agent+Insulin. The value of z is 5.6569. The value of p is <0.00001. The result is significant at p<0.05 (Table 2).

In our study, 14 (14.0%) patients had <5 years Duration of diabetes, 60 (60.0%) patients had 6-9 years Duration of diabetes and 26 (26.0%) patients had >10 years Duration of diabetes (Table 3).

The value of z is 6.7371. The value of p is <0.00001. The result is significant at p<0.05.

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In No of cases, 20 (50.0%) patients had 18.5-24.9 (Normal) BMI, 23 (73.9%) patients had 25-29.9 (Overweight) BMI and 7 (71.4%) patients had >30 BMI. In No of positive cases, 10 (50.0%) patients had 18.5-24.9 (Normal) BMI, 17 (73.9%) patients had 25-29.9 (Overweight) BMI and 5 (71.4%) patients had >30 BMI. Association of BMI with Type 2 Diabetes Mellitus was statistically significant (p = 0.0069) (Table 5).

Table 1: Distribution of BMI

	Cases	
BMI	N	Percentage
18.5-24.9	40	40
25-29.9	46	46
>30	14	14
Total	100	100
Range	20-33	
Mean	25.8	
SD	3.1	

Table 2: Distribution based on mode of treatment

	Cases	
Treatment	No	Percentage
Oral hypoglycemic agent	70	70
Oral hypoglycemic agent+Insulin	30	30
Total	100	100

Table 3: Distribution of duration of diabetes in my study subject

	Cases	
Duration of diabetes	No	Percentage
<5 years	14	14
6-9 years	60	60
>10 years	26	26
Total	100	100

Table 4: Distribution based on mode of Treatment

	Cases	
Treatment	N	Percentage
Oral hypoglycemic agent	70	70
Oral hypoglycemic agent + Insulin	30	30
Total	100	100

Table 5: Distribution of silent myocardial infarction in asymptomatic patients of Type 2 Diabetes Mellitus with BMI

BMI	No. of cases	No. of positive cases	positive cases (%)	Chi square	p-value
18.5-24.9 (Normal)	20	10	50	14.1049	0.0069
25-29.9 (Overweight)	23	17	73.9		
>30	7	5	71.4		
Total	50	32	64		

In our study, 40 (40.0%) patients had 18.5-24.9 BMI, 46 (46.0%) patients had 25-29.9 BMI and 14 (14.0%) patients had >30 BMI. The value of z is 4.9377. The value of p is <0.00001. The result is significant at p<0.05. In above table showed that the mean BMI of patients was 25.8±3.1 (Table 1).

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Diabetes has become the epidemic proportions worldwide. Micro albuminuria indicates the onset of endothelial dysfunction in DM. Nowadays micro albuminuria is used as an important maker for cardiovascular disease risk. The prevalence of silent myocardial ischemia in type 2 DM is variable and it ranges from 9 to75%.

In our study, 100 asymptomatic patients with type 2 DM who had micro albuminuria, undergone treadmill exercise test to identify silent myocardial ischemia.

In our study, out of 100 cases 58 were males and 42 were females. In the age group of 31-40 years of age 12 patients are present. 6 were males, 6 were female's. In the age group of 41-50 years of age 34 were present, 22 were males and 12 were females. In the 51-60 years of age group 54 were present, 30 were males and 24 were females. Most patients in the age group of 51-60 years of age.

Forty percent patients were with normal body mass index, 46% patients were overweight while only 14% patients were obese. In this study population, more number of patients were having diabetes duration of 6-9 years, followed by 26% patients with

the duration of more than or equal to 10 years, next 14% patients having diabetes duration of less than or equal to 5 years.

In our study 100 patients, 70% was on OHA alone, remaining 30% were on both OHA and Insulin.

In our study out of 100 cases TMT positive cases are 64% and negative cases are 64% patients.

Another study from India showed the prevalence of micro albuminuria increased with poor glycaemic control. This study also detected that micro albuminuria is an independent risk factor for asymptomatic myocardial ischemia[3].

Another study elicited silent MI are significantly more common in type 2 diabetic patients with micro albuminuria. Due to low cost and easy availability of urine albumin detection tests, it can be used as a biomarker for prediction of silent MI in diabetic patients[4].

Yet another study from India, shows for identification of silent myocardial ischemia in diabetic patient's treadmill test has a significant role. Prevalence of asymptomatic myocardial ischemia in type 2 diabetic patients is 37.3%[5]. Duration of diabetes has a strong correlation for stress inducible ischemia on Treadmill test. It may be a low cost, reliable and easily available non-invasive screening test for earlier identification of CAD in type 2 diabetic patients.

In this study 100 of outpatients, Treadmill test positive cases are 64% patients and negative cases are 36% patients.

In our study 60 patients with diabetes duration between 6-10 years. Treadmill tests was positive in 63.3%.

Another study 51 includes 500 patients with type 2 DM associated with normal resting ECG found that, 62 (12.4%) patients had silent myocardial ischemia on exercise treadmill testing and also abnormalities of exercise stress test were associated with longer duration of DM ($p<0.005$).

The study done by Patel *et al*., they showed that the prevalence of micro albuminuria progressively increasing with the duration of diabetes mellitus[6].

In another study, observed that longer the duration of DM with micro albuminuria, higher risk is the predisposition for silent MI.

Achari *et al*. in their study of 120 asymptomatic type 2 diabetics evaluated for presence of silent myocardial ischemia by a standard treadmill exercise test by using the Bruce protocol[7]. They found that 51 (42.5%) had findings for myocardial ischemia. In another study done by Garg PK et al they studied 40 patients of type 2 DM and compared them with 30 healthy volunteer controls[8]. All participants undergone exercise test (bicycle ergometry). They found that prevalence of asymptomatic myocardial ischemia was 3.3 times higher among of Type 2 diabetes. In our study, shows that increasing age also is a risk factor for development of asymptomatic Myocardial Ischemia. Mubarakali *et al*. and their study calculated 24 hours. urinary protein excretion in 152 patients with DM[8]. Micro albuminuria was detected in 28% of the diabetic subjects. The prevalence of Micro albuminuria was higher in men 64% than in women 36%. Meisinger *et al*., identified 58% of the diabetic patients with micro albuminuria were males as compared to only 42% were females[10]. In my present study also found that 58% diabetic patients with micro albuminuria were males and but only 42% were females. My study shows similar results with other studies.

In my study, out of 100 type 2 diabetic patients with micro albuminuria, 64% patients are positive foe silent myocardial ischemia in treadmill exercise test. In one study showed that abnormal exercise stress test findings are significantly more common in DM patients with micro albuminuria.

Martin *et al*. evaluated the correlation of Silent myocardial ischemia (SMI) with micro albuminuria in patients with Type 2 diabetes[11]. About 52% participants had Silent myocardial ischemia during treadmill stress testing. Further detailed analysis, they observed that CAD events were also significantly associated with Micro albuminuria.

Another study done by Combet *et al*., they compared the prevalence and severity of SMI in asymptomatic Type 2 diabetic patients with presence and absence of microalbuminuria[12]. Diabetic patients with micro albuminuria also had a higher prevalence of ischemic response (>1 mm ST depression) (65 vs. 40%, $p = 0.016$), reduced time of total exercise (5 vs. 7 minutes $p<0.001$), reduced working capacity (6 vs. 8 METs, $p<0.001$). In these participants, the higher prevalence of myocardial ischemic response at low workloads suggests a higher prediction for future coronary events. On further analysing the studies, albumin excretion rate was observed that it could be the strongest independent predictor of myocardial ischemic response. This study also evident that silent myocardial ischemia is more prevalent in asymptomatic Type 2 diabetic patients with micro albuminuria.

In our study we identified that, 64% of asymptomatic Type 2 diabetic patients with micro albuminuria had positive treadmill stress test, which is implying Silent myocardial ischemia.

CONCLUSION

We conclude that, in 20-40% of DM patients, Diabetic Coronary Artery Disease occurs. Diabetic Coronary Artery disease is something special because of asymptomatic and manifest in advanced stage (due

to diabetic autonomic neuropathy). My study consisted of 100 known asymptomatic type 2 diabetic patients with confirmed micro albuminuria without clinical and electrocardiographic signs of CAD were evaluated for the prevalence of asymptomatic myocardial ischemia by using exercise treadmill stress testing. The current study showed that abnormal MPI findings are significantly more common in diabetic patients with microalbuminuria. With respect to low cost and availability of urine Alb detection tests, it might be as a biomarker for prediction of SMI in daibetic population. The prevalence of asymptomatic myocardial ischemia in this study was 64%. 13 patients with diabetes duration more than 10 years, Treadmill test was positive in all 13 patients (100%).

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