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Original Research Paper

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STUDY OF POST PRANDIAL LIPID ABNORMALITY IN TYPE 2 DIABETES MELLITUS AND ITS RELATION WITH CARDIOVASCULAR COMPLICATIONS

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ABSTRACT

Background: Various studies have shown that postprandial dyslipidaemia is more important in the pathogenesis of the vascular changes and atherosclerosis and that it increases the risk of the cardiovascular events.

Aims and Objectives: To study the post prandial lipid abnormalities in T2DM and compare with cardio vascular complication.

Materials and Methods: Hundred subjects were studied after dividing them in to Cases (n=50) and Control (n=50) at department of Medicine Gandhi Medical College, & associated Hospitals (Hamidia Hospital) Bhopal from Aug 2018 to July 2019. Fasting and Postprandial Blood Sugar (FBS) (PPBS), Glycosylated Haemoglobin (HbA1c), Lipid Profile (Fasting and post prandial), ECG, and TMT was performed for all the patients.

Results: Out of 50 patients, 70% had abnormal TG, 56% had abnormal TC, 36% had abnormal HDL and 52% had abnormal LDL. On comparing post prandial lipid abnormality between diabetes and non-diabetes patients, it was found that there was significant difference in terms of post prandial lipid abnormality as revealed by the significant p value of <0.001. Out of 35 patients with abnormal TG, 85.7% had abnormal ECG and out of 28 patients with abnormal TC, 71.4% had abnormal ECG. Similarly out of 18 abnormal HDL patients, 83.3% had abnormal ECG and out of 26 patients with abnormal LDL, 92.3% had abnormal ECG finding. Majority of patients with normal post prandial lipid profile had normal ECG findings. On comparing the lipid profile with TMT findings it was found that majority of patients with abnormal post prandial lipid profile had positive TMT.

Conclusion: Post prandial lipid profile abnormality is common among the T2DM patients which significantly correlates with positive TMT result and also significant ST-T changes in ECG.

KEYWORDS : Lipid abnormality, type 2 diabetes mellitus, ECG, hyperlipidaemia

INTRODUCTION:

Diabetic patients are often hyperlipidaemic and they are at a high risk for coronary heart disease. (Alvin CP 2004) The high cardiovascular mortality which is associated with Type 2 diabetes mellitus (T2DM) is due to a prolonged, exaggerated, postprandial state. The abnormal lipid profile in the postprandial state is more significant than the abnormal lipid profile in the fasting state in causing atherosclerotic complications in T2DM. (Tentolouris N 2007)

Diabetes mellitus is characterized by a high incidence of cardiovascular disease (CVD), nearly 80% of T2DM patients die of a cardiovascular incident. (Colwell JA 1993) T2DM patients have an excess risk of developing atherosclerosis, resulting in high cardiovascular disease (CVD) morbidity and mortality. Therefore, with the rise of the prevalence of diabetes, it may be expected that the global burden of cardiovascular disease will also increase.

Since the so-called traditional risk factors such as high cholesterol, hypertension, smoking, and low high density lipoprotein (HDL) cholesterol, cannot fully explain the excessive cardiovascular disease risk of T2DM patients, other risk factors need to be identified. (Haffner SM 1998)

It is required to develop risk factor interventions to minimize the long-term complications. (Samia J 2000) Present study will investigate the postprandial lipid abnormality in T2DM and its correlation with cardio-vascular complications among the diabetic patients.

MATERIAL & METHODS :

Present observational, cross sectional and hospital based Study was performed on 100 subjects at department of Medicine Gandhi Medical College, & associated Hospitals (Hamidia Hospital) Bhopal from Aug 2018 to July 2019.

After a 12 hours overnight fast, a standardized meal was given to all subjects. Providing 600 K. cal. consisting of 60% carbohydrates, 20-25% proteins, 15-20%, Fats (3 Roti, $1^{1/2}$ cup rice. 1 cup of vegetable curry, 1 cup of dal, 1 cup of curd). Blood was collected in fasting and 4 hrs after meal for lipid profile measurements.

Fifty patients with T2DM and 50 age and sex matched healthy controls were studied. Diabetes diagnosed according to ADA criteria (FBS> 126 mg/dl, PPBS> 200 mg/dl and patients were on usual dose of insulin or oral hypoglycemic drugs were included.

Patients with familial hyperlipidaemia, nephropathy, hepatic disease, hypothyroidism, alcoholism and patient on drugs affecting the lipids (anti hyperlipidaemic agents, Beta blockers, Thiazide Diuretics.) and fasting triglycerides >250 mg/dl were excluded from the present study.

Fasting and Postprandial Blood Sugar (FBS) (PPBS), Glycosylated Haemoglobin (HbA_{1c}), Lipid Profile (Fasting and post prandial), ECG, and TMT was performed for all the patients.

All the data analysis was performed using IBM SPSS ver. 20 software. Frequency distribution and cross tabulation was performed to prepare the tables. PRISM and Microsoft excel was used to prepare the tables. Quantitative data was expressed as mean and standard deviation whereas categorical data was expressed as number and percentage. ANOVA using simple mean and was performed to compare the mean whereas chi square test was used to compare the categorical data. Level of significance was assessed at 5%.

RESULTS:

In present study majority of the diabetic patients were in age group between 51-60 years (38%) followed by 41-50 years (24%) and 61-70 years (20%). Similarly majority of the non-diabetes patients belong to age between 51-60 (38%) followed

41-50 years (24%) and 61-70 years (20%). In present study the 50% were male and 50% were female with Male: Female ratio of 1:1

Table1:Comparing Post prandial lipid levels between groups

	Group	Mean
TG (mg/dl)	D	219.20
	ND	94.02
TC (mg/dl)	D	256.84
	ND	80.50
HDL (mg/dl)	D	36.68
	ND	46.66
LDL (mg/dl)	D	112.02
	ND	81.42

D; diabetes, ND; non diabetes

Table2:Post prandial Lipid abnormality in diabetes patients

Lipid type	No of patients	Percentage
TG	35	70
TC	28	56
HDL	18	36
LDL	26	52

Abnormal lipid level; TG > 150 mg/dl, TC: >200 mg/dl, HDL; male <40, female <50, LDL >100 mg/dl

Table 3: Comparing post prandial lipid abnormality between diabetes and non-diabetes patients

Lipid type	Non-diabetes	Diabetes	P value
TG	2 (4%)	35 (70%)	<0.001
TC	7 (14%)	28 (56%)	<0.001
HDL	6 (12%)	18 (36%)	<0.001
LDL	9 (18%)	28 (52%)	<0.001

Table 4: Comparing post prandial lipid levels with ECG findings in diabetes patients

Lipid		ECG		Total
		Abnormal	NORMAL	
TG	Abnormal	30 (85.7%)	5 (14.3%)	35
	Normal	3(20%)	12 (80%)	15
TC	Abnormal	20 (71.4%)	8 (28.6%)	28
	Normal	2 (9%)	20 (91%)	22
HDL	Abnormal	15 (83.3%)	3 (16.7%)	18
	Normal	1 (3.1%)	31 (96.9%)	32
LDL	Abnormal	24 (92.3%)	2 (7.7%)	26
	Normal	4 (16.6%)	20 (83.4%)	24

Abnormal ECG includes :- ST-T changes, left atrial enlargement, left ventricular hypertrophy, left bundle branch block , right bundle branch block

DISCUSSION:

T2DM and lipid profile together are the essential predictors and also increases risk factors for cardiovascular diseases (CVD), dyslipidemia, metabolic syndrome and Hypertension. Among metabolic abnormalities, dyslipidemia is most common abnormality associated with DM. In the present study, we identify the post prandial lipid profile status in diabetic patients.

In present study diabetes was more common among the old age people. Our study result was correspondence to study done by Raghavendra et al , where the higher prevalence of diabetic (45%) was present among age group 51-60 years, followed by age 41-50 years (30%) and 21 % patients had age between age group 30-40 years. [29]. Elisabeth et al studied fourteen T2DM patients and 12 control subjects aged between 35 to 60 years old. Both diabetic and control subjects had similar ages (49.9±8.5 versus 48.9±8.1 years). (Cavallero E 1995) In Kumar JG et al study the mean age of diabetic patients was 60.3±25.2 and non-diabetic patients was 50.5±34 years. (Kumar JG 2017)

In present study in both the group there was similar gender distribution. Similarly Gandiah et al observed 68% males and 32% females diabetic patients. Similarly 68% males and 32% female were non diabetic patients. That means gender distribution was similar among the groups. (Gandiah P 2016) In Raghavendra et al study out of 100 non-diabetic controls, 58% were males and 42% were females, and in 100 diabetic cases, 52% were males and 48% females. (Raghavendra S 2018)

The abnormal lipid profile in the postprandial state is more significant than the abnormal lipid profile in the fasting state in causing atherosclerotic complications in T2DM. Very few studies are available on the estimation of the postprandial lipid profile in T2DM patients. In present study on comparing the lipid parameters between diabetes and non-diabetes it was found that mean post prandial triglyceride was significantly high in diabetes patients (219.20) as compared to non-diabetes patients (94.02). Total post prandial cholesterol was also high in diabetes patients (256.84) as compared to non-diabetes patients(80.50), post prandial HDL in diabetic patients was 36.68 and in non-diabetic was 46.66 and post prandial LDL were also found to be significantly high in diabetics (112.02) as compared to non-diabetic subjects (81.42) . Similarly Raghavendra et al compared postprandial lipid profile among the cases and controls and observed that TG (189.87 ± 14.70), TC (238.13 ± 22.09) and LDL were higher in diabetic patients as compared to non-diabetic subject. While HDL was higher in non-diabetic subjects at extremely statistically significant p value 0.0001. (Raghavendra S 2018) In another study conducted by Kumar V et al the postprandial different lipids –TC, TG, HDL, and LDL was significantly higher in diabetic subjects with macrovascular disease as compared to non-diabetic groups. (Kumar V et al) Also, Suryabhan and colleagues observed a significant increase in the serum TC, TG and LDL-cholesterol levels in the postprandial lipid state in the diabetic patients as compared to those in the non-diabetic subjects at p<0.001. The HDL-cholesterol level was significantly decreased in the postprandial lipid state in the T2DM patients as compared to that in the non-diabetic subjects (p<0.001). (Suryabhan Ll2013)

Abnormal lipid profile observed in T2DM was related to insulin resistance which leads to increased release of free fatty acids from fatty tissue and impaired insulin dependent muscle uptake of free fatty acids. In present study, on analyzing post prandial Lipid abnormality in diabetes patients it was found that out of 50 patients, 70% had abnormal TG, 56% had abnormal TC, 36% had abnormal HDL and 52% had abnormal LDL. In majority abnormal TG was observed followed by abnormal TC. In Borle A et al study increased LDL and triglycerides was observed in 33 (66%) and 32 (64%) study subjects respectively. Lower HDL cholesterol values were observed in 26 (52%) study subjects. Along with isolated dyslipidemia combined lipid fraction abnormalities were also seen. (Borle A 2016) Another study by Suresh and colleagues observe that post prandial Lipid abnormalities TC, TG, HDL and LDL was found 43.8%, 44.7%, 38.5% and 77% respectively in diabetic patients. (Suresh P Kumar 2019) According to Krauss RM, dyslipidemia is a most common metabolic abnormality and frequently associated with diabetic millitus. (Krauss RM 2004) In present study on comparing post prandial lipid abnormality between diabetes and non-diabetes patients, it was found that there was significant difference in terms of post prandial lipid abnormality as revealed by the significant p value of <0.001. Similarly in Madhu SV et al study significant postprandial lipid abnormalities were observed in the diabetic subjects

particularly of TG and HDL-C. Triglyceride area under the curve, postprandial triglyceride area under incremental curve and peak postprandial triglyceride levels were all significantly higher in diabetic subjects compared to controls. In the case of HDL-C, while the HDL-C nadir and HDL-C Area under the curve were significantly lower than controls there was no difference once adjustment was made for fasting HDL-C values and area under decremented curves were compared.(Madhu SV 2005)

In present study on comparing the lipid profile with ECG findings it was found that out of 35 patients with abnormal TG, 30 patients had abnormal ECG (85.7%) and out of 28 patients with abnormal TC, 20 patients had abnormal ECG (71.4%). Similarly out of 18 abnormal HDL patients, 15 patients had abnormal ECG (83.3%) and out of 26 patients with abnormal LDL, 24 patients had abnormal ECG finding (92.3%). Majority of patients with normal post prandial lipid profile had normal ECG findings, and distribution was significant (p value <0.001). In similar study Gupta S, et al recorded that none of the control group had ECG abnormality whereas, 26% asymptomatic diabetics had ECG abnormalities. Most of the asymptomatic cases with ECG changes had 5-10 year of duration of diabetes mellitus; 70% patients with ECG changes had poor glycaemic control, increased triglyceride and decreased High Density Lipoprotein (HDL) levels. Most common abnormality observed was ST-T changes, followed by Left Atrial Enlargement (LAE), Left Ventricular Hypertrophy (LVH), Left Bundle Branch Block (LBBB) and Right Bundle Branch Block (RBBB).(Gupta S 2017)

Santiago et al in similar study with T2DM patients of 5.9 years recorded that at the beginning of the study, 24.9% of patients had ECG abnormalities; at the end, 44.3% had abnormalities. Cardiovascular events occurred in 65 patients (29.4%). The relative risk (RR) of a cardiovascular event in a patient with an ECG abnormality was 8.28 (95% confidence interval [CI], 3.36-20.42). Only hypertension (RR = 2.29; 95% CI, 1.24-4.22) and age were significantly related to the occurrence of a cardiovascular event. (de Santiago A 2007) Multiple regression analysis that included classical risk factors and ECG findings showed that an ECG abnormality was a significant independent predictor, with adjusted RR = 5.95 (95% CI, 2.29-15.47).

Although the patients history, physical examination and non-invasive techniques like resting ECG, holter monitoring, stress test (TMT), stress echocardiography, stress thallium imaging are valuable in establishing the diagnosis of myocardial ischemia in diabetes. In present study on comparing the lipid profile with TMT findings it was found that majority of patients with abnormal post prandial lipid profile had positive TMT which was revealed by significant p value <0.001. Similar results were posted by Gupta RK et al where out of 102 diabetic patients, TMT was positive in 32 (31.37%) patients; more in males (59.73%). Mean cholesterol (189.81 mg %), triglycerides (135.19 mg %) and LDL (116.28 mg %) levels were significantly high in TMT positive cases (P<0.001).(Gupta RK 2015)

Another study by Khanapure, et al recorded that out of 82 cases of asymptomatic T2DM patients, 32.9% were positive for TMT. The risk factors like age between 56 to 65 yrs (46%), males (36%), duration of diabetes > 15yrs (50%), cases on sulfonyureas and metformin combination (33%) and on insulin therapy (45%), BMI between 30 to 34.9 (70.83%), abdominal waist to hip ratio between 0.86 to 0.99 (30%), HbA1C more than 10% (44%), FBS more than 200mg/dl (42%) and, PPBS more than 350mg/ dl (58%), Total Sr. cholesterol level more than 240mg/dl (58%), T.G level more than 200mg/dl (53%), HDL levels less than 30mg/dl (47%) and HDL level between 31 to 45 mg/dl (23%), LDL level more than 160mg/dl (45%), VLDL more than 40mg/dl (50%), showed high percentage of positive treadmill test. (Khanapure SP 2017)

Present study has some limitations in terms of small sample size, single centered and cross sectional due to which it is not a pure replica of actual population. There is a need of a large randomized clinical trial to provide strength to present study findings.

CONCLUSION:

Study concludes that majority of the patients with T2DM had abnormal post prandial lipid profile which significantly correlates with positive TMT result and also significant ST-T changes in ECG. Hence post prandial lipid profile which is easily accessible can be used as an important tool for assessing cardiovascular complications in patients with T2DM.

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