



ORIGINAL RESEARCH PAPER

Medicine

ASSOCIATION OF DYSLIPIDEMIA AND TYPE 2 DIABETES MELLITUS- A SHORT STUDY IN A TERTIARY CARE CENTRE

KEY WORDS:

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ABSTRACT Type 2 diabetes mellitus has a profound impact on individuals and society, with its devastating complications taking a huge toll in terms of morbidity and mortality. Compared with non diabetic individuals, patients with type 2 diabetes have a two to four fold higher risk of cardiovascular disease, and dyslipidemia is an important contributor to the increased risk in this. In this study out of 50 cases 60% of them were dyslipidemic. Majority of them had a diabetic dyslipidemia pattern followed by combined dyslipidemia, isolated hypertriglyceridemia, other pattern characterised by elevated levels of LDL with decreased HDL levels and isolated lower HDL level. Prevalence of dyslipidemia was more in males however prevalence of and mean TG, LDL, TC, TC/LDL levels more in females. Duration of diabetes mellitus had positive correlation with dyslipidemia.

INTRODUCTION

Dyslipidemia remains an important association with type2 diabetes mellitus. The prevalence of dyslipidemia in type 2 diabetes mellitus has been show to vary depending upon the ethnicity of the population. Afro- Caribbean subjects in the UK have lower rates of CHD. Much of the difference in CHD incidence may be explained by the absence of the typical diabetic dyslipidemia and ethnicity.

Diabetic dyslipidemia pattern is highly atherogenic and is associated with coronary artery disease. It has been found that Asian Indians are predisposed to premature coronary artery disease. Certain unique clinical and biochemical abnormalities in Indians which include increased insulin resistance, greater abdominal adiposity i.e. Higher waist circumference despite lower body mass index, lower adiponectin and higher high sensitive C-reactive protein levels has lead to the term "Asian Indian Phenotype". This particular phenotype makes Indians more prone to diabetes and premature coronary artery disease.

METHODS AND MATERIALS:-

Study population and design was a total 50 patients with type 2 diabetes mellitus also meeting the inclusion and exclusion criteria were considered for the study. They were screened for type 2 diabetes mellitus and dyslipidemia. Study period was 18 months.

Investigations done for the study purpose includes: Fasting blood sugar, Fasting lipid profile (LDL cholesterol, Triglycerides, HDL cholesterol, VLDL) Total cholesterol, Post Prandial blood sugar and HbA1c.

Statistical tests of be employed. Continuous variables, in terms of MEAN +/- SD and categorical variables in terms of frequency and percentage. Bar and pie diagrams was used to represent the statistical data. Chi square test (2x2 tables), to compare data between two groups.

Criteria for the diagnosis of diabetes mellitus: Symptoms of diabetes plus random blood glucose concentration ≥ 11.1 mmol/L (200mg/dl) or Fasting plasma glucose ≥ 6.9 mmol/L (126mg/dl). Two hour plasma glucose ≥ 11.1 mmol/L (200ml/dl) during an oral glucose tolerance test. HbA1C $> 6.5\%$. Random blood sugar is defined as without regard to time since the last meal. Fasting blood sugar is defined as no caloric intake for at least 8 hours. (8 hours after a small meal and 12 hours of a large meal). The serum should also be tested in the fasting state for the lipid profile and glycosylated hemoglobin determination.

Glycemic statuses of the patients are divided into:

HbA1c	Glycemic status
$\leq 8\%$	Good
$>8\%$	Poor

Cardiovascular risk status of patients according to their lipid levels are tabulated accordingly:

Lipids	Plasma concentration	Cardiovascular status
LDL cholesterol	>3.5 mmol/L	HIGH
	2.6 mmol/L – 3.4 mmol/L	BORDERLINE
	<2.6 mmol/L	LOW
Triglycerides	$>4.$ mmol/L	HIGH
	$2.2.$ mmol/L – 4.5 mmol/L	BORDERLINE
	<2.2 mmol/L	LOW
HDL	<0.9 mmol/L	HIGH
	1.2 mmol/L – 0.9 mmol/L	BORDERLINE
	>1.2 mmol/L	LOW

Lipid levels of patients according to their glycemic status:

HbA1C	Lipids	Recommended level for adults with diabetes
$\leq 8\%$	LDL – Cholesterol Triglycerides HDL – Cholesterol	<2.6 mmol/L <1.7 mmol/L >1.0 mmol/L
$>8\%$	LDL – Cholesterol Triglycerides HDL – Cholesterol	<2.6 mmol/L <1.7 mmol/L >1.0 mmol/L

CASE STUDY

Descriptive statistical analysis has been carried out in the present study. Mean value of fasting blood sugar of 50 patients was found to be 171.29 ± 59.8 mg/dl, 64 (64%) of the patients had fasting blood sugars above 140 mg/dl and only 11 (11%) of the patients had fasting blood sugars < 11 mg/dl while the mean value of post Prandial blood sugar was 247.32 ± 83.4 mg/dl, 71 (72%) of the patients were found to have post Prandial blood sugars above 200mg/dl and only 2 (4%) of the patients had post Prandial sugars less than 140 mg/dl. Number of patients with HbA1c > 9 were 24 (48%), only 2 (4%) of patients had HbA1c < 7 while 8 (16%) had HbA1c between 7.8 and 16 (32%) had HbA1c in between 8 to 9%. The mean value of HbA1c in general was $9.08 \pm 1.6\%$.

Dyslipidemia was found to be present in 30 (60%) diabetics

among 50 patients. Total cholesterol were found to be less than 200 mg/dl in 34 (68%) patients, 200–240 in 10 (20%) of patients and > 240 is 6 (12 %). Mean total cholesterol among males was 184.89 + 49.97 and females were 188.09 + 40.4 mg/dl. The number of patients with total triglycerides < 150 mg /dl as 26 (52%) 150 – 199 mg/dl was 12 (24%), 200-499 mg/dl was 07 (14%) and those with TG > 500 mg/dl was 05 (10%), mean TG levels in males was 160.28 +- 66.03 mg/dl and in females was 162.77+- 56.47mg/dl.

High density lipoprotein levels below 40 mg/dl seen in 09 (18%) patients, 40 patients have HDL between 40-60 mg/dl (80%). 20 patients had LDL < 100 mg/dl, 15 patients had between 100-130mg/dl, 10 had between 130-160 mg/dl and 05 had > 160 mg/dl. Very low density lipoprotein (VLDL) was found less than 30 mg /dl in 25 patients and more than 30 mg/dl in 25 of the 50 patients. The mean value of HDL, LDL and VLDL in males were 40.75 +/- 7.54 mg/dl, 114.86 +/- 41.33. Mg/dl, 32.05 +/- 13.21 respectively and in females HDL was 38.86 +- 5.78 mg/dl, LDL was 118.05 +- 33.94 mg/dl and VLDL was 32.53 +- 11.12 mg/dl.

The number of patients with HbA1c less than 7% was 2. Patients had 7-8% was 8, 8-9% was 16 and more than 9% in 24. In male patients, the mean values in mg/dl of TC, TG, HDL, LDL and VLDL were 181.70 +- 40.38, 129.15 +- 49.50, 38.90 +- 8.92, 116.90 +- 33.32, and 25.90 +- 9.92 respectively. In female patients it were 187.40 +- 47.36, 169.40 +- 62.22, 37.46+- 6.21, 116.05 +- 39.49 and 33.83+- 12.37 correspondingly.

DISCUSSION

Dyslipidemia remains an important association with type 2 diabetes mellitus. It is a well know fact that diabetes mellitus carries a high risk for accelerated atherosclerosis and is associated with increased morbidity and mortality.

It has been found that Asian Indians are predisposed to premature coronary artery disease. Certain unique clinical and biochemical abnormalities in Indians which include increased insulin resistance, greater abdominal adiposity i.e. higher waist circumference despite lower body mass index, lower adiponectin and higher high sensitive C- reactive protein levels has lead to the term "Asian Indian Phenotype". This particular phenotype makes Indians more prone to diabetes and premature coronary artery disease.

In this study, the prevalence of dyslipidemia was 60% in 50 patients with type 2 diabetes mellitus. These patients were included in the study after excluding a wide variety of factors which can alter lipid profile of the diabetic patients. A national cross- sectional study of 2473 Canadian patients with type 2 diabetes revealed a similar result with 55% of patients having dyslipidemia. This proportion rose to 66% in patients with diabetes for 15 years¹. Kayoed et al studied 113 diabetic patients in a hospital based study conducted in Nigeria which revealed the prevalence of dyslipidemia (at least one abnormal lipid profile) to be 50.4%².

The commonest type of dyslipidemia found in this study was diabetic dyslipidemia (25%) (increased triglyceride levels, increased levels of LDL and decreased HDL). It was followed by combined dyslipidemia (20%) (Hyper triglyceridemia (6%) and other patterns which include increased LDL with decreased HDL (5%) and isolated decrease in HDL (4%). In a hospital based study in Malaysia involving 240 type 2 diabetic patients, 70% were dyslipidemia with diabetic dyslipidemia pattern was observed in 9.3% combined dyslipidemia 23.2, in another study conducted in Collar, combined dyslipidemia dominated followed by isolated dyslipidemia with low HDL^{4,5}.

Hypertriglyceridemia was seen in 48% of the total patients while isolated hypertriglyceridemia alone was seen in 6% of the diabetics. Prevalence of hypertriglyceridemia was more in females (48.8%) than in males (43.9%). The mean values of triglyceride levels in females (162.77 mg/dl) slightly higher than in males (160.28mg/dl). In a study conducted in urban slums in Delhi, the prevalence of triglyceridemia in type 2 DM were 61%, while

prevalence of hypertriglyceridemia was 78% in type 2 DM subjects was seen in a hospital based study in Abbottabad, Pakistan^{4,6}.

Prevalence of low HDL was noted in 34 % of the diabetics in the study with females to complete. Gupta et al has showed 24% of urban population has low HDL while Tai et al had demonstrated 34% of the subjects with low HDL in multi ethnic study in Singapore were Asian Indians. Misra et al showed a 15% male with low HDL and 16% females with low HDL in urban slums^{5,7}.

Hypercholesterolemia was found to be present in 33% of diabetics with its prevalence higher in females (34.9%) than males (28.1%). The mean value in females was 88.09 mg/dl whereas in males it was 184 mg/dl. According to a study conducted in Malaysia, 73.2% patients had hypercholesterolemia among the 848 type 2 diabetes mellitus patients included in the study. Type 2 diabetic patients have a high frequency of atherogenic dyslipidemia especially for TC and LDL – C. A different study conducted in urban slum population in northern India in type 2 diabetes patients, hypercholesterolemia was found to be 26.8% in males and 27.5% in females. In another study which was conducted in Saudi Arabia, 56.6% of the total patients had hypercholesterolemia^{8,5,9}.

Majority of the diabetics in the study had poor glycemic control. Mean value of fasting blood sugar of 50 patients was found to be 171.29 +- 59.8mg/dl, 32 (64%) of the patients had fasting blood sugars above 140 mg/dl and only 05(10%) of the patients had fasting blood sugars < 110 mg/dl while the mean value of post Prandial blood sugar was 247.32 +- 83.4 mg/dl, 36(71%) of the patients were found to have post prandial blood sugars above 200 mg/dl and only 2(4%) of the patients had post prandial sugars less than 140 mg/dl. Number of patients with HBA1C > 9 were 57%, only 4% of patients had HBA1c < 7 while 16% had HBA1C between 7-8 and 33% had HBA1c between 8-9%. This poor control may be attributed to the low rates of insulin therapy administered in the diabetics and failure oral hypoglycemic therapy⁹.

Triglycerides showed marked increase in their mean value along with other sub fractions of lipids in poor glycemic control group except HDL which showed a decrease and LDL levels remained the same. The mean values of total cholesterol, TG, HDL, LDL, VLDL, TC/HDL ratio in HBA1C < 8% were 18.7 +/- 40.38mg/dl, 15 +/- 49.5mg/dl, 38.92 +/- 8.92mg/dl, 116.9 +/- 33.32mg/dl, 25.9 +/- 9.92 mg/dl, 4.82 +/- 1.33 respectively. While in HBA1c > 8% group TC, TG, HDL, LDL, VLDL, TC/HDL were 187.4 +/- 47.36 mg/dl, 169.4 +/- 62.22 mg/dl, 116.05 +/- 39.49 mg/dl, 33.38 +/- 12.37 mg/dl and 5.09 +/- 1.3 respectively. A study by Chintamani Bodhe et al showed that severity of dyslipidemia increase in patients with higher HbA1c value. As elevated HbA1c and dyslipidemia are independent risk factors of cardiovascular disorders (CVD), diabetic patients with elevated HbA1c and dyslipidemia can be considered as very high risk group for CVD. Improving glycemic control can substantially reduce the risk of cardiovascular events in diabetics¹⁰. Ram Vind Mahto et al proved that HbA1c can be used as a potential biomarker for predicting dyslipidemia in type 2 diabetic patients in addition to glycemic control with his study. In a study done in Saudi Arabia, it was seen that there is a direct relation between glycemic status and lipid profile in both the genders¹¹.

According to this study, the dyslipidemia in the male patients was found to be 61.4% and in females it was 58.13%. Jayarama et al studies showed that prevalence of dyslipidemia among diabetic males was 95.4% and 86.75% in females⁵ whereas a study conducted in Pakistan showed that 50.5% were females and 49.4% were males¹². Another study done in Iran supports this with similar results¹³.

Mean values of individual parameters like TG, TC, HDL, LDL and VLDL in females was 162.77mg/dl, 188.09mg/dl, 37.74mg/dl, 118.05mg/dl and 32.53 mg/dl respectively which were higher than in males. The TG, TC, HDL, LDL and VLDL mean values in males were 160.28 mg/dl, 184.89mg/dl, 37.75 mg/dl, 114.86 mg/dl and 32.05mg/dl correspondingly.

Almost all studies, including this, pointed to a higher prevalence of hypertriglyceridemia in females. Fontbonne et al. in a prospective cohort study showed that an elevated plasma level of TG in diabetic patients was positively and significantly correlated with CAD events and CAD mortality. Hypertriglyceridemia may be the best lipid predictor of CVD in type 2 diabetic patients₁₃.

Duration of diabetes and dyslipidemia has shown correlation with dyslipidemia where by prevalence of dyslipidemia was higher in the group with longer duration of diabetes. All the patients with more than 20 years of diabetes had dyslipidemia while patients with 10-20 years, 5-10 year and 1-2 years showed involvement of 80%, 50%, 23.8% respectively. According to a Canadian study, patients with type 2 DM for less than 2 years had dyslipidemia prevalence of 55% whereas in those with type 2 DM for more than 15 years, it rose to 66%₁₃.

CONCLUSIONS

The study has shown the frequency of dyslipidemia in type 2 DM is 60%. Most prevalent pattern of dyslipidemia is diabetic dyslipidemia pattern. Gender alters the lipid profile in type 2 DM and females are associated with higher non HDL fraction. Poor Glycemic control results in worsening of dyslipidemic profile.

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