ASSOCIATION OF LIPID PROFILE WITH FASTING AND POST PRANDIAL GLUCOSE LEVEL IN TYPE 2 DIABETIC PATIENTS

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ABSTRACT

INTRODUCTION: The cardiovascular disease (CVD) is associated with diabetes mellitus and dyslipidemia plays important role in CVD. This paper explores the frequency and pattern of dyslipidemia in type 2 diabetes mellitus patients and that compared with healthy control. The correlation of glucose level with lipid profile including Non-HDL/HDL and TG/HDL has been projected in this study.

MATERIAL AND METHODS: This case-control study includes 263 type 2 diabetes mellitus and compared with 55 healthy controls. The diagnosis of Diabetes mellitus was made according to the World Health Organization (WHO) criteria and the criteria for dyslipidemia was obtained by National Cholesterol Education Program Expert Panel/American Treatment Protocol III (NCEP/ATP III).

RESULTS: Most common dyslipidemia was found in increase TG (49.42%) followed by decreased HDL (48.66%), increased LDL (40.30%) and increased TC (33.84%) respectively. The proportion is much higher in male than female. The statistically significant differences between control and case for glucose and lipid profile were observed in FBS ($p < 0.001$), PPBS ($p < 0.001$), HDL ($p < 0.01$), Non-HDL/HDL ($p < 0.002$) and TG/HDL ($p < 0.039$). TG, TC and LDL were statistically non- significant between control and case. The Pearson's correlation coefficient shows significant correlation of FBS and PPBS with TG ($p < 0.01$), Non-HDL/HDL ($p < 0.01$) and TG/HDL ($p < 0.01$) respectively.

CONCLUSION: Our study has suggested the dyslipidemia is associated with DM with increased TG, low HDL, high cholesterol and LDL. The increased Non-HDL/HDL and TG/HDL could be better indicator than single lipid abnormality which needs to be verified prospectively by including large population and controls.

KEYWORDS: FBS; PPBS; Lipid profile; Type 2 DM; South West Nepal

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INTRODUCTION

Diabetes mellitus (DM) is a chronic disease that occurs when the body cannot produce enough insulin or cannot use insulin effectively.[1] The number of people with type 2 Diabetes Mellitus (T2DM) is growing rapidly worldwide. This rise is associated with economic development, ageing populations, increasing urbanization, dietary changes, reduced physical activity and changes in other lifestyle patterns.[2] CVD is the most common cause of death and disability among people with DM. For people with, high blood pressure, high cholesterol, high blood glucose and other risk factors contribute to the increased risk of cardiovascular complications. Studies have found that many people with undiagnosed DM already have complications, such as chronic kidney failure, retinopathy and neuropathy.[3] People with DM are two to six times more likely to develop CVD than people without DM.[4,5]

The majority of the 382 million people with DM are aged between 40 and 59, and 80% of them live in low and middle income countries. In 2013, 72.1 millions population were diabetic and the population is projected to increase by 71% by 2035. Approximately 5.1 million people aged between 20-79 years died from diabetes in 2013, accounting for 8.4% of global all cause mortality among people in this age group.[6] There are evidences about association between dyslipidemia and the increased risk of CVD in patients with T2DM. [7] T2DM is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities, including reduced HDL cholesterol, a predominance of small dense LDL particles, and elevated triglycerides.[8] Some investigator have suggested that non HDL cholesterol (LDL+IDL+VLDL cholesterol) may be superior to LDL cholesterol alone as a predictor of CVD among diabetic patients, largely because cholesterol- enriched VLDL may confer a greater CVD risk than LDL cholesterol alone. [9, 10] Hence, this study was conducted to explore the pattern distribution of dyslipidemia in T2DM residing in south west region of Nepal and further to correlate the glucose level with lipid profile including Non-HDL/HDL and TG/HDL ratio which may be better predictor of dyslipidemia in DM.

MATERIAL AND METHODS

This case-control study was carried out at Universal College of Medical Sciences & Teaching Hospital, Bhairahawa during June 2014 to November 2014. A total of 263 T2DM patients whose diagnosis was made according to the WHO criteria were enrolled in this study. The age-sex matched 55 healthy controls without any metabolic disease were also enrolled.
Blood samples were drawn after at least 12 hours of overnight fasting. Serum fasting glucose and lipid profile (total cholesterol, HDL, LDL and triglyceride) were measured. 2-hr sample after breakfast was taken to estimate post prandial blood glucose. Serum Glucose was estimated by glucose oxidase and peroxidase method, serum TG by glucose phosphate oxidase, phenol antipyrine method, serum TC by cholesterol oxidase, phenol antipyrine method and HDL by cholesterol oxidase, phenol antipyrine method. All reagents are procured from Erba, Germany and measured in Erba XL200-fully automated analyzer. The calculation of LDL was done by using Freidewald's formula as LDL cholesterol=TC-(TG/5)-HDL cholesterol.

The classification and diagnosis of diabetes was made cut off for dyslipidemia were considered with TC≥200 mg/dl, TG≥150 mg/dl and LDL≥130 mg/dl. Cut off for HDL for men was ≤40 mg/dl and for women was ≤50 mg/dl.[11] Recent trend on lipid profile measurement has been included by calculating Non-HDL/HDL and TG/HDL respectively to show dyslipidemia and its association with fasting and post prandial blood sugar.

The study received approval from the institutional research ethical committee. The statistical analysis was done by SPSS-16. The data are represented in frequency for qualitative attributes, mean ± SD for quantitative attributes. Variables were compared for its mean using student's "t" test and relationship among variables was made by using Pearson's correlation. The p-value <0.05 was considered to be statistically significant.

RESULTS

Out of the 263 patients, 151(57.41%) were male and 112 (42.58%) were female. The mean age of patients was 51.53 ± 15.15 years. The proportion of healthy controls (n=55) were matched with that of patients, including 31 male and 24 female whose mean age was 50.08 ± 14.89 years.

Most common dyslipidemia was found in increase TG (49.42%) followed by decreased HDL (48.66%), increased LDL (40.30%) and increased TC (33.84%) respectively. The proportion is much higher in male than female.

The statistically significant differences between control and case for glucose and lipid profile were observed in FBS ($p<0.001$), PPBS ($p<0.001$), HDL ($p<0.01$), Non-HDL/HDL ($p<0.002$) and TG/HDL ($p<0.039$). TG, TC and LDL were statistically non- significant between control and case.
The Pearson's correlation coefficient shows significant correlation of FBS and PPBS with TG ($p<0.01$), Non-

HDL/HDL ($p<0.01$) and TG/HDL ($p<0.01$) ratio respectively.

Table 1: Distribution of Lipid Profile in patients with Type 2 DM (n=263)

Variables	Male (n=151)	Female (n=112)	Total (n=263) (%)
TC			
<200 mg/dl	97 (36.88)	77 (29.27)	174 (66.15)
≥200 mg/dl	54 (20.53)	35 (13.31)	89 (33.84)
TG			
<150 mg/dl	65 (24.71)	68 (25.86)	133 (50.57)
≥150 mg/dl	86 (32.69)	44 (16.73)	130 (49.42)
HDL			
<40(M)/<50(F) mg/dl	88 (33.46)	40 (15.2)	128 (48.66)
≥40(M)/=50(F) mg/dl	63 (23.96)	72 (27.37)	135 (51.33)
LDL			
<130 mg/dl	94 (35.74)	63 (23.96)	157 (59.69)
≥130 mg/dl	67 (25.47)	39 (14.83)	106 (40.30)

Table 2: Blood glucose and lipid profile (mean ± SD) in patients with T2DM and control

Variables	Control (n=55)	Cases (n=263)	p-value
FBS (mg/dl)	97.85 ± 11.60	156.44 ± 23.12	0.001
PPBS (mg/dl)	129.95 ± 25.13	214.62 ± 32.94	0.001
TC (mg/dl)	171.38 ± 43.31	189.43 ± 42.53	0.108
HDL (mg/dl)	54.53 ± 10.18	41.33 ± 7.89	0.01
LDL (mg/dl)	100.82 ± 44.26	114.05 ± 36.74	0.157
TG (mg/dl)	144.85 ± 26.01	171.15 ± 87.76	0.153
Non-HDL/HDL	2.63 ± 1.01	3.69 ± 1.20	0.002
TG/HDL	2.76 ± 0.84	4.42 ± 3.17	0.039

Table 3: Correlation between blood glucose and lipid profile in patients with T2DM

Variables	Age	TC	HDL	LDL	TG	Non-HDL/HDL	TG/HDL
FBS	0.18**	0.06	-0.10	-0.02	0.28**	0.20**	0.31**
PPBS	0.25**	0.07	-0.05	-0.01	0.23**	0.16**	0.25**

** represents $p < 0.01$

DISCUSSION

The major dyslipidemia 49.42% found in our research was increased TG in patients with T2DM. Low HDL was another dyslipidemia seen in 48.66%. The increased LDL and cholesterol were observed in 40.40% and 33.84% respectively in patients with T2DM. In the Framingham Heart Study[12] 13% of men and 24% of women with DM had increased total plasma cholesterol levels. A similar pattern of altered plasma lipid profiles was observed in the UK Prospective Diabetes Study (UKPDS).[13] In their study, total cholesterol levels of those with DM and control individuals did not differ. However, women with T2DM had markedly higher LDL cholesterol levels than women who were not diabetic. The plasma TG levels of patients with T2DM were substantially increased whereas HDL cholesterol levels were markedly reduced in both men and women with DM compared with the non-diabetic controls.

The pattern of lipid disorder differs between ethnicities and populations. The spectrum of dyslipidemia in DM can include all the various types of dyslipidemia identified in the general population.[14] The patients who have low HDL are highly associated with risk of coronary heart disease (CHD) and atherosclerosis. The clustering of two or more lipid abnormalities could be more dangerous than single lipid abnormality.

The high TG and low HDL in present study made us explore the interaction with other lipid parameters. Thus we explored Non-HDL/HDL and TG/HDL ratio and found to be significantly high in DM than control indicating better indicator of dyslipidemia than single lipid indicator. Moreover there was significant correlation observed between glucose profile and Non-HDL/HDL as well as TG/HDL ratio respectively. These two indicators of lipid status can further be investigated in larger samples to come into conclusion of superior predictor of dyslipidemia in DM. Insulin resistance and low HDL levels might have a common mediator; several key enzymes that are involved in HDL cholesterol metabolism are altered in people with insulin resistance.[15,16]

Further evidence confirms that T2DM is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities that are well recognized predictors for CHD, including reduced plasma levels of high density lipoprotein cholesterol particles and elevated plasma levels of TG.[17]As a result of insulin resistance in the adipose tissue and obesity, the free fatty acid flux from the adipocytes is increased, which leads to an increased lipid [very low density lipoprotein (VLDL) and TGs] synthesis in the hepatocytes. This is responsible for the dyslipidemia which is found in T2DM with elevated TGs, reduced HDL-C, and increased small dense low-density lipoprotein (LDL) particles.[18] The macrovascular complications such as CHD and CVD are two to four times greater in the patients with T2DM.[19]

The limitation of this study was inclusion of a few numbers of healthy controls and severity of disease state in DM patients was not assessed. This study has given platform for future study to assess the severity of DM in large population with dyslipidemia as one of the major predictor for CVD. The poor glycemic control, prolonged duration, coexisting hypertension predicts dyslipidemia in T2DM.[20]

Our study has suggested the dyslipidemia is associated with

DM with increased TG, low HDL, high cholesterol and LDL. The increased Non-HDL/HDL and TG/HDL could be better indicator than single lipid abnormality which needs to be verified prospectively by including large population and controls. DM patients should be screened regularly for dyslipidemic condition and proper management should be instituted to risk associated with CHD and atherosclerosis.

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