

## FREQUENCY OF DYSLIPIDEMIA IN PATIENTS OF TYPE 2 DIABETES WITH HYPERTENSION IN SOUTHERN PUNJAB TERTIARY CARE HOSPITAL

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### ABSTRACT

**Objective:** To determine the frequency of dyslipidemia in patients of type 2 diabetes with hypertension.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Combined Military Hospital Multan, from Jun 2014 to Dec 2014.

**Material and Methods:** A total of 145 diagnosed patients of diabetes mellitus aged >35 years, were included through non-probability consecutive sampling. Dyslipidemia was defined on the basis of laboratory report of fasting lipid profile with serum cholesterol >180 mg/dl, serum triglyceride >150 mg/dl and HDL <40 mg/dl in males and <50 in females. The data was analyzed using computer software program SPSS version 19.

**Results:** There were 145 patients. Males were 78 (53.8%) while females were 67 (46.2%), mean age being 54.27 ± 7.91 years. Mean BMI was 28.63 ± 3.93 years. Total serum cholesterol was found to be >180mg/dl in 83 (57.2%) patients. Serum triglyceride was found to be >150 mg/dl in 102 (70.34%) patients. HDL was found to be low in 116, 145 mg/dl (80%) patients. Mean for total cholesterol level was 202.03 ± 39.24 mg/dl. Mean triglyceride level was 188.85 ± 48.98 mg/dl. Mean HDL level was 38.82 ± 8.32 mg/dl. Hyperlipidemia was found to be present in 117 (80.7%) of the patients. There was no significant effect of age, gender, duration of diabetes, duration of hypertension, BMI and number of smoking pack years on the frequency of dyslipidemia.

**Conclusion:** Patients with type 2 diabetes mellitus and hypertension are at a high risk of having dyslipidemia and the most frequently identified lipid abnormality in these patients is a low HDL level.

**Keywords:** Dyslipidemia, Hypertension, Type 2 Diabetes.

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### INTRODUCTION

Type 2 diabetes is a chronic metabolic disorder that results from decrease in both insulin action and secretion. Its prevalence is increasing rapidly and can be inferred by the International Diabetes Federation (IDF) 2006 report stating that approximately 246 million people worldwide are suffering from this disease and the prevalence is anticipated to cross the figure of 380 million within 20 years<sup>1</sup>. The majority of patients having type-2 diabetes carry a two-to four-time higher risk of cardiovascular disease as major cause of death. There are multiple major risk factors that attribute to this increased cardiovascular mortality, including age (>64.2 years), diabetes duration (>15.2 years), systolic blood pressure (>145 mmHg), dyslipidemia, smoking and

obesity<sup>2</sup>. Dyslipidemias cause endothelial damage and dysfunction and loss of physiological vasomotor activity leading to development of atherosclerosis which can lead to hypertension. A study concluded that there is an association between abnormal plasma lipids, syndrome X, type 2 diabetes, decreased concentrations of high density lipoprotein cholesterol and hypertension. This describes a combination of previously reported risk factors for coronary artery disease<sup>3</sup>.

Dyslipidemia in type-2 diabetic patients is characterized by both quantitative and qualitative abnormalities in lipoproteins which are known to be responsible for the increased risk of macrovascular disease<sup>4</sup>. Each lipid and lipoprotein fraction is affected by insulin resistance and hyperglycemia. The usual pattern of diabetic dyslipidaemia is predominantly elevated triglyceride levels along with a decreased HDL chole-

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terol levels. The concentration of LDL cholesterol is usually not considerably different from non-diabetic subjects. However, type-2 diabetic patients typically have a predominance of small, dense LDL particles, which possibly increases atherogenicity by a greater susceptibility to oxidation even if the absolute concentration of LDL cholesterol is not significantly increased. HDL cholesterol has a complex structure and an inverse relation with concentration and risk of atherosclerotic events<sup>5</sup>. Hypertriglyceridaemia often is rather modest. A fasting lipid profile (total cholesterol [TC], HDL-C, TG and calculated LDL-C) is recommended to be performed at the time of diagnosis of diabetes<sup>6</sup> and then every 1 to 3 years, as clinically indicated. More frequent testing should be done if treatment for dyslipidemia is started<sup>7</sup>.

## MATERIAL AND METHODS

A cross-sectional study was conducted from Jun 2014 to Dec 2014 at General Medicine department of Combined Military Hospital Multan (CMH). With confidence level  $z$  95%, expected prevalence of dyslipidemia  $P$  75.8%<sup>8</sup> and  $d$  7%, a sample size of 145 patients was calculated using sample formula

$$N = \frac{z^2 x P(1-P)}{d^2}$$

One hundred and forty five diagnosed patients of diabetes mellitus aged more than 35 years of both genders with random blood sugar levels >200 mg/dl or fasting blood sugar >126 mg/dl with blood pressure of >130/80mmHg on two different occasions 1 week apart were included via non-probability consecutive sampling. Dyslipidemia was defined on the basis of laboratory report of fasting lipid profile showing serum cholesterol >180 mg/dl, serum triglyceride >150 mg/dl and HDL <40mg/dl males and <50mg/dl in females. Patients excluded from the study were those with type 1 diabetes, having established macrovascular complications like ischemic heart disease (IHD) & stroke, family history of dyslipidemia, decompensated heart failure, chronic liver disease, chronic renal failure.

After approval from "Hospital Ethical Committee", patients were selected according to inclusion and exclusion criteria. Written informed consent was obtained from the study participants after introducing them to the study and its objectives. All patients were investigated for the presence of dyslipidemia by getting a fasting lipid profile from CMH laboratory. Name, age, laboratory reports and hospital ID number were entered in the specially designed Proforma.

All data collected was entered in SPSS version 19. Frequencies and percentages were calculated for qualitative variables like gender and dyslipidemia including hyper-cholesterolemia, hypertriglyceridemia and HDL. Stratifi-

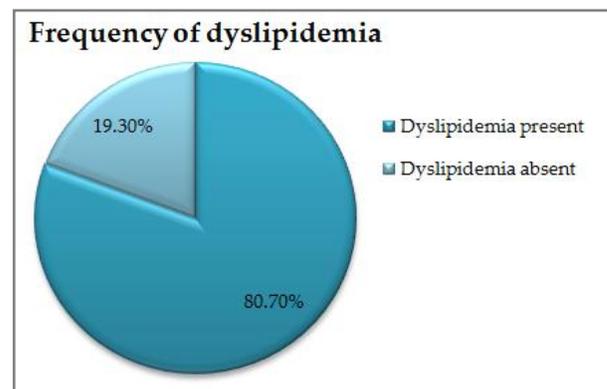


Figure-1: Frequency of dyslipidemia.

cation was done with regards to age, gender, duration of diabetes, hypertension, no. of smoking pack years and BMI to see the effect of these on outcome by applying chi-square test. A  $p$ -value  $\leq 0.05$  considered as a significant value.

## RESULTS

One hundred forty five patients were studied and following results were found. It was observed that there were 45 patients in age group <50 years. Males were 27 (60%) while females were 18 (40%). Mean total cholesterol was  $201.31 \pm 40.26$  mg/dl. Mean triglyceride level was found to be  $193.40 \pm 40.26$  mg/dl. Mean HDL level was  $40.33 \pm 8.89$  mg/dl. Hyperlipidemia was present in 35 (77.8%). LDL was found to be high in 24 (53.3%), Serum triglyceride was found to high in 32 (71.1%), HDL was found to be low in 34 (75.5%) patients. In the age group of 51-60

years, there were 66 patients in total. Males were 37 (56.1%) while females were 29 (43.9%). Mean total cholesterol was  $206.27 \pm 39$  mg/dl. Mean triglyceride level was found to be  $188.45 \pm 47.45$  mg/dl. Mean HDL level was  $37.82 \pm 8.31$ mg/dl. Hyperlipidemia was present in 53 (80.3%). Cholesterol was found to be high in 42 (63.6%), Serum triglyceride was found to high

17 (50%). Serum triglyceride was found to high in 25 (73.5%), HDL was found to be low in 29 (85.2%) patients. A *p*-value was calculated and found out to be 0.875 (fig-1, 2 & 3).

The effect of gender was analyzed it was found that among 78 males with diabetes and hypertension, and mean duration of diabetes was  $9 \pm 4.3$  years, mean duration of hypertension was

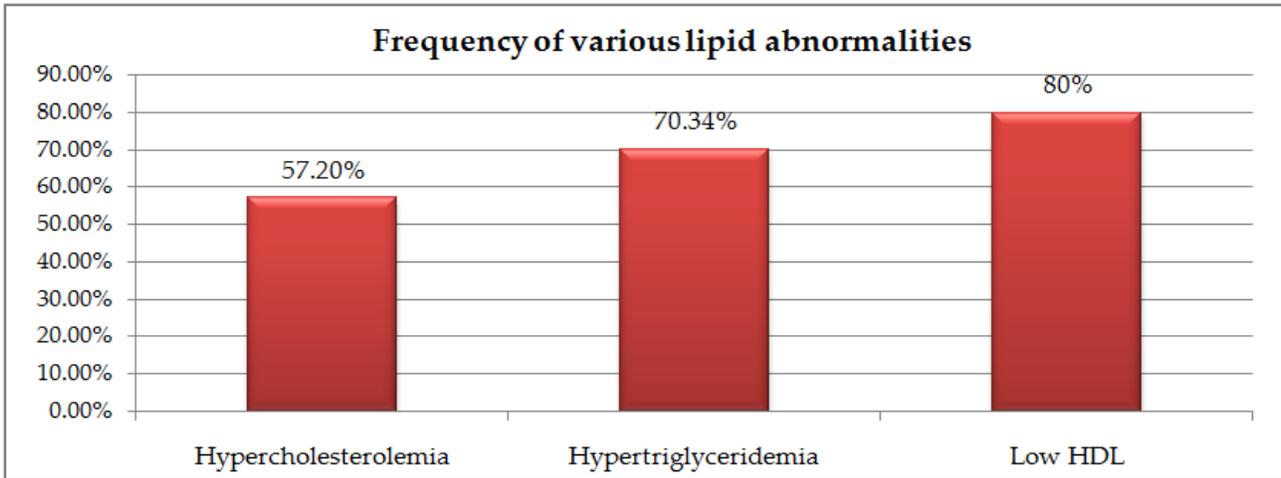


Figure-2: Frequency of various lipid abnormalities in the patients population.

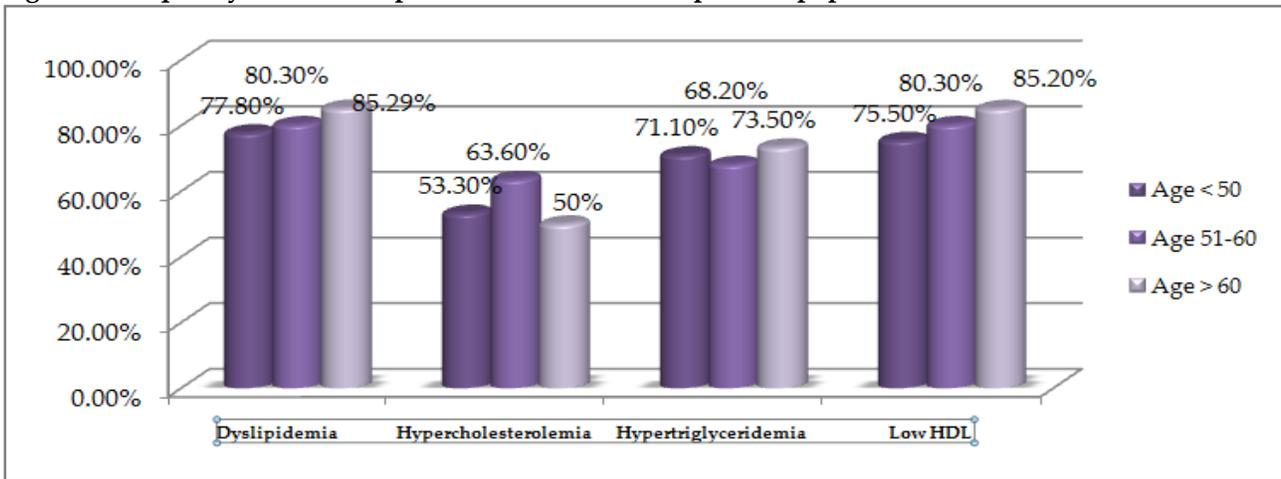


Figure-3: Effect of age on the frequency of dyslipidemia in patient population.

in 45 (68.2%), HDL was found to be low in 53 (80.3%) patients. In the age group >60 years, there were 34 patients in total. Males were 14 (41.2%) while females were 20 (58.8%). Mean total cholesterol was  $194.74 \pm 38.36$  mg/dl. Mean triglyceride level was found to be  $195.32 \pm 50.41$  mg/dl. Mean HDL level was  $38.76 \pm 7.43$ . Dyslipidemia was found to be present in 29 (85.29%). Raised serum cholesterol was present in

$8.6 \pm 2.37$  years, mean BMI was  $28.50 \pm 3.73$  mg/dl, mean total cholesterol was  $202.96 \pm 39.78$  mg/dl, mean triglyceride level was  $191.74 \pm 48.84$  mg/dl and mean HDL was  $36.01 \pm 7.65$ . Dyslipidemia was found to be present in 62 (79.4%). Among 67 females, the mean duration of diabetes was  $9.94 \pm 3.8$  years, mean duration of hypertension was  $7.72 \pm 2.34$  years, mean BMI was  $28.78 \pm 4.17$ , mean total cholesterol was  $200.94 \pm$

38.88 mg/dl, mean triglyceride level was  $191.43 \pm 38.88$  mg/dl and mean HDL was  $42.09 \pm 7.89$  mg/dl. Dyslipidemia was found to be present in 55 (82.1%). A *p*-value was found out to be 0.833.

When the effect of duration of diabetes was noted it was observed that there were 65 patients with duration of diabetes <10 years. Mean cholesterol was  $201.42 \pm 40.39$  mg/dl, mean triglyceride was  $191.45 \pm 49.42$  mg/dl, and mean HDL was  $39.28 \pm 8.52$  mg/dl. Dyslipidemia was diagnosed to be present in 51 (78.5%).

On the other hand there were 80 patients

found to be present in 51 (82.3%). There were 83 patients with duration of hypertension >8 years. Mean cholesterol was  $195.08 \pm 36.12$ mg/dl, mean triglyceride was  $191.37 \pm 47.56$ mg/dl, and mean HDL was  $38.70 \pm 8.06$ mg/dl. Dyslipidemia was diagnosed to be present in 66 (79.5%). When Chi-square test was applied the *p*-value turned out to be 0.679 (table-II).

When the effect of BMI was noted it was found that there were 63 patients with BMI <28, mean cholesterol was  $205.48 \pm 42.01$ mg/dl, mean triglyceride level was  $192.08 \pm 44.52$ mg/dl, and

**Table-I: Effect of duration of diabetes on the frequency of dyslipidemia.**

	Duration <10 years (n=65)	Duration >10 years (n=80)	<i>p</i> -value
Mean age	$48.77 \pm 8.05$	36/80 (45 %)	0.540
Mean duration of HTN	$7.65 \pm 2.08$	$8.64 \pm 2.54$	
Mean BMI	$28.28 \pm 3.85$	$28.28 \pm 3.85$	
Dyslipidemia	51/65 (78.5%)	66/80 (82.5%)	

**Table-II: Effect of duration of hypertension on the frequency of dyslipidemia.**

	Duration <8 years (n=62)	Duration >8 years (n=83)	<i>p</i> -value
Mean age	$51.39 \pm 8.07$	$56.42 \pm 7.10$	0.679
Mean duration of Diabetes	$8.65 \pm 4.07$	$10.02 \pm 4.03$	
Mean BMI	$27.90 \pm 3.99$	$29.17 \pm 3.81$	
Dyslipidemia	51/62 (82.3%)	66/83 (79.5%)	

**Table-III: Effect of smoking on the frequency of dyslipidemia.**

	Smoking <5 P/Y (n=59)	Smoking >5 P/Y (n=86)	<i>p</i> -value
Mean age	$53.17 \pm 8.84$	$55.02 \pm 7.16$	0.795
Mean duration of Diabetes	$8.90 \pm 4.17$	$9.80 \pm 4.02$	
Mean duration of HTN	$6.64 \pm 1.91$	$6.05 \pm 2.01$	
Mean BMI	$25.46 \pm 2.99$	$25.35 \pm 2.99$	
Dyslipidemia	47/59 (79.7%)	70/86 (81.4%)	

with duration of diabetes >10 years. Mean cholesterol was  $202.52 \pm 38.53$ mg/dl, mean triglyceride was  $191.72 \pm 46.02$ mg/dl, and mean HDL was  $38.45 \pm 8.18$ mg/dl. Dyslipidemia was diagnosed to be present in 66 (82.5%). When chi-square test was applied the *p*-value turned out to be 0.540 (table-I).

When the effect of duration of hypertension was analyzed it was noted that there were 62 patients with duration of hypertension <8 years. Mean cholesterol was  $211.32 \pm 41.57$ mg/dl, mean triglyceride was  $191.90 \pm 47.58$  mg/dl, and mean HDL was  $38.98 \pm 8.70$ mg/dl. Dyslipidemia was

mean HDL was  $38.84 \pm 8.57$ mg/dl. Dyslipidemia was found to be present in 51 (81%). On the other hand there were 82 patients with BMI >28, mean cholesterol was  $199.38 \pm 37.02$ mg/dl, mean triglyceride level was  $191.23 \pm 49.78$ mg/dl, and mean HDL was  $38.80 \pm 8.17$ mg/dl. Dyslipidemia was found to be present in 66 (80.5%). When Chi-square test was applied the *p*-value was found out to be 0.944.

When the effect of number of smoking pack years was noted it was found that there were 59 patients with smoking pack years <5. Mean cholesterol was  $203.22 \pm 39.38$ mg/dl,

mean triglyceride was  $198.93 \pm 47.57$ mg/dl, and mean HDL was  $38.14 \pm 9.02$ mg/dl. Dyslipidemia was found to be present in 47 (79.7%). On the other hand, among those with no. of smoking pack years  $>5$  there were 86 patients in total. Mean cholesterol was  $201.21 \pm 39.36$ mg/dl, mean triglyceride was  $186.57 \pm 46.91$ mg/dl, mean HDL was  $39.29 \pm 7.81$ mg/dl. Dyslipidemia was found to be present in 70 (81.4%). A *p*-value was found to be 0.795 (table-III).

## DISCUSSION

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia resulting from several hereditary and environmental factors due to defects in insulin secretion, insulin action or both<sup>3</sup>. The most important abnormalities include chronic hyperglycemia, dyslipidemia and insulin resistance. Lipid abnormalities commonly found in patients of diabetes mellitus include increase in the levels of very low density lipoprotein cholesterol (VLDL-c), increased free fatty acid liberation, and increased endothelial nuclear factor KB. Some studies favoring this hypothesis indicate that oxidation of lipoproteins increases their atherogenic potential and these lipids from persons with diabetes mellitus are more susceptible to oxidation than those from normoglycemic persons<sup>8</sup>. The hepatic metabolism of lipoproteins is mainly controlled by insulin and this has implications for the lipid profiles and this increases the risk of developing ischemic heart disease by almost 20 fold. According to another study low HDLC is also felt to be a precursor of metabolic syndrome and type-II diabetes<sup>9</sup>.

Dyslipidemia, as defined by the World Health Organization (WHO), is considered to be present when: fasting plasma triglyceride  $>171$  mmol/L and plasma high density lipoprotein cholesterol  $<1.0$  mmol/l for men and  $<1.2$  mmol/L for women<sup>10</sup>. Characteristic abnormalities in lipids in type 2 diabetes mellitus include elevated triglycerides (TG) levels, decreased atheroprotective high density lipoprotein cholesterol (HDL-c) levels and increased levels of small

dense LDL-c. Dyslipidemia is a modifiable biological risk factor<sup>10</sup>. It is believed that the favorable atherogenic lipid profile at least partly explains the low incidence of IHD and myocardial infarction in the tropical black population. According to United Kingdom Prospective Diabetic Study (UKPDS), four key features of diabetic dyslipidemia are: 1) hyper-triglyceridemia, 2) a high proportion of small dense low-density lipoprotein-cholesterol (LDL), 3) low high-density lipoprotein-cholesterol (HDL), and 4) postprandial lipemia. Plasma LDL levels per se are not usually higher than those of nondiabetic patient. There is sufficient clinical evidence that high circulating levels of LDL and low levels of HDL are atherogenic, and that correcting these abnormalities slows the progression of CAD.

We studied 145 patients, and analyzed effects of various factors as age, gender, duration of diabetes, hypertension, BMI, and number of smoking pack years on dyslipidemia. We found out that hyperlipidemia was found to be present in 117 (80.7%) of the patients. Mean for total cholesterol level was  $202.03 \pm 39.24$  mg/dl. Mean triglyceride level was  $188.85 \pm 48.98$  mg/dl. Mean HDL level was  $38.82 \pm 8.32$ . Total serum cholesterol was found to be  $>180$  in 83 (57.2%) patients. Serum triglyceride was found to be  $>150$  in 102 (70.34%) patients. HDL was found to low in 116 (80%) patients. It suggested that low HDL was the most commonly identified dyslipidemia in patients with type 2 diabetes with hypertension followed by hypertriglyceridemia and then hypercholesterolemia. There was no significant effect of age, gender, duration of diabetes, hypertension, BMI, number of smoking pack years.

Our results were similar to those observed in other studies, as a study conducted in Nepal in 2012, a total of 108 type 2 diabetic were evaluated<sup>9</sup>. Their fasting lipid profile, fasting blood glucose, weight, height and blood pressure were evaluated. The prevalence of dyslipidemia (at least one abnormal lipid profile) was 90.7%. 24.1% had single dyslipidemia while 66.6% had combined dyslipidemia. Reduced HDL

constituted the highest single abnormality (62%) followed by hypertriglyceridemia (56.5%), hypercholesterolemia (53.7%) and high LDL in (44.4%). The duration of DM was not significantly associated with dyslipidemia ( $p>0.05$ )<sup>10</sup>.

Some studies also indicate that although there is inverse relationship between HDL levels and cardiovascular events, but it's difficult to establish a causal relationship<sup>13</sup>, resultantly they say that targeting low HDL with drugs is also of not much benefit<sup>14</sup> instead exercise, weight loss and smoking cessation is more beneficial<sup>15</sup>.

### CONCLUSION

Patients with type 2 diabetes mellitus and hypertension are at a high risk of having dyslipidemia, and the most commonly identified lipid abnormality in these patients is a low HDL level.

### CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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