

Dyslipidemia in Diabetic Patients with Acute Myocardial Infarction

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Abstract

The present study was undertaken to check the lipid profile in patients of acute myocardial infarction with chronic diabetes and to evaluate the variations in various lipid levels in different age, gender and in patients with different habits of diet, smoking and alcohol consumption. A total of 92 subjects aged between 40-70 years were included. 5 ml of fasting blood sample was collected from antecubital vein under aseptic precautions in a plain vacutainer and incubated at room temperature; serum was separated by centrifuge machine at 2000 rpm for 5 minutes. The samples were analyzed for estimation of four biochemical parameters: total cholesterol, serum triglyceride, serum HDL and blood sugar using Abbott Architect Autoanalyser. Mean levels of HDL were below the normal range in smokers and non-vegetarians whereas mean TG levels were elevated among alcoholics, smokers and non-vegetarians. High TG levels and low HDL levels are the predominant lipid abnormalities in chronic diabetic patients with AMI. There is also a significant association between smoking and these parameters.

Key Words

Diabetes mellitus, Triglyceride, Acute myocardial infarction, Coronary heart disease, Coronary artery disease, Coronary vascular diseases.

Introduction

The prevalence of type 2 diabetes mellitus worldwide is approximately 200 million and has been predicted to touch 366 million by 2030 (1). Type 2 diabetic patients have many risk factors for cardiovascular diseases which includes hyperglycemia, dyslipidemia, altered inflammatory mediators and coagulation profile. Dyslipidemia is the main contributing factor in the formation and progression of atherosclerosis which play a dominant role in causing CAD.

Insulin resistance is the main cause of type 2 diabetes mellitus which progressively deteriorates beta cell functions. Other causes which lead to development of insulin resistance are obesity, environmental factors, ageing and genetic defects. Insulin resistance leads to decreased disposal of insulin-stimulated glucose and release of many free fatty acids from adipocytes which inhibit the action of insulin on liver leading to increased gluconeogenesis (2). Hypercholesterolemia, has emerged as a strong risk factor for cardiovascular disease. Total cholesterol can be broken down into a diagnostic

lipoprotein profile, including high density lipoprotein (HDL), low density lipoprotein (LDL), intermediate density lipoprotein (IDL) and very low-density lipoprotein (VLDL).

HDL is considered to be beneficial as higher levels have a correlation with reduced risk of negative cardiovascular events, in large measures by promoting reverse cholesterol transport, an anti-atherogenic process resulting in cholesterol from peripheral tissues returning to the liver for subsequent processing (3). Elevated LDL cholesterol and TG are considered detrimental as their increased concentration is well correlated with poor cardiovascular outcome (4).

Atherosclerosis of coronary arteries is more severe and has diffuse pattern in diabetics than in non-diabetics. Myocardial infarction is one of the most serious diseases with high incidence and mortality. Mortality rate in AMI with diabetes is almost double than in general population and contributing factors could be autonomic neuropathy, diabetic cardiomyopathy and increased levels of non-

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esterified fatty acids which have adverse cardiac and metabolic effects (5). Therefore, for the successful management of CVD associated with diabetes, along with targeting hyperglycemia risk factors should be identified and treatment should also be targeted towards their improvement. The present study was undertaken to study the fasting blood sugar and lipid profile in patients of acute myocardial infarction with diabetes and to evaluate the variations in various lipid markers in these patients with different habits of diet, smoking, alcoholism, age and gender.

Material and Methods

The study was conducted at GMC, Jammu on subjects admitted in CCU unit with AMI. The approval of Institutional Ethics Committee was obtained. A total of 92 subjects aged between 40-70 years were included. All the four parameters, i.e. total cholesterol, serum triglyceride, serum HDL and fasting blood sugar were analysed within first 24 hours of acute episode by using fully automated analyzer SIEMEN. The diagnosis of AMI was established by clinical examination, ECG and serum cardiac enzymes estimation.

The patients were selected based on the following criteria: known diabetics (Type 2) with more than five years of duration, alcoholic or non-alcoholic, smoker or non-smoker, vegetarian or non-vegetarian.

The patients excluded from the study were those with thyroid dysfunction, liver or kidney disease, patients on hypolipidemic drugs, patients with previous attacks of AMI.

Fasting blood samples were collected from the patients admitted in the CCU. 5 ml blood was taken from the patients for the estimation of four biochemical parameters: total cholesterol, serum triglycerides, serum HDL and fasting blood sugar. Serum was separated from blood by centrifugation.

Results

Present study was carried out on 92 subjects, out of which 62 (67.39%) were males and 30 (32.61%) were females. Most patients were in the age group of 50 to 59 (n=23) years, followed by age group of 40 to 49 (n=22) and 60 to 69 (n=19) years. Among males, most were alcoholics (66.32%) and smokers (69.35%). No history of alcohol intake or smoking was observed in female patients. Around 56.52% patients were vegetarians and 43.48% non-vegetarians (Table 1).

Table 2 shows mean levels of blood sugar, cholesterol,

HDL, LDL, TG and VLDL. Gender wise, mean triglyceride levels were found to be above normal both in male and female patients, but more elevated in males while other parameters were within the normal range.

Among alcoholics, mean cholesterol level was seen in the upper limits of normal, mean HDL level was within the normal range, mean VLDL level was elevated, while mean triglyceride level was more elevated (Fig. 1).

Among smokers, mean HDL level was seen in the lower limits of the normal range, mean VLDL was elevated, while mean triglyceride level was more elevated (Fig. 2).

Among non-vegetarians, mean cholesterol level was seen in the upper limits of normal, mean HDL level was seen in the lower limits of the normal range, mean VLDL was elevated, while mean triglyceride level was more elevated (Fig. 3). Mean LDL level was normal in all the groups evaluated.

Table 1: Comparison of patients according to gender, lifestyle and dietary habits

Variables		No. (%)	Statistical inference (Fisher's exact test)
Males		62 (67.39)	p<0.0001**
Females		30 (32.61)	
Males	Alcoholics	41 (66.13)	p=0.0006**
	Non-alcoholics	21 (33.87)	
	Smokers	43 (69.35)	p<0.0001**
	Non-smokers	19 (30.65)	
Vegetarians		52 (56.52)	p=0.10*
Non-vegetarians		40 (43.48)	

*Not significant; **Highly significant

Discussion

Dyslipidemia is a predominant feature and an established risk factor for CAD in patients with Type 2 DM, and is seen to play an important role in the increased CVD risk associated with diabetes (6). The dyslipidemia associated with Type 2 DM is typically more complex than simple elevation of systemic low-density lipoprotein cholesterol (LDL-C) levels. The high atherogenicity associated with diabetic dyslipidemia is probably related

Table 2: Mean levels of blood sugar, serum cholesterol, HDL, LDL, TG and VLDL (mg/dl)

Distribution of Patients	Mean Sugar levels	Mean Serum cholesterol levels	Mean HDL levels	Mean LDL Levels	Mean TG levels	Mean VLDL levels
Males (n=62)	158.4	174.3	41.2	90.1	215	43
Females (n=30)	169.3	169.5	42.8	93.3	165.6	33.1
Alcoholics (n=41)	154.5	190	44.1	91.3	273.1	54.6
Non-alcoholics (n=51)	167.7	174.1	43.0	98.3	164.2	32.8
Smokers (n=43)	138.5	161.0	32.5	76.2	261.4	52.3
Non-smokers (n=49)	167.4	172.0	43.9	96.3	159.1	31.8
Vegetarians (n=52)	179	161.1	44.6	83	167.7	33.5
Non-vegetarians (n=40)	154.1	180.8	34.0	93.3	267.3	53.5

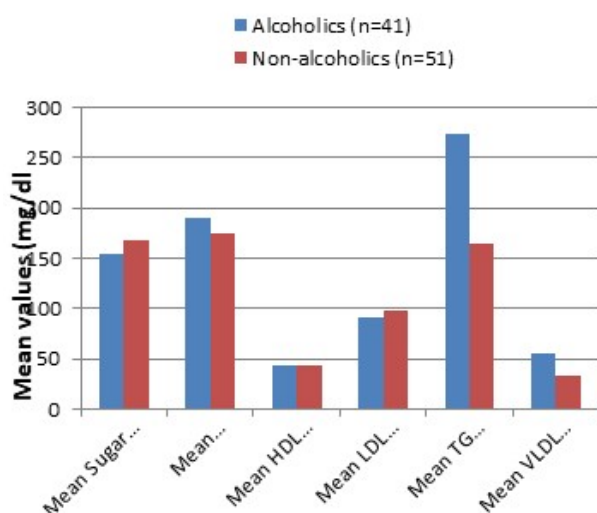


Fig. 1: Shows levels of all the parameters in alcoholics and non-alcoholics

to the characteristic finding of low plasma concentrations of HDL-C, elevated levels of apolipoprotein B and elevated TG levels, as well as to abnormalities in lipoprotein particle size and subclass distribution. Among the wide range of lipoprotein subclasses that have been described, disproportionate amounts of small, dense LDL particles and small HDL particles are thought to constitute a particularly atherogenic profile due to a high susceptibility to oxidation (7,8).

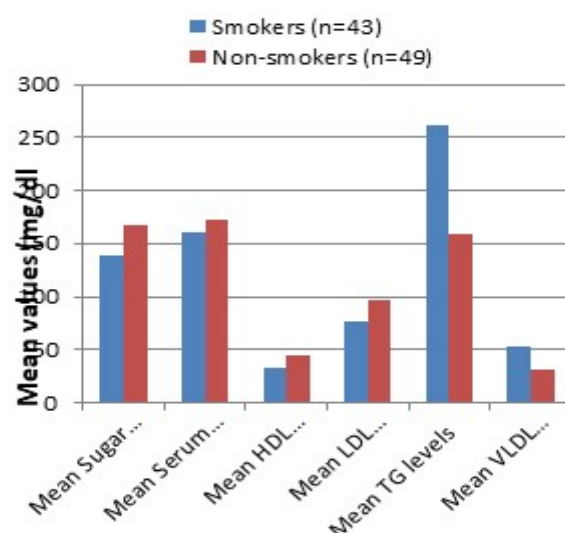


Fig. 2: Shows levels of all the parameters in smokers and non-smokers

In our study, total number of patients who participated were 92 in number, out of which the maximum number of participants were in the age group of 45-65 years. The numbers of male participants were 67.39% whereas the numbers of female participants were 32.61% both the genders had highly elevated blood sugar levels out of which females showed slight elevation as compared to males. The mean cholesterol levels in the population studied were found to be normal, though the levels in

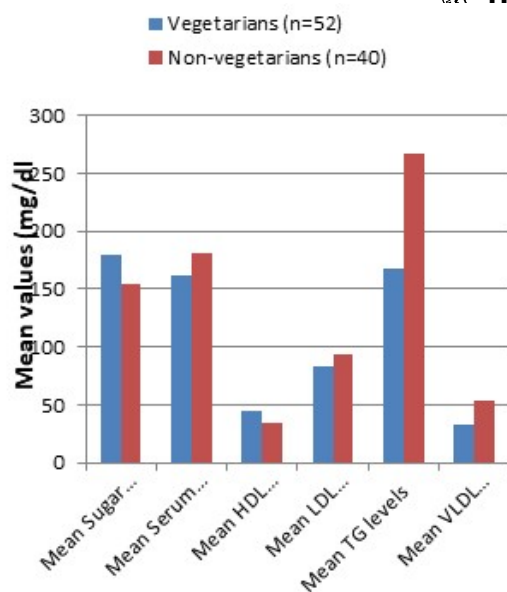


Fig. 3: Shows levels of all the parameters in vegetarians and non-vegetarians

alcoholic patients (190.0mg/dl), as well as in non-vegetarians (180.8mg/dl) were in the upper range of normal. On the contrary, Shivanand *et al.* in their study have shown high levels of the total cholesterol which were seen to increase with increase in age in males without correlation with female age (9).

The mean levels of HDL-C were significantly below the normal range especially in smokers (32.5mg/dl) and non-vegetarians (34.0 mg/dl). Mean HDL levels in the smokers were lowest among all the study groups evaluated

Mean TG levels were found to be elevated among non-vegetarians (267.3mg/dl) and smokers (261.4mg/dl) and highest among alcoholics (273.1 mg/dl) as compared to respective study groups evaluated. VLDL levels were elevated among alcoholics (54.6mg/dl), smokers (52.3mg/dl) and non-vegetarians (53.5mg/dl) whereas the mean LDL levels in the population studied were found to be normal.

In the study of Goldberg *et al.*, overall 30-40% of patients with diabetics had triglyceride levels >200mg/dl and 10% had TG >400 mg/dl and LDL cholesterol were the strongest independent predictor of CHID (10). Our results are also in accordance with the study done by Mufeed *et al.* who showed that levels of total cholesterol, VLDL- cholesterol, LDL-cholesterol and TG of patients with AMI in both genders were significantly high when compared with healthy controls but HDL-cholesterol was found to be decreased (11).

Dyslipidemia is one of the primary causes of coronary

artery disease (CAD). Elevated total cholesterol (TC), triglycerides (TG), low-density lipoprotein- cholesterol (LDL-C) and lowered high-density lipoprotein cholesterol (HDL-C) are conventional risk factors in myocardial infarction patients (6).

Iqbal *et al.* in their study have shown high prevalence of hypertriglyceridemia and low HDL-cholesterol (which constitute a component of metabolic syndrome) in Pakistani AMI patients suggesting that these two lipid abnormalities could be playing a major role in the development of atherosclerosis in Pakistani (7).

Khan *et al.* in their study have also observed significant decrease in HDL levels in AMI patients. High serum levels of HDL are associated with reduced risk for the development of atherosclerotic disease. HDL particles are anti-atherogenic, secondary to their capacity to drive cholesterol transport and antagonize inflammatory pathways, thrombosis and oxidation (12).

Aquel *et al.* have observed that low levels of HDL is a main risk factor in patients presenting with AMI in Kuwaiti patients suggesting that strategies of primary prevention should focus on modalities of treatment that increase HDL (13).

Gorecki *et al* in their study observed high levels of total cholesterol and LDL during the first 24 hours of AMI and these parameters have a strong negative prognostic value (14).

In the study conducted by Shivanand *et al.*, the mean values of all the lipid fractions (TC, TG, LDL and VLDL) were higher in diabetics, but there were decreased HDL levels in few age groups though not statistically significant, whereas several other studies have shown significantly low levels of HDL in diabetics (9).

High levels of TG in coronary heart disease have also been reported among Indians and Egyptians which could be due to their genetic makeup and nutritional habits involving high consumption of saturated fats (15).

In our study comparative analysis of lipid levels between males and females showed high levels among males as compared to females. Mean cholesterol levels were in the upper range of normal in males (174.3mg/dl) as compared to females (169.5mg/dl), whereas mean TG levels were significantly high in males (215.0mg/dl) especially in alcoholics (273.1mg/dl), smokers (261.4mg/dl) and non-vegetarians (267.3mg/dl) as compared to females (165.6 mg/dl). The comparative analysis of lipid levels between smokers and non-smokers showed high levels of TG among smokers (261.4mg/dl) as compared to non-smokers (159.1 mg/dl). Smokers showed

significantly low levels of HDL (32.5mg/dl) as compared to non-smokers (43.9mg/dl).

We have seen a significant correlation between smoking and lipid levels especially TG and HDL levels. Jabar Ali *et al.* have also shown cigarette smoking as a risk factor for cardiovascular disease in their study (16).

We also compared the levels among vegetarians and non-vegetarians, the levels of cholesterol were in upper range of normal in non-vegetarians (180.8 mg/dl) as compared to vegetarians (161.1mg/dl) whereas the levels of TG were significantly high in non-vegetarians (267.3mg/dl) as compared to vegetarians (167.7mg/dl).

Similarly, when the levels were compared between alcoholics and non-alcoholics, alcoholics showed significantly high mean TG levels (273.1mg/dl) as compared to non-alcoholics (164.2mg/dl). The mean HDL levels in alcoholics (44.1mg/dl) and non-alcoholics (43.0mg/dl) were found to be within the normal range. Alcohol induces an increase in HDL levels, reduces LDL and lipoprotein - a levels and a decrease in insulin resistance (17). Gerlich *et al.*, in their study have observed that alcohol consumption is an important risk factor for an acute attack of Myocardial infarction (18). Some studies have reported that heavy intake of alcohol promotes the progression of atherosclerosis whereas binge drinking triggers an embolic stroke and AMI. Thus, heavy alcohol consumption may be associated with increased morbidity and mortality rate. Since alcohol consumption and concomitant smoking are very common in general population so making people aware of the triggering effect of these factors on AMI may help to decrease the incidence of this life-threatening coronary event.

Conclusion

Our data shows that high levels of TG and low levels of HDL cholesterol are the most prominent lipid abnormalities in chronic diabetic patients with AMI. These two lipid abnormalities constitute an important component of metabolic syndrome known as atherogenic dyslipidemia. Our dietary habits could also have contributed to this dyslipidemia in AMI patients. A focus on strategies to decrease TG levels and increase HDL cholesterol levels in diabetic patients such as cessation of smoking and alcohol and use of low-fat diet but high in polyunsaturated fatty acids and decreased consumption of saturated and trans fatty acids greatly reduce future coronary events.

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