Cardiovascular Risk Status According To Lipids Levels In Type 2 Diabetic Patients

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Abstract: Background: Diabetes mellitus is a common secondary cause of hyperlipidaemia, particularly, if glycaemic control is poor, which in-turn is an important risk factor for atherosclerosis and coronary heart diseases. The aim of the study was to define dyslipidaemia pattern among type 2 diabetic patients using ATP (Adult treatment panel) III guidelines for the classification of lipoprotein concentrations into cardio vascular disease risk categories. Method: The present study was conducted on 100 type 2 diabetics males aged 40-60 years. Among them, 30patients having HbA1c levels ≤7 were categorized as having good glycaemic control (group-1), and 70 patients having HbA1c levels >7 were categorized as having poor glycaemic control (group-2). We assessed the percentage of patients falling into desirable, borderline and high risk categories according to the criteria laid down by ATP III guidelines. Result: Mean age (49.09 vs 50.5 years, P=0.13) and duration of diabetes (6.9 vs 8 years, P=0.07) was not different between the two groups. Compared to good glycaemic control group, diabetics with poor glycaemic control were significantly more in high cardiovascular risk status ($P < 0.05$) according total cholesterol levels. According to LDL-C levels and TG levels number of diabetics with poor glycaemic control were significantly higher in borderline cardiovascular risk status ($P<0.01$). Conclusion: We concluded that diabetic patients particularly those with poor glycaemic control are at high cardiovascular risk status according to serum cholesterol levels and borderline risk according to LDL-C levels and TG levels. Reductions in Trans and saturated fats are mainstays for reducing LDL-C. Reduced body weight (10%), more physical activity and improvement in glycaemic control more favourably modified TG, HDL-C and LDL-C.

Key Words: Cardiovascular risk status, HbA1c, Lipid profile

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Introduction: The first systematic description was written by the Arelaeus of cappadosis in Asia Minor, probably in the 1st century AD, the disease as "A melting down of flesh into the urine". The discovery by Van Mering and Minikowaski in 1889 that pancreactomy causes a metabolic disorder called Diabetes mellitus is the result of insulin deficiency. It is characterized by either the absence of insulin that is Type 1 or which is insensitive to the insulin that is Type 2. It is a complex disease where the carbohydrate and fat metabolism is impaired[1]. Type 2 diabetes is a disorder of insulin resistance and failure of Beta cell of pancreas causing chronic hyperglycaemia.[2] According to the International Diabetes Federation (IDF), India has more diabetics than any other country in the world after china, diabetes affects more than 50 million Indians , 7.1% of the nation's adults and kills about 1 million Indians a year.[3] Macro-vascular complications such as myocardial infarction, stroke, and peripheral vascular disease, are common causes of morbidity and premature mortality.[4] Micro- vascular disease, primarily affecting the nerves, eyes, and kidneys, can lead to neuropathy, blindness, and renal failure. Cardiovascular diseases (CVD) are the number one cause of death globally: more people die annually from CVDs than from any other cause .An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke. Low- and middle-income countries are disproportionally affected: over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women.[5]

There is high risk of cardiovascular diseases in people with type 2 diabetes, while cardiovascular death in top killer in this population. Eighty percent of mortality in adults with type 2 diabetics results from complications of coronary artery disease, or peripheral arterial diseases.[6] Epidemiological studies have shown that diabetics have 2-4 times higher risk of developing cardiovascular diseases. An elevated concentration of Triglyceride(TG) and LDL –C are a major risk factor for atherosclerosis and coronary heart disease(CHD) .[7] Elevations in LDL-C can produce full blown atherosclerosis and premature CHD in the complete absence of other

risk factor. Using the current National Cholesterol Education Programme Adult Treatment Panel III guideline, diabetes is considered to be a CHD risk equivalent.[8]Diabetes mellitus is a common secondary cause of hyperlipidaemia, particularly, if glycaemic control is poor, which in-turn is an important risk factor for atherosclerosis and coronary heart diseases. Diabetes care is complex and requires that many issues, beyond glycaemic control, be addressed. It is a chronic disease and usually irreversible. Therefore the patients with diabetes often have to consult health-care providers for the remainder of their lives.
They are prone to certain complications and evidence supporting the benefits of glycaemic control as well as control of blood pressure and lipid levels in the prevention or delay in onset & severity of diabetes complications.[9]

Material and Method: The study was conducted on 100 type-2 diabetic patients with permission from Institutional Ethics committee. All our subjects were males between 40 to 60 years age. They were all non smokers, normotensives, with moderate built and moderately active life style. Those with history of alcoholism, familial dyslipidemia, renal disorders, endocrine disorders and those on lipid lowering drugs and beta blockers were excluded from the study. After eliciting history, detailed physical and systemic examination anthropometric measurements were done. Blood samples were collected in fasting state for following serum investigations:

Lipid profile: Fasting total cholesterol, TG and HDL-C was tested by "End point Biochemistry" method.[10] The serum LDL-C concentration was calculated from the serum concentrations of total cholesterol, HDL-C and TG using the formula, LDL-C = TC – (HDL-C+TG/5)(mg/dl). The VLDL-C concentration was calculated from the values of TG (as TG/5). (2) Fasting blood glucose by Glucose oxidase-Peroxidase (God-Pod) method. (Normal level: 70-110 mg/dl).(3) HbA1C by ion exchange resin method (Normal: ≤7 *%)* .(4) Post prandial blood glucose (PP_2BS). (Normal level: < 140 mg/dl). 30 patients having HbA1c levels ≤7 were categorized as having good glycaemic control (group-1), and 70 patients having HbA1c levels > 7 were categorized as having poor glycaemic control (group-2). We assessed the percentage of patients falling into desirable, borderline and high risk categories according to the criteria laid down by Adult treatment panel III of National Cholesterol Education Program (NCEP).

Students' T- test was applied to compare the general parameters between the 2 groups; chi square test (with Yates correction) was applied to compare number of patients with the cardiovascular risk parameters in the two groups as well as within each group. P value of < 0.05 was considered as statistically significant.

Result: Mean age and duration of diabetes in between good glycaemic control and poor glycaemic control group are not different. (P value > 0.05)

Table 1: Mean Age and duration of diabetes in the two groups (values are mean ± SD)

	Good glycaemic control (HbA1c ≤7%) N=30	**poor glycaemic control (HbA1c >7%) N=70**	**P value**
Age (years)	49.09 ± 5.80	50.5 ± 5.66	0.13
Duration of Diabetes (years)	6.9 ± 3.05	8 ± 3.36	0.07

Cardiovascular risk status according to LDL-C levels:
In our study (table-2) out of 100 type-2 diabetic patients 29, 52 and 19 patients had low, borderline and high risk LDL-C levels respectively. Out of 30 patients with good glycaemic control 23 (76.66%) had low risk, 05 (16.67%) had borderline risk and 02 (6.67%) had high risk LDL-C levels. Out of 70 patients with poor glycaemic control 06 (8.57%) had low risk, 47 (67.14%) had borderline risk and 17(24.29%) had high risk LDL-C levels. Low, borderline and high cardiovascular risk status was statistically significant between good and poor glycaemic control group according to LDL-C levels.

Table 2: Category of cardiovascular risk status based on lipid levels

Lipids	Recommended level for adults with Diabetes	Cardio-vascular risk	No. of patients	Group 1 Patients with good glycaemic control (HbA1c ≤7%)	Group 2 Patients with poor glycaemic control (HbA1c >7%)	P value (comparing two Groups)
LDL-C	<100 mg/dl	Low	29	23	06	0.00
	100-129 mg/dl	Borderline	52	05	47	0.0008
	≥130 mg /dl	High	19	02	17	0.06
	P value (comparing risk levels)			0.000	0.000	
HDL-C	<35 mg/dl	High	13	02	11	0.23
	35-45 mg/dl	Borderline	21	04	17	0.27
	>45 mg/dl	Low	66	24	42	0.25
	P value (comparing risk levels)			0.26	0.56	
TG	<200 mg/dl	Low	46	24	22	0.03
	200-399mg/dl	Borderline	54	06	48	0.001
	(≥400mg/dl)	High	-	-	-	
	P value (comparing risk levels)			0.000	0.00	
Total cholesterol	<200 mg/dl	Low	34	25	9	0.02
	200-239mg/dl	Borderline	19	3	16	0.14
	(≥240mg/dl)	High	47	2	45	0.01
	P value (comparing risk levels)			0.000	0.002	

Thus our study demonstrates that diabetics especially the patients with poor glycaemic control are at high cardiovascular risk status as determined by their LDL-C levels.

Cardiovascular risk status according to HDL-C levels: In our study (table-2) out of 100 type-2 diabetic patients 66, 21 and 13 patients had low, borderline and high risk HDL-C levels respectively. Out of 30 patients with good glycaemic control 02 (6.67%) had high risk, 04(13.33%) had borderline risk and24 (80%) had low risk HDL-C levels. Out of 70 patients with poor glycaemic control 11(15.71%) had high risk, 17(24.29%) had borderline risk and 42 (60%) had low risk HDL-C levels. Low, borderline and high cardiovascular risk status was not statistically significant between good and poor glycaemic control group according to HDL-C levels. From our study we concluded that majority of our patients of both groups fall in low risk HDL-C category. More number of patients with poor HDL-C levels than those with good glycaemic control.

Cardiovascular risk status according to TG levels: In our study (table-2 shows that) out of 100 diabetic patients 46 had low risk and 54 had borderline TG levels. None had high risk TG levels. Out of 30 patients with good glycaemic control 24 (80%) had
low risk and 06 (20%) had borderline risk, and none had high risk TG levels .Out of 52 patients with poor glycaemic control 22 (31.43%) had low risk, 48 (68.57%) had borderline risk and and none had high risk TG levels. Low, borderline cardiovascular risk status was statistically significant between good and poor glycaemic control group according to TG level.

Cardiovascular risk status according to Serum cholesterol levels: In our study (table-2 shows that) out of 100 diabetic patients 34 had low risk and 19 had borderline TG levels, 47 had high risk Serum cholesterol. Out of 30 patients with good glycaemic control 25 (83.34%) had low risk and 3(10.00%) had borderline risk and 2 (06.66%) had high risk serum cholesterol levels .Out of 70 patients with poor glycaemic control 9 (12.87%) had low risk, 16 (22.86%) had borderline risk and 45 (64.27%) had high risk serum cholesterol levels. Low and high cardiovascular risk status were statically statistically significant between good and poor

glycaemic control group and not borderline cardiovascular risk according to Total Cholesterol level.

Thus, our study demonstrated that (i) greater number of patients with good glycaemic control had low cardiovascular risk TG levels (ii) greater number of patients with poor glycaemic control had borderline cardiovascular risk TG levels.iii) greater number of patients with high risk serum cholesterol and LDL-C were in poor glycaemic control, greater number of patient with low risk serum cholesterol were in good glycaemic control.

Discussion: Glycaemic control status of all the patients was determined on the basis of HbA1c levels, 30% patients had good glycaemic control and 70% had poor glycaemic control... Using Adult treatment panel III guidelines cardiovascular risk status based on lipid levels was determined. The patients with poor glycaemic control are at borderline to high cardiovascular risk status as determined by TG and LDL-C levels and serum cholesterol levels.

Eid Mohamed, Mafauzy Mohamed et al[12] studied 211 type 2 diabetic subjects and observed that 6(26 %) patients in the high risk HDL-C group, 65 (31 %) were in the borderline risk group, and 90 (43 %) were in the low risk group. Type 2 diabetic patients with high, borderline, and low risk LDL –C level were 131 (62 %), 53 (25 %) and 20 (10 %), respectively .Only seven (3 %) and 53(25 %) of patients had TG concentration in the high and borderline risk categories, respectively, but 151 (72 %) had a low risk TG level. Among the patients with good glycaemic control, 16 % and 84 % had TG level in the borderline high and low risk categories, respectively. In acceptable glycaemic control group the proportion of patients with high, borderline high and low risk TG were 3%, 27 % and 70 %, respectively. In poor glycaemic control group the high, borderline high and low risk TG were observed in 3 %, 25 % and 72 %patients, respectively. Significant differences in the proportions of patients with high, borderline high and low risk TG between glycaemic control groups were observed.

Similar results were found among urban African-Americans with type 2 Diabetes. In this study, Cook et al[13] found that the percentages of African-Americans with LDL-C >100 mg/dl was 86 %, HDL-C < 45 mg/dl was 74% and high and borderline triglycerides was 19 %. In another study in Malaysia, Ismail et al[14] found that 90.9 % of their subjects had LDL-C >100 mg/dl, 52.6 % had HDL-C < 45 mg/dl and 27.3 % had TG > 200 mg/dl. Nasir Ahmed et al [15] studied on 100 type 2 diabetic subjects and observed that patients with good glycaemic control (HbA1c ≤8%) were having better lipid profile than poorly controlled group. 78 were found to have Hypertriglyceridaemia, while, 92 had LDL-C in borderline cardiovascular risk status. Out of 78 patients with Hypertriglyceridaemia 46 (59%) were poorly controlled diabetics (HbA1c>8%) emphasizing the importance of good glycaemic control. However none of patients had a low HDL-C as found in some other study. Syed Shahid Habib[16] observed that 56.6, 23.6, 77.1 and 48.9 percent of diabetic's subjects had borderline to high risk levels of TC, TG, LDL-C and HDL-C respectively.

Shameem Ahmad Siddiqui et al[17] studied on 1200 type-2 diabetes patients. There was poor glycaemic control, in 87.5% subjects judged on blood HbA1c levels. These patients had higher total cholesterol, LDL-C and low HDL-C levels in blood. The percentage of patients with high, borderline and near optimal risk LDL-C was 62.7, 26.9 and 10.4% respectively, while HDL-C >40mg/dl were seen in 67%. Raised VLDL-C (above 40 mg/dl) was seen in 32.9% cases. The group with high LDL and VLDL is at risk of developing cardiovascular disease. Hypertriglyceridaemia was found in 55% and hypercholesterolemia in 45.4% cases.

Conclusion: Thus we concluded from our study that diabetic patients particularly those with poor glycaemic control are at high cardiovascular risk status according to LDL-C levels and serum cholesterol levels and borderline risk according to TG levels. Our study indicates prevalence of lipid disorders in patients with type-2 diabetes. There is a

positive association between dyslipidemia and glycaemic control. Raised triglyceride and LDL-C levels are established risk factors for coronary artery diseases. In addition to weight reduction, physical exercise and anti diabetic drugs for fair glycaemic controls, the optimal care of diabetic patients should also include periodic screening for lipid abnormalities. The lipid lowering drugs may also be considered for achieving effective lipid control. Reductions in Trans and saturated fats are mainstays for reducing LDL-C. Reduced body weight (10%), more physical activity and improvement in glycaemic control more favourably modified TG and HDL-C and LDL-C.

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