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Study of Pattern of Dyslipidaemia among Type 2 Diabetes Mellitus Patients Seeking Care in GMERS Medical College Patan, Gujarat, India

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Abstract

Background: Patients with type-2 diabetes have increased risk of myocardial infarction associated with atherogenic dyslipidemia. The diabetic dyslipidemia is characterised by elevations of low density lipoproteins (LDL), triglycerides (TG) and decreased high density lipoproteins (HDL). Lipid particles in diabetic dyslipidemia patients are more atherogenic than in non-diabetic people. Therefore, lipid abnormalities in diabetes should be aggressively treated the at the earlier.

Objective: (a) To study the pattern of dyslipidemia in diabetic patients, and (b) To compare lipid profile among patients with poor glycaemic control and good glycaemic control patients. (c) To access cardiovascular risk status according to criteria of Adult treatment panel III of National Cholesterol Education Program (NCEP).

Material & Method: The present study was carried out at GMERS medical college, Patan Gujarat during period from July 2018 to December 2018. All patient was advised for 12-14 hours overnight fasting and blood samples were collected on next morning before breakfast for lipid profile, FBS, PPBS, HbA1C. Cardiovascular risk status was evaluated according to the criteria of Adult treatment panel III of National Cholesterol Education Program (NCEP).

Results: Out of 150 patients, 46 (30.6%) patients had good glycaemic control and 104 (69.4%) had poor glycaemic control. 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.

Conclusion: From the present study we can conclude that diabetic patients with poor glycaemic control are at higher cardiovascular risk according to serum cholesterol, LDL-C levels and TG levels. In addition to glycemic control, HbA1c can be utilized as a potential biomarker to predict dyslipidemia in type 2 diabetic patients

Keywords: *Glycaemic control, HbA1c, Dyslipidemia, Cardiovascular risk.*

Introduction

Diabetes mellitus (DM) is a group of metabolic diseases caused by peripheral insulin resistance or impaired insulin secretion or both. It is characterised by impaired carbohydrate metabolism with raised blood glucose as well as altered lipid and protein metabolism.[1] According to International Diabetes Federation, 41 million diabetic patients were in India (2006) which will increase to 70 million in 2025. Majority of them are type 2 diabetic patients. [2] Diabetes mellitus is ranked 7th among leading causes of mortality in developing nations.[3] Coronary heart disease, stroke, diabetic retinopathy, diabetic renal disease and neuropathy etc are major complication of diabetes. Impaired lipid metabolism are major contributors to these complications. [4] Patients

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with type-2 diabetes have increased risk of myocardial infarction associated with atherogenic dyslipidemia. [5]

The diabetic dyslipidemia is characterised by elevations of low density lipoproteins (LDL), triglycerides (TG) and decreased high density lipoproteins (HDL). Lipid particles in diabetic dyslipidemia patients are more atherogenic than in non-diabetic people. [6] Serum triglycerides, Very Low Density Lipoproteins (VLDL), cholesterol are increased at fasting and after meal. In post meal, Low Density Lipoproteins (LDL) remain high for longer period. HDL remain low in type-2 diabetes patients with central obesity. [3] On other end, Insulin resistance causes unrestricted lipolysis leading to increased fatty acid flux in liver and increased synthesis of hepatic triglyceride. Also decreased triglyceride clearance due to less activity of endothelial insulin dependent lipoprotein lipase. [1] Also persistent hyperglycemia causes glycosylation of all proteins, especially collagen cross linking of arterial wall which leads to endothelial cell dysfunction and contributing further to atherosclerosis. [3] Therefore, lipid abnormalities in diabetes should be aggressively treated the at the earlier.

Various studies reported the existence of dyslipidemia in type 2 diabetes patients. [7, 8] In view of this study was caried out with objective to study pattern of dyslipidemia in type 2 diabetes mellitus patients attending out patients department of GMERS medical college in Patan, Gujarat.

Aims & Objective: (a) To study the pattern of dyslipidemia in diabetic patients, and (b) To compare lipid profile among patients with poor glycaemic control and good glycaemic control patients. (c) To access cardiovascular risk status according to criteria of Adult treatment panel III of National Cholesterol Education Program (NCEP).

Material & Method: This prospective cross-sectional study was carried out at GMERS medical college, Patan Gujarat after approval from Institutional Ethics committee. All the diabetic patients between 30 to 80 years who visited the diabetic clinic during period from July 2018 to December 2018 were included as study participants. An informed consent was taken from each patient. The patients with history of smoker, alcoholism, familial dyslipidemia, cerebrovascular disease, patients taking beta blockers and lipid lowering drugs were excluded from the study. Systemic examination and anthropometric measurements were done. All patients was advised for 12-14 hours overnight fasting and blood samples were collected on next morning before breakfast for following investigations:

- Lipid profile: Total cholesterol, TG and HDL-C were measured by "End point Biochemistry" method. The serum LDL-C concentration was calculated using the formula, "LDL-C = TC– (HDL-C+TG/5) (mg/dl)". The VLDL-C concentration was calculated from "TG/5" formula.
- Fasting blood glucose was measured by Glucose oxidase-peroxidase method. (Normal level: 70-110 mg/dl).
- HbA1C was measured by ion exchange resin method (Normal: ≤7 %).
- Post prandial blood glucose (PP2BS). (Normal level: < 140 mg/dl).

The data was collected by predesign, pretested questionnaire. Diabetic patients were classified into 2 groups according to their glycemic index. Total 46 patients were having good glycaemic (HbA1c levels ≤7, group-1), and 104 patients were categorized as having poor glycaemic control (HbA1c levels > 7group-2). We evaluated the patients falling into desirable, borderline and high risk categories according to the criteria of Adult treatment panel III of National Cholesterol Education Program (NCEP) [9].

Statistical analysis: Data was entered in Microsoft office excels 2007 and analyzed with Epi info 7.1 software. The values of parameters were given in mg/dL. Comparison of qualitative variables was analyzed by Chi square test. A p-value less than 0.05 was considered significant was considered significant.

Result: Mean age, gender and duration of diabetes in between good glycaemic control and poor glycaemic control group were comparable (p value > 0.05).

Table 1: Comparison of mean age, gender and duration of diabetes between two groups.

Characteristics	Good glycaemic control n=46	Poor glycaemic control n=104	p value
Age (year)	50.1 ± 4.70	51.1 ± 5.21	0.09
Duration of diabetes (year)	7.2 ± 2.08	8.1 ± 4.25	0.08
Male	31 (67.3%)	72 (69.2%)	0.12
Female	15 (32.6%)	32 (30.7%)	

Table 2: Shows cardiovascular risk status according to lipid profile of patients.

Cardiovascular risk status according to TG levels: Out of 150 diabetic patients 13 (8.7%) showed high risk TG levels. Another 68 (45.3%) and 69 (46.0%) patients had low and borderline TG level. Proportion of high cardiovascular risk status according to TG level was equal among both groups (8.7%) but borderline cardioascular risk status was significantly higher in patients with poor glycemic control (57.7%) as compared to good glycemic control (19.6%, p=0.001).

Cardiovascular risk status according to LDL-C levels: Out of 150 type-2 diabetic patients 43 (28.7%), 71 (47.3%) and 36 (24.0%) patients had low, borderline and high risk LDL-C levels respectively. Out of 46 patients with good glycaemic control 31 (67.4%) had low risk, 08 (17.4%) had borderline risk and 07 (15.2%) had high risk LDL-C levels. Out of 104 patients with poor glycaemic control, 12 (11.5%) had low risk, 63 (60.6%) had borderline risk and 29 (27.9%) had high risk LDL-C levels. Therefore, proportion of borderline and high cardiovascular risk status was significantly higher among poor glycaemic control group according to LDL-C levels.

Table 2: Cardiovascular risk status according to lipid profile of patients

Lipids	Recommended level for adults with Diabetes	Cardiovascular risk	No. of total patients (%)	Good glycaemic control n (%)	Poor glycaemic control n (%)	X^2 & p value
TG	<200 mg/dl	Low	68 (45.3)	33 (71.7)	35 (33.7)	$X^2 = 20.28$ p = 0.001
	200-399mg/dl	Borderline	69 (46.0)	9 (19.6)	60 (57.7)	
	≥400mg/dl	High	13 (8.7)	4 (8.7)	9 (8.7)	
LDL-C	<100 mg/dl	Low	43 (28.7)	31 (67.4)	12 (11.5)	$X^2 = 49.4$ p = 0.001
	100-129 mg/dl	Borderline	71 (47.3)	08 (17.4)	63 (60.6)	
	≥130 mg /dl	High	36 (24.0)	07 (15.2)	29 (27.9)	
HDL-C	<35 mg/dl	Low	88 (58.7)	33 (71.7)	55 (52.9)	$X^2 = 5.21$ p = 0.07
	35-45 mg/dl	Borderline	38 (25.3)	08 (17.4)	30 (28.8)	
	>45 mg/dl	High	26 (17.3)	05 (10.9)	21 (20.2)	
Total cholesterol	<200 mg/dl	Low	46 (30.7)	32 (69.6)	14 (13.5)	$X^2 = 49.2$ p = 0.001
	200-239mg/dl	Borderline	36 (24.0)	8 (17.4)	28 (26.9)	
	≥240mg/dl	High	68 (45.3)	6 (13.0)	62 (59.6)	
Total			**150 (100)**	**46 (100)**	**104 (100)**	

Cardiovascular risk status according to HDL-C levels: Total 88 (58.7%), 38 (25.3%) and 26 (17.3%) patients had low, borderline and high risk HDL-C levels respectively. There was no significant difference in cardio vascular risk between patients with poor glycemic control and good glycaemic control diabetes patients.

Cardiovascular risk status according to serum cholesterol levels: Out of 150 diabetic patients 46 (30.75) had low risk and 36 (24.0%) had borderline TG levels, 68 (45.3%) had high risk Serum cholesterol level. Out of 104 diabetes patients with poor glycemic control, 62 patients were categorized in high cardiovascular risk status according to cholesterol level which was significantly higher than patients with good glycaemic control (6, 13.0%).

Thus, it was observed that poor glycaemic control diabetes patients with high level of LDL and cholesterol level had higher cardiovascular risk and greater number of patients with poor glycaemic control had borderline cardiovascular risk TG levels.

Discussion

This study was carried out to evaluate cadiovascular risk status according to lipid profile of type 2 diabetes patients. The Diabetes complications and control trial (DCCT) suggested HbA1c as the gold standard of glycemic control. The level of HbA1c value ≤7.0% was appropriate for reducing the risk of cardiovascular complications[10]. Therefore, we categorized diabetic patients into 2 groups as per the HbA1c cutoff of 7.0%. Out of 150 patients, 46 (30.6%) patients had good

glycaemic control and 104 (69.4%) had poor glycaemic control. 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. TG, Cholesterol and LDL are well known risk factors for cardiovascular diseases. [11] High level of triglyceride, cholesterol, LDL-cholesterol and low HDL-cholesterol may be due to the lack of muscular exercise and increase calorie intake diabetes mellitus patients [12, 13].

Eid Mohamed, Mafauzy Mohamed et al[14] analyzed 211 type 2 diabetic subjects and reported 90 (43 %) were in the low risk group HDL-C groups, 65 (31 %) were in the borderline risk group and 6 (26 %) patients in the high risk group. Type 2 diabetic patients with low risk, borderline and high LDL–C level were 20 (10 %), 53 (25 %) and 131 (62 %) respectively. Only seven (3 %) and 53 (25 %) patients had high and borderline TG level categories respectively but 151 (72 %) had a low risk TG level. Among the good glycaemic control patients, 84 % and 16 % had low risk and borderline high TG level respectively. In patients with poor glycaemic control group the high, borderline high and low risk TG were observed in 3 %, 25 % and 72 % of patients respectively. It was reported that high risk TG was higher among poor glycemic control than good glycemic control patients. Shameem Ahmad Siddiqui et al [15] studied lipid profile among 1200 type-2 diabetes patients. Out of 1200, 87.5% subjects had poor glycaemic control. These patients had higher total cholesterol, LDL-C and low HDL-C levels in blood. The percentage of patients with high LDL-C was 62.7% while raised HDL-C (>40mg/dl) was seen in 67% patients. VLDL-C > 40 mg/dl was observed in 32.9% cases. Hypertriglyceridaemia and hypercholesterolemia were observed in 55% and 45.4% respectively.

Ram Vinod Mahato et al[11] conducted study among 294 type 2 diabetic patients. Patients with poor glycemic control had significantly higher value of TC (P=0.024), TG (P=0.030), LDL-C (P=0.011) as compared to the patients with HbA1c value ≤ 7.0%. Khan HA et al[16] also studied impact of glycaemic control on lipid parameters among 3 groups: group 1, good glycaemic control (HbA1c6%-9%) and group 3, worst glycaemic control (HbA1c>9%). There was no significant differences in TG, cholesterol, HDL level in 3 groups but significant difference among three groups was not observed in LDL-C level. M Agarwal [17]also reported that Proportion of dyslipidemia among uncontrolled diabetes patients (82.5%) was higher as compared to controlled or well-treated diabetes group (71.8%).

Severity of dyslipidemia increases with increasing HbA1c value. Dyslipidemia and higher HbA1c are independent risk factors of CVD. Therefore, diabetic patients with dyslipidemia and elevated HbA1c can be considered as a high risk group for CVD. Improving glycaemic control can decrease the risk of cardiovascular events in diabetics. [18] It was estimated that a reduction in HbA1c for only 1% reduces myocardial infarction by 14%, risk of microvascular complications by 37%, and diabetes-related deaths by 21%. [19]

Limitation of Study: In present study, there was small sample size; so further research should be conducted in this direction with larger sample size.

Conclusion

From the present study we can conclude that diabetic patients with poor glycaemic control are at higher cardiovascular risk according to serum cholesterol, LDL-C levels and TG levels. There is a positive association between glycaemic control in diabetes patients and dyslipidemia. This indicates that HbA1c can be utilised as a potential biomarker to predict dyslipidemia in type 2 diabetic patients in addition to glycemic control.

Declarations

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Conflict of Interest: Nil

Ethical approval: The study was approved by the Institutional Ethics Committee, GMERS medical college, Patan

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References

1. Sheshiah V, Balaji V. A handbook on Diabetes Mellitus. 6th ed. New Delhi: all india publishers & distributers. 2013:29-54.

2. Sicree R, Shaw J, Zimmet P. Diabetes and impaired glucose tolerance. In: Gan D, Diabetes Atlas. International Diabetes Federation, 3rd ed. Belgium: International Diabetes Federation. 2006; 15-09.
3. Bhambhani GD, Bhambhani RG, Thakor NC. Lipid profile of patients with diabetes mellitus: a cross sectional study. Int J Res Med Sci 2015; 3:3292-5.
4. Borle A, Chhari N, Gupta G, Bathma V. Study of prevalence and pattern of Dyslipidaemia in Type 2 Diabetes Mellitus patients attending Rural Health Training Centre of medical college in Bhopal, Madhya Pradesh, India. Int J Community Med Public Health 2016; 3:140-44.
5. American Diabetes Association. Diagnosis and Classification of Diabetes Mellitus, Diabetes Care. 2011, 34, 62-9.
6. Goldberg IJ. Clinical review 124: Diabetic Dyslipidemia: Causes and Consequences. J Clin Endocrinol Metabol. 2001; 86: 965-71.
7. Song Q, Liu X, Wang A, Wang Y, Zhou Y, Zhou W, et al. Associations between non-traditional lipid measures and risk for type 2 diabetes mellitus in a Chinese community population: a cross-sectional study. Lipids Health Dis. 2016; 15:70.
8. Gordon L, Ragoobirsingh D, Morrison E Y, Choo-Kang E, McGrowder D, Martorell E. Lipid profile of type 2 diabetic and hypertensive patients in the jamaican population. J Lab Physicians. 2010; 2:25-30.
9. Executive Summary of the Third Report of THE National Cholesterol Education Programe (NCEP)Expert Panel on detection, Evaluation, And Treatment of High Blood cholesterol in Adults (Adult Treatment Panel III)JAMA 2001; 285:2486-7
10. Rohlfing CL, Wiedmeyer HM, Little RR, England JD, Tennill A, Goldstein DE. Defining the relationship between plasma glucose and HbA1c: analysis of glucose profiles and HbA1c in the Diabetes Control and Complications Trial. Diabetes care. 2002 Feb 1; 25 (2):275-78.
11. VinodMahato R, Gyawali P, Raut PP, Regmi P, Singh KP, Pandeya DR, Gyawali P. Association between glycaemic control and serum lipid profile in type 2 diabetic patients: Glycated haemoglobin as a dual biomarker. Biomedical Research 2011; 22 (3): 375-80.
12. Das S, Samal KC, Tripathy BB. Factors influencing plasma lipids and lipoprotein cholesterol in Indian NIDDM. J. Dia. Assoc. Ind. 1992; 32 (2).
13. Yogi K. Lipid peroxide and human diseases. Chemistry and Physics of Lipid. 1999; 45:337-51.
14. Mohamed E, Mohamed M, Rashid FA. Dyslipidaemic pattern of patients with type 2 diabetes mellitus. The Malaysian journal of medical sciences: MJMS. 2004 Jan; 11 (1):44-1.
15. Syes SH. Frequency distribution of atherogenic dyslipidaemia in Saudi type 2 diabetic patients. Pak J Physiol 2006; 2 (2):20-2.
16. Khan HA, Sobki SH, Khan SA. Association between glycaemic control and serum lipids profile in type 2 diabetic patients: HbA 1c predicts dyslipidaemia. Clinical and experimental medicine. 2007 Mar 1; 7 (1):24-9.
17. Agarwal M, Patel JP, Lala MK. Association between glycemic control and serum lipid profile in known diabetic patients of Civil Hospital, Ahmedabad. International Journal of Medical Science and Public Health. 2016 Feb 1; 5 (2):356-61.
18. Selvin E, Wattanakit K, Steffes MW, Coresh J, Sharrett AR. HbA1c and peripheral arterial disease in diabetes: the Atherosclerosis Risk in Communities study. Diabetes care. 2006 Apr 1; 29 (4):877-82.
19. American Diabetes Association. Glycemic targets. Sec. 5. In standards of medical care in diabetes-2016. Diabetes Care 2016; 39 Suppl 1:S39-46.