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Original Article

Correlation between Glycated Hemoglobin and Dyslipidemia in Patients with Type 2 Diabetes Mellitus in a Tertiary Care Hospital, Maharashtra, India

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Abstract

Introduction: Dyslipidemia is one of the major risk factors for cardiovascular disease in diabetes mellitus Type 2. The aim of the study was to understand the pattern of dyslipidemia among the Type 2 diabetic patients and to understand its association with glycated hemoglobin (HBA1C).

Materials and Methods: This is a retrospective cross-sectional study carried out in KIMS, Karad, Maharashtra, India, to assess the relationship between glycemic control (as reflected by HBA1C) and serum lipid profile in Type 2 diabetic patients which included a total of 100 Type 2 diabetic patients (54 males; 46 females; mean age years). Venous blood samples were collected from all the patients after at least 8 h fasting.

Results: The sera were analyzed for HBA1C, fasting blood glucose (FBG), total cholesterol, triglycerides (TG), high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol. The levels of HBA1C, FBG, and LDL did not differ significantly between males and females. Female patients showed significantly higher serum cholesterol and HDL but significantly lower TG levels as compared to males. There was a highly significant correlation between HBA1C and FBG. Both HBA1C and FBG exhibited direct correlations with cholesterol, TG, and LDL and inverse correlation with HDL; the magnitude of significance for all these lipid parameters being greater with HBAIC than FBG. There was a linear relationship between HBA1C and dyslipidemia. The levels of serum cholesterol and TG were significantly higher and of HDL significantly lower in patients with worse glycemic control as compared to patients with good glycemic control.

Conclusion: The findings of this study clearly showed that HBA1C is not only a useful biomarker of long-term glycemic control but also a good predictor of lipid profile.

Key words: Cholesterol, Diabetes mellitus, Dyslipidemia, Glycated hemoglobin, High-density lipoprotein cholesterol, Low-density lipoprotein cholesterol, Triglycerides

INTRODUCTION

Dyslipidemia is one of the major risk factors for cardiovascular disease in diabetes mellitus Type 2.[1,2] The aim of the study was to understand the pattern of dyslipidemia among the Type 2 diabetic patients and to understand its association with Glycated hemoglobin (HBA1C).

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It is estimated that currently India has 62.4 million people with diabetes mellitus. This is a major public health challenge, and it is increasing in epidemic proportions. Chronic hyperglycemia leads to micro- and macro-vascular complications. The lipid abnormalities in diabetics such as increased cholesterol, increased LDH, high triglycerides (TG), and low high-density lipoprotein (HDL) are contributing to the mortality and morbidity. Worsening of glycemic control deteriorates lipid and lipoprotein abnormalities and particularly of diabetes mellitus. The combination of hyperglycemia, dyslipidemia, and hypertension produces enhanced atherogenic environment within the circulation. This leads to increased risk of ischemic heart disease, stroke, and myocardial infarction. Diabetes mellitus is considered as coronary heart disease

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equivalent. Insulin resistance, relative insulin deficiency, and obesity are associated with deranged lipid profile. The American Diabetes study has come to a conclusion that HBA1C <7 mg/dl signifies optimal blood glucose levels. The management should focus on controlling diabetes and managing lipid levels which will reduce mortality and morbidity for ischemic heart disease and other diabetic complications.[2,3-10]

HBA1C is routinely measured to check the glycemic control over a preceding 8-12 weeks of time. It is used as an indicator for the state of glycemic control. Progression of the disease and the development of the complications in diabetic patients. The aim of the study was to examine the impact of the glycemic control on the lipid profile of Type 2 diabetic patients and to know the importance of HBA1C as an indirect indicator of dyslipidemia.

MATERIALS AND METHODS

- Design of the study - Retrospective cross-sectional descriptive study
- Duration of the study - The study was carried out on diabetic patients during 6-month period from 1st January 2016 to 31th June 2016
- Source of the data - History, physical examination, laboratory investigations were obtained from the medical records department
- Method of collection of data - Total of 100 patients records were accessed from the medical records department in KIMS Karad.

Inclusion Criteria

All diagnosed cases of Type 2 diabetes mellitus.

Exclusion Criteria

- Age below 18 years
- Type 1 diabetics
- Patients on lipid lowering agents
- Acute coronary syndrome
- Stroke.

The lipid profile of the study was analyzed according to the ATP lll classification for identification of dyslipidemia, Low HDL <40 mg/dl.

High low-density lipoprotein (LDL) >190 mg/dl, high cholesterol >200 mg/dl, and high TG >200 mg/dl.

RESULTS

A total of 100 patients with Type 2 diabetes mellitus were followed (52 males and 48 females) (Figure 1). The mean age was 62.91 years with age range of 30-85 years (Table 1). Poor glycemic control (HBA1C >8) was seen in 62% of total patients. Poor glycemic control was associated with dyslipidemia in 41.5% of total patients, whereas 20.5% accounted for poor glycemic control without dyslipidemia, the maximum frequency of abnormal lipid profile status in all patients was low LDL cholesterol (LDL-C) (Tables 2 and 3) and the age group with maximum patients with both dyslipidemia and higher HBA1C levels was 51-60 years.

Table 1: Demographic data of diabetes mellitus

Number of cases	100
Male	52
Female	48
Mean age of year	62.91
Age range (year)	30-85

Table 2: Lipid profile and HBA1C of diabetic patients

Parameter	Mean±SD
Total cholesterol	149.73±47.37
TG	173.27±53.61
LDL	65.86±54.27
HDL	38.61±15.45
HBA1C	8.92±2.24

TG: Triglyceride, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, HBA1C: Glycated hemoglobin, SD: Standard deviation

Table 3: Frequency of abnormal lipid profile status in all patients

Dyslipidemia	Total	Male	Female
Hypercholestrolemia	36	17	19
Hypertriglyceridemia	32	14	18
low HDL-C	60	33	27
high LDL-C	8	3	5
No abnormal lipid profile	16	9	6
One abnormal lipid profile	45	20	25
Two abnormal lipid profile	28	14	14
>Two abnormal lipid profile	11	4	7

LDL-C: Low-density lipoprotein cholesterol, HDL-C: High-density lipoprotein cholesterol

DISCUSSION

In our study conducted in a tertiary health-care center in Maharashtra, India, the lipid profile, fasting blood glucose (FBG), and HBA1C were investigated. A total number of 100 patients were included in the study. Abnormality of cholesterol metabolism may lead to cardiovascular disease and heart attacks. This study reveals a high prevalence of hypercholesterolemia, hypertriglyceridemia, high LDL, and low HDL levels which are well-known risk factors for cardiovascular disease and incidence of poor glycemic control in Type 2 diabetic patients. Insulin affects the liver

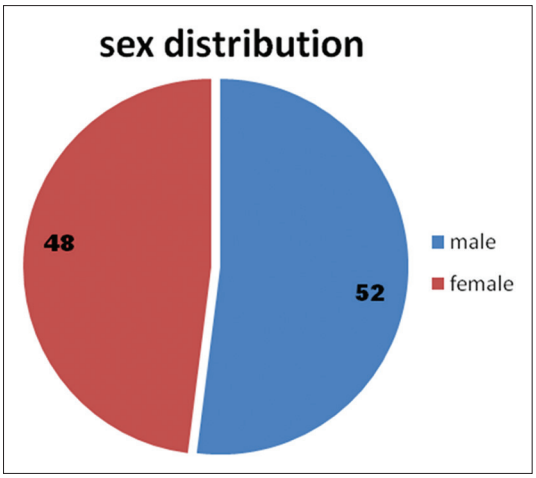

Figure 1: Sex distribution among study population

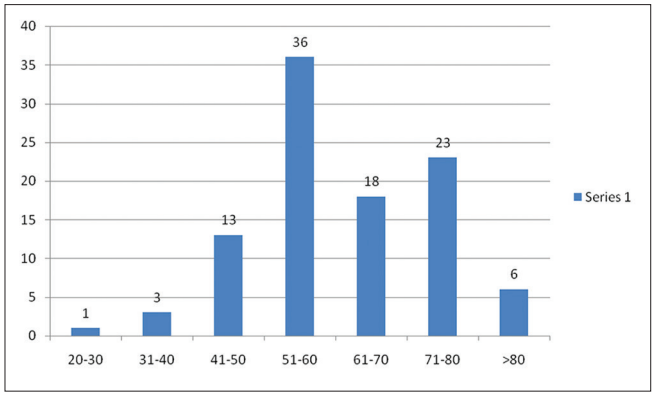

Figure 2: Age distribution among the study population

Apo-lipoprotein production. It regulates the enzymatic activity of lipoprotein lipase and cholesterol ester transfer protein. All these factors are likely cause of dyslipidemia in diabetes mellitus [11]. Worse glycemic control with dyslipidemia was seen maximum in the individual of the age group 51-60 years (Figure 2). The core of this study revolved around identification of an association between dyslipidemia and poor glycemic control. The percentage of dyslipidemic individuals among the study population amounted to 62%, among which 41.5% accounted for dyslipidemia with poor glycemic control (HBA1C >8 mg/dl), thus showing a positive correlation between dyslipidemia and HBA1C among patients in the population under study (Figure 4). The pattern of dyslipidemia showed that 84% of the patients with abnormal lipid profiles and 16% of patients has no lipid profile abnormality; one lipid profile abnormality was seen in 45% of the study population, 28% had two lipid profile abnormalities, and 11% of the individuals had more than two abnormal lipid profile parameters. 84% among the study group of 100 patients had lipid profile abnormalities, among these 36 patients had hypercholesterolemia, 32% had hypertriglyceridemia, 8% had high LDL-C, and 60% had

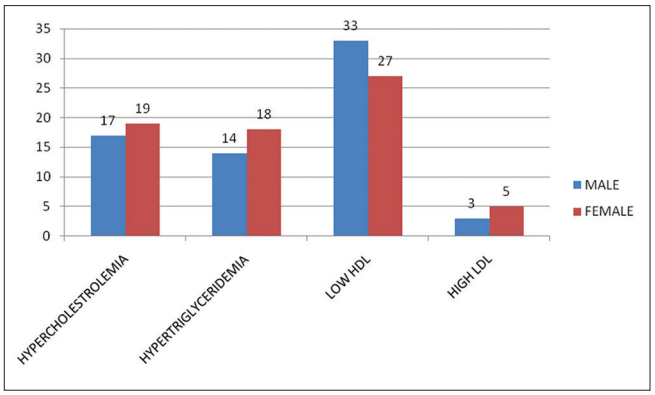

Figure 3: Lipid profile among diabetic patients

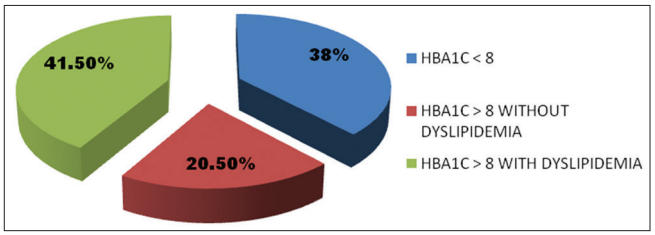

Figure 4: Correlationship between glycated hemoglobin and dyslipidemia

low HDL cholesterol levels (Figure 3). Lipid abnormalities were more significant in women study patients in comparison with those of the male study patients (Figure 3). The significant correlation between HBA1C and FBG is in accordance with various previous study done all over the world. Higher levels of FBG were noted in patients with poor glycemic control (84% of total study population of Type 2 diabetics).[11]

CONCLUSION

This study shows a clear and strong association between lipid profile and HBA1C. All the findings are consistent with other similar studies conducted different countries. Patients should be educated about regular monitoring of the lipid profiles and if found to be abnormal should control blood glucose and cholesterol very effectively. Achieving the target in HBA1C will contribute in improving the lipid state, and hence may lessen the diabetic complications in Type 2 diabetic patients.

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