RESEARCH

EVALUATION OF THE PREVALENCE & ATHEROGENIC INDEX AND THE PATTERN OF DYSLIPIDEMIA IN DIABETIC PATIENTS IN A TERTIARY CARE CENTRE IN WESTERN ODISHA, INDIA

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Abstract

Background: In India, Type 2 Diabetes Mellitus (T2DM) is one of the main causes of public health issues. One of the leading causes of morbidity and mortality in diabetes mellitus is cardiovascular disease (CVD). One of the key risk factors for atherosclerosis and CVD is dyslipidaemia, a consequence of diabetes mellitus. **Aim:** To evaluate the atherogenic index of plasma (AIP) in people with type 2 diabetes and determine the prevalence and pattern of dyslipidaemia. **Materials and Methods:** Between January 2020 and July 2020, 110 diabetic individuals who were not using any lipid-lowering medication participated in the trial. Fasting blood sugar, glycated haemoglobin, total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides were just a few of the variables examined. AIP, or atherogenic index of plasma, was developed. **Result:** 85.5% of total diabetic patients were detected to have dyslipidaemia. Most common type was isolated single parameter dyslipidaemia with low HDL (39.1%). Mixed dyslipidaemia was found in 7.3% diabetic patients. Individuals with poor glycaemic control (HbA1c≥ 7) were shown to have higher total and LDL cholesterol levels than patients with good glycaemic control (HbA1c <7) (p value<0.05). AIP > 0.24 indicated that 82.7% of all diabetic individuals were at high risk for CVD. **Conclusion:** Patients with type 2 diabetes mellitus were reported to have a high frequency of dyslipidaemia. Isolated single parameter dyslipidaemia with low HDL was the most prevalent form. According to AIP, the majority of patients were discovered to be at high risk for CVD.

INTRODUCTION

Type 2 diabetes, often known as T2DM or T2D, is a clinical condition marked by decreased insulin production and increased insulin resistance.[1] One of the most prevalent chronic diseases in the world, diabetes mellitus is on the rise. It is one of the top five causes of death. In India as well, it is a serious public health issue. In India, there were an estimated 62.4 million diabetic patients in 2011, and that figure is expected to increase to 101.2 million by 2030.[2,3,4] Beyond glycemic control, there are numerous factors that need to be addressed in diabetes care.[5] Although the primary clinical goal in managing diabetes is still glycemic control, long-term care focuses on preventing microvascular and macrovascular consequences. Cardiovascular disease is the main cause of death in diabetic people in about 80% of cases (CVD). Comparatively speaking, Asians are more likely than Whites to get coronary heart disease (CHD).[6] In particular, if glycaemic management is inadequate, which is a significant risk factor for atherosclerosis and coronary heart disease, hyperlipidaemia is a frequent consequence of diabetes mellitus.[7,8] Different forms of dyslipidaemia that are recognised in the general population can be included in diabetes mellitus. However, one phenotype that is primarily associated with insulin resistance and insulin deficit is more prevalent in diabetes mellitus patients. Low levels of high density lipoprotein cholesterol (HDL-C), a rise in low density lipoprotein cholesterol (LDL-C), and high levels of plasma triglycerides are characteristics of this phenotype (TG).[9] The logarithm of the ratio of plasma TG to HDL-C (log10 TG/HDL-C) is known as the atherogenic index of plasma (AIP). It closely relates to the risk of CVD. It can serve as a standalone index for calculating cardiac risk.[10] Any change in a lipid profile parameter's level raises a person's chance of developing atherosclerotic problems.[11] To estimate atherogenic risk, the atherogenic index can be

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employed as a supplement to the lipid profile. Compared to standard lipid measures, AIP is more helpful.[12,13] Even if the other parameters seem to be normal, it can be used as a signal.[14] The purpose of this study was to assess the atherogenic index in people with type 2 diabetes mellitus and determine the prevalence and different patterns of dyslipidaemia.[15,16]

MATERIALS AND METHODS

Hundred & ten (110) patients who were known to have type 2 diabetes mellitus and attended a tertiary care facility in Western Odisha, India, between January 2020 and July 2020 but were not taking any lipid-lowering medications participated in this cross-sectional study. The study covered patients who were older than 40 years. Critically sick patients and those with other secondary dyslipidaemia-related conditions were eliminated.

All of the patients were interviewed using a pre-designed pro forma after receiving informed consent. Following tests, investigation reports were examined by the biochemistry department. A number of variables were examined, including glycated haemoglobin (HbA1c), total cholesterol (TC), triglycerides (TG), low density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C). The autoanalyzer Cobas C311 was used to determine fasting plasma glucose and lipid profile, including TC, LDL-C, HDL-C, VLDL-C, and TG. The atherogenic index of plasma (AIP) was computed using the log10 TG/HDL-C calculation. Nephelometry was used to measure the amount of glycated haemoglobin.

Guidelines from the ATPIII (Adult Treatment Panel III) and NCEP (National Cholesterol Education Program) were used to diagnose dyslipidemia, which is indicated by one or more of the following criteria: LDL-C >100 mg/dl, TG >150 mg/dl, and HDL-C <40 mg/dl. Glycemic control was poor in patients with HbA1c ≥7% and in those with HbA1c<7%, glycemic control was considered good. Patients with dyslipidaemia were divided into three groups: mixed dyslipidaemia (all three parameters TG, LDL-C and HDL-C were abnormal), combined two parameter dyslipidaemia (any two parameters abnormal), and isolated single parameter dyslipidaemia (any one parameter abnormal). Patients with good diabetes control (HbA1c < 7%) and those with poor glycaemic control (HbA1c ≥7%) had their lipid profile values compared.[5] AIP was used to group patients into three risk categories: low risk (-0.3 to 0.1), medium risk (0.1 to 0.24), and high risk (greater than 0.24).[17] SPSS version 20 was used to analyse the data. Descriptive data were used to determine the number of patients with dyslipidaemia in each category (males and females, patients with good glycemic control and patients with poor glycemic control). Descriptive data were also used to determine the number of patients in each category with low, moderate, and high CVD risk. Using an independent samples T test, the means of various parameters, including Fasting plasma glucose and HbA1c between patients with and without dyslipidemia, as well as TC, HDL-C, LDL-C, TG, and AIP, were compared between males and females. Graphs and tables were created with Microsoft Word.

RESULTS

Among 110 type 2 diabetic patients who were included in the study, 56 were males and 54 were females. 85.5% of total patients were found to have dyslipidaemia [Figure 1].Among males, 82.1% patients had dyslipidaemia. Whereas in females, the proportion of patients with dyslipidaemia was 88.9% [Figure 2].

The proportion of patients with mixed (combined three parameter) dyslipidaemia, combined two parameter dyslipidaemia and isolated single parameter dyslipidaemia were 7.3%, 29.1% and 49.1% respectively. Among the male diabetic patients, the proportions of mixed (combined three parameter) dyslipidaemia, combined two parameter dyslipidaemia and isolated single parameter dyslipidaemia were found to be 7.1%, 25% and 50% respectively. Among females, 7.4%, 33.3% and 48.2% of patients had mixed (combined three parameter) dyslipidaemia, combined two parameter dyslipidaemia and isolated single parameter dyslipidaemia respectively [Table 1].

The most common pattern of dyslipidaemia was isolated single parameter dyslipidaemia. Isolated dyslipidaemia with low HDL-C was found to be most common in both males (39.3%) and females (38.9%). Second most common pattern was combined two parameter dyslipidaemia with high triglycerides and low HDL-C in both males (23.2%) and females (31.5%).None of the patients had isolated single parameter dyslipidaemia with high triglycerides and combined two parameter dyslipidaemia with high LDL-C and triglycerides.

No statistically significant difference was found in parameters such as age, fasting plasma glucose (FPG), glycated haemoglobin (HbA1c), total cholesterol (TC), HDL cholesterol (HDL-C), LDL cholesterol (LDL-C), triglycerides (TG) between males and females. Also, there was no statistically significant difference in variables like age, FPG and HbA1c between patients with dyslipidaemia and those without dyslipidaemia.

Out of the 110 patients enrolled in the study, 71(64.5%) patients had poor glycaemic control (HbA1c≥7). Statistically significant elevation of total cholesterol and LDL cholesterol was found in patients with poor glycaemic control as compared to those with good glycaemic control (HbA1c<7) [Table 2]. The patients with dyslipidaemia in patients with good glycaemic control and patients

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with poor glycaemic control were 84.8% and 86.0% respectively [Table 3].

Among the total subjects, 91 (82.7%) were found to be at high risk for CVD (AIP >0.24), 12 patients (10.9%) were at moderate risk (AIP 0.1 to 0.24) and 7 (6.3%) had low risk for CVD (AIP -0.3 to 0.1) [Table 4].

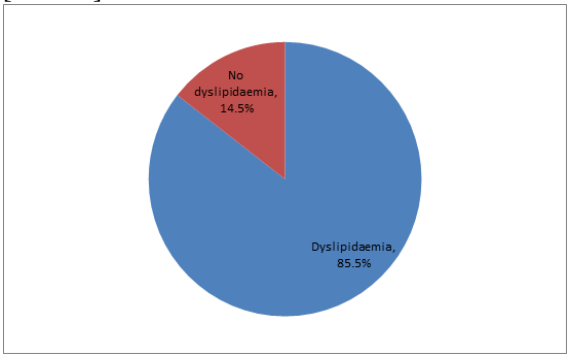

Figure 1: Prevalence of dyslipidaemia in type 2 Diabetes mellitus patients.

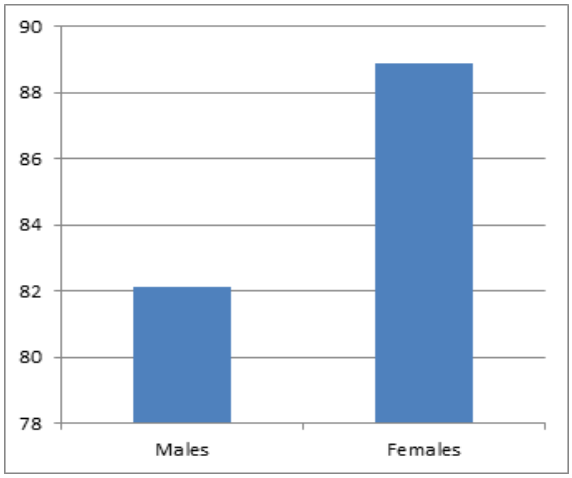

Figure 2: Prevalence of dyslipidaemia in males and females.

Table 1: Prevalence of different types of dyslipidaemia in males and females.

	Males	Females	Total
Mixed	7.1%	7.4%	7.3%
Combined two parameter dyslipidaemia	25%	33.4%	29.1%
LDL-C>100 & HDL-C<40	1.8%	1.9%	1.8%
TG>150 & HDL-C<40	23.2%	31.5%	27.3%
Isolated single parameter dyslipidaemia	50%	48.2%	49.1%
LDL-C>100	10.7%	9.3%	10%
HDL-C<40	39.3%	38.9%	39.1%

Table 2: Comparison of lipid parameters in patients having poor glycemic control with patients with good glycemic control.

	HbA_{1c}<7	HbA_{1c}≥7	p value
TC	116.23±31.07	132.15±50.44	.004
HDL-C	33.59±13.22	33.97±11.20	.576
LDL-C	55.08±26.77	73.65±45.39	.008
TG	150.15±98.62	158.21±117.25	.48
AIP	0.61±0.36	0.56±0.34	0.73

Table 3: Comparison of the prevalence of various kinds of dyslipidaemia in patients with and without good glycemic control.

	HbA_{1c}<7	HbA_{1c}≥7
Mixed	2.6%	9.9%
Combined two parameter dyslipidaemia	33.4%	26.8%
LDL-C>100 & HDL-C <40	2.6%	1.4%
HDL-C<40 & TG>150	30.8%	25.4%
Isolated single parameter dyslipidaemia	48.8%	49.3%
LDL-C>100	2.6%	14.1%
HDL-C<40	46.2%	35.2%

Table 4: According to AIP, the number of patients with low, moderate, and high CVD risk in persons with both good and poor glycemic control.

	Low Risk	Moderate Risk	High Risk
HbA1c<7	1	6	32
HbA1c ≥7	6	6	59

DISCUSSION

It is widely known that people with type-2 diabetes mellitus have a significantly increased risk of macrovascular problems due to dyslipidaemia (T2DM). Diabetes dyslipidaemia frequently shows up as increased triglyceride levels(TG), decreased HDL cholesterol, or increased levels of low-density lipoprotein cholesterol (LDL-C). Guidelines from the Adult Treatment Panel III (ATPIII) and National Cholesterol Education Programme (NCEP) defined dyslipidaemia as having one or more of the following abnormalities in the blood: triglycerides >150 mg/dl, HDL cholesterol <40 mg/dl, or LDL cholesterol >100 mg/dl.[18] In our study, 85.5% of total diabetic patients were found to have

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dyslipidaemia which was similar to different studies done in the past in different parts of India.[18,19,20,21,22]The prevalence was also similar to a study done in Nepal.[23]

No statistically significant difference in lipid parameters were found in males and females.

In our study, 64.5% patients were in the category of those having poor glycaemic control (HbA1c≥7). Patients with poor glycaemic control had statistically higher total and LDL cholesterol levels than did patients with adequate glycaemic control.

A study conducted in Nepal found that isolated single parameter dyslipidaemia with low HDL-C was the most prevalent pattern.[23] In contrast, a study conducted in Bhopal, Madhya Pradesh, India, found that mixed dyslipidaemia—a condition in which TG and LDL-C were elevated while HDL-C was decreased—was the most prevalent pattern.[21]

AIP revealed that 82.7% of the total individuals had a high risk of developing CVD (AIP > 0.24). Moderate risk (AIP 0.1 to 0.24) and low risk (AIP -0.3 to 0.1), respectively, were 10.9% and 6.3%.

Patients were found to be at high risk for CVD in 85.3% of cases of poor glycaemic control and 80% of cases of good glycaemic control.

Diabetic patients' dyslipidaemia is brought on by insulin resistance or insufficiency, which encourages visceral adipocyte lipolysis and raises plasma and liver free fatty acid levels. Additionally, the endothelium enzyme lipoprotein lipase's activity declines. AIP revealed that 82.7% of the total individuals had a high risk of developing CVD (AIP > 0.24). AIP 0.1 to 0.24) and low risk, respectively, were 9.9% and 6.3%. (AIP -0.3 to 0.1).

Patients were found to be at high risk for CVD in 85.3% of cases of poor glycaemic control and 80% of cases of good glycaemic control.

In diabetic patients dyslipidaemia is brought on by insulin resistance or insufficiency, which encourages visceral adipocyte lipolysis and raises plasma and liver free fatty acid levels. Additionally, the endothelium enzyme lipoprotein lipase activity declines. All of these result in hepatic steatosis, increased plasma levels of bigger, TG-rich very low density lipoprotein 1 (VLDL1) particles, increased hepatic apolipoprotein B (ApoB) secretion, poor chylomicron clearance, and reduced receptor-mediated endocytosis in the liver.[24,25] The decrease in HDL-C may be caused by increased hepatic lipase activity, which catalyses HDL cholesterol.[26]

CONCLUSION

In conclusion, Patients with type 2 diabetes mellitus were reported to have a high frequency of dyslipidaemia. Isolated single parameter dyslipidaemia with low HDL cholesterol was the most prevalent kind of dyslipidaemia. Most diabetic patients have a high risk of developing cardiovascular disease.

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