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Research Article

Prevalence and Patterns of Dyslipidemia among Type 2 Diabetes Mellitus Patients in Mukalla City ,Yemen, in 2017

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Abstract

Background: Patients with diabetes mellitus are at high risk of cardiovascular events because of abnormal lipid levels status. Dyslipidemia is common in patients with type 2 diabetes mellitus. However; in Yemen this issue was not yet addressed. The aim of this study is to determine the prevalence and patterns of dyslipidemia in patients with T2DM in Mukalla city, Yemen, in 2017.

Methodology: A Cross-sectional study was conducted in a randomly selected eligible patients from the diabetic registry of the AL Noor Charity Center (ACC), Mukalla city in eastern Yemen during the period from May-July 2017. A well structured questionnaire and blood investigation for lipid profile and blood sugar were the tools of data collection from 120 randomly selected T2DM patients registered in the ACC.

The prevalence of dyslipidemia in type 2 diabetic patients was 85%, prevalence of dyslipidemia in males was 86% while in females was 84% but the difference was not significant (P-value 0.4).

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Regarding age group, BMI and duration of DM, there is no significant association exist with dyslipidemia. About half of the studied T2DM patients have high serum cholesterol level (52.5%), while 22.5% had low serum HDL- C levels and 39.2% had high serum triglyceride level, most of patients had serum LDL-C levels above normal range (67.5%), so the common patterns of dyslipidemia in this study were LDL-C followed by cholesterol.

Conclusion: High prevalence of dyslipidemia among type 2 diabetes mellitus in Mukalla city were observed and so the common patterns of dyslipidemia is LDL-C followed by cholesterol. This study emphasizes the importance of screening of lipid profile as these abnormalities may lead to development of cardiovascular diseases.

Keywords: Diabetes Mellitus (DM); Dyslipidemia; Yemen

Introduction

Diabetes Mellitus (DM) is a syndrome consisting of metabolic, vascular and neuropathic components that are interrelated. It is defined as group of metabolic disorder that is characterized by hyperglycemia resulting from defect in insulin secretion, insulin action or both, which leads to alteration in carbohydrate, fat and protein metabolism [1].

Type1 Diabetes Mellitus (T1DM) and Type 2 Diabetes Mellitus (T2DM) are the commonest types of DM, this classification is important for both clinically in assessing the need for treatment, and also in understanding the causes of diabetes which are entirely different in the two groups [2]. Type 2 Diabetes Mellitus is a heterogeneous condition characterized by the presence of both impaired insulin secretion and insulin resistance [3].

Diabetes is a major global health problem. It has been estimated that there are about 366 million diabetes patients worldwide and the majority of them are suffering from diabetes type 2 [4]. Six countries in the Middle East are rated among the top 10 countries in the world with the highest prevalence of diabetes [5]. Yemen is now reported rapid increase in the incidence of diabetes [6]. In the year 2000, the prevalence of diabetes in the whole of Yemen increased from 4.7 to 6.57 %, in 2004, the total prevalence of type 2 diabetes mellitus in the urban cities of Yemen was about 4.6 % [7,8].

Diabetes care is complex and requires that many issues, beyond glycemic control, be addressed [9]. They are prone to certain complications and evidence emerged in the 1990's supporting the benefits of glycemic control as well as control of blood pressure and lipid levels in the prevention or delay in onset and severity of diabetes complications [10,11]. Glycemic control remains the major clinical objective in management of diabetes whereas long-term management targets in prevention of micro vascular and macro vascular complications.

Diabetes mellitus is a common secondary cause of hyperlipidemia, particularly if glycemic control is poor, which in-turn is an important risk factor for atherosclerosis and coronary heart disease [12,13]. The lipid abnormalities are common in DM because insulin

resistance or deficiency affects key enzymes and pathways in lipid metabolism [14]. A range of 70% to 97% of adults with type 2 diabetes have one or more lipid abnormalities, this called diabetic dyslipidemia or atherogenic dyslipidemia [15,16]. Diabetic dyslipidemia is characterized by elevated Triglycerides (TG) level, low High-Density Lipoprotein Cholesterol (HDL-C) level and the presence of smaller and denser Low-Density Lipoprotein Cholesterol (LDL-C) particles [17,18]. Besides, abnormality in the level of each of the major lipids has been independently related with increased risk of cardiovascular disease [19].

Dyslipidemia is may be primary (genetic) or secondary and diagnosed by measuring plasma levels of Total Cholesterol (TC), Triglycerides (TG), and individual lipoproteins. It is traditionally classified by patterns of elevation in lipids and lipoproteins [20].

Dyslipidemia is a well-recognized and modifiable risk factor that should be identified early to institute aggressive cardiovascular preventive management [21]. Patients with T2DM are at greater risk of developing vascular diseases because of lipid changes. Lipid abnormalities and insulin use is critically discussed in diabetics [22]. The most typical lipoprotein pattern reported in diabetes, also known as diabetic dyslipidemia or atherogenic dyslipidemia consists of moderate elevation in (TG) levels, and low (HDL-C) values. These variations in lipid profile in DM should not be generalized to all region and should be individualized to specific regions as ethnic, hereditary and environmental factors influence lipid profile for regional example, in the United Arab Emirates (UAE) showed that 31% of diabetic patients suffered from dyslipidemia, and in Jordan present over 90% of patients with T2DM had one or more types of dyslipidemia The most common of dyslipidemia in these study was high (LDL-C) and high (TG) [23,24]. However; in Yemen this issue was not yet addressed. The aim of this study is to determine the prevalence and patterns of dyslipidemia in patients with T2DM in Mukalla city, Yemen, in 2017.

Patients and Methods

Patients

All adults (both males and females) at age of > 40 years, who receiving care in Al-Noor Charity Center (ACC) during the period from May-July 2017 constituted the study population for purpose of this work. A sample size of 120 eligible patients was statistically calculated based on an expected proportion of 34.29% [25,26].

The Inclusion criteria were determined as all medically diagnosed T2DM patients above 40 years of age of both sex (male and female) who registered on diabetic treatment schedule and visited ACC at regular intervals) while patients who already taking lipid-lowering drugs and pregnant women were excluded. ACC is a primary health care center and it is a community based services center of NGO in Mukalla city at eastern Yemen. It is the only center in Mukalla establishing diabetic registry and clinic ten years ago.

Methods

A Cross-sectional study was conducted in a randomly selected eligible patients from the diabetic registry of the AL Noor Charity Center (ACC), Mukalla city in Yemen during the period from May-July 2017. A well structured questionnaire was the tool for data collection from patients. The questionnaire include personal data, family history, history of the illness. Samples of blood were collected from

patients by well trained 4th medical laboratory students in Hadramout University. All the obtained data are fed on computer using the statistical package of social sciences version (SPSS version 23). Statistical methods used for univariate analysis are mean, median, standard deviation, range and interquartile range, for bivariate analysis, independent t-test for difference between two sample means, chi square test for association between categorical variables. A cut-off point of 0.05 was determined for significance level.

A total 120 blood samples were collected from patients with T2DM > 40 year who receiving care in ACC, every patient spent at least 12-14 hours overnight fasting and the 5 ml venous blood sample was collected in a disposable syringe on morning (before breakfast) for the serum lipid profile and fasting blood glucose. After that the blood dispensed in a gel tube and left to clot at room temperature (25 °C), and then separated by centrifuge at (3000 rpm) for 10 minutes to collect serum. Spectrophotometer was used to determine fasting blood glucose and cobas integra 400 pulse was used to estimate the lipid profile (TG -TC -LDL-C - HDL-C). All patients agreed to participate, a signed consent were taken from them.

Laboratory investigation

Blood sample was collected for estimation Fasting Blood Glucose (FBG) and serum lipid profile including Total Cholesterol (TC), Triglyceride (TG), High Density Lipoprotein Cholesterol (HDL-C), and Low Density Lipoprotein Cholesterol (LDL-C). The FBG estimation of enzymatic method, glucose oxidase and peroxidase method by use spectrophotometer . This method is linear up to 500 mg/dl, all samples exceeding 500 mg/dl they are diluted and re-assayed. The results were multiplied by the dilution factor. The lipid profile (TC - TG - HDL-C) estimation of enzymatic method by use cobas integra 400 pluse. TC by cholesterol oxidase - peroxidase method, TG by glycerol phosphate oxidase - peroxidase method , HDL- C by cholesterol oxidase - peroxidase method , and LDL-C calculation by Freidewald Formulae. LDL-C = Total Cholesterol - HDL - (Triglycerides/5).

The outcome variables

Fasting Blood Glucose (FBG) normal range (70-110 mg/dl), Low Density Lipoprotein Cholesterol (LDL-C) normal range (50-100 mg/dl), High Density Lipoprotein Cholesterol (HDL-C) normal range, male (40-100 mg/dl), female (50-110 mg/dl), Triglyceride (TG) normal range (60-150 mg/dl), Total Cholesterol (TC) normal range (140-200 mg/dl) [27]. Other outcome variables are: Body Mass Index (BMI) based on classification of world health organization, 2015 as Underweight (BMI less than 18) average (18-24), Overweight (25.0-30) and Obesity (BMI > 30).

The criteria for abnormal lipid levels were used based on the American Diabetes Association 2004 [28]. Hypercholesterolemia referred to a Total Cholesterol (TC) level of ≥ 200 mg/dl, HDL-C was considered low when the level is < 40 mg/dl in males, and < 50 mg/dl in females; LDL-C was considered high when the level is ≥ 100 mg/dl; Hyper-Triglyceridemia (TG) referred to a level ≥ 150 mg/dl. Dyslipidemia was defined using the National Cholesterol Education Programme - Adult Treatment Panel III (NCEP - ATP III) (2002) as the presence of one or more of the previous abnormalities in serum lipids. Atherogenic dyslipidemia was defined according to the international diabetes federation as elevated triglyceride and low HDL-C .

Results

The mean age of participants was 54.81 years (± 9.33). Out of 120 diabetic patients enrolled in the study, 61 were females (50.8%), 52.4% were unemployed, 30% were illiterates, 35.8% were overweight and 25% were obese (Table 1).

Characteristics		Frequency	Percentage %
Age	41-50 years	47	39.2
	51-60 years	43	35.8
	> 60 years	30	25
Gender	Male	59	49.2
	Female	61	50.8
Occupation	Government	29	24.2
	Private work	28	23.4
	unemployed	63	52.4
	Illiterate	36	30
	Read and write	26	21.7
Education status	Primary	33	27.5
	Secondary	14	11.7
BMI	University+	11	9.1
	Average (BMI = 18-24)	47	39.2
	Over-weight (BMI = 25-30)	43	35.8
	Obese (BMI > 30)	30	25

Table 1: Demographic characteristics the studied Type 2 diabetic patients attending AL Noor Charity Clinic (ACC), Mukalla city, in 2017.

The prevalence of dyslipidemia in type 2 diabetic patients was 85%, prevalence of dyslipidemia in males was 86% while in females was 84% but the difference was not significant (P-value 0.4). Regarding age group, BMI and duration of DM, there is no significant association exist with dyslipidemia (Table 2).

The mean serum cholesterol level was 204.66 mg/dl (±49.39), mean serum triglyceride was 143.52 mg/dl (±70.57), mean serum HDL-C was 50.70 mg/dl (±15.97), mean serum LDL-C was 124.77 mg/dl (±42.64) (Table 2). About half of the studied DM patients have high serum cholesterol level (52.5%), while 22.5% had low serum HDL-C levels and 39.2% had high serum triglyceride level, most of patients had serum LDL-C levels above normal range (67.5%), so the common patterns of dyslipidemia in this study were LDL-C followed by cholesterol (Table 3).

Discussion

Patients with Diabetes Mellitus have a high prevalence of atherosclerosis and Coronary Artery Disease (CAD). The major risk factors in DM are hyperglycemia, dyslipidemia and hypertension [29]. There is a twofold to fourfold excess risk of coronary artery disease in type 2 DM compared to non-diabetics [30]. Various patterns of lipid abnormalities are seen in patients with type 2 DM. Lipid abnormalities may be the result of the unbalanced metabolic state of diabetes (i.e. hyperglycemia and insulin resistance) and improved control of hyperglycemia does moderate diabetes-associated dyslipidemia [30].

The overall prevalence of diabetic dyslipidemia in this study was found to be 85.00%. This result was consistent with findings in other studies in India 82.5%,Tanzania 83.0% and in Nepal 85.33% but was lower than what was reported in Jordan where over 90% of patients with type 2 DM had one or more types of dyslipidemia [24, 31-33]. The difference between the results of this study and Jordan study extended to the types of dyslipidemia, in this study; 52.5% of T2DM participants had hypercholesterolemia while in Jordan was 77.2%, low High-Density Lipoprotein (HDL) was 22.5% while in Jordan was 83.9%, the high LDL (91.5%) were observed in Jordan while in this study was 67.5%. The variation in the patterns of dyslipidemia may be the result of the variations in the dietary habits.

Characteristic		Number of Diabetic patients have dyslipidemia n= 102	Number of Diabetic patients have no dyslipidemia n=18	Total N= 120	Prevalence of dyslipidemia	P-value
Sex	Male	51	8	59	86%	
	Female	51	10	61	84%	0.43
	Total	102	18	120	85%	
Age	41-54 years	51	8	59	86%	
	>54 years	51	10	61	84%	0.43
	Total	102	18	120	85%	
BMI	Average	39	8	47	82%	
	Over weight/obese	63	10	73	86%	0.532
	Total	102	18	120	85%	
Duration of DM	≤10 years	79	16	95	83%	
	>10 years	23	2	25	92%	0.222
	Total	102	18	120	85%	

Table 2: Prevalence of dyslipidemia among type 2DM by gender in Mukalla city, Yemen.

Lipid indicator	Mean ± SD	Abnormal value	Normal		Abnormal	
			Frequency	Percentage %	Frequency	Percentage %
Cholesterol	204.66 ± 49.39	200≤	57	47.5	47.5	52.5
Triglyceride	143.52 ± 70.57	150≤	73	60.8	60.8	39.2
HDL	50.70 ± 15.97	<40	93	77.5	77.5	22.5
LDL	124.77 ± 42.64	>100	39	32.5	32.5	67.5
FBS	184.50 ± 38.18	>110	23	19.2	19.2	80.8

Table 3: Indicators of lipid profile among T2DM patients, ACC, Mukalla, in 2017.

The common Diabetic dyslipidemia pattern were reported elsewhere. Diabetic dyslipidemia typically consists of elevated triglyceride, low High-Density Lipoprotein Cholesterol (HDL-C), and the predominance of small dense Low-Density Lipoprotein (LDL) particles [34]. Fonseca VA and Dragana Lovre D in 2017 reported that dyslipidemia characterized by elevated plasma Triglyceride (TG), low levels of High-Density Lipoprotein Cholesterol (HDL-C) and increased small, dense Low-Density Lipoprotein (LDL) particles [35]. Also Haider J. Warraich HJ and ; Jamal S. Rana JS in 2017 emphasized on the similar definition and reported that particular to individuals with diabetes is the pattern of elevated triglycerides, small dense low density lipoprotein cholesterol, and reduced levels of high density lipoprotein cholesterol, described as dyslipidemia of diabetes [36]. Moreover, although LDL lowering has been particularly beneficial in people with diabetes but plasma LDL concentrations are similar to the concentrations in people without diabetes, and there was no difference in LDL levels between type 1 and 2 DM patients [37].

In this study, the commonest lipid abnormality being elevated LDL-C (67.50%) followed by low HDL-C (25%). Although the pattern of dyslipidemia in this study differed from the "typical" diabetic dyslipidemia (namely high TG and low HDL-C with no difference in the levels of TC or LDL-C). But Similar findings were also noted in the Third US National Health and Nutritional Examination Survey and the Behavioral Risk factors Surveillance System where majority DM patients had LDL-C of 58% in Gaborone in Ghana and Nepal [33,37-39].

Four independent factors were investigated in this study regarding dyslipidemia, age, sex BMI and duration of DM; none of them appear any significant association with dyslipidemia in T2DM . controversial results were found in different studies. Regarding gender; the mean Low-Density Lipoprotein (LDL) levels were higher in females than in males but there was no difference in cholesterol, triglyceride and High-Density Lipoprotein (HDL) levels between genders [37]. Women and men with Type 2 Diabetes Mellitus (T2DM) have an increased incidence of atherosclerotic cardiovascular disease which is attributed to multiple risk factors including dyslipidemia. Regarding age and BMI; Presence of dyslipidemia was significantly associated with increasing age, smoking status, hypertension, diabetes, and body mass index [40]. Despite the young age of the group under study, they already present a high prevalence of dyslipidemia, which is an important risk factor for cardiovascular disease [41]. Hyperlipidemia was associated with high body mass index [37]. The determinants of dyslipidemia identified in this study higher body mass index [42].

The difference in prevalence, patterns and associated factors of dylipidemia in different countries and studies sue to complex factors but genetic predisposition may be and diet habits may be important factors, although precise reason for such dyslipidemia is unknown, genetic predisposition and characteristic body composition (excess truncal subcutaneous fat and intra abdominal fat) may be important contributors.

Limitation of the study

The study subjects were restricted to patients over 40 years of age and above while patients at or under 40 years of age were not enrolled in the study including children, hope this limitation is further covered in future studies.

Conclusion

High prevalence of dyslipidemia among type 2 diabetes mellitus in Mukalla city were observed and so the common patterns of dyslipidemia is LDL-C followed by cholesterol. This study emphasizes the importance of screening of lipid profile as these abnormalities may lead to development of cardiovascular diseases. Hence we recommend type 2 diabetic patient should undergo the routine monitoring of blood sugar and lipid profile so that any abnormalities can be identified and preventive measures along with interventions can be initiated at the earliest.

Competing Interest

Authors have declared that no competing of interests exist.

Authors Contributions

The first author design the proposal, supervise the whole work, write the discussion section. The second author revised the proposal, supervise the data collection phase. The other authors participated in design in the proposal, data collection, and laboratory investigations. All the authors participated in data analysis and writing the raft report. Author and all co-authors revise and approve the final manuscript.

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