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Original Article

Success Rate in Achieving Guideline Targets for Lipid Parameters for Atherosclerotic Cardiovascular Risk Prevention in Patients with Type 2 Diabetes mellitus: A Retrospective Analysis

Hande Erman

Department of Internal Medicine, University of Health Sciences, Kartal Dr. Lütfi Kırdar City Hospital, İstanbul, Türkiye

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Correspondence: Hande Erman, Sağlık Bilimleri Üniversitesi, Kartal Dr. Lütfi Kırdar Şehir Hastanesi, İç Hastalıkları Kliniği, İstanbul, Türkiye
E-mail: handeerman@yahoo.com

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ABSTRACT

Objective: Atherosclerotic cardiovascular disease (ASCVD) is a major cause of morbidity and mortality worldwide. The aim of the study was to reveal the success rates of glycemic control, serum low-density lipoprotein cholesterol (LDL-C), serum triglyceride (TG), and non-high-density lipoprotein cholesterol (non-HDL-C) targets in type 2 diabetes mellitus (T2DM) patients according to recent guidelines.

Methods: The study was a retrospective observational study of 389 previously diagnosed T2DM patients (217 women and 172 men) in an outpatient diabetes clinic. Demographic characteristics, comorbidities, medications, and laboratory measurements were recorded from the electronic system. ASCVD risks and target rates for LDL-C, TG, non-HDL-C, and HbA1c were evaluated according to 2019 European Society of Cardiology (ESC)/European Atherosclerosis Society (EAS) guidelines.

Results: In total subjects, mean values of age, BMI, and HbA1c were 57.95±9.53 years, 31.45±5.36 kg/m^2, and 7.83±1.35%, respectively. Of the total cases, 22.6% had moderate, 12.6% had high, and 64.8% had very high ASCVD risks. The percentages of patients with target LDC-C, TG, and Non-HDL-c values were low in overall patient group (7.8%, 45.5%, and 8.9%, respectively). Coronary artery disease was found more frequently in men with T2DM than in women (p=0.001). Diabetic polyneuropathy was seen more prominent in patients with statin treatment (p<0.001). Although lower LDL-C was seen in patients under statin treatment (p<0.001), the percentage of patients with target LDL-C was similar in both groups (p=0.239). In this study 8.9% of total T2DM patients were on target for Non-HDL-C values. It is noteworthy that, patients using statins have lower Non-HDL-C and better target rates (p<0.001 and p=0.029). In patients with >7% HbA1c, LDL-C target success rates were lower (p=0.028), but Non-HDL-C target success rates were higher (p=0.039).

Conclusion: In this pilot observation, the rate of achievement of the lipid targets recommended by 2019 ESC/EAS was low. More attention is needed to achieve success rates of lipid parameters and manage the risk of ASCVD in T2DM patients.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most common chronic diseases in the last decades, causing disabling and costly complications that result in poor quality of life. According to the International Diabetes Foundation, the worldwide prevalence of diabetes was 536.6 million in 2021 and is expected to increase to 783.2 million people by 2045.[1] In 2013, a nationally representative study reported that the prevalence of T2DM in Turkey was 13.7%. Furthermore, it was estimated that 31.5% of Turkish adults will be diagnosed with diabetes by 2025.[2] The increasing burden of DM forces clinicians to be aware of the best management strategies for the complications and comorbidities in T2DM. Although maintaining optimal glycemic control is considered the primary goal of diabetes management, it is not enough to prevent both microvascular and macrovascular complications of diabetes.[3] According to the guidelines of the European Society of Cardiology (ESC)/European Atherosclerosis Society (EAS), in addition

to glycemic control, which is accepted as <7% for HbA1c, the achievement of treatment targets for LDL-C, non-HDL-C, and serum TG is important for cardiovascular disease (CVD) prevention.[4] Recent evidence suggested that the initiating factor in atherosclerosis is the retention of LDL-C and the cholesterol-rich apolipoprotein (Apo)-B-containing lipoproteins within the arterial intima.[5] Furthermore, the causal effect of LDL-C on ASCVD risk is supposed to be related to both absolute magnitude and cumulative duration of exposure to LDL-C.[6] Therefore, the earlier and targeted approach to dyslipidemia in T2DM patients may have a major impact on atherosclerosis. To target better management strategies for lipid profile control of T2DM patients, first, we aimed to demonstrate the achievement rates for serum lipids in T2DM patients. The findings of the study will further provide evidence for the management of cardiovascular risk factors in patients with T2DM.

MATERIALS AND METHODS

Study population

This study is a retrospective analysis investigating the success state of T2DM patients in the achievement-targeted lipid parameters according to ESC guidelines. Inclusion criteria consisted of previously confirmed T2DM patients, either male or female, between the ages of 18 and 75 years. Patients with thyroid disease, malignancy, pregnancy, and known hemoglobinopathies in their records were excluded from the study.

The measurements of all parameters were performed in the same outpatient clinic. The demographic characteristics, laboratory parameters, medications, and comorbidities of all patients were collected from electronic medical records. Body mass index (BMI) was calculated using the formula weight (kg)/height $(m)^2$. Laboratory parameters included fasting blood glucose, glycated hemoglobin (HbA1c), liver and renal function tests, serum albumin, total cholesterol, LDL-C, TG, and non-HDL-C were recorded manually from the electronic records. Serum levels of LDL-C were calculated according to the Friedewald formula. Total cholesterol, TG, and non-HDL-C were measured by conventional methods with commercially available kits (COBAS 311, Roche Diagnostics GmbH, Mannheim, Germany), and serum glucose measurements were determined enzymatically using the hexokinase method (Roche Diagnostics GmbH, Mannheim, Germany). HbA1c was measured with high-performance liquid chromatography. The urinary albumin–creatinine ratio was calculated, and microalbuminuria was defined when urine albumin/creatinine was 30–300 µg/mg. eGFR was calculated based on the Modification of Diet in Renal Disease formula that is recommended in patients with diabetes.[7] The institutional Ethics Committee approval (no.: 2022/514/222/31; dated March 30, 2022) was obtained before the beginning of the study, and a waiver of informed consent was approved due to the retrospective design of the study.

Definitions

T2DM patients were classified according to atherosclerotic cardiovascular disease (ASCVD) risk on available ESC guidelines.[4] Young T2DM patients (<50 years) with DM duration <10 years, without other risk factors categorized as moderate risk. Patients with DM without target organ damage, with DM duration >10 years, or another additional risk factor were categorized as high risk. Patients with target organ damage or documented ASCVD, either clinical or unequivocal on imaging categorized as very high risk. The same guidelines were used to define LDL-C, non-HDL-C, and TG targets.[4] According to the standards of ESC for the goals for cardiovascular prevention, the components of each lipid were defined as follows: TG <150 mg/dL was defined as on target; non-HDL-C <85, 100, and 130 mg/dL were defined as on target for very high, high, and moderate risk people, respectively. Risk stratification for LDL-C is as follows: in individuals at moderate risk <100 mg/dL, in patients at high risk <70 mg/dL, in patients with very high-risk LDL-C goal of <55 mg/dL are recommended.[4] In this study, LDL-C levels on target are assessed according to recommendations by ASCVD risk stratification.

Statistical analysis

Continuous data were expressed as mean±standard deviation (SD). Descriptive statistics were conducted according to gender, glycemic control status, and presence of statins in treatment. The categorical variables were expressed as numbers and percentages. Laboratory parameters, presence of comorbidities, and diabetic complications were compared. The Mann–Whitney U tests were used to calculate the difference between continuous variables and ordinal variables. Pearson's chi-squared or Fisher's exact test was used to identify the difference between categorical variables. The SPSS statistics V.24.0 software package (IBM) was used for the statistical analysis of the data. Two-sided $p<0.05$ was considered statistically significant.

RESULTS

A total of 389 patients (217 women and 172 men) were enrolled in this study. Table 1 shows the characteristics of the study subjects. In total subjects, mean values of age, BMI, and HbA1c were 57.95±9.53, 31.45±5.36, and 7.83±1.35, respectively. Of the total cases, 22.6% had moderate, 12.6% had high, and 64.8% had very high ASCVD risks. High and very high ASCVD risks are more common in men, while the moderate risk of ASCVD is more pronounced in women ($p=0.053$). Serum LDL-C, TG, total cholesterol, and non-HDL-C values are compared in Table 1. No dramatic differences were observed in lipid parameters between men and women. When patients were evaluated according to ESC/EAS 2019 hyperlipidemia guideline targets, the number of patients on target for LDL-C, TG, and non-HDL-C was low in the overall patient group (7.8%, 45.5%, and 8.9%, respectively). T2DM with microalbuminuria was found in 30.1% of the patients, neuropathy

Table 1. Summary of demographic data and laboratory findings of patients according to gender

Characteristics	Overall (n=389)	Men (n=172)	Women (n=217)	p
	Mean±SD	Mean±SD	Mean±SD	
Age (years)	57.95±9.53	58.07±9.56	57.86±9.52	0.992
DM duration (years)	12.72±7.45	12.77±7.34	12.68±7.56	0.851
BMI (kg/m^2)	31.45±5.36	29.67±3.77	32.87±5.98	<0.001
FBG (mg/dL)	153.92±50.84	158.10±50.47	150.64±50.99	0.125
HbA1c (%)	7.83±1.35	7.97±1.41	7.72±1.30	0.339
HbA1c on target, n (%)	99 (25.44)	138 (80.2)	34 (15.6)	0.021
Total cholesterol (mg/dL)	202.74±46.43	196.46±50.61	207.87±36.62	0.008
LDL-C (mg/dL)	121.49±38.63	117.01±40.81	124.87±36.62	0.130
LDL-C on target, n (%)	29 (7.8)	14 (8.7)	15 (7.0)	0.564
Triglyceride (mg/dL)	180.26±112.10	190.44±128.83	172.24±96.47	0.305
Triglyceride on target, n (%)	177 (45.5)	78 (45.3)	99 (45.6)	0.957
Non-HDL-C (mg/dL)	156.05±44.99	153.99±48.94	157.63±41.75	0.435
Non-HDL-C on target, n (%)	34 (8.9)	17 (10.3)	17 (7.9)	0.470
AST (IU/L)	21.74±11.08	22.90±12.16	20.82±10.09	0.056
ALT (IU/L)	25.41±19.40	28.17±23.73	23.22±14.79	0.003
eGFR (mL/min/1.73 m^2)	88.03±20.73	87.64±20.82	88.34±20.70	0.937
Albumin (g/dL)	4.37±0.28	4.41±0.28	4.34±0.28	0.017
ASCVD risk, n (%)				
Moderate	88 (22.6)	29 (16.9)	59 (27.2)	0.053
High	49 (12.6)	24 (14.0)	25 (11.5)	
Very high	252 (64.8)	119 (69.2)	133 (61.3)	
Complications, n (%)				
Microalbuminuria	117 (30.1)	56 (32.6)	61 (28.1)	0.374
Neuropathy	144 (41.5)	56 (38.4)	88 (43.8)	0.323
Retinopathy	94 (27.6)	34 (24.3)	60 (30.0)	0.246
Comorbidities, n (%)				
HT	254 (65.3)	119 (69.2)	135 (62.2)	0.151
CAD	105 (27)	61 (35.5)	44 (20.3)	0.001
CVD	33 (8.5)	18 (10.5)	15 (6.9)	0.212
PAD	20 (5.1)	14 (8.1)	6 (2.8)	0.170
Treatments, n (%)				
Statins	183 (47)	88 (51.2)	95 (43.8)	0.154
Fenofibrate	17 (4.4)	12 (7.0)	5 (2.3)	0.043
Insulin	213 (54.8)	100 (58.1)	113 (52.1)	0.260
Metformin	342 (87.9)	152 (88.4)	190 (87.6)	0.876
Sulfonylurea	57 (14.7)	31 (18.0)	26 (12.0)	0.112
Pioglitazone	8 (2.1)	3 (1.7)	5 (2.3)	0.738
DPP4i	200 (51.49)	89 (51.7)	111 (51.2)	0.919
SGLT2i	55 (14.1)	20 (11.6)	35 (16.1)	0.206
Acarbose	7 (1.8)	4 (2.3)	3 (1.4)	0.704
GLP-1	12 (3.1)	4 (2.3)	8 (3.7)	0.561
Glinides	7 (1.8)	2 (1.2)	5 (2.3)	0.471

Statistical significance at <0.05. DM: Diabetes mellitus; BMI: Body mass index; FBG: Fasting blood glucose; HbA1c: Glycated hemoglobin; LDL-C: Low-density lipoprotein cholesterol; Non-HDL-C: Non-high-density lipoprotein cholesterol; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; eGFR: Estimated glomerular filtration rate; ASCVD: Atherosclerotic cardiovascular disease; HT: Hypertension; CAD: Coronary artery disease; CVD: Cerebrovascular disease; PAD: Peripheral artery disease; DPP4i: Dipeptidyl peptidase inhibitors; SGLT2i: Sodium-glucose cotransporter-2 inhibitors.

was found in 41.5% of the patients, and retinopathy was found in 27.6% of the patients in similar percentages in both men and women (p<0.05 for all). The percentages of patients with comorbidities were determined as 65.3% for hypertension, 27% for coronary artery disease (CAD), 8.5% for cerebrovascular disease, and 5.1% for peripheral arterial disease. CAD was found more frequently in men with T2DM than in women (p=0.001). Other comorbidi-

ties were seen at similar rates in both men and women. Men and women patients were similar in terms of antihypertensive, antidiabetic treatment (p>0.05). On the other hand, the rate of fenofibrate use in men was higher than in women (p=0.043) (Table 1).

We further compared T2DM patients by statin use status. It was observed that the duration of DM was longer in patients using statins, and a higher percentage of patients had HT and CAD (p<0.05). Among microvascular complications, neuropathy was seen more prominent in patients with statin treatment (52.5%, p<0.001). Although lower serum total cholesterol and LDL-C were seen in patients on statin treatment (p<0.001 for both), the percentage of patients who are on target for LDL-C was similar in both groups (p=0.239). Serum non-HDL-C values and the target success rates were similar in both men and women (p=0.470). Of the total participants, 8.9% were on target for non-HDL-C. The percentage of patients with moderate and high risk for ASCVD was lower in statin use (12.6% and 8.7%, respectively). However, the percentage of patients who have a very high risk for ASCVD was higher in patients receiving statin treatment (78.7%) (Table 2).

Lipid parameters and ASCVD risk stratification of the study participants according to glycemic control are assessed in Table 3. DM duration, FBG, and HbA1c values were higher in the poor glycemic control group as expected (p<0.001 for all). The number of patients whose on-target value for LDL-C was lower in the group with HbA1c >7% (p=0.028). On the other hand, success rates for target non-HDL-C were higher in the group with >7% HbA1c (p=0.039). Microvascular complications were more common in poor glycemic control, 34.1% for microalbuminuria, 46.2% for neuropathy, and 32.2% for retinopathy (p=0.002, p=0.001, and p=0.001, respectively). Very high and high ASCVD risks were more prominent in patients with poor glycemic control (70.3% and 14.5%, respectively). On the other hand, 44.4% of the patients with HbA1c <7% had moderate ASCVD risks, which was

Table 2. Comparative analysis of demographic characteristics of the study group according to statin use

	Statin use (+) (n=183)	Statin use (–) (n=206)	p
	Mean±SD	Mean±SD	
Age (years)	60.17±8.31	55.98±10.11	<0.001
Gender (male), n (%)	84 (40.8)	88 (48.1)	0.154
DM duration (years)	14.74±7.20	10.92±7.32	<0.001
BMI (kg/m^2)	31.17±4.73	31.71±5.86	0.668
FBG (mg/dL)	149.42±45.24	157.87±55.09	0.196
HbA1c (%)	7.79±1.15	7.87±1.51	0.601
HbA1c on target, n (%)	39 (21.3)	60 (29.1)	0.081
Total cholesterol (mg/dL)	192.62±47.56	211.77±43.56	<0.001
LDL-C (mg/dL)	111.89±39.57	130.39±35.58	<0.001
LDL-C on target, n (%)	17 (9.4)	12 (6.2)	0.239
Triglyceride (mg/dL)	170.68±102.38	188.81±119.72	0.193
Triglyceride on target, n (%)	88 (48.1)	89 (43.2)	0.359
Non-HDL-C (mg/dL)	145.98±46.49	164.93±41.76	<0.001
Non-HDL-C on target, n (%)	22 (12.4)	12 (5.9)	0.029
ASCVD Risk, n (%)			<0.001
Moderate	23 (12.6)	65 (31.6)	
High	16 (8.7)	33 (16.0)	
Very high	144 (78.7)	108 (52.4)	
Complications, n (%)			
Microalbuminuria	60 (32.8)	57 (27.7)	0.272
Neuropathy	85 (52.5)	59 (31.9)	<0.001
Retinopathy	53 (33.5)	41 (22.5)	0.023
Comorbidities, n (%)			
HT	145 (79.2)	109 (52.9)	<0.001
CAD	72 (39.3)	33 (16)	<0.001
CVD	21 (11.5)	12 (5.8)	0.046
PAD	10 (5.5)	10 (4.9)	0.786

Statistical significance at <0.05. SD: Standard deviation; DM: Diabetes mellitus; BMI: Body mass index; FBG: Fasting blood glucose; HbA1c: Glycated hemoglobin; LDL-C: Low-density lipoprotein cholesterol; Non-HDL-C: Non-high-density lipoprotein cholesterol; ASCVD: Atherosclerotic cardiovascular disease; HT: Hypertension; CAD: Coronary artery disease; CVD: Cerebrovascular disease; PAD: Peripheral artery disease; DPP4i: Dipeptidyl peptidase inhibitors; SGLT2i: Sodium-glucose cotransporter-2 inhibitors.

Table 3. Characteristics of the study participants according to glycemic regulation

	HbA1c < 7.0	HbA1c ≥ 7.0	p
	Mean±SD	Mean±SD	
Age (years)	58.06±9.11	57.91±9.58	0.922
Gender (men), n (%)	34 (34.3)	138 (47.6)	0.021
DM duration (years)	9.40±7.33	13.84±7.17	<0.001
BMI (kg/m^2)	31.02±5.15	31.60±5.42	0.266
FBG (mg/dL)	121.33±31.59	164.82±51.42	<0.001
HbA1c (%)	6.42±0.37	8.31±1.23	<0.001
Total cholesterol (mg/dL)	200.47±39.89	203.51±48.50	0.794
LDL-C (mg/dL)	121.76±34.54	121.39±40.04	0.699
LDL-C target, n (%)	12 (12.2)	17 (6.2)	0.028
Triglyceride (mg/dL)	161.92±99.59	186.54±115.57	0.083
Triglyceride on target, n (%)	128 (44.1)	49 (49.5)	0.061
Non-HDL-C (mg/dL)	152.14±38.13	157.43±47.15	0.301
Non-HDL-C on target, n (%)	21 (7.5)	13 (13.1)	0.039
eGFR (mL/min/1.73 m^2)	87.62±19.54	88.17±21.15	0.518
Statin use, n (%)	39 (39.4)	144 (49.7)	0.076
Complications, n (%)			
Microalbuminuria	18 (18.2)	99 (34.1)	0.002
Neuropathy	22 (26.5)	122 (46.2)	0.001
Retinopathy	11 (13.4)	83 (32.2)	<0.001
Comorbidities, n (%)			
HT	56 (56.6)	198 (68.3)	0.036
CAD	22 (22.2)	83 (28.6)	0.209
CVD	3 (3.0)	30 (10.3)	0.013
PAD	2 (2.0)	18 (6.2)	0.075
ASCVD risk, n (%)			
Very high	48 (48.5)	204 (70.3)	<0.001
High	7 (7.1)	42 (14.5)	
Moderate	44 (44.4)	44 (15.2)	

Statistical significance at <0.05. DM: Diabetes mellitus; BMI: Body mass index; FBG: Fasting blood glucose; HbA1c: Glycated hemoglobin; LDL-C: Low-density lipoprotein cholesterol; Non-HDL-C: Non-high-density lipoprotein cholesterol; eGFR: Estimated glomerular filtration rate; ASCVD: Atherosclerotic cardiovascular disease; HT: Hypertension; CAD: Coronary artery disease; CVD: Cerebrovascular disease; PAD: Peripheral artery disease.

more frequent than in patients with poor glycemic control (p<0.001) (Table 3).

A total of 88 T2DM patients were found to be at moderate risk for ASCVD, with 36% at target for HbA1c, 15% at

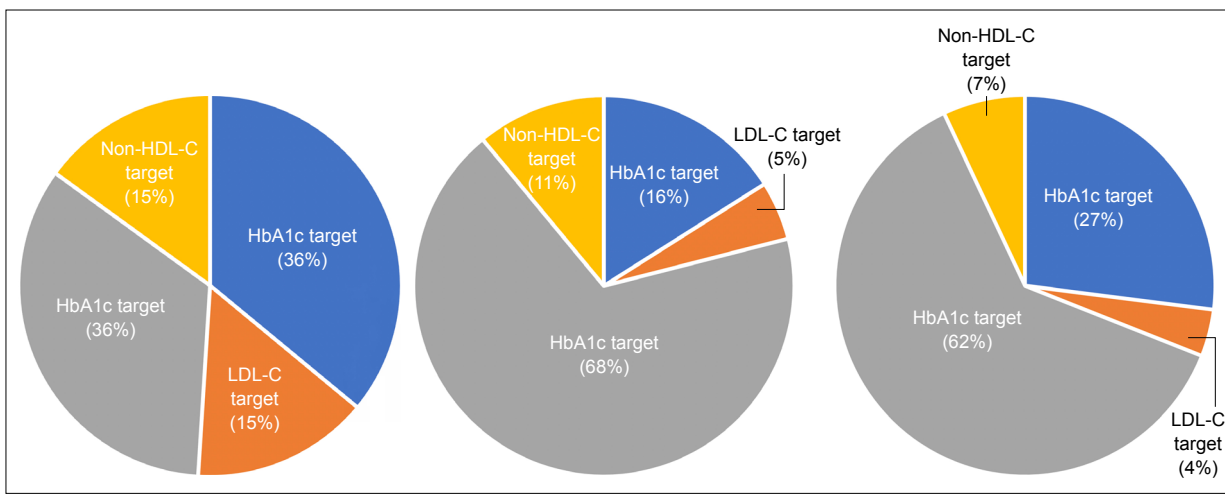

Figure 1. Distribution of treatment goal success in T2DM patients with moderate risk, high risk and very high risk for ASCVD.

target for LDL-C, 34% at target for TG, and 15% at target for non-HDL-C. Forty-nine T2DM patients were found to be at high-risk ASCVD, with 16% at target for HbA1c, 5% at target for LDL-C, 68% at target for TG, and 11% at target for non-HDL-C. On the other hand, 252 T2DM patients were found to be at moderate risk for ASCVD, with 27% at target for HbA1c, 4% at target for LDL-C, 62% at target for TG, and 7% at target for non-HDL-C (Fig. 1).

DISCUSSION

T2DM represents a major public health problem, and cardiovascular complications increase the risk of mortality in patients with diabetes. However, glycemic control is not sufficient to reduce the risk of diabetes-related cardiovascular events.[3] It has been suggested that women with diabetes are almost twice as vulnerable to cardiovascular risk factors as men.[8] Therefore, in this study, the lipid profile control rates in men and women with T2DM were evaluated according to current guidelines. First, according to the ASCVD risk stratification of recent guidelines, success rates for target TG, non-HDL-C, and LDL-C for all T2DM patients were 45%, 8.9%, and 7.8%, respectively.[4] Second, it was observed that glycemic control rates were higher in men than in women. In Western Europe, only 32.1% of the very high-risk patients, 51.9% of the high-risk, and 55.7% of the moderate-risk patients achieved their LDL-C goal.[9] A populational cross-sectional study from China revealed that 10.4% of very high-risk patients and 11.1% of high-risk patients who attained the LDL-C goal failed to achieve the non-HDL-C goal in the overall population. Furthermore, they showed that diabetes is a strong predictor of failure to achieve non-HDL-C and LDL-C goals.[10] Globally, limited data indicate suboptimal or inadequate control of dyslipidemia and, unfortunately, increased incidence of CVD in T2DM patients.[11,12] In the light of these data, in addition to glycemic control, it can be predicted that low control rates of lipid profiles in T2DM are a problem that needs to be resolved.

In the present study, 64.8% of the patients with T2DM were at very high risk, 12.6% were at high risk, and 22.6% were at medium risk. In a large populational study in Italy, 70.4% of the patients were at very high risk, 29.3% were at high risk, and less than 1% were at medium risk.[11] It is well known that patients with T2DM have an increased risk of CVD compared with those without T2DM.[3] Therefore, supporting both clinicians and patients for individualized and adequate control of LDL-C, TG, and non-HDL-C levels, as well as glycemic control, is essential. To date, there are few data regarding the LDL-C success rates according to recent guidelines and the lipid-lowering drug treatment prevalence in T2DM patients. In the study by Morieri et al.,[12] among 63.861 T2DM patients, 61% were on statin therapy, and 9.2% received ezetimibe. In another population study in the USA, it was shown that 76% of T2DM patients were on statin treatment, 9% received fibrate, and 5% received niacin.[13] Cosentino et al.[15] reported that the LDL-C targets recommended by the 2019 ESC/EAS and EASD guidelines for dyslipidemia and cardiovascular prevention were achieved in 14% of the population. Recently, Vural Keskinler et al.[14] demonstrated that 19% of the T2DM patients had LDL-C levels lower than 100 mg/dL, and only 4 patients had LDL-C levels <70 mg/dL among 420 patients from Turkey. Furthermore, they recorded that 66% of patients with both T2DM and CAD were using statins. In this study, the percentage of patients who could not reach the LDL-C target despite the use of statins was found to be very high. According to the ASCVD risk stratification of 2019 ESC/EAS guidelines, 47% of patients received statin treatment at least 3 months, with only 7.8% of T2DM patients in this study at LDL-C target. Similar low rates are striking for both men and women. Although 78.7% of T2DM patients receiving statin have a very high ASCVD risk, the percentage of patients on LDL-C target was the same as the patients who did not receive statin treatment. Although the lack of data on statin dosage limits the interpretation of the results, it can be speculated that the intensification of lipid-lowering treatment is a major challenge in the management of hyperlipidemia in T2DM patients.

Glycemic control helps to reduce the risk of progression of microvascular complications, and HbA1c is the current gold standard parameter for the assessment of glycemic control.[16] In this study, microvascular complications, such as microalbuminuria, diabetic neuropathy, and diabetic retinopathy, were more prominent in patients with HbA1c≥7%, which is consistent with the literature.[17–19] Previous studies indicated that diabetic polyneuropathy is more associated with the duration of diabetes, lipid status, and age rather than glycemic control.[20,21] In the current study, diabetic polyneuropathy was more prominent in patients who require statin treatment among microvascular complications. This may be explained by the longer duration of DM and older participants in statin users rather than the statin treatment itself. Another important finding is that despite similar HbA1c and BMI values in statin users and nonusers, the insufficient success rate in reaching LDL-C targets is noted, which has drawn the attention of clinicians to lipid-lowering treatments, as well as glycemic control and weight control. In addition, patients with poor glycemic control have an increased rate of ASCVD and hypertension.

Plasma TG influences ASCVD risk through changes in the concentration of TG-rich lipoproteins, which is estimated by non-HDL-C.[4,22] Improvement of glycemic regulation is generally accompanied by the improvement in hypertriglyceridemia.[23] It was previously known that serum TGs may be transiently elevated by uncontrolled hyperglycemia due to inadequate insulin activity and lipolysis.[24] However, here, serum TGs did not differ according to glycemic control. Several studies have reported the association of increased BMI with insulin sensitivity and hypertriglyceridemia in T2DM.[25,26] Therefore, the fact that patients with and without HbA1c target have similar BMI values may have served the homogenous distribution of serum TG values.

As non-HDL-C contains all the atherogenic lipoproteins, namely chylomicron, very low-density lipoprotein, LDL-C, and intermediate-density lipoprotein, accumulating evidence demonstrates the importance of non-HDL-C for ASCVD risk prediction.[27,28] Current guidelines suggest non-HDL-C and Apo-B as secondary goals to prevent ASCVD. Secondary goals are recommended for patients at very high CVD risk after reaching the LDL-C targets.[4] A population-level observational cohort study revealed that among 314 patients with recurrent atherosclerotic events, 12.7% had the non-HDL-C targets.[29] A recent study showed that 3.1% of the T2DM patients had non-HDL-C goal attainment.[30] In this study, 8.9% of total T2DM patients were at non-HDL-C targets. It is noteworthy that patients with a history of at least 3 months of statin use had lower non-HDL-C and better target rates. While this study demonstrates that our rates of achieving non-HDL-C targets are low, it will further guide the management of hyperlipidemia and ASCVD risk in T2DM patients.

This study had several limitations. First, lack of information on blood pressure measurements and smoking information on records may have an impact on the results, which can be resulted in underestimation of the cardiovascular risk factors of T2DM patients. Second, due to the lack of information about medical history and complications of diabetes, a large number of patients with T2DM were excluded, which may be resulted in bias. Third, several organizations, including ESC, EAS, and ADA, recommend lifestyle changes that include diet modification and increased physical activity.[31] Unfortunately, the medical records of the study group did not contain lifestyle information. Finally, Apo-B is strongly associated with ASCVD is and one of the important targets for managing dyslipidemia.[4] An analysis of Apo-B measurement will further strengthen the previous suggestions. Nevertheless, this novel study includes real-life data on clinicians' success rate in controlling the lipid profile of T2DM patients.

CONCLUSION

Despite great efforts to reduce the modifiable risk factors of ASCVD, there are still problems in achieving and maintaining targets in LDL-C, non-HDL-C, and serum TGs, which are recommended management strategies in T2DM patients. As far as we know, there are few studies investigating the achievement rate of reaching lipid targets in T2DM patients in Turkey. This study draws particular attention to the low control rates of LDL-C, non-HDL-C, and serum TG in T2DM patients, both on without lipid-lowering treatment. It is important to highlight the importance of lipid-lowering agents in T2DM patients to protect the risk of ASCVD when indicated according to recent guidelines and to maintain clinicians' awareness of intensification of the lipid-lowering treatments.

Ethics Committee Approval

This study approved by the Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee (Date: 30.03.2022, Decision No: 2022/514/222/31).

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Conflict of Interest

None declared.

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Tip 2 Diyabet Hastalarında Kardiyovasküler Riski Önlemede Güncel Lipid Tedavi Hedeflerine Ulaşma Oranlarının Geriye Dönük Olarak Değerlendirilmesi

Amaç: Aterosklerotik kardiyovasküler hastalık (ASCVD) tüm dünyada özellikle tip 2 diyabetli (T2DM) hastalarda önemli bir morbidite ve mortalite nedenidir. Çalışmanın amacı, T2DM tanılı hastalarda, güncel kılavuzlarda yer alan glisemik kontrol, serum düşük yoğunluklu kolesterol (LDL-K), trigliserit (TG) ve HDL dışı kolesterol (Non-HDL-K) hedeflerine ulaşmada başarı oranlarını göstermektir.

Gereç ve Yöntem: Bu çalışmada önceden tanı almış 389 T2DM hastası (217 kadın, 172 erkek) geriye dönük olarak değerlendirildi. Hastaların kullanmakta olduğu ilaçlar, demografik özellikleri ve laboratuvar tetkikleri elektronik kayıt sistemi ve hasta dosyalarından kaydedildi. Hastaların ASCVD riskleri, 2019 Avrupa Kardiyoloji Derneği (ESC)/Avrupa Ateroskleroz Derneği (EAS) kılavuzlarına göre belirlendi ve LDL-K, TG, Non-HDL-K, HbA1c için hedef oranları kaydedildi.

Bulgular: Hastaların tamamındaki ortalama yaş, vücut kitle indeksi (VKİ) ve HbA1c değerleri sırasıyla 57.95±9.53 yıl, 31.45±5.36 kg/m^2 ve %7.83±1.35 saptandı. Olguların %22.6'sı orta, %12.6'sı yüksek ve %64.8'i çok yüksek ASCVD riskine sahipti. LDL-K, TG ve Non-HDL-K değerleri hedefte olan hasta sayısının düşük olduğu görüldü (sırasıyla %7.8, %45.5, %8.9). Erkeklerde koroner arter hastalık sıklığı kadınlara göre daha fazlaydı (p<0.001). Diyabetik polinöropati sıklığı statin kullanan hastalarda daha fazlaydı (%52.5, p<0.001). Statin kullanmakta olan hastaların LDL-K değerleri daha düşük olmasına rağmen (p<0.001), hedef LDL-K değerine ulaşma oranı her iki grupta benzerdi (p=0.239). T2DM hastalarında Non-HDL-K değeri %8.9 oranında hedefteydi. Statin kullanan hastalarda Non-HDL-K değerlerinin daha düşük olması ve daha iyi hedef oranlarının gözlenmesi dikkat çekicidir. HbA1c <7% olan hastalarda LDL-K hedefe ulaşma oranı daha düşükken (p=0.028), Non-HDL-K hedef başarısı daha yüksekti (p=0.039).

Sonuç: Bu çalışmada T2DM tanılı hastalarda, 2019 ESC/EAS kılavuzunda önerilen lipid tedavi hedeflerine ulaşma oranlarının düşük olduğu görülmektedir. ASCVD riski yüksek olan hasta gruplarında güncel kılavuzlarda önerilen tedavi hedeflerine ulaşmak farkındalık gerektirmektedir.

Anahtar Sözcükler: Hiperlipidemi; kardiyovasküler risk; tip 2 diyabet.