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Correlation of lipid profiles with coronary artery plaque levels in patients undergoing coronary angiography

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Abstract

This study aims to observe the effect of lipid profiles (total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), triglyceride (TG)) on coronary artery plaque rates of patients undergoing coronary angiography at Zonguldak Bülent Ecevit University (ZBEUN) Health Practice and Research Hospital. A total of 500 patients who underwent coronary angiography (CAG) between January 2019 and December 2020 at ZBEUN Health Practice and Research Hospital participated in this retrospective study. The sample of this study consists of 250 patients with a stenosis level below 50% and 250 patients with stenosis level of 50% and above according to CAG results. Information and data about the patients were accessed through the Hospital Information Management System (HIMS). The mean age of the individuals participating in the study was 63 years, the mean age of women was 65±12.3, and the mean age of men was 62±11.8. The majority of patients are men (74.2%). When we categorized the lipid profiles as low, optimal and high, LDL, triglyceride and total cholesterol values were found to be significantly higher and HDL values were found to be significantly lower in those with a stenosis degree of 50% and above ($p<0.001$). While the rate of those with a stenosis degree of 50% and above was found to be higher in the age groups of 55-64 and over 80 years (60.1% and 57.8%, respectively), the rate of those with a stenosis degree below 50% was found to be higher in other age groups. No significant difference was detected between lipid profiles according to gender and age. It is well known that dyslipidemia increases coronary artery risk and its treatment reduces cardiovascular events and mortality in patients at high risk for cardiovascular diseases. The increase in LDL, TG, total cholesterol levels and the decrease in HDL levels caused an increase in the level of coronary artery plaque.

Keywords: Coronary artery disease, low density lipoprotein ,high density lipoprotein, triglycerides, total cholesterol

Introduction

Coronary artery disease (CAD) is one of the major cardiovascular diseases (CVD) affecting the global human population. This disease has been proven to be the most important leading cause of death in both of low income and developed countries. According to the 12-years results of the TEKHARF study, conducted by the Turkish Cardiology Association since 1990 in Türkiye, it is thought that there are approximately 2 million coronary artery patients and 160 thousands of our citizens have lost their lives from CAD [1,2].

The most common cause of CAD is atherosclerosis. Atherosclerosis is an insidious, chronic, inflammatory process whose typical lesion is atheroma plaques. It is a multifactorial disease that affects the intima layers of medium-large sized arteries as a result of the loss of the elasticity of the arteries, leading to arterial stenosis and occlusion. There are many factors that determine the progression of atherosclerosis and the emergence of cardiovascular consequences. Hypercholesterolemia is the most important factor that triggers atherosclerosis [3,4]. When atherosclerotic plaques become unstable, cardiovascular events such as thrombosis or embolization can occur [5].

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Risk factors in atherosclerotic CVD are examined under two headings: modifiable and non-modifiable. Non-modifiable risk factors include age, male gender and a history of CAD in first-degree relatives before 55 years old. Modifiable risk factors include smoking, hypercholesterolemia, diabetes mellitus, hypertension and obesity. The greatest and most well-proven risk factor for the development of CAD is high cholesterol levels [6-8].

Dyslipidemia is defined as an abnormal level of any plasma lipids. Dyslipidemias include clinically elevated cholesterol and/or TG levels that may be accompanied by decreased HDL levels. In most of these patients, elevated TG levels are associated with low HDL cholesterol levels and increased LDL cholesterol levels [9,10]. Cholesterol is a very important lipid for our body. It is involved in the structure of cell membranes, the formation of bile acids and is used in the synthesis of steroid hormones. Cholesterol, which is needed by the tissues, is carried by lipoproteins labeled with Apolipoprotein B (Apo B). Cholesterol, which is needed by the tissues, is carried by labeled lipoproteins with Apo B. In circulation labeled lipoproteins with Apo B continuously enter and exit vascular intima to supply the cholesterol needs of the tissues. As a result of factors such as inflammation, oxidative stress, endothelial dysfunction or presence of more labeled lipoproteins with Apo B in the circulation, these lipoproteins are phagocytosed by macrophages, calcified, necrosed and accumulated in the vascular intima. This lesion, which has not yet narrowed the lumen, forms fatty streaks, which are the initial stages of atherosclerosis. The vast majority (>90%) of lipoproteins containing Apo B are composed of LDL, which has an atherogenic structure. The amount of lipoproteins containing apolipoprotein B, the duration of exposure, and number and severity of other accompanying risk factors are determinative in this aspect. HDL cholesterol provides reverse transport of cholesterol and protects lipoproteins from oxidation. Its main protein is apolipoprotein A-1 and many studies have proven an inverse relationship between HDL cholesterol levels and the risk of coronary artery disease.

Statin group drugs reduce cholesterol levels, have cardiovascular protective effects and also have LDL-lowering effect called the “pleiotropic” effect. Statins are the first-line treatment for primary and secondary prevention of cardiovascular disease. Other drugs used in the treatment of dyslipidemia are fibrate group drugs, cholesterol absorption inhibitors, omega-3, niacin, and proprotein convertase subtilisin/kexin type 9 (PCSK-9) inhibitors [11,12].

Reducing the risk factors that cause cardiovascular diseases reduces cardiovascular cases and related deaths. For this reason, reducing risk factors is very important for primary prevention. In our study, patients who underwent coronary angiography at the Cardiology Department of Bülent Ecevit University and who had not previously used dyslipidemic drugs were retrospectively examined. Lipid levels were compared according to degree of coronary artery occlusion, and effect of blood lipid levels to arterial occlusion was investigated.

Due to coronary lesions and their severity may increase in patients without lipid control, necessary and early intervention may be recommended for primary prevention in these patients. Preventing dyslipidemia, especially as family physicians working in primary care, is an important approach to preventive medicine. Recognizing dyslipidemia early and starting treatment is very important in preventing CAD from progressing and becoming mortal.

Material and Methods

Patient Population and Data Collection

Our study is a case-control study conducted on patients who underwent coronary angiography at Cardiology Clinic of Zonguldak Bülent Ecevit University between January 2019 and December 2020. The study's ethics committee approval was obtained at Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee dated 15.09.2021 and numbered 2021/17. The sample consists of 500 patients aged 18 and over who had CAG on the specified dates (between January 2019 and December 2020), had no previous use of dyslipidemic drugs, and had not undergone coronary angiography. The minimum number of patients in the g power 3.1.9.7 program was calculated as 470 and 500 patients were selected to increase the data among the 4875 individuals hospitalized in the cardiology clinic on the specified dates. The research group was divided into groups according to gender, age and coronary artery plaque degree. Coronary artery plaque levels were divided by %50 and above,and below of %50. This distinction was made by looking at the 2018 ESC/EACTS Revascularization Guide. The vascular occlusion odds of the patients were obtained by looking at their coronary angiography reports. Coronary angiography result reports, genders, and file numbers were obtained from Hospital Information Management System (HIMS).

Statistical Method

The analysis of the obtained data was made using SPSS 20.0 Statistical Package Program. The obtained parametric data were evaluated by finding the arithmetic mean ($\bar{x}$), standard deviation (S), minimum and maximum values, and the qualitative data were evaluated as distributions (%). Chi-square, Mann Whitney U and t tests were used to examine the differences between the groups, Shapiro Wilk test was used as a normal distribution test. "$p<0.05$" was accepted as the statistical significance level.

Results

25.8% of the participants were female and 74.2% were male. The mean age of the women was 65.7±12.3, and the mean age of the men was 62±11.8. When distribution according to age groups was examined, the number of people and rates were as follows; 14 people (2.8%) between the ages of 30-39, 112 people (22.4%) between the ages of 40-54, 143 people (28.6%) between the ages of 55-64, 186 people (37.2%) between the ages of 65-79, and 45 people (9%) aged 80 and over (Table 1).

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Table 1. Distribution of participants according to age and gender

		Gender		
		Female n (%)	Male n (%)	Total n (%)
Facility				
Age	**30-39**	2 (1.6)	12 (3.2)	14 (2.8)
	40-54	24 (18.6)	88 (23.7)	112 (22.4)
	55-64	37 (28.7)	106 (28.6)	143 (28.6)
	65-79	50 (38.8)	136 (36.7)	186 (37.2)
	80 and over	16 (12.4)	29 (7.8)	45 (9)
Total		129 (25.8)	371 (74.2)	500 (100)

When the degree of stenosis was evaluated according to age groups, it was seen that the majority of the participants aged 30-39 (78.6%) had a degree of coronary artery stenosis below 50%. The rate of having a stenosis degree of 50% and above was higher in the groups aged 55-64 and over 80. A significant difference was found between age and degree of stenosis (p=0.007) (Table 2).

Table 2. Age-related stenosis rates

Age	Degree of stenosis		p
	Below 50% n (%)	50% and over n (%)	
30-39	11 (78.6)	3 (21.4)	
40-54	61 (54.5)	51 (45.5)	
55-64	57 (39.9)	86 (60.1)	0.007
65-79	102 (54.8)	84 (45.2)	
80 and over	19 (42.2)	26 (57.8)	
Total	250 (100)	250 (100)	

Lipid values were classified as low, optimal and high. When the classification of lipid values and degree of stenosis were compared; rates of having high LDL, TG and total cholesterol values in those with a stenosis degree of less than 50% were found to be 15.6%, 34.4% and 20.8% respectively, in those with a stenosis degree of 50% and above these rates were found to be 48%, 58.4% 51.2%. The rates of having low HDL values in those with a stenosis degree of less than 50% were found to be 90%, this rate was found to be 94.8% in those with a stenosis degree of 50% and above. A significant difference was found between blood lipids and the degree of stenosis (p<0.001) (Table 3).

Table 3. Effect of lipid values measured in blood tests on the degree of stenosis

		Degree of stenosis		p
		Below 50% n (%)	50% ve over n (%)	
Blood lipids	**LDL optimal**	211 (84.4)	130 (52)	<0.001
	LDL high	39 (15.6)	120 (48)	
	HDL optimal	25 (10)	13 (5.2)	<0.001
	HDL low	225 (90)	237 (94.8)	
	TG optimal	164 (65.6)	104 (41.6)	<0.001
	TG high	86 (34.4)	146 (58.4)	
	Total kolesterol optimal	198 (79.2)	122 (48.8)	<0.001
	Total kolesterol high	52 (20.8)	128 (51.2)	

The rate of those with low HDL values according to gender was found to be 88.4% in women and 93.8% in men. A significant difference was found between gender and HDL values (p=0.045) (Table 4).

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Table 4. Change in HDL values according to gender

		HDL values		Total n (%)	p
		Optimal n (%)	Low n (%)		
Gender	**Female**	15 (11.6)	114 (88.4)	129 (100)	0.045
	Male	23 (6.2)	348 (93.8)	371 (100)	
Total		38 (7.6)	462 (92.4)	500 (100)	

When the lipid profiles of the participants were evaluated according to gender; the median HDL value was higher in women than in men, and the median LDL value was higher in men (Table 5).

Table 5. Evaluation of lipid profiles of participants according to gender

Lipit profile	Gender	x̄±S	Median	Min	Max
LDL	**Female**	103.18±37.22	101	33	232
	Male	112.04±39.33	109	80	248
HDL	**Female**	44.66±11.9	44	17	80
	Male	39.73±11.9	38	19	114
TG	**Female**	144±80.50	120.50	50	564
	Male	199.51±131.75	168	24	1208
Total cholesterol	**Female**	177.33±43.98	175	79	332
	Male	185.23±48.179	183	69	348

Discussion

CAD is an insidious process affected by many factors. One of the most important risk factors for this disease is high LDL-C levels, low HDL-C levels, and increased TG levels in the blood. However, genetic evidence does not support the protection of HDL cholesterol against atherosclerosis. In addition, many treatments that increase HDL cholesterol levels have not been successful in improving coronary disease [13,14]. In their study with patients who underwent coronary angiography and were diagnosed with vascular occlusion and healthy volunteers, Türkoğlu and colleagues showed that serum total cholesterol, LDL-C, VLDL-C, and triglyceride values were significantly higher than in the control group, HDL-C levels were significantly lower [15]. In the study conducted by Shuko et al., they did not find any statistically significant difference when they compared the serum total cholesterol and LDL-C levels of patients diagnosed with coronary artery disease and healthy volunteers. They observed that serum HDL cholesterol levels were lower and triglyceride levels were higher in patients with coronary artery disease compared to the control group [16]. Ledwozyw et al. found that plasma TG, cholesterol, total lipids and lipid peroxide levels were significantly higher in patients with atherosclerotic lesions compared to the control group [17]. Studies have highlighted that pathologies observed in coronary angiography are closely linked to lipid profiles. We have known for many years that dyslipidemia is an important and modifiable risk factor for coronary artery disease [18]. According to the results of our study, it was seen that TG, LDL cholesterol and total cholesterol levels were higher and HDL cholesterol levels were lower in patients with coronary artery pathology. The data we obtained indicate that if LDL cholesterol and total cholesterol levels are not controlled, there will be an increase in coronary artery disease pathologies. It is well known that dyslipidemia increases the risk of coronary artery disease and that its treatment reduces cardiovascular events and mortality in patients at high risk for cardiovascular disease. Increased LDL, TG, total cholesterol levels and decreased HDL levels caused coronary artery plaque formation.

We know that age is an important risk factor for CVD. The incidence of CAD increases dramatically with age. In the study conducted by Mack and Blankenhorn, the factors affecting the formation of new coronary lesions were investigated. Among these factors, advanced age, hypertension and high cholesterol levels are at the top of the list [19,20]. In our study, the mean age of the patients was 63. The mean age of the women was 65.7±12.3, and the mean age of the men was 62±11.8. A statistically significant difference was found between age and stenosis rate (p=0.007).

Male gender has always been considered an independent risk factor for cardiovascular disease. Hoit BD et al. indicated that early age CAD is more common in males [21]. Joshi P et al. found that female individuals had ACS 5.6 years older than male individuals. Shammas NW et al., in their study investigating the effect of gender differences on long-term outcomes in ACS in 162 patients, found no difference in Sx scores between male and female genders [22,23]. In our study, the male gender ratio was

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74.2%. The coronary artery stenosis rate in men was significantly higher than in women ($p<0.05$).

Limitations of this study are presence of chronic diseases affecting coronary artery disease (diabetes, hypertension, family history of coronary artery disease, hyperlipidemia) was not taken into account, and patients were selected only from Zbeun Hospital. Another limitation is that the patients' height, weight and BMI indexes were not checked and their smoking status was not questioned.

Conclusion

In patients who have coronary angiography due to ischemic heart disease, the lesions increase in the coronary arteries with the increase in LDL-C, total cholesterol, TG levels. A significant positive correlation was found between coronary artery stenosis and level of total cholesterol, LDL-cholesterol, triglyceride; and a negative correlation was found between HDL-cholesterol level and coronary arter stenosis. Our findings indicated that increase in coronary lesions may be related to lipid profile and advanced age. In addition, 371 of 500 patients were male and male gender was a risk. Protecting people from dyslipidemia, which is a significant health problem in our country, and treating it early is an important duty of primary care physicians. Preventing dyslipidemia, which is a modifiable risk factor, is an important preventive duty of family physicians. Since coronary lesions may increase in patients with poor lipid control, early intervention may be recommended for primary prevention. Early recognition of dyslipidemia and initiation of treatment is very important in preventing progression of CA.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The study's ethics committee approval was obtained at Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee dated 15.09.2021 and numbered 2021/17

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