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Original scientific paper

LIPID VARIABLES IN RELATION TO CORONARY ARTERIES ATHEROSCLEROSIS EXTENT IN ST ELEVATED ACUTE MYOCARDIAL INFARCTION

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Abstract

Aim: The association between different lipid profiles and the extent of the coronary lesion in acute myocardial infarction (AMI) has been rarely reported in epidemiological and clinical studies. This study aimed to evaluate the association between different lipid profiles and the extent of coronary atherosclerotic disease lesions in patients with acute myocardial infarction (AMI).
Method: In our study, we analyzed data for 50 consecutive patients, with acute myocardial infarction undergoing coronary angiography at the Clinical Hospital of Tetovo. Patients were classified by coronary angiography into one-vessel disease (1VD), two-vessel disease (2VD), and three-vessel disease (3VD), with obstructive coronary artery disease (CAD), defined as ≥50% angiographic stenosis. Laboratory analysis for lipid fractions was performed.
Results: One-way analysis of variance, showed a statistically significant association between the mean of total cholesterol to high-density lipoprotein cholesterol ratio (TC/HDL) and the number of coronary arteries involved with an obstructive lesion (p=0.021). No significant association showed between extent of coronary artery lesion and non-HDL (p=0.33), HDL (p=0.438), low density lipoprotein cholesterol (LDL) (p= 0.713), triglycerides (TG) (p=0.352), and TG/HDL ratio (p=0.143). In multiple regression analysis, TC/HDL ratio value statistically significantly predicted the extent of the coronary atherosclerotic lesion (p=0.044). Conclusion: The results of our study showed that TC to HDL ratio (TC/HDL), appeared as the most powerful marker of extension of the coronary lesion in patients with AMI. In patients with suspected CAD, this fact makes it possible for the TC / HDL ratio to be used as an easy and non-invasive method to measure the extent and severity of coronary heart disease.

Keywords: Lipid variables, Coronary lesion extent, Acute myocardial infarction.

1. Introduction

Dyslipidemias are well-known risk factors for the development of coronary artery disease [Choy PC et al. 2004]. Several clinical and epidemiological studies have indicated a strong association between different lipid profiles and atherosclerosis (Lewington S et al., 2007, Zhao X et al., 2021). Low-density lipoproteins (LDL) and triglycerides (TG) increase in concentration is directly associated with the development of coronary artery disease (Ference BA.et al.,2017, Sarwar N. et al.,2007). An inverse association is shown between plasma HDL levels and the risk of atherosclerotic cardiovascular diseases (Rye KA et al., 2008, Wilson PW et al.,1988). Although this association between different lipid fractions and coronary artery disease is known, data on the relationship between different lipoprotein fractions and the extent of the coronary lesion are very rare in the literature. (Jin Z et al.,2006, Conkbayir C et al.,2015, Penalva RA et al. 2008). Therefore, we can presume that if there was a link between lipid fraction and the extent of coronary lesions in patients with acute myocardial infarction, then this could be used as an easily applicable method in deciding on the strategy of diagnostic and therapeutic decisions in patients with atherosclerotic coronary diseases at risk of acute myocardial infarction. In this regard, we conducted a study to evaluate the association between different lipid profiles and the extent of coronary atherosclerotic disease in patients with acute myocardial infarction.

2. Methods

In this retrospective, a single-center study we enrolled 50 consecutive patients with acute myocardial infarction who underwent coronary angiography during hospitalization at the Clinical Hospital of Tetovo, from January to April 2022. The diagnosis of acute myocardial infarction was made in patients who presented with characteristic retrosternal pain or discomfort lasting more than 30 minutes, with ST-segment elevation and increased biochemical markers of myocardial necrosis (total CK and CK-MB). All patients underwent coronary angiography after admission to the intensive care unit, by trans femoral/transracial route using standard percutaneous techniques in the typical orthogonal projections. Patients were classified by coronary angiography into one-vessel disease (1VD), two-vessel disease (2VD), and three-vessel disease (3VD), with obstructive coronary artery disease (CAD), defined as ≥50% angiographic stenosis.
Blood for examination was taken according to the protocol during the admission to the intensive care unit. Fasting before the blood test was not mandatory. Laboratory measurements of lipid variables were performed: Total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides (TG). Triglyceride to HDL-C (TG/HDL) and total cholesterol to HDL-C (TC/HDL) ratios was calculated. Non-HDL-C is calculated as total cholesterol minus HDL-C.

Statistical analysis

The data were analyzed using the Statistical Software SPSS version 26.0. Continuous variables were presented by mean and standard deviation. The categorical variables were expressed as count or percentage. To evaluate the association between lipid profile and extension of coronary lesion, the means were compared using the ANOVA test.
Pearson's chi-square test was used to evaluate a relationship between categorical variables. A multiple logistic regression analysis was conducted to predict the extent of coronary artery lesions, in terms of number of vessels involved, from risk factors and demographic characteristics. The P value < 0.05 was considered to indicate statistical significance.

3. Results

Table 1 presents the demographic and clinical data of the studied subjects. The mean age was 60.12 ± 12.12 years, of the 14% were females. Of the total number of patients, 36% had diabetes, 46% had hypertension, and 60% were smokers. Lipid profile analysis showed the mean value for total cholesterol (TC) was 4.93 ± 1.362 mmol/L, for triglycerides (Trig) 1.81 ± 0.93 mmol/L, for Low-density lipoprotein cholesterol (LDL-C) 2.79 ± 1.27 mmol/L and High-density lipoprotein cholesterol (HDL-C) 1.05 ± 0.29 mmol/L. Trig/HDL cholesterol ratio was 1.92 ± 1.40, TC/HDL cholesterol ratio was 4.96 ± 1.85 and Non-HDL was 3.88 ± 1.33. One vessel disease were 37 (74%) patients, two-vessel disease 7(14%) patients, and 3 vessel disease 6 (12%) patients.

Table 1: Demographic and clinical characteristics of the study population

Variable	n (%)
Age (years), (min-max)	60.12±12.12, (33-88)
Female, n (%)	7 (14)
Hypertension, n (%)	23 (46)
Diabetes mellitus, n (%)	18 (36)
Smoking	23(60)
TC (mmol/L)	4.93 ± 1.362
LDL-cholesterol (mmol/L)	2.79 ± 1.27
TG (mmol/L	1.81 ± 0.93

HDL-cholesterol(mmol/L)	1.05 ± .29
TG/HDL	1.92 ± 1.40
TC/HDL	4.96 ± 1.85
Non-HDL	3.88 ± 1.33
Vessels involved	12.58 ± 5.73
One vessel n (%)	37 (74)
Two-vessel n (%)	7 (14)
Three vessel n (%)	6 (12)

TC: total cholesterol; LDL: low-density lipoprotein; TG: Triglycerides; HDL: high-density lipoprotein. TG/HDL: Ratio of TG and HDL; TC/HDL: Ratio of TC and HDL; Non-HDL: TC-HDL

Test for the association of different lipid profiles and the number of vessels involved showed that the mean of TC/HDL was significantly associated with the number of vessels involved (p=0.021*). No statistically significant difference was noticed between the number of vessels involved and the means of TC, Non-HDL, HDL-C, LDL-C, TG, and TG/HDL ratio, (p=0.504, p=0.332, p=0.438, p=0.713, p=0.352, and p=0.143 respectively). Corresponding mean lipid levels and ratios classified in the number of vessels involved are presented in Table 2 and Figure 1 and 2.

Table 2 – Association between lipid variables and lesion extent

Variable	*Lesion extent*			*p*
	One vassel	**Two vassel**	**Three vassel**	
TC (mmol/L)	4.81 ± 1.35	5.12 ± 1.44	5.48 ± 1.36	0.504
LDL-C (mmol/L)	2.81 ± 1.30	2.95 ± 1.26	3.26 ± 0.93	0.713
TG (mmol/L	1.73 ± 0.98	1.78 ± 0.57	2.33±0.89	0.352
HDL-C(mmol/L)	1.08 ± .28	1.00 ± .39	0.92 ± .25	0.438
TG/HDL-C ratio	1.70±1.44	2.41 ± 2.20	2.75 ± 1.62	0.143
TC/HDL-C ratio	4.57 ± 1.29	5.62±2.19	6.64±3.30	0.021*
Non-HDL-C mmol/L	3.72 ± 1.31	4.12 ± 1.25	4.55 ± 1.58	0.332

*TC: total cholesterol; LDL-C: low-density lipoprotein cholesterol; TG: Triglycerides; HDL-C: high-density lipoprotein cholesterol. *P<0.05*

The association between Lesion extent and gender, diabetes, smoking, and hypertension is presented in Table 3. We didn't find any significant association with several vessels involved.

Table 3. Analysis of association between lesion extent and gender, diabetes, smoking, and hypertension.

		Lesion ext.			
		One vessel	Two vessels	Three vessels	p
GENDER	Female	5 (13.5)	0 (0)	2 (33.3)	0.222
	Male	32 (86.5)	7 (100.0)	4 (66.7)	
DIABETES	Diabetic	12 (32.4)	3 (42.9)	3 (50.0)	0.651
	Non-Diabetic	9 (67.6)	14 (57.1)	10 (50.0)	
SMOKING	Smoker	20 (54.1)	5 (71.4)	4 (66.7)	0.625
	Non-Smoker	17 (45.9)	2 (28.6)	2 (33.3)	
HYPERTENSIOM	Hypertensive	18 (48.6)	1 (14.3)	4 (66.7)	0.137
	No hypertensive	19 (51.4)	6(85.7)	2 (33.3)	

*Pearson Chi-Square Tests. *p<0.05*

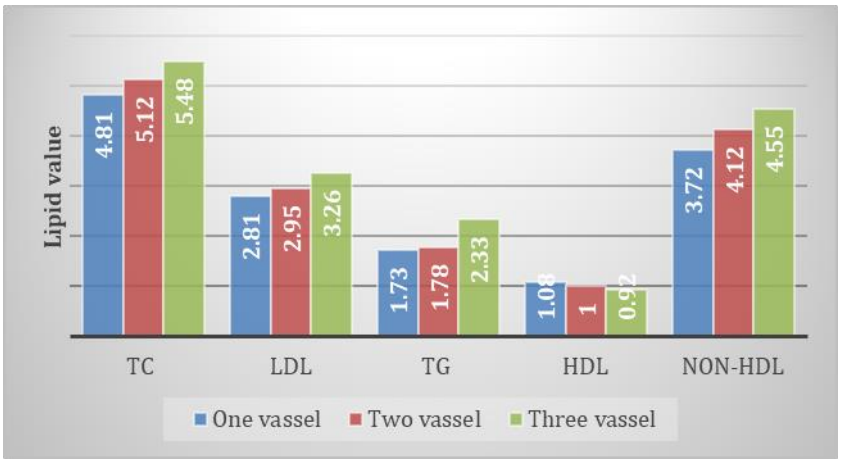

Figure 1. Mean lipid values and ratios across number of vassel involved

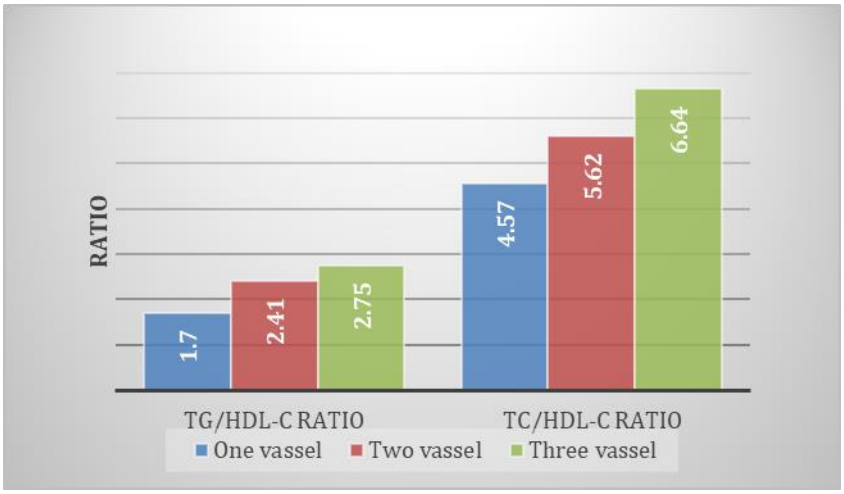

Figure 2. Mean lipid ratios and ratios across number of vassel involved

Multiple regression was run to predict several vessels involved to gender, age, smoking hypertension, diabetes mellitus, and lipid profile. TC/HDL statistically significantly predicted several vessels involved ($p<0.05$). Variables were statistically significant to the prediction for $p < 0.05$.

Table 4. A multiple regression analyses to predict number of vessels involved

						95% Confidence Interval for Exp(B)	
Variables	*B*	*Std. Error*	*Wald*	*Sig.*	*Exp(B)*	*Lower Bound*	*Upper Bound*
TC/HDL	0.959	0.476	4.051	0.044	2.609	1.025	6.638
Non-HDL	-0.050	0.567	0.008	0.930	0.951	0.313	2.891
Age	0.024	0.062	0.146	0.702	1.024	0.907	1.156
Smoking	0.958	1.617	0.351	0.554	2.606	0.110	62.015
Diabetes	0.193	1.256	0.024	0.878	1.213	0.103	14.232
Hypertension	-3.263	1.919	2.893	0.089	0.038	0.001	1.644

TC, and HDL were excluded from analysis due to multicollinearity
*HDL: high-density lipoprotein. *P<0.05*

4. Discusion

We investigated the possible association between coronary lesion extent and the levels of different lipid profiles. In our study, the levels of all lipid variables assessed were associated with the extension of the coronary lesion, but only the ratio of total cholesterol to HDL-C (TC/HDL) was associated significantly. Studies related to this topic in the literature are very few and contradictory. An observational Chinese study of patients undergoing diagnostic coronary angiography found that TC, LDL, and non-HDL were associated with more widespread coronary lesions (Jin Z et al.,2006). In another study, it was reported that TG / HDL played an important role in predicting CAD (Conkbayir C et al.,2015). A conclusion like that of our study was found in an earlier Brazilian study where the TC / HDL ratio proved to be a marker for the severity of coronary heart disease about number of coronary arteries involved. Their patients were with non-ST elevation myocardial infarction (Penalva RA et al. 2008). In our study age, smoking, hypertension, and diabetes were not shown to be significantly associated with the extent of the coronary lesion in patients with AMI. In another study where the sample selected was composed of patients undergoing coronary angiography for diagnostic purposes, hypertension, diabetes, and smoking showed significant association with the Friesinger score (Agarwal, D et al., 2015). It seems that the selection of samples, the concomitant diseases, and the tool used for the quantification of coronary lesions was the cause for some different results. In our study, the calculated lipid value, TC/HDL-C was shown to be a better indicator of coronary lesion extent than TC and HDL-C itself. Several studies have demonstrated the same, for coronary risk, as well as for the determination of subclinical atherosclerosis. (Khan HA et al.,2013, Millán J et al.,2009, Acevedo M et al.,1012, Calling, S et al.,1021). Although dyslipidemia is not the only cause of atherosclerosis coronary lesions, the possibility to prevent or even reduce the progression of atherosclerotic plaques through pharmacological preparations (statins) has been shown as a real opportunity (Choy PC et al.2004). Therefore, a non-invasive marker of the extension of atherosclerotic coronary disease remains an important goal.

5. Conclusion

The results of our study showed that TC to HDL-C ratio appeared as the most powerful indicator and predictor of extension of the coronary lesion in patients with AMI. This fact makes it possible, in patients with suspected CAD, for the TC / HDL ratio to be used as an easy and non-invasive method to measure the extent and severity of coronary heart disease.

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