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MULTIFACTORIAL ANALYSIS OF CARDIOVASCULAR RISK FACTORS IN A GROUP OF PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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Abstract

Background and Aims*: Acute myocardial infarction is one of the main causes of mortality worldwide, atherosclerosis being the most common mechanism of coronary artery obstruction. Many cardiovascular (CV) risk factors are associated with these pathogenic processes. The aim of our study was to investigate a group of patients with ST-segment elevation acute myocardial infarction in terms of the prevalence of cardiovascular risk factors.* ***Materials and Methods****: We investigated 97 patients with acute myocardial infarction (AMI) and 30 persons without AMI (control group) for CV risk parameters (metabolic syndrome, diabetes, sedentary, dyslipidemia, glycosylated hemoglobin- HbA1c), and the risk of developing AMI.* ***Results:*** *We found statistically significant differences ($p<0.05$) for the patients with metabolic syndrome, diabetes, sedentary lifestyle, high level of total cholesterol, LDLc, HbA1c, low level of HDLc for the risk to develop AMI.* ***Conclusion****: This study emphasizes the need to implement measures of primary and secondary prevention, and carry out a strict control of cardiovascular risk factors as well as implicitly improve the therapeutic conduct.*

key words: *atherosclerosis, acute myocardial infarction, metabolic syndrome, diabetes.*

Background and Aims

Cardiovascular diseases and their complications represent the leading cause of mortality in Romania. The underlying cause of these diseases is atherosclerosis, *a systemic process affecting all vascular beds in the organism*. The cardiovascular risk factors are intrinsic to the process of atherosclerosis [1].

The screening of risk factors, including lipid profile, blood *glucose* levels, weight, etc., should be considered in men ≥ 40 years and women ≥ 50 years or post-menopausal. The total cardiovascular risk estimation using diagrams/software based on multiple risk factors (such as the SCORE diagrams) is recommended for asymptomatic adults without evidence of cardio-vascular disease (CVD). Individuals who are at high risk may be discovered on the basis

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of existing CVD, diabetes, moderate or severe renal disease, very high level of individual risk factors or high SCORE risk [2,3]. The metabolic syndrome and diabetes represent major cardiovascular risk factors both in Romania as well as worldwide.

Cardiovascular risk management (both in primary and secondary prevention) is based on the assessment and proper treatment of all cardiovascular risk factors. It is important to point out that not only the number of accumulated risk factors is important, but also the magnitude of each factor, both being proportional with the cardiovascular risk [4].

The aim of our retrospective study was to assess which are the main cardiovascular risk factors for the patients with AMI in our region (Constanta County, Romania) in order to facilitate guidance and optimization of the primary and secondary prevention measures.

Materials and Methods

In our study we have included 127 persons, 97 patients hospitalized during the year 2012 in the Clinic of Cardiology of the „Sf. Apostol Andrei" Clinical Emergency County Hospital, Constanta, with the diagnosis of ST segment elevation acute myocardial infarction (AMI) and 30 persons (control group), in which we analyzed the presence of cardiovascular risk factors and their correlation with AMI. No prior pre-selection was performed, the enrollment of the 97 patients from the study group having been randomly made. The control group consisted of 30 persons matched for sex and age, employed at a company in Constanta, who had been directed to our clinic for their routine medical examination. They were invited to participate in this study as a control group. For this study we have obtained the consent of the hospital Ethics Committee and the patients signed an Informed Consent prior to inclusion in the study. The study was performed according to the Helsinki declaration and good clinical practice guidelines.

For the patients included in our study we have dosed the level of total cholesterol, low density lipoprotein cholesterol (LDLc), high density lipoprotein cholesterol (HDLc), triglycerides (TG) and glycated hemoglobin (HbA1c). We defined a patient as sedentary if his/her total physical activity was less than 30 minutes per day.

For the diagnosis of metabolic syndrome, we used the criteria for the clinical diagnosis of the Metabolic Syndrome proposed by IDF / AHA in 2009 [5], as detailed in Table 1.

Table 1. Criteria for the Clinical Diagnosis of the Metabolic Syndrome (IDF/AHA 2009). Adapted after [5].

Measure	Categorical cut points
Elevated waist circumference	Population- and country-specific definitions. For European Caucasians > 80 cm (F) and > 94 cm (M).
Elevated triglycerides (drug treatment for elevated triglycerides is an alternate indicator)	≥150 mg/dL
Reduced HDL cholesterol (drug treatment for reduced HDL cholesterol is an alternate indicator)	<40 mg/dL for males and <50 mg/dL for females
Elevated blood pressure (drug treatment for elevated blood pressure is an alternate indicator)	Systolic ≥130 mm Hg and/or diastolic ≥85 mm Hg
Elevated fasting blood glucose (drug treatment for elevated glucose is an alternate indicator)	≥100 mg/dL

For the diagnosis of diabetes we used the 2014 American Diabetes Association (ADA) diagnostic criteria [6] as detailed in Table 2.

Statistical analysis was made using the IBM SPSS Statistics 20 software. We included the calculation of mean values, standard deviations, minimum values, maximal values, medium values, and proportions or percentages (for

qualitative variables). For comparison of mean values, the t Student test p-value was calculated in conformity with this value and the statistical significance was defined for a $p < 0.05$.

Table 2. The 2014 American Diabetes Association (ADA) diagnostic criteria. Adapted after [6].

Parameter	Diabetes
HbA1c	≥ 6.5% (48 mmol/mol)*
FPG	≥ 7.0 mmol/L (≥126 mg/dL)*
2hPG	≥ 11.1 mmol/L (≥200 mg/dL)*
Random plasma glucose	≥ 11.1 mmol/L (≥ 200 mg/dL) in a patient with classic symptoms of hyperglycemia

* In the absence of unequivocal hyperglycemia, criteria 1–3 should be confirmed by repeat testing. (FPG = fasting plasma glucose; 2hPG = 2 hours plasma glucose)

Results

The entire study group contained 127 persons, 97 patients with AMI and 30 persons in the control group as detailed in Table 3.

Table 3. Distribution of patients in the study group.

Study group		Nr. of patients	%
Valid	AMI	97	76.4
	Control	30	23.6
	Total	127	100.0

The gender distribution in the group with AMI was 63 male patients (64.9%) and 34 female patients (35.1%) as shown in Figure 1.

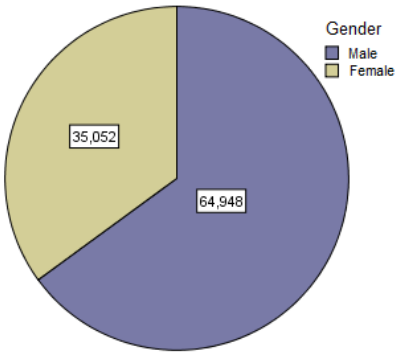

Figure 1. *Distribution by gender of patients with acute myocardial infarction.*

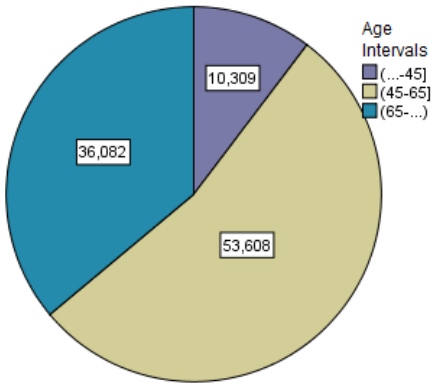

Figure 2. *Distribution by age group of patients with acute myocardial infarction.*

The age of AMI subjects ranged between 29 years and 89 years, with a mean age of 61.29 years. Regarding the distribution on age groups in the AMI patients, we had 10 patients (10.3%) in the age group below 45 years, 52 patients (53.6%) in the age group 46-65 years and 35 patients (36.1%) in the group > 65 years, as shown in Figure 2.

The number of patients with metabolic syndrome in the AMI and control groups is given in Figure 3.

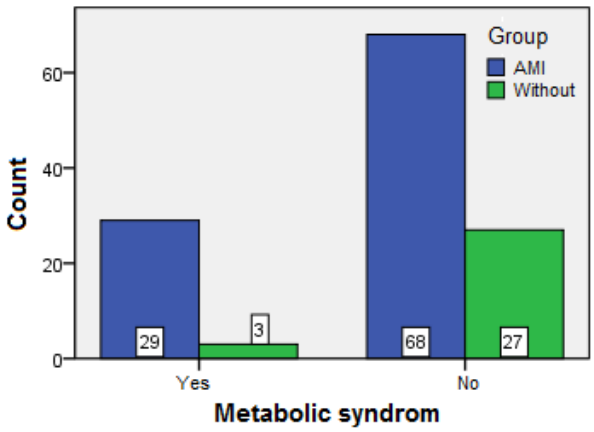

Figure 3. *Distribution of patients with metabolic syndrome in the two study groups.*

We found an association between the two variables of study (AMI/Control group and metabolic syndrome presence): χ^2_{calc} =4.813, df = 1, p=0.028.

The OR (odds ratio or the ratio risk/chance), i.e. the ratio between the risk of having a

positive event (AMI) in the patients with metabolic syndrome and the risk of having a positive event (AMI) in the patients without metabolic syndrome was 3.838 (95% CI = 1.078-13.661), a statistically significant result.

The number of patients with diabetes in the AMI and control groups is given in Figure 4.

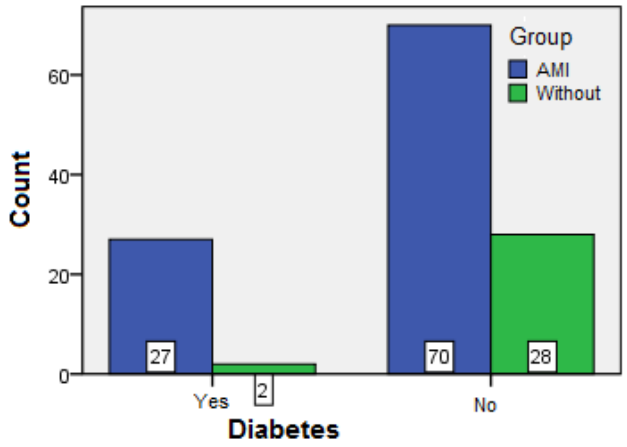

Figure 4. *Distribution of patients with diabetes in the two study groups.*

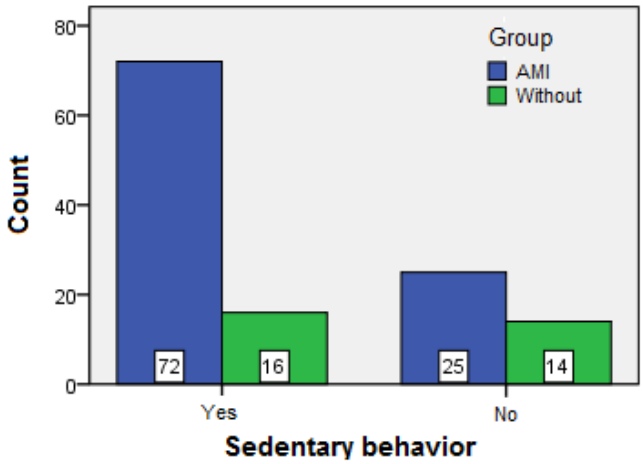

Figure 5. *Distribution of patients with sedentary behavior in the two study groups.*

We found an association between the two variables of study (AMI/Control group and diabetes presence): χ^2_{calc} = 5.827, df =1, p=0.016.

The OR, i.e. the ratio of the risk of having a positive event (AMI) in the patients with diabetes and the risk of having a positive event (AMI) in the patients without diabetes was 5.4 (95% CI = 1.203-24.242), a statistically significant result.

The number of patients with sedentary behavior in the AMI and control groups is given in Figure 5.

We found an association between the two variables of study (AMI/Control group sedentary behavior presence): χ^2_{calc} = 4.701, df = 1, p=0.03.

The OR, i.e. the ratio of the risk of having a positive event (AMI) in the patients with sedentary behavior and the risk of having a positive event (AMI) in the patients without sedentary behavior was 2.52 (95% CI = 1.078-5.892), a statistically significant result.

We give the descriptive statistics for the lipid profile and HbA1c values in the AMI and control groups in Table 4.

Table 4. Lipid profile and HbA1c values in the two study groups.

	Group	No.	Mean	Std. Deviation	Std. Error Mean
Col T (mg/dL)	AMI	97	195.7320	49.02455	4.97769
	Control	30	171.3263	17.46868	3.18933
LDLc (mg/dL)	AMI	97	128.7320	40.55488	4.11772
	Control	30	105.9950	13.10177	2.39205
HDLc (mg/dL)	AMI	97	43.9691	17.81821	1.80917
	Control	30	55.6640	8.73415	1.59463
Trigl (mg/dL)	AMI	97	156.0412	87.14223	8.84795
	Control	30	163.3333	137.95310	25.18667
HbA1c (%)	AMI	97	5.7113	1.63273	0.16578
	Control	30	4.7300	0.93924	0.17148

(ColT = total cholesterol)

There was a significant difference between the average value of total cholesterol in the AMI and control groups (t = 4.128; df = 122.6; p<0.001; M_{Diff} = 24.40 mg/dL; 95%-CI of the Difference = 12.70-36.10 mg/dL).

We also found a significant difference between the average value of LDLc in the AMI and control groups (t = 4.775; df = 124.7; p<0.001; M_{Diff} = 22.73 mg/dL; 95%-CI of the Difference = 13.31- 32.16 mg/dL).

There was a significant difference between the average value of HDLc in the AMI and control groups (t = -3.462; df = 125; p<0.001; M_{Diff} = -11.69 mg/dL; 95%-CI of the Difference = -18.38, -5.00 mg/dL).

We also found a significant difference between the average value of HbA1c in the AMI and control groups (t = 4.11; df = 85.87; p<0.001; M_{Diff} = 0.98%; 95%-CI of the Difference = 0.50-1.45%).

However, there was no significant difference between the average value of triglycerides in the AMI and control groups (t = -0.345; df = 125; p=0.73; M_{Diff} = -7.29 mg/dL; 95%-CI of the Difference = -49.14, 34.56 mg/dL).

Discussion

Comparing our findings with data from the national register of ST elevation AMI (RO-STEMI) [7], we have found similar values regarding the average age of developing acute myocardial infarction: 61.29 years vs. 63 years (RO-STEMI), and in terms of gender distribution: 64.9% male patients vs. 68.56% males in RO-STEMI. These findings suggest that our study is representative for the Romanian population.

Both studies highlight the fact that middle-aged men are most commonly affected by AMI. A worrying aspect is that a fairly large proportion is represented by patients younger than 45 years (10.3%).

Comparing the study group with acute myocardial infarction and the control group, we have noticed a statistically significant difference (p <0.05) for the patients with metabolic syndrome, diabetes, and sedentary behavior.

According to our study, diabetic patients have a 5.4 times higher risk of AMI than non-diabetic patients, a result which was again statistically significant. The results of our study, concordant with the literature data, showed that glycosylated hemoglobin is a risk factor for AMI.

The risk of AMI in the group of patients with metabolic syndrome was 3.838 times higher than in patients without metabolic syndrome, an also statistically significant result. Finally, sedentary patients had a significantly increased (2.52 times higher) risk of AMI.

The increased risk of developing AMI for patients with metabolic syndrome, diabetes,

sedentary, with high levels of HbA1c is explained by the physiological processes found in this group of patients.

In diabetes three major biochemical/hormonal changes are seen: hyperglycemia, hyperinsulinemia, and increased circulation of free fatty acids. The metabolic environment in diabetes is pro-inflammatory, due to higher pro-inflammatory factors (interleukin-1, interleukin-6, tumor necrosis factor, fibrinogen) and oxidative stress, all contributing to endothelial injury, with a rapid onset and progression of atherosclerotic lesions. Hyperinsulinemia causes a decrease in endothelial NO (nitric oxide) synthesis level and increased sympathetic stimulation, which explains the higher rate of acute coronary events.

In the Multi-Ethnic Study of Atherosclerosis it was reported that persons with metabolic syndrome or diabetes have a greater incidence and progression of CAC (coronary artery calcium) compared to those without [8]. Similarly, in smaller cohorts, impaired fasting glucose and insulin resistance have been shown to be related to the progression of CAC [8].

As expected, the total cholesterol level, LDLc, and HDLc significantly correlated with the risk of AMI. This association was not found with the serum triglyceride level.

Our study confirmed the close relationship between the metabolic syndrome, diabetes, sedentary behavior, the level of total Cholesterol, LDLc, HDLc, HbA1c, and the development of ST segment elevation acute myocardial infarction, emphasizing their negative role in the process of atherosclerosis.

Although our study was not done on a very large group of patients, many of the results are statistically significant, very useful in the understanding and management of cardiovascular risk factors in the studied region, with a view to supporting primary and secondary prevention. According to data from literature, over 50% of the reduction in mortality due to coronary disease is related to the control of risk factors and 40% due to improvements in therapeutic behavior, highlighting the importance of primary and secondary preventive measures.

Conclusion

Physical inactivity, metabolic syndrome, diabetes, dyslipidemia, and a high level of HbA1c were major cardiovascular risk factors in the patients with ST-segment elevation acute myocardial infarction. Our study highlights the need for cardiovascular prevention, through a coordinated set of actions both at public and individual level, aiming to reduce the impact of cardiovascular disease and secondary disabilities.

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