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ORIGINAL PAPER

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Troponin and CRP as Indicators of Possible Ventricular Arrhythmias in Myocardial Infarction of the Anterior and Inferior Walls of the Heart

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ABSTRACT

Introduction: Heart rhythm disorders are quite common in the clinical course of acute myocardial infarction and have a significant influence on the prognosis of the disease. **Aim:** To investigate the type and frequency of ventricular arrhythmias in patients with acute myocardial infarction (AMI) by sex and age, according to localization of myocardial infarction, and correlated with troponin and C reactive protein (CRP). **Material and Methods:** A prospective, analytical, comparative clinical study was performed. A total of 100 patients was included who were hospitalized at the Clinic for Heart Disease and Rheumatism at the Clinical Center University of Sarajevo for a period of 6 months, of both sexes, aged from 20 to 90 years. The occurrence of ventricular arrhythmias, CRP and troponin, were observed in relation to the localization (anterior and inferior myocardial wall). **Results:** It was found that men are more represented in comparison to women and that the largest number of males were in the age group of 51-60 years of life and women in the age group of 71-80 years. It has been established that there is no significant difference between ventricular arrhythmia according to localization of AMI. By determining the mean CRP and troponin levels, a positive correlation was found between CRP and troponin values and recorded ventricular arrhythmias. **Conclusion:** There is a positive correlation between the troponin and CRP values and ventricular arrhythmias, not related to the localization of AMI, which is important in prevention and planning the treatment of complications of potentially malignant ventricular arrhythmias and fatal outcome at AMI. **Keywords:** troponin, C-Reactive Protein, myocardial infarction, arrhythmia.

1. INTRODUCTION

According to the criteria of the World Health Organization (WHO) and modifications by the European Cardiac Society (ESC) and the American College of Cardiology, the acute myocardial infarction (AMI) diagnosis is established if at least two of the three criteria are present: a history of chest pain, characteristic changes on the electrocardiogram (ECG) and elevated serum cardiac markers (1). The role of heart rhythm disorders in the complication of clinical course of patients with acute myocardial infarction has long been recognized, leading to the formation of coronary units where arrhythmia, which was most often responsible for fatal outcome in patients, was timely and successfully resolved. After the formation of coronary units, 72 to 96% of patients with acute myocardial infarction were diagnosed with the presence of some of the rhythm disorders (2). Heart rate rhythm disorders have a significant influence on the prognosis of such patients due to potentially malignant ventricular arrhythmias and the risk of sudden cardiac death. The mechanism of arrhythmia in acute myocardial infarction remains relatively unknown, and the main hypothesis is considered to be the presence of "micro reentry" mechanisms due to inhomogeneity of the electrical properties of ischemic myocardial infarction.

2. AIM

Aim of article was to investigate the incidence of AMI according to age and sex and localization of myocardial infarction (anterior and inferior heart wall), determine the type and frequency of ventricular arrhythmias in patients with acute myocardial infarction depending on

the localization of the infarction and to establish correlation between measured troponin and CRP values, and recorded ventricular arrhythmias according to localization of myocardial infarction.

3. MATERIAL AND METHODS

A prospective, analytical, comparative clinical study was performed. The study included a total of 100 subjects with diagnosis of AMI of the anterior or inferior walls of the heart who were hospitalized at the Clinic for Heart, Blood Vessel and Rheumatic Diseases at the Clinical Center University of Sarajevo for a period of 6 months (from November 2017 to May 2018). The population of both sexes were included in the study, aged from 20 to 90 years who have had roughly similar therapeutic approach to AMI. Ventricular arrhythmias were observed, namely ventricular extrasystoles (VES) by Lown scale, ventricular tachycardia and ventricular fibrillation. Troponin and C reactive protein (CRP) values were determined. Methods of common approach to AMI patients were used, namely disease history and physical examination of patients, standard electrocardiogram (ECG), ECG monitoring during average three-day monitoring in intensive coronary unit, and laboratory parameters of peak values of troponin and CRP findings from venous blood samples were used. Descriptive statistics (mean value, median, standard deviation, standard error), nonparametric tests of significance and test of the correlation were used in statistical data processing. Comparison of the distribution of parameters (age, sex, localization of the infarction and the presence of rhythm disorders) between the investigated groups were tested by the Chi-Square test. The value of $p < 0.05$ was taken as statistically significant.

4. RESULTS

Of the total number of subjects, 69 were men. Chi-square test showed a significant difference in sex representation of subjects with AMI, $\chi^2 = 14.440$, $p = 0.001$, $p < 0.05$, in favor of males, and a significant difference in the age groups of patients, $\chi^2 = 58.2$; $p = 0.001$, $p < 0.05$ in the age group of 51 to 60 years. The analysis showed that the majority of men affected by AMI were in the age group from 51 to 60, 23 of them, while the majority of AMI-treated women were in the age group 71 to 80, 12 of them. The Chi square test showed that there is a significant difference in the localization of infarction in patients, $\chi^2 = 4.84$; $p = 0.028$; $p < 0.05$, in favor of infarction of the inferior wall, and there is no significant difference in the presence of rhythm disorders in patients with respect to the localization of the infarction, $\chi^2 = 0.408$;

Rhythm disorders	Localization of the infarction	
	Inferior heart wall	Anterior heart wall
Yes	32	23
No	29	16
Total	61	39

$\chi^2 = 0,408$; $p=0,523$; $p>0,05$

Table 1. Frequency of heart rhythm disturbance in patients with regards to the localization of the infarction

Type of ventricular arrhythmias	Existence of ventricular disorders	Troponin value		CRP value	
		Mean value	Frequency	Mean value	Freq.
Monomorphic VES	Yes	106.93	31	43.73	31
	No	60.46	69	24.69	69
Polymorphic VES	Yes	81.31	10	20.15	10
	No	74.15	90	31.75	90
Bigeminy VES	Yes	82.84	4	25.90	4
	No	74.53	96	30.79	96
Couplet VES	Yes	108.98	11	26.10	11
	No	70.65	89	31.15	89
Nonsustained VT	Yes	249.26	95	14.96	5
	No	65.69	5	31.41	95
Sustained VT	Yes	71.39	4	87.80	4
	No	75.01	96	28.21	96
VES R/T	Yes	20.15	2	33.95	2
	No	75.95	98	30.52	98
Ventricular fibrillation	Yes	46.73	7	57.07	7
	No	76.98	93	28.60	93

Table 2. Correlation between levels of Troponin and CRP and recorded ventricular arrhythmias (VES-ventricular extrasystoles, VT-ventricular tachycardia).

$p = 0.523$; $p > 0.05$ (Table 1). Single monomorphic VES is the most common ventricular arrhythmia, regardless of the localization of the infarction (Table 2).

Correlation of troponin levels and ventricular arrhythmias was positive and statistically significant ($p < 0.05$, $p = 0.047$, $r = 0.267$), meaning ventricular arrhythmias were more common with higher levels of troponin. CRP and ventricular arrhythmia correlations were positive and statistically significant ($p < 0.05$, $p = 0.026$, $r = 0.222$), meaning ventricular arrhythmia was more frequent in higher CRP levels.

Statistical analysis showed that the death of patients occurred in the age groups 61-70 years, 71-80 years and in the age group of 81-90 years. Mortality was highest in the age group of 71 to 80 years. Analysis showed that one subject died of primary ventricular fibrillation (PVF), while three died of secondary ventricular fibrillation and seven from other AMI complications. Mortality was more frequent among male subjects. Statistical analysis also showed that 7 subjects (63.6%) who died had a localization of the infarction at the inferior heart wall, while 4 subjects (36.4%) had localization of the infarction at the anterior heart wall. The Chi square test showed that there was no significant difference in the localization of the infarction in subjects who died, $\chi^2 = 0.818$; $p > 0.05$ ($p = 0.366$).

5. DISCUSSION

The data analysis showed that the males were present in 69% of cases, and the females in 31%. One study conducted in Iran covered 3,000 subjects and analysis of gender structure showed that 1381 (46%) subjects were female and 1619

(54%) were male. In study conducted in Bangladesh in 2006 the ratio between men and women was 4: 1 (3). In the age of 45, first cases of confirmed coronary artery disease in women occurred, which is consistent with the information that starting climax women lose their protection against this disease. Framingham study data suggest that the presence of menopause triggers the escalating risks of coronary disease up to three times in comparison to women who are not in menopause in the same age (4). The most frequent anatomical localization of AMI among subjects included in the study was inferior wall (61% of cases). In the paper of Cricri et al. it was also the case that inferior AMI localization was the most common in the included subjects. Ventricular arrhythmias were present in 55% of subjects with AMI. Based on one study, subjects with AMI were divided in three clinical groups: high risk, medium-risk and low-risk subjects (5, 6). About 20% of subjects with AMI, treated prior to the period of fibrinolytic therapy, were in the high-risk group. This group of patients is characterized by the presence of cardiac failure, continuous myocardial ischemia, and complex ventricular rhythm disorders (polymorphic and/or VES in the form of R to T or ventricular tachycardia-VT). In most cases, they were patients with AMI of the anterior wall and already experienced myocardial infarction. In this group, mortality in the first year after AMI was 20 to 50%. In contrast, low-risk patients, about 25% of them, did not have these characteristics. The mortality of this group of patients in the first year after AMI was only 2% to 5%. The association of significant rhythm disorders with the AMI outcome is described in many studies. The presence of VT, ventricular fibrillation (VF) and acute atrial fibrillation (AF) in patients with AMI has been proven to be associated with older age and heart failure. According to literature, VT and VF occur in 1.9% to 10.2% of patients, mostly in the first 48 hours. These arrhythmias are more common in older people and a higher degree of clinical classification of cardiac insufficiency according to Killip. In the analysis of 2317 patients with AMI, treated for 20 years in the Mayo Clinic, 7.5% of patients had some form of ventricular arrhythmia (in 5.7% VF and 1.8% VT), which was associated with increase in mortality by six times. In 3 out of 4 patients (78%) ventricular arrhythmias occurred within the first 48 hours of the onset of symptoms of AMI. Therefore, the recognition of high-risk patients and the prevention of ventricular arrhythmias can significantly improve the outcome of treatment (7). The analysis showed that the mean value of troponin in the subjects with AMI, was 74.86 ± 120.84 . The results of the CH study (Cardiovascular Health Study) during 2-3 years of follow-up of patients with heart failure showed increased levels of highly sensitive troponin T by more than 50 percent compared to baseline (7). The results of the meta-analysis of 16 studies showed that the level of troponin T in patients with rhythm disorder is a predictor of total mortality and a worse treatment outcome (8, 9). Benc et al. registered significant serum CRP values in the 110 patients with acute myocardial infarction with ST segment elevation and the mean value of 35.0 ± 21.6 mg/L, and that indicated that inflammation plays a significant role in the progression, destabilization and rupture of atherosclerotic lesions, and that CRP is a

predictor of fatal outcome in patients with acute infarction and ST elevation (10). Unlike primary VF induced by myocardial ischemia, VF which is caused by big necrosis, severe cardiac insufficiency, cardiogenic shock, aneurysm, is called secondary ventricular fibrillation, and it occurs 48 hours later and has a worse prognosis. One-year mortality of these patients is 85% unlike primary VF, where one-year mortality is 15%. VF is the cause of sudden cardiac death in patients in out-of-hospital conditions before they reach the hospital, while during the hospitalization VF occurs in 5 to 10% of patients with AMI (11,12). Primary ventricular fibrillation is the most common cause of sudden cardiac death during myocardial infarction. It most often occurs after the first hour after myocardial infarction, and then its frequency is gradually reduced. In the first 4 hours, occur up to 80% of all ventricular fibrillation in acute myocardial infarction. Epidemiological data show that the incidence of primary fibrillation is significantly reduced, most likely due to electrolyte imbalance correction, the therapeutic measures to reduce infarction size, as well as the use of beta-blockers (13,14, 15).

6. CONCLUSION

In our research, men were more present than women, and majority of men were in the age group of 51-60 years, and women in the age group of 71-80 years which is consistent with the nature of the disease. The most frequent localization of AMI was inferior wall, for which we did not find a logical explanation for examined population in the literature. All types of ventricular arrhythmias were identified, and most common were single VES, monomorphic and polymorphic. It was found that there was no significant difference in ventricular arrhythmia according to AMI localization. Determining the mean value of troponin and CRP in subjects with AMI showed a positive correlation between troponin levels and CRPs and recorded ventricular arrhythmias, which is important in prevention and planning the treatment of ventricular arrhythmias and potentially malignant arrhythmias with possible fatal outcome.

- **Author's contribution:** Each author participated in each step of research. E.H. revised it critically. Each author gave final approval for final version of article.
- **Conflict of interest:** none declared.

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