

PECULIARITIES OF HEART RHYTHM DISORDERS AND VENTRICULAR REPOLARIZATION STATUS IN PATIENTS WITH MYOCARDIAL INFARCTION WITHOUT ELEVATION OF SEGMENT ST DEPENDING ON THE INDICATORS OF STRUCTURAL REMODELING OF THE LEFT VENTRICLE

©V. Yu. Maslovskyi

National Pirogov Memorial Medical University, Vinnytsia

SUMMARY. Despite advances in the treatment of acute myocardial infarction in most developed countries, this pathology remains the leading cause of morbidity and mortality. The search for opportunities to predict the development of complications, study of remodeling processes and their impact on the development of electrical instability of the myocardium is currently considered as a promising area of non-invasive diagnosis of myocardial infarction.

The aim – to establish the features of cardiac arrhythmias and the condition of ventricular repolarization in patients with NSTEMI depending on the indicators of structural remodeling of the left ventricle.

Material and Methods. We conducted a comprehensive study of 200 patients with NSTEMI aged 38 to 80 years. All patients were examined according to the current protocol of diagnosis and treatment of patients with acute coronary syndrome without ST-segment elevation and daily Holter ECG monitoring was performed for 3–5 days after hospitalization.

Results. An increase in the left ventricular myocardial mass index and a change in the geometric model are associated with an increase in the probability of developing myocardial electrical instability, in particular extrasystoles of any topic and paroxysmal tachycardia. At the same time, changes in structural remodeling indicators did not reveal correlations with ventricular repolarization disorders in the early NSTEMI period.

Conclusions. Evaluation of the indicators of structural remodeling of the ventricular myocardium in the early period of NSTEMI allows to predict the risk of electrical instability of the myocardium and to carry out appropriate preventive measures.

KEY WORDS: myocardial infarction without ST segment elevation; structural-geometric remodeling; arrhythmia.

Introduction. Improving the diagnosis and treatment of myocardial infarction remains a priority in modern cardiology. First of all, this is due to the leading role of this pathology in the structure of overall and cardiovascular mortality worldwide [1]. Despite progress in the treatment of acute myocardial infarction in most developed countries, this pathology remains the leading cause of morbidity and mortality [2]. The long-term prognosis of this category of patients remains disappointing, primarily due to the development of myocardial dysfunction due to post infarction remodeling and the development of prognostically unfavorable arrhythmias on the background of electrically unstable myocardium [3]. The search for opportunities to predict the development of complications, study of remodeling processes and their impact on the development of electrical instability of the myocardium is currently considered as a promising area of non-invasive diagnosis of myocardial infarction [4]. Such a form of infarction as myocardial infarction without ST-segment elevation is characterized by an unfavorable long-term prognosis due to the development of myocardial dysfunction, electrical instability of the myocardium or the development of recurrent coronary events [5].

The aim of the study was to establish the features of cardiac arrhythmias and the state of ventricular repolarization in patients with NSTEMI depend-

ing on the indicators of structural remodeling of the left ventricle.

Material and Methods. We examined 200 patients with acute myocardial infarction without ST-segment elevation (NSTEMI) aged 38 to 80 (mean 62.0 ± 0.71 , median – 62 and interquartile range – 55 and 70) years, who were hospitalized in the Municipal Non-Profit Enterprise "Vinnytsia Regional Clinical Medical and Diagnostic Center for Cardiovascular Pathology" with urgent indications.

The criteria for including patients in the study were:

1. verified NSTEMI, first diagnosed;
2. age up to 80 years;
3. the absence of contraindications to percutaneous coronary interventions and the use of the main groups of pharmacological agents included in the basic therapy of NSTEMI;
4. informed consent of the patient to participate in the study.

The criteria for exclusion from the study were:

1. STEMI, transferred in the past and recurrent acute myocardial infarction;
2. age of patients 80 years and older;
3. the presence of sinoatrial or atrioventricular block II–III degree, implanted or the need for implantation of an artificial pacemaker;
4. chronic heart failure NYHA-III, IV before the incident of acute myocardial infarction;

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5. diseases of the respiratory system, kidneys and liver, which were accompanied by signs of pulmonary, renal and hepatic failure; anemic conditions with a hemoglobin level below 110 g/L;

6. the presence of rheumatic and congenital heart defects, idiopathic and inflammatory myocardial lesions;

7. malignancies, severe neuropsychiatric disorders, alcohol abuse;

8. the presence of contraindications to percutaneous coronary interventions and the use of the main groups of pharmacological agents included in the basic therapy NSTEMI;

9. reluctance and refusal of the patient to participate in the study.

All patients were examined according to the NSTEMI protocol [6] and daily Holter ECG monitoring was performed for 3–5 days after hospitalization.

All of the research corresponds to the principles of the Declaration of Helsinki of the World Medical Association.

Results and Discussion. We analyzed the features of daily heart rate (HR) regulation, cardiac arrhythmias and ventricular repolarization in NSTEMI patients depending on: 1) the value of the left ventricular myocardial mass index (LVMI) ($LVMI \leq$ and $> 115 \text{ g/m}^2$) patients with NSTEMI); 2) values of the relative thickness of the LV myocardium ($RWT \leq$ and > 0.45 – the value of the indicator taken as the median for the total sample of patients NSTEMI).

It was found that in the group with $LVMI > 115 \text{ g/m}^2$, compared with the group with $LVMI \leq 115 \text{ g/m}^2$ (Table 1), determined a significant increase in the total number of supraventricular extrasystoles (SE) per day (1048 vs. 581, $p=0,03$) and, accordingly, their average number per 1 hour (44 vs. 24, $p=0,03$), the frequency of cases with registration of asymptomatic episodes of supraventricular tachycardia / atrial fibrillation (SVT/AF) per day (24.7% vs. 12,6%, $p=0,03$), the total number of paired and group ventricular arrhythmias (VE) per day (38 vs. 16, $p=0,03$) and the total duration of episodes of ventricular tachycardia (VT) per day (90 vs. 62 s, $p=0,04$).

Table 1. The structure of cardiac arrhythmias and the condition of ventricular repolarization in NSTEMI patients depending on the value of the left ventricular myocardial mass index

Holter ECG (n=200)	$LVMI \leq 115 \text{ g/m}^2$ (n=103)	$LVMI > 115 \text{ g/m}^2$ (n=97)	P
Total number of SE per day	581 (257; 1966)	1048 (442; 6831)	0.03
Average number of SE per 1 hour	24 (10; 81)	44 (18; 284)	0.03
SVT / AF episodes per day number of patients (%)	13 (12,6 %)	24 (24,7 %)	0.03
Total number of paired / group VE per day	16 (13; 34)	38 (21; 49)	0.03
The total duration of VT episodes per day, sec.	62 (44; 92)	90 (70; 110)	0.04
SMI episodes per day, number of patients (%)	21 (20,4 %)	11 (11,3 %)	Un
The average number of SMI episodes per day	2 (1; 4)	3 (2; 3)	Un
Total duration of SMI episodes per day, min	10 (7; 20)	15 (12; 20)	Un
Average background HR on SMI episodes, 1 min	122 (104; 134)	128 (97; 136)	Un

Notes: 1. Comparison of percentages between groups was performed by the criterion χ^2 , absolute values – by Mann–Whitney U test; 2. Un – unreliable ($p > 0,05$).

In turn, the analysis of Holter ECG results depending on the value of RWT LV (Table 2) showed that in the group of patients NSTEMI and $RWT > 0,45$, compared with $RWT \leq 0,45$, there was a significant increase in total SE during the study (989 vs. 566, $p=0,02$) and, accordingly, their number per 1 hour

(41 vs. 24, $p=0,02$) and the frequency of cases with registration > 100 episodes of SE per 1 hour of study (20.9 % vs. 10.0%, $p=0,04$). In turn, in the case of $RWT \leq 0,45$ there was a significant increase in the frequency of cases with episodes of VT per day (17.8 % vs. 8.2 %, $p=0,04$).

Table 2. The structure of cardiac arrhythmias and the condition of ventricular repolarization in NSTEMI patients depending on the relative thickness of the left ventricular myocardium

Holter ECG (n=200)	$RWT \leq 0,45$ (n=90)	$RWT > 0,45$ (n=110)	P
1	2	3	4
Total number of SE per day	566 (250; 1500)	989 (419; 7103)	0.02
Average number of SE per 1 hour	24 (10; 62)	41 (18; 295)	0.02
Average number of SE per 1 hour > 10 , number of patients (%)	40 (44.4 %)	54 (49.1 %)	Un
Average number of per 1 hour > 100 , number of patients (%)	9 (10.0 %)	23 (20.9 %)	0.04
Episodes of VT per day, number of patients (%)	16 (17.8 %)	9 (8.2 %)	0.04

1	2	3	4
SMI episodes per day, number of patients (%)	16 (17.8 %)	16 (14.5 %)	Un
The average number of SMI episodes per day	2 (1; 3)	3 (2; 4)	Un
Total duration of SMI episodes per day, min	14 (7; 18)	12 (9; 21)	Un
Average background heart rate in SMI episodes per 1 min	122 (100; 133)	126 (110; 136)	Un

Notes: 1. Comparison of percentages between groups was performed by the criterion χ^2 , absolute values – by Mann–Whitney U test; 2. Un – unreliable ($p > 0.05$).

The study of the condition of ventricular repolarization depending on the indicators of structural remodeling of LV did not reveal significant differences in the groups $LVMi \leq$ and $> 115 \text{ g/m}^2$ and $RWT \leq$ and > 0.45 . Thus, the number and duration of silent myocardial ischemia (SMI) episodes did not show significant differences in all groups of patients studied.

Thus, the results of the analysis indicate only the association of the frequency of registration of various supraventricular cardiac arrhythmias (primarily, the frequency and number of SE and transient episodes of SVT/AF) with the difficulty of structural remodeling of LV and the nature of LV geometry. It should be assumed that the increase in LVMi as a marker of the severity of structural remodeling of LV and RWT as a marker of concentric LV model contribute to the development of various supraventricular arrhythmias in patients with NSTEMI.

According to a number of studies, increasing the value of LVMi in various cardiovascular pathologies contributes to the development of electrical instability of the ventricular myocardium and acts as a trigger for severe ventricular arrhythmias [7]. The results of our study, which were conducted on a sample of NSTEMI patients without severe structural myocardial damage (median LVMi – 115 g/m^2 in the absence of ejection fraction $< 40\%$), confirm this fact, showing a significant increase the total number of paired and group VE per day and the total duration of transient episodes of VT per day at $LVMi > 115 \text{ g/m}^2$. On the other hand, it should be thought that the predisposition to eccentric LV models ($RWT < 0.45$) in NSTEMI patients may contribute to the development of severe and

prognostically dangerous ventricular arrhythmias, in our study this was confirmed by a significant increase in VT episodes per day ($p = 0.03$).

At the same time, our data on the lack of correlations between the state of ventricular repolarization with different indicators of structural-geometric remodeling do not coincide with the data of other studies [8]. In our opinion, this is due solely to the number of objects observed, because it is quite logical that the probability of destabilization with increasing the degree of structural remodeling of the myocardium.

Conclusions. 1. An increase in the left ventricular myocardial mass index and a change in the geometric model is associated with an increase in the probability of developing myocardial electrical instability, in particular, extrasystoles of any topic and paroxysmal tachycardia.

2. Changes in structural remodeling did not reveal correlations with ventricular repolarization disorders in the early NSTEMI period.

3. Evaluation of the indicators of structural remodeling of the ventricular myocardium in the early period of NSTEMI allows to predict the risk of electrical instability of the myocardium and to take appropriate preventive measures.

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ОСОБЛИВОСТІ ПОРУШЕНЬ СЕРЦЕВОГО РИТМУ ТА СТАНУ РЕПОЛЯРИЗАЦІЇ ШЛУНОЧКІВ У ПАЦІЄНТІВ NSTEMI ЗАЛЕЖНО ВІД ПОКАЗНИКІВ СТРУКТУРНОГО РЕМОДЕЛЮВАННЯ ЛІВОГО ШЛУНОЧКА

©В. Ю. Масловський

Вінницький національний медичний університет імені М. І. Пирогова

РЕЗЮМЕ. Незважаючи на прогрес у лікуванні гострого інфаркту міокарда в більшості розвинених країн, ця патологія залишається лідером серед провідних причин захворюваності та смертності. Пошук можливостей прогнозування розвитку ускладнень, вивчення процесів ремоделювання та їх впливу на розвиток електричної нестабільності міокарда в даний час розглядається як перспективний напрямок неінвазивної діагностики інфаркту міокарда.

Мета – встановити особливості порушень серцевого ритму та стан реполяризації шлуночків у пацієнтів з NSTEMI залежно від показників структурного ремоделювання лівого шлуночка.

Матеріал і методи. Нами було проведено комплексне дослідження 200 пацієнтів з NSTEMI у віці від 38 до 80 років. Усі пацієнти обстежені відповідно до діючого протоколу діагностики та лікування пацієнтів з гострим коронарним синдромом без елевації сегмента ST та проведене добове холтеровське моніторування ЕКГ протягом 3–5 днів після госпіталізації.

Результати. Збільшення індексу маси міокарда лівого шлуночка та зміна геометричної моделі асоціюються із підвищенням ймовірності розвитку проявів електричної нестабільності міокарда, зокрема, екстрасистоїї будь якої топіки та пароксизмальної тахікардії. В той же час, зміни показників структурного ремоделювання не виявили кореляційних зв'язків із порушеннями реполяризації шлуночків у ранньому періоді NSTEMI.

Висновки. Оцінка показників структурного ремоделювання міокарда шлуночків у ранньому періоді NSTEMI дозволяє прогнозувати ризик розвитку електричної нестабільності міокарда та проводити відповідні профілактичні заходи.

КЛЮЧОВІ СЛОВА: інфаркт міокарда без елевації сегмента ST; структурно-геометричне ремоделювання; порушення ритму.

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Електронна адреса для листування: vmaslovskiy@gmail.com; 0675050078