ISSN 2521-1455 (Print)
ISSN 2523-4250 (Online)

DOI: 10.21802/artm.2021.4.20.51
UDC 616.124.2: 616.127-005.8

GENDER FEATURES OF STRUCTURAL-GEOMETRIC REMODELING OF THE LEFT VENTRICLE IN PATIENTS WITH MYOCARDIAL INFARCTION WITHOUT ELEVATION OF ST SEGMENT

V.I. Maslovskyi

National Pirogov Memorial Medical University, Vinnytsya, Ministry of Health of Ukraine,
Department of Internal Medicine №3, Vinnytsya, Ukraine,
ORCID ID: 0000-0001-5184-1799, e-mail: vmaslovskyi@gmail.com

Abstract. Recently, there has been a tendency to increase the incidence of myocardial infarction without elevation of the ST segment, which, according to some data, accounts for about half of all registered MI. The main problem with this type of infarction is that the long-term prognosis in these patients remains unsatisfactory, and mortality one year after the catastrophe is equal to or even higher than mortality from ST-segment elevation myocardial infarction, which encourages continued predictors of unfavorable prognosis.

Objective: to determine the gender characteristics of the structural and geometric remodeling of the left ventricle in patients with myocardial infarction without ST segment elevation.

Materials and methods. We conducted a comprehensive study of 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). The structural and functional state of the myocardium and types of left ventricular remodeling according to transthoracic echocardiography were studied.

Results. Analysis of the obtained data shows that echocardiographic parameters in patients with NSTEMI depending on gender did not reveal significant differences between different groups. The exception was the size of the right atrium, which was significantly higher in the group of men compared to women with comparable values of the size of the right ventricle and the ratio of the size of the left to the right atrium. Analysis of the nature of structural and geometric remodeling of the left ventricle in general by groups showed that almost half of the subjects registered concentric hypertrophy of the left ventricle. Concentric left ventricle remodeling was observed in one third of patients and in other patients - normal geometry and eccentric left ventricle hypertrophy. Thus, it was found that concentric models of left ventricle – concentric hypertrophy and concentric remodeling – were registered in the vast majority of patients with NSTEMI. The latter can be explained by a significant proportion of hypertension which was identified by us in most patients and, of course, contributed to the development of concentric models of left ventricle.

Analysis of the nature of structural and geometric remodeling of the left ventricle depending on gender showed that in the group of men, compared with women, there was a significant increase in the incidence of concentric remodeling. At the same time, in women, compared with men, there was a significant increase in cases of more severe types of structural remodeling - concentric and eccentric hypertrophy.

Thus, we found that gender differences in echocardiographic parameters in patients with NSTEMI relate exclusively to indicators of structural and geometric remodeling of the left ventricle. Signs of concentric and eccentric left ventricular hypertrophy predominate in women, and indicators of normal geometry and concentric left ventricular remodeling in men. This distribution of types of remodeling indicates a more severe course and unfavorable prognosis of NSTEMI in women.

Keywords: NSTEMI, structural-geometric remodeling of the left ventricle, myocardial ischemia.

Introduction. Despite some progress in the treatment of acute myocardial infarction in most developed countries, this pathology remains the leader among the leading causes of morbidity and mortality [1]. In Ukraine, cardiovascular disease is the leading cause of death [2]. According to this indicator, our country remains one of the world leaders. Nationally, mortality from cardiovascular disease has increased by almost 8% over the past 29 years: to 449,376 in 2019 and accounts for 64.3% of total deaths, while in 1990 there were 350,605 deaths from cardiovascular disease, which amounted to 56.5%, respectively [3]. The largest number of pre-hospital deaths in people with acute myocardial infarction is sudden death in the 1st hour of the disease [4]. More than half of patients diagnosed with coronary heart disease die suddenly. In approximately 30% of cases, sudden death is the first manifestation of coronary heart disease and is most often associated with malignant ventricular arrhythmias (ventricular tachycardia or ventricular fibrillation). Almost all cases of primary ventricular fibrillation occur in the first 4 hours. acute myocardial ischemia [5, 6]. Of great importance is the dissemination of knowledge among the population (especially at risk of acute myocardial infarction) about the specific symptoms of the disease, which reduces the period from the first symptoms to seek qualified medical care. A significant contribution is made by cardiac medical examination, which is used to select patients who are shown pharmacological or surgical modification of coronary artery disease [7].

ISSN 2521-1455 (Print)
ISSN 2523-4250 (Online)

The most important factor influencing the activation of remodeling processes today is considered to be tissue perfusion of the myocardium – the presence of adequate microcirculation in the affected area. However, regardless of the patency of the coronary artery that caused the heart attack, at different levels of vascular damage and the development of collateral blood flow, different volumes of necrosis zone are noted. One of the most typical consequences of common acute myocardial infarction is left ventricle remodeling. The left ventricular cavity loses its elliptical shape due to apoptosis of cardiomyocytes and replacement of dead cells with connective tissue, redistribution of volume load on the intact myocardium. From the 1st to the 14th day of acute myocardial infarction, the change in the geometry of the left ventricular cavity is dominated by the process of dilatation, then compensatory hypertrophy of the unaffected myocardium comes to the fore.

Rationale for the study. Existing methods of diagnosis of NSTEMI make it possible to timely determine the timing of percutaneous interventions for the timely treatment and prevention of early complications of myocardial infarction. The stratification of the risk of adverse events, carried out on the GRACE scale, includes a large number of clinical and instrumental indicators, a comprehensive analysis of which allows you to choose the optimal time for invasive treatment. However, in our opinion, it is quite reasonable to further search for additional predictors of adverse course of NSTEMI, taking into account the gender characteristics of structural changes in the myocardium.

Aim is to determine the features of structural-geometric remodeling of the left ventricle in patients with myocardial infarction without ST segment elevation depending on gender.

Materials and methods. We conducted a comprehensive study of 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 are urgent demonstrations were hospitalized in the Municipal Non-Profit Enterprise "Vinnytsia Regional Clinical Medical and Diagnostic Center for Cardiovascular Pathology".

The criteria for including patients in the study were:

1. Verified NSTEMI, first diagnosed. The inclusion of only primary myocardial infarction (MI) was due to the need to exclude the impact of previous coronary artery disease and related structural post-infarction left ventricular remodeling (LV) on the course of the disease;
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;
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.

Results. The results of the analysis of echocardiographic parameters in patients with NSTEMI depending on gender did not reveal significant differences between different groups. The exception was the size of the right atrium (RA), which was significantly higher in the group of men compared with women (36 vs. 34 mm, $p = 0.02$) with comparable ($p > 0.20$) values of the size of the right ventricle (RV) and the ratio of the size of the left to the right atrium (LA / RA).

The analysis of the nature of structural and geometric remodeling of the left ventricle in the group as a whole showed that almost half of the subjects were registered concentric left ventricular hypertrophy (LVH) – 102 (51.0%). Concentric remodeling of LV (CR) was observed in one third of patients – 67 (33.5%) and only in 17 (8.5%) and 14 (7.0%) patients – normal geometry (NG) and eccentric LV hypertrophy (EG) in accordance. Therefore, it was necessary to recognize the fact that concentric models of LV – concentric hypertrophy and concentric remodeling – were registered in the vast majority of NSTEMI patients. The latter could be explained by a significant proportion of hypertension, which was determined by us in 85.5% of respondents and, of course, contributed to the development of concentric models of LV (Fig. 1).

Analysis of the nature of structural and geometric remodeling of the left ventricle depending on gender showed that in the group of men, compared with women, there was a significant increase in the incidence of LV CR (41.5% vs. 13.8%, $p = 0.0002$). At the same time, in women, compared with men, there was a significant increase in cases of more severe types of structural remodeling of the left ventricle – CH (65.5% vs. 45.1%, $p = 0.009$) and EH (15.5% vs. 3.5%), $p = 0.003$).

ISSN 2521-1455 (Print)
ISSN 2523-4250 (Online)

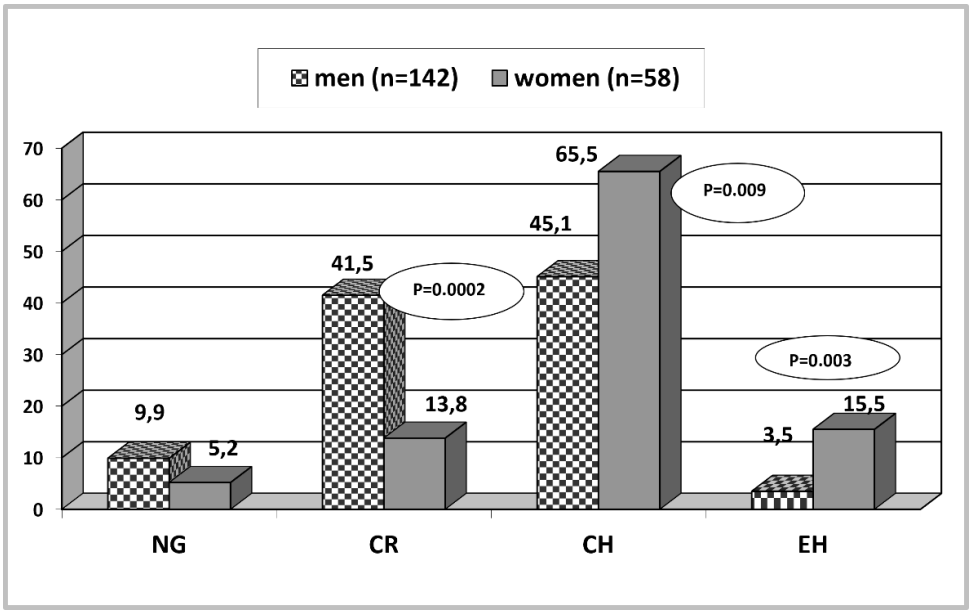

Fig. 1. The nature of structural-geometric remodeling of LV by Ganau in NSTEMI patients depending on gender.

Notes: 1. The distribution of types of structural-geometric remodeling of the left ventricle is given in%: NG – normal geometry, KR – concentric remodeling, KH – concentric hypertrophy and EH – eccentric hypertrophy;
2. Statistical significance of the percentage difference between the groups is calculated by the criterion $\chi 2$.

Thus, the results of the analysis indicate that in patients with NSTEMI in the absence of significant gender differences in the values of standard echocardiography, there are significant differences in the nature of structural and geometric remodeling of the left ventricle by Ganau. In addition, it was necessary to state the fact of more severe structural remodeling of the left ventricle in women compared to men, which was characterized by a significant increase in severe and prognostically unfavorable variants of remodeling – CH and EH of the left ventricle. The obtained data provide an opportunity to allow the fact of worsening and further prognosis of NSTEMI in female patients.

Discussion. We have established certain patterns that relate to remodeling indicators and have gender characteristics. Previous studies of this category of patients also found similar patterns in patients with MI who underwent percutaneous coronary intervention, and confirmed differences in results between sex and age [8]. Age has a stronger effect on the result in women than in men. Women are more likely to have poorer overall survival, and older women are at higher risk of heart failure after MI.

Left ventricular (LV) changes after MI include complex interactions between cellular and extracellular components under the influence of neurohumoral factors. Treatment to prevent adverse LV remodeling and to stimulate post-MI remodeling includes early revascularization, pharmacotherapy of neurohormonal blockade, and ventricular dyssynchrony therapy. Despite various definitions of adverse LV remodeling studied by several imaging techniques, the presence of an enlarged LV cavity and / or a reduced ejection fraction is consistently associated with poor clinical outcomes [9].

However, even outside the acute state, mechanisms such as inflammatory signaling, extracellular remodeling, or proapoptotic signaling that promote postinfarction remodeling are regulated by mitochondrial reactive oxygen species [10].

Conclusions:

1. It is established that gender differences in echocardiographic parameters in NSTEMI patients relate exclusively to indicators of structural and geometric remodeling of the left ventricle.
2. In female patients, signs of concentric and eccentric LV hypertrophy predominate, while in men – indicators of normal geometry and concentric LV remodeling.
3. Such a distribution of types of remodeling suggests a more severe course and unfavorable prognosis of NSTEMI in female patients.

References:

1. Koshelya II, Skryp VV. Epidemiology of ischaemic heart disease and myocardial infarction in Transcarpathian region. Ukraine. Nation's Health. 2019; 3:51-54. DOI: https://doi.org/10.24144/2077-6594.3.2019.191633.
2. Ipatov AV, Moroz OM, Khanyukova IYa, Mametyev AO, Sanina NA, Korobkin YuI, Molchanov RM. Osnovni pokaznyky invalidnosti ta diyalnosti medykosotsialnykh ekspertnykh komisiy Ukrayiny za 2020 rik: analityko-informatsiynyy dovidnyk. Dnipro: Aktsent PP. 2021. ISBN 978-966-921-223-8 [in Ukrainian].
3. Tsentr hromadskoho zdorov'ya Ukrayiny. Sertsevo-sudynni zakhvoryuvannya – holovna prychyna smerti ukrayintsiv. Vysnovky z doslidzhennya Hlobalnoyi tyaharya khvorob u 2019 rotsi (GBD — Global Burden of Disease). 2021; Sichen, 04. [in Ukrainian]. Available from: https://phc.org.ua/news/sercevo-sudinni-zakhvoryuvannya-golovna-prichina-smerti-ukrainciv-visnovki-z-doslidzhennya.

ISSN 2521-1455 (Print)
ISSN 2523-4250 (Online)

4. Terenda NO. Osnovni tendentsiyi ta prohnozni otsinky zahalnoyi ta pervynnoyi zakhvoryuvanosti na semichnu khvorobu sertsya v Ukrayini. Visnyk sotsialnoyi hihiyeny ta orhanizatsiyi okhorony zdorovya Ukrayiny, 2016; 3(69):31-35. http://nbuv.gov.ua/UJRN/VSG_2016_3_8 [in Ukrainian].
5. Moran AE, Forouzanfar MH, Roth GA, Mensah GA, Ezzati M, Murray CJ, Naghavi M. Temporal trends in ischemic heart disease mortality in 21 world regions, 1980 to 2010: the Global Burden of Disease 2010 study. Circulation, 2014; 129(14):1483-1492. DOI: https://doi.org/10.1161/CIRCULATIONAHA.113.004042.
6. Avoid able mortality: OECD / Eurostatlists of preventable and treatable causes of death. 2021; October. Retrieved from https://www.oecd.org/health/healthsystems/Avoidable-mortality-2021-Joint OECD-Eurostat-Listpreventable-treatable-causes-of-death.pdf
7. Townsend N, Wilson L, Bhatnagar P, Wickramasinghe K, Rayner M, Nichols M. Cardiovascular disease in Europe: epidemiological update 2016, European Heart Journal, 2016; 37(42):3232-3245. DOI: https://doi.org/10.1093/eurheartj/ehw334.
8. Jhih-Yuan Shih, Zhih-Cherng Chen, Hsien-Yuan Chang, et al. Risks of age and sex on clinical outcomes post myocardial infarction. IJC Heart & Vasculature. 2019; June. 23:100350. DOI: https://doi.org/10.1016/j.ijcha.2019.100350.
9. Ankeet S Bhatt, Andrew P Ambrosy, Eric J Velazquez. Adverse Remodeling and Reverse Remodeling After Myocardial Infarction. Curr Cardiol Rep. 2017; Aug. 19(8):71. DOI: https://doi.org/10.1007/s11886-017-0876-4.
10. Heiko Bugger, Katharina Pfeil. Mitochondrial ROS in myocardial ischemia reperfusion and remodeling. Biochim Biophys Acta Mol Basis Dis. 2020; Jul, 1; 1866(7):165768. DOI: https://doi.org/10.1016/j.bbadis.2020.165768.

УДК 616.124.2:616.127-005.8

ГЕНДЕРНІ ОСОБЛИВОСТІ СТРУКТУРНО-ГЕОМЕТРИЧНОГО РЕМОДЕЛЮВАННЯ ЛІВОГО ШЛУНОЧКА У ПАЦІЄНТІВ ІЗ ІНФАРКТОМ МІОКАРДА БЕЗ ЕЛЕВАЦІЇ СЕГМЕНТА ST

В.Ю. Масловський

Вінницький національний медичний університет ім. М. І. Пирогова МОЗ України, кафедра внутрішньої медицини №3,
м. Вінниця, Україна,
ORCID ID: 0000-0001-5184-1799,
e-mail: vmaslovskyi@gmail.com

Резюме. В останній час спостерігається тенденція до зростання частоти інфаркту міокарда без елевації сегмента ST, який, за деякими даними, становить близько половини всіх зареєстрованих ІМ. Основна проблема такого типу інфаркту полягає в тому, що довгостроковий прогноз у цих пацієнтів залишається незадовільним, а смертність через рік після катастрофи дорівнює або навіть перевищує смертність від інфаркту міокарда з елевацією сегмента ST, що спонукає до продовження пошуку предикторів несприятливого прогнозу перебігу захворювання.

Мета: визначити гендерні особливості характеру структурно-геометричного ремоделювання лівого шлуночка у хворих на інфаркт міокарда без елевації сегмента ST.

Матеріали і методи. Нами було проведено комплексне дослідження 200 пацієнтів із гострим інфарктом міокарда без елевації сегмента ST (ІМбелST) у віці від 38 до 80 (середнє значення 62,0 ± 0,71, медіана – 62 та інтерквартильний розмах – 55 та 70) років. Досліджено структурно-функціональний стан міокарда та типи ремоделювання лівого шлуночка за даними трансторакальної ехокардіографії.

Результати. Аналіз отриманих даних свідчить про те, що у хворих на ІМбелST за відсутності значущих статевих відмінностей у величинах стандартних ехокардіографічних параметрів спостерігаються достовірні відмінності в характері структурно-геометричного ремоделювання лівого шлуночка за Ganau. Крім того, слід зазначити факт більш вираженого структурного ремоделювання лівого шлуночка у жінок порівняно з чоловіками, що характеризувалося значним збільшенням тяжких та прогностично несприятливих варіантів ремоделювання – концентричної та ексцентричної гіпертрофії лівого шлуночка.

Ключові слова: ІМбелST, структурно-геометричне ремоделювання лівого шлуночка, ішемія міокарда.

УДК 616.124.2:616.127-005.8

ГЕНДЕРНЫЕ ОСОБЕННОСТИ СТРУКТУРНО-ГЕОМЕТРИЧЕСКОГО РЕМОДЕЛИРОВАНИЯ ЛЕВОГО ЖЕЛУДОЧКА У ПАЦИЕНТОВ С ИНФАРКТОМ МИОКАРДА БЕЗ ЭЛЕВАЦИИ СЕГМЕНТА ST

В.Ю. Масловский

Винницкий национальный медицинский университет им. М. И. Пирогова МОЗ Украины, кафедра внутренней медицины №3, г. Винница, Украина,
ORCID ID: 0000-0001-5184-1799,
e-mail: vmaslovskyi@gmail.com

Резюме. В течение последнего времени наблюдается тенденция роста частоты инфаркта миокарда без элевации сегмента ST, который, по некоторым данным, составляет около половины всех зарегистрированных ИМ. Основная проблема данного типа инфаркта состоит в том, что долгосрочный прогноз у этих пациентов остается неудовлетворительным, а смертность через год после катастрофы равна или даже превышает смертность от инфаркта миокарда с элевацией сегмента ST, что побуждает к продолжению

ISSN 2521-1455 (Print)
ISSN 2523-4250 (Online)

поиска предикторов неблагоприятного прогноза заболевания.

Цель: определить гендерные особенности характера структурно-геометрического ремоделирования левого желудочка у больных инфарктом миокарда без элевации сегмента ST.

Материалы и методы. Нами было проведено комплексное исследование 200 пациентов с острым инфарктом миокарда без элевации сегмента ST (ИМбелST) в возрасте от 38 до 80 (среднее значение 62,0±0,71, медиана – 62 и интерквартильный размах – 55 и 70) лет. Исследованы структурно-функциональное состояние миокарда и типы ремоделирования левого желудочка по данным трансторакальной эхокардиографии.

Результаты. Анализ полученных данных свидетельствует о том, что у больных ИМбелST при отсутствии значимых гендерних различий в величинах стандартных эхокардиографических параметров наблюдаются достоверные отличия в характере структурно-геометрического ремоделирования левого желудочка по Ganau. Кроме того, следует отметить факт более выраженного структурного ремоделирования левого желудочка у женщин по сравнению с мужчинами, что характеризовалось значительным увеличением тяжелых и прогностически неблагоприятных вариантов ремоделирования – концентрической и эксцентрической гипертрофии левого желудочка.

Ключевые слова: ИМбелST, структурно-геометрическое ремоделирование левого желудочка, ишемия миокарда.

Стаття надійшла в редакцію 10.12.2021 р.
Стаття прийнята до друку 19.12. 2021 р.