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Profile of a patient with non-ST segment elevation myocardial infarction in actual clinical practice

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Aim. To describe profile of a modern portrait with non-ST-segment elevation myocardial infarction (non-STEMI) through a comprehensive analysis of the Emergency Cardiology Unit (ECU) practice, which discharge a function of a regional vascular centre.

Material and methods. To describe the non-STEMI trends of the last decade, we analysed the annual reports on ECU work. The main analysis included patients with a documented non-STEMI treated in 2019 (n=221). We used information from the department database. A Microsoft Excel software was used to create the database. The base has been filled in by the ECU head in real time since 2009. Statistical data processing was performed using the Statistica 10,0 software package. The methods of descriptive statistics and Yates-corrected chi-square test were used.

Results. The following clinical and demographic trends of the last decade were revealed: an increase in the number of patients with non-STEMI, proportion of male patients, mean age of patients, proportion of patients with MI with non-obstructive coronary artery disease; no decrease in in-hospital mortality, despite the introduction of modern guidelines, pharmacological and invasive treatment of non-STEMI. In 2019, the proportion of male patients and patients 75 years and older was 62,4% and 32%, respectively. The mean age of patients was 64,6±13,0 years. Clopidogrel was the predominant $P2Y_{12}$ receptor blockers (56,1%). A total of 176 patients (79,6%) underwent the invasive procedures. Endovascular myocardial revascularization was performed in 97 patients (43,9%), while in the group over 75 years old — in 16 (7%) patients. The leading causes for absence of myocardial revascularization were chronic kidney disease (4,6%), severe coronary artery disease (6,3%), "borderline" (50-60%) coronary artery stenosis. The overall in-hospital mortality rate was 9,0%, while in the group of patients over 75 years old — 19,7%. Mortality rates did not differ in patients with and without myocardial revascularization (p=0,2). However, the incidence of pulmonary oedema was higher in the conservative treatment group (p=0,04).

Conclusion. Treatment of patients 75 years and older remains the main barrier in management of patients with non-STEMI. We observe the treatment-risk paradox, which consists in choosing a less aggressive treatment strategy in the group of the most high-risk patients. Other relevant aspects in the management of non-STEMI patients are the selection of a method for myocardial revascularization in multivessel coronary artery disease, assessment of the hemodynamic significance of coronary artery stenosis, and patients with non-obstructive coronary artery disease.

Keywords: acute coronary syndrome, myocardial infarction, register.

Relationships and Activities. The work was carried out within the exploratory research № 0421-2020-0018 "Development of technologies for personalized diagnosis, risk stratification and treatment of acute and chronic types of coronary artery disease and its risk factors."

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Reducing mortality from cardiovascular diseases (CVD) is one of the priority goals of the national project "Health Care", approved in 2018. To achieve this goal, the federal project "Fight against CVD" was developed, according to which the expected reduction in mortality from CVD by 2024 should be 25%. The leading position among the reasons of death is occupied by myocardial infarction (MI). Thus, in 2017, the hospital mortality rate from MI in the Russian Federation was 13,2% [1]. In the European Union, by 2015, this figure was 6,8% [2]. Non-ST segment elevation MI (NSTEMI) remains one of the most common causes of emergency hospitalizations [3-5]. Researchers have observed trends for an increase in the proportion of patients with NSTEMI in the structure of acute coronary syndrome (ACS), an increase in long-term mortality and recurrent ischemic events in patients with NSTEMI compared to patients with ST-segment elevation, a sharp slowdown in the rate of decline in hospital mortality in NSTEMI, despite the increasing introduction of percutaneous coronary intervention (PCI) [3, 6].

To this day, approaches to the management of patients with ST-segment elevation MI have clear algorithms, which makes it easier to work with this category of patients [7]. While approaches to the aggressive treatment of patients with NSTEMI vary from immediate PCI to the possibility of planned intervention [8]. This is largely due to the heterogeneity of patients with NSTEMI, which makes it necessary to conduct a strict risk stratification and follow a patient-oriented approach in work. The area of the Russian Federation is an additional factor that affects the care delivery to patients with NSTEMI, namely, routing, accumulation of local experience in each region, and slower pace of recommendation implementation in clinical practice. Thus, each department that delivers care to patients with ACS is faced with the issue on what needs to be done to reduce mortality rate in this group of patients.

Analysis of departments operation and register studies are the tools that provide a detailed description of patients in one or another region, assess the implementation of clinical recommendations and disease outcomes, identify existing barriers, develop new prospects and medical technologies, and promote the exchange of best practices between medical institutions. The aim of this work was to describe a modern portrait of a patient with NSTEMI by conducting a comprehensive analysis of the routine practice of the Chest-Pain Unit (CPU), which serves as a regional vascular center. The CPU operation analysis was faced with the following objectives: 1) to study the clinical and demographic NSTEMI trends and trends of invasive strategy for the treatment of patients with NSTEMI; 2) to describe anamnestic, demographic, and clinical characteristics of patients; 3) to assess the treatment of patients from the time of admission until discharge from the hospital; 4) to assess the reasons why myocardial revascularization was not performed in the acute period of the disease; 5) to assess in-hospital complications and outcomes of the disease; 6) identify barriers to the health care delivery.

Material and methods

CPU is a part of the regional vascular center and provides assistance to patients with MI living in the territory of Tomsk and Tomsk region.

To describe the clinical and demographic NSTEMI trends and trends in the introduction of an invasive therapeutic strategy of patients with NSTEMI in the last decade, we analyzed data from the annual reports on CPU operation.

The main analysis included patients with confirmed NSTEMI [9] who were under medical treatment in CPU in 2019 (n=221). We used data from the unit's database that reflects the main anamnestic and clinical characteristics of patients. To create a database, the Microsoft Excel table processor is used. The database has been maintained in the unit since 2009. The head of the unit is responsible for entering data in real time. All patients being under medical treatment in the unit sign their consent to receive inpatient medical care and consent to the personal data processing. No cases of consent withdrawal by means of a corresponding written document have been registered.

The main operating parameters of the unit are given in Table 1.

The statistical data processing was performed using the software package Statistica 10.0. The

comparison of discrete values was carried out using the χ^2-criterion adjusted for Yates continuity. The data are presented as absolute and relative frequencies, mean and standard deviation (M±SD), or median and interquartile range (Me (Q1; Q3)). The differences were considered statistically significant at $p<0,05$.

Results

We found an increasing trend in the number of patients with NSTEMI (Figure 1). Among the demographic indicators, we noted a tendency to increase in the proportion of men and increase in the average age of patients (Figure 2, 3). Patients with NSTEMI invariably represent a heterogeneous group of patients with a severe disease course, as indirectly indicated by the high risk of hospital mortality according to the GRACE scale (Figure 4). There is a tendency to increase in patients with NSTEMI and the absence of obstructive coronary artery damage (MINOCA) (Figure 5). Another observation is the persistence of hospital mortality rates in NSTEMI, despite the active introduction of an invasive management strategy for this group of patients and an increase in the frequency of endovascular myocardium revascularization (Figure 6).

The further analysis group consisted of 221 patients with NSTEMI who were under medical treatment in 2019. The proportion of male patients was 62,4%. The average age of the patients was 64,6±13,0 years. The proportion of patients aged 65 years and older was 29,9%, 75 years and older — 32%. The main clinical and anamnestic characteristics of patients, data on the coronary bed anatomy, complications and outcomes of the disease are shown in Table 2.

Data on drug treatment of patients with NSTEMI are shown in Table 3.

Invasive strategy (coronary angiography and/or endovascular myocardium revascularization) as a primary strategy (Table 4) for the care of patients with NSTEMI was used in 176 patients, which was 79,6%. Endovascular revascularization

Table 1
Basic parameters of the CPU operation

Value	Description
Mode of operation	7/24
Standards for providing assistance applied in the unit	ESC recommendations for management of patients with ACS, standard of specialized medical care for MI of the Ministry of Health of the Russian Federation
Number of residents served by the branch	786763
Area of the territory served by the branch	10818 km^2
Number of patients with MI for 1 month	100
Presence of cardiological ICU	Yes
Ability to detect highly sensitive troponin 24 hours a day	Yes
Ability to perform echocardiography 24 hours a day	Yes
Ability to perform PCI 24 hours a day	Yes
Possibility of IABC conduction	Yes
Possibility of ECMO conduction	No
Possibility of substitutive renal therapy	No
Availability of emergency cardiac surgery	No

Abbreviations: ICU — intensive care unit, IABC — intra-aortic balloon counterpulsation, MI — myocardial infarction, ACS — acute coronary syndrome, PCI — percutaneous coronary intervention, ECMO — extracorporeal membrane oxygenation.

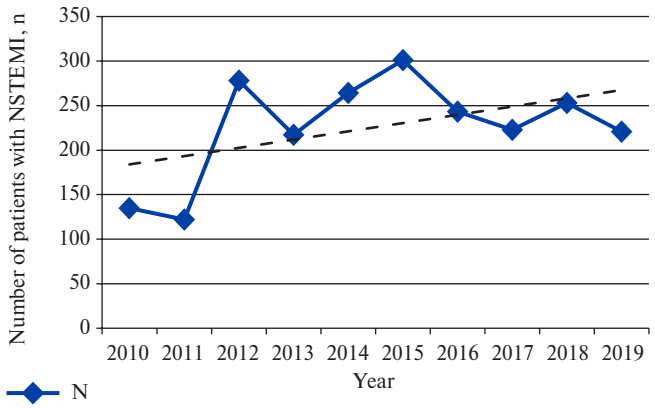

Figure 1. Dynamics of the number of patients with NSTEMI.
Abbreviation: NSTEMI — non-ST-segment elevation myocardial infarction.

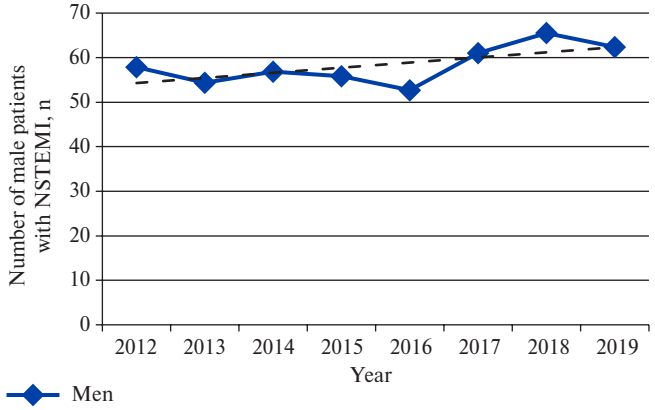

Figure 2. Dynamics of the number of male patients with NSTEMI.
Abbreviation: NSTEMI — non-ST-segment elevation myocardial infarction.

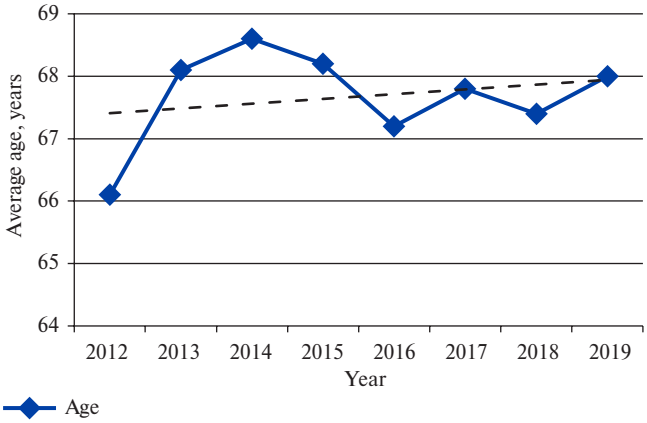

Figure 3. Dynamics of the average age of patients with NSTEMI.

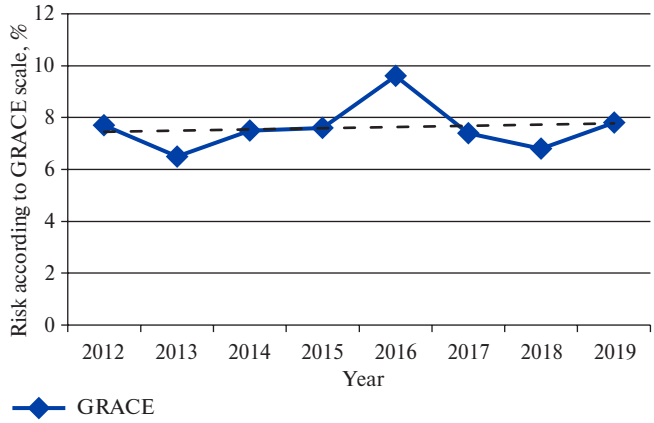

Figure 4. Dynamics of the average risk value according to the GRACE scale.

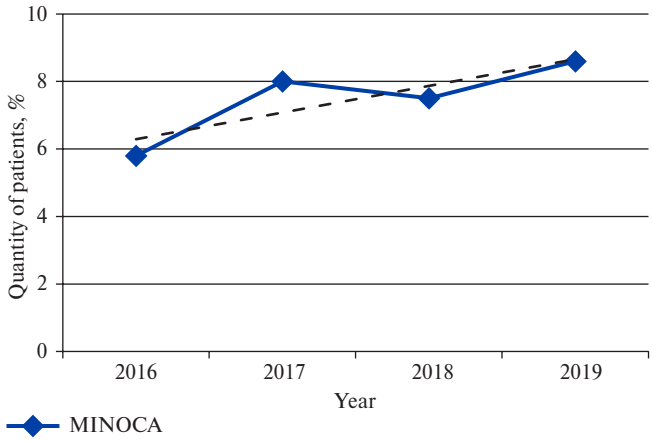

Figure 5. Proportion of patients with MINOCA.
Abbreviation: MINOCA — myocardial infarction without obstructive coronary atherosclerosis.

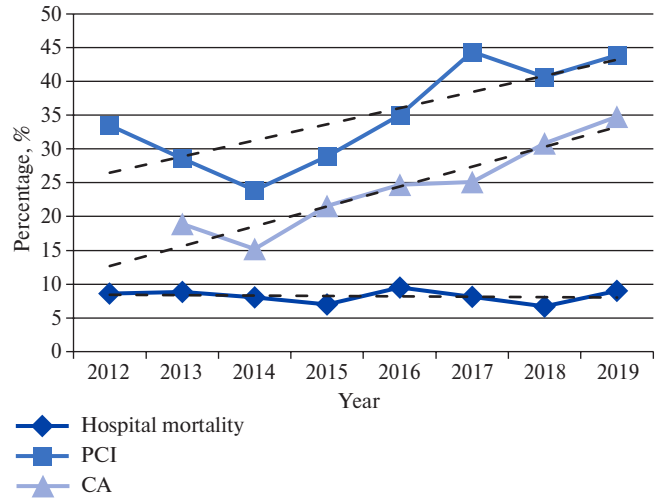

Figure 6. Proportion of patients with NSTEMI who underwent an invasive strategy and dynamics of hospital mortality rates.
Abbreviations: CA — coronary angiography, PCI — percutaneous coronary intervention.

Table 2

Clinical and anamnestic characteristics, coronary bed state, complications and outcomes of the disease in patients with NSTEMI

Indicator	Parameter
Number of patients, n	221 (100%)
Age, years	68±13,0
Male sex, n	138 (62,4%)
Number of patients admitted from onset of MI symptoms to hospitalization, n:	
Within 24 hours	121 (54,6%)
Within 72 hours	44 (19,9%)
Later than 72 hours	40 (18,1%)
Time could not be assessed	16 (7,4%)
Time from the of MI symptoms to hospitalization in patients admitted in the first 24 hours, min	276 (150; 543)
Anamnesis of MI, n	100 (45,2%)
Hemoglobin at admission, g/l	135 (120; 149)
Glomerular filtration rate at admission (according to the Cockcroft-Gault formula), ml/min	61 (43; 80)
Left ventricular ejection fraction, %	57 (46; 63)
Hospital mortality risk according to the GRACE scale at admission, %	7,8±13,2
Hemorrhagic complication risk according to the CRUSADE scale at admission, %	10,7±7,2

Table 2. Continued

Indicator	Parameter
MINOCA, n	19 (8,6%)
MI localization:	
Anterior MI, n	123 (55,7%)
Posterior MI, n	48 (21,7%)
Anterior-posterior MI, n	28 (12,7%)
IM of unspecified localization, n	22 (9,9%)
Risk factors for coronary artery disease:	
Hypertension disease, n	216 (97,7%)
Dyslipidemia, n	172 (77,8%)
Smoking at the time of admission or in anamnesis, n	103 (47,9%)
Obesity, n	72 (33,0%)
Diabetes mellitus, n	60 (27,0%)
Impaired glucose tolerance, n	15 (6,8%)
Coronary bed anatomy (coronary arteries with stenoses >50%):	
Single-vessel disease, n	29 (13,1%)
Two-vessel disease, n	36 (16,9%)
Three-vessel disease, n	100 (45,2%)
MI complications:	
Cardiogenic shock, n	21 (9,5%)
<65 years (n=84)	1 (1,2%)
65-74 years (n=66)	5 (7,6%)
⩾75 years (n=71)	15 (21,1%)
Pulmonary edema, n	40 (18%)
<65 years (n=84)	8 (9,5%)
65-74 years (n=66)	9 (13,6%)
⩾75 years (n=71)	23 (32,4%)
Somatogenic delirium, n	12 (5,4%)
Cardiogenic shock + pulmonary edema, n	15 (6,8%)
Pulmonary edema + somatogenic delirium, n	4 (1,8%)
Cardiogenic shock + pulmonary edema + somatogenic delirium, n	1 (0,45%)
Left ventricular aneurysm, n	4 (1,8%)
Relapse in the hospital, n	7 (3,2%)
NYHA class at release:	
I, n	52 (23,5%)
II, n	76 (34,4%)
III, n	61 (27,6%)
IV, n	7 (3,2%)
Hospital mortality rate:	
Total, n	20 (9%)
<65 years (n=84)	1 (1,2%)
65-74 years (n=66)	5 (7,6%)
⩾75 years (n=71)	14 (19,7%)
Cause of death, n=20 (100%):	
Cardiogenic shock, n	16 (80%)
Cerebral edema, n	2 (10%)
Multiple organ failure, n	2 (10%)

Note: data is presented as absolute and relative values, M±SD, Me (Q1; Q3).
Abbreviations: MI — myocardial infarction, MINOCA — myocardial infarction without obstructive coronary atherosclerosis.

of the myocardium was performed in 97 patients, which was 43,9%. In the group of patients over 75 years of age, endovascular revascularization was performed in 16 patients, which was only 7% of all patients or 16,5% of patients who underwent revascularization. The conservative treatment strategy as the primary care strategy was chosen for 45 (20,4%) patients.

Further, Table 5 shows the reasons why endovascular myocardium revascularization was not performed.

Data on complications of infarction and mortality during myocardial revascularization in acuity and in its absence are shown in Table 6.

Discussion

Patients with NSTEMI still represent a heterogeneous group of patients with a severe disease course. An important aspect is the presence of a large number of elderly patients [10]. In the clinical and anamnestic characteristics of patients, attention is drawn to the preservation of wide prevalence of modifiable risk factors and presence of previous MI. In addition, the relevant indicator is the increasing number of patients with MINOCA. A section on the management of this category of patients has already been included in recommendations of the European Society of Cardiology on patient management with ACS without persistent ST-segment elevation 2020 (hereinafter — the recommendations 2020) [11]. The recommendations emphasize the need for comprehensive multimodal diagnosis and personalized approach to the treatment and follow-up of patients with MINOCA both in the short and long term [11, 12].

A good side in the medical treatment of NSTEMI is the widespread use of dual antiplatelet therapy, beta-blockers, statins, angiotensin-converting enzyme inhibitors and sartans, low-molecular-weight heparins. These indicators hold out the corresponding indicators of the countries of Europe and North America [3, 5, 6]. However, with regard to antiplatelet therapy, the predominant $P2Y_{12}$ receptor inhibitor is clopidogrel, which does not comply with the current recommendations for the NSTEMI treatment. Today, taking into account the increase in PCI frequency, the data of the ISAR-REACT 5 study and the recommendations 2020 pose a new challenge for the wider introduction of prasugrel into the practice of treating patients with NSTEMI [11, 13].

Table 3

Drug therapy of patients with NSTEMI

Medication	Number of patients and %
Acetylsalicylic acid	205 (92,8%)
$P2Y_{12}$	218 (98,6%)
Clopidogrel	124 (56,1%)
Aspirin+clopidogrel	111 (50,2%)
Ticagrelor	81 (36,6%)
Aspirin+ticagrelor	81 (36,6%)
Prasugrel	13 (5,9%)
Aspirin+prasugrel	13 (5,9%)
Dual antiplatelet therapy	205 (92,8%)
IIb/IIIa blockers	7 (3,2%)
Low molecular weight heparin	162 (73,3%)
Beta-blockers	190 (86,0%)
Angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers	189 (85,5%)
Statins	208 (94,1%)

Table 4

Primary therapeutic strategy for patients with NSTEMI and its outcomes

Indicator	Parameter		
I. Invasive therapeutic strategy	176 (79,6%)		
	Coronary angiography and/or endovascular myocardium revascularization	Endovascular revascularization of the myocardium	Coronary angiography and/or endovascular myocardium revascularization
	176 (79,6%)	97 (43,9%)	79 (35,7%)
— Urgent invasive therapeutic strategy (<2 h)	21 (9,5%)	16 (7,2%)	5 (2,3%)
— Early invasive therapeutic strategy (<24 h)	108 (48,9%)	56 (25,4%)	52 (23,5%)
— Invasive (<72 h)	20 (9,0%)	10 (4,5%)	10 (4,5%)
— Planned invasive (>72 h)	22 (9,9%)	12 (5,4%)	10 (4,5%)
— Time frame assessment was not possible	5 (2,3%)	3 (1,4%)	2 (0,9%)
II. Conservative strategy	45 (20,4%)		

Table 5

Therapeutic strategy after coronary angiography and the reasons why endovascular myocardium revascularization was not conducted

Indicator	Parameter
I. Myocardial revascularization	97 (43,9%)
II. Conservative strategy, on grounds of:	124 (56,1%)
1. Three-vessel disease of coronary bed, including:	52 (23,5%)
— Surgical revascularization is recommended for 1-3 months.	16 (7,2%)
— Surgical revascularization is doubtful (patients aged 75 years and older)	14 (6,3%)
— Conducting surgical revascularization for index MI within 21 days is recommended	9 (4,1%)
— Presence of coronary artery stenosis of 50-60%	4 (1,8%)
— Presence of indications for repeated surgical myocardium revascularization	2 (0,9%)
— Reason for the selected strategy could not be determined	7 (3,2%)
2. MINOCA	19 (8,6%)
3. Single- or two-vessel disease of coronary bed in presence of coronary artery stenosis of 50-60%	16 (7,2%)
4. Chronic kidney disease	11 (5,0%)
<65 years (n=84)	0
65-74 years (n=66)	1 (0,45%)
⩾75 years (n=71)	10 (4,6%)
5. Anemia	6 (2,7%)
6. Combination of chronic kidney disease and anemia	1 (0,45%)
7. Fragility	7 (3,2%)
8. Refusal of coronary angiography	5 (2,3%)
9. Severity of condition	3 (1,3%)
10. Acute cerebrovascular accident at the time of admission	1 (0,45%)
11. Technical limitations — patient's weight	1 (0,45%)
12. The reasons could not be assessed	2 (0,9%)

Note: data is presented as n (%).
Abbreviations: MI — myocardial infarction, MINOCA — myocardial infarction without obstructive coronary atherosclerosis.

Table 6

MI complications and mortality depending on the performance/non-performance of myocardial revascularization in disease acute period, n=221

Indicator	Patients who underwent myocardial revascularization in disease acute period, n=97	Patients who did not undergo myocardial revascularization in disease acute period, n=124	P-value
Cardiogenic shock	8 (3,6%)	13 (5,9%)	0,5
Pulmonary edema	12 (5,4%)	28 (12,7%)	0,04
Psychosis	5 (2,3%)	7 (3,2%)	0,8
LV aneurysm	1 (0,45%)	3 (1,3%)	0,8
Relapse in the hospital	3 (1,3%)	4 (1,8%)	0,9
NYHA class:			
I	31 (14,0%)	21 (9,5%)	0,02
II	36 (16,3%)	40 (18,1%)	0,1
III	19 (8,6%)	40 (18,1%)	0,02
IV	3 (1,3%)	4 (1,8%)	0,9
Mortality	6 (2,7%)	14 (6,3%)	0,2

Note: data is presented as n (%).
Abbreviation: LV — left ventricle.

The trend that characterizes the frequency of choosing an aggressive treatment of patients with NSTEMI in CPU, on the one hand, indicates a positive trend — a high proportion of patients who underwent PCI, compared with the data of the Russian RECORD-3 register, but on the other hand — a slower introduction of high-tech medical care in Russia compared to the indicators of European registers [3, 6, 14]. The issue on revascularization of elderly patients remains open. Thus, in CPU, in group of patients 75 years and older, revascularization was carried out only in 7% of all patients or in 16,5% of patients who underwent revascularization, despite the fact that elderly patients belong to the most high-risk category of patients, which is confirmed by the frequency of acute left ventricular failure and high mortality observed in this group. This occurrence called the "risk-treatment paradox" is typical not only for Russia, but also for most highly developed countries [15]. Among the reasons why myocardial revascularization was not performed in elderly patients, attention is drawn to prevalence of chronic kidney disease and presence of multivessel damage to the coronary bed. Treatment of elderly patients is certainly a difficult task. Nevertheless, risk stratification is the basis for choosing a patient management strategy. Moreover, according to the recommendations 2020, diagnostic and therapeutic algorithms for the management of elderly patients do not differ from those of a younger category of patients [11].

An important follow-up, characteristic for the world clinical practice, is the preservation of hospital mortality rates in patients with NSTEMI, despite the active introduction of invasive strategy and an increase in the frequency of endovascular myocardium revascularization. At the same time, a positive aspect is a decrease in the frequency of manifestations of heart failure in patients who underwent revascularization during the acute disease period. The remaining mortality rates are largely due to the problem of treating a group of patients 75 years and older. It is also important to say that our analysis does not take into account the PCI methodology impact, namely the selected access, catheter and stent.

Revascularization of patients with multivessel coronary artery disease and management of patients with so-called "frontier" stenosis of the coronary arteries remains other topical issues.

Conclusion

A comprehensive analysis of the unit's work allowed to obtain a modern clinical portrait of a patient with NSTEMI. Clinical and demographic trends include an increase in the number of patients with NSTEMI, the proportion of male patients, and the average age of patients. Patients with NSTEMI are a heterogeneous group of patients with a severe disease course. At the same time, despite the active introduction of medical and MI invasive treatment, the mortality rates among patients with NSTEMI remain high. In the most frequent cases, patients 75 years and older have restrictions on myocardial revascularization. The main limitations are the presence of chronic kidney disease and multivessel disease of the coronary bed. It is in this category of patients that we observe the frequent development of acute heart failure and the highest mortality rates.

The data standardization and the analysis of unit's work made it possible to clearly identify the aspects of providing assistance for patients with NSTEMI that require changes and contribute to high mortality rates. The analysis data allowed to identify trends, assess own results from the point of view of world practices, focus on the main barriers, and finally form directions for overcoming them. One of the main directions is to provide assistance to patients with NSTEMI 75 years and older, which primarily require strict risk stratification and a patient-oriented approach. Other areas include issues of myocardial revascularization in multivessel coronary damage, development of emergency cardiac surgery, assessment of hemodynamic significance of coronary artery stenosis, multimodal heart imaging in patients with MINOCA. The relevance of these areas is also emphasized by the new recommendations of the European Society of Cardiology 2020.

Thus, the analysis of our own practice is an integral part of the CPU operation: tool for assessing the implementation of existing recommendations, point of transition to new recommendations, stage in the development of approaches to overcome local and world-level barriers that prevent mortality reduction in NSTEMI.

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Relationships and Activities. The work was carried out within the exploratory research № 0421-2020-0018 "Development of technologies for personalized diagnosis, risk stratification and treatment of acute and chronic types of coronary artery disease and its risk factors."

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