Pereverzeva K. G.[1], Loukianov M. M.[2], Andreenko E. Yu.[2],
Klyashtorny V. G.[2], Pravkina E. A.[1], Drapkina O. M.[2], Yakushin S. S.[1]

[1] Ryazan State Medical University named after academician I.P. Pavlov, Ryazan, Russia

[2] State National Medical Research Centre for Preventive Medicine, Moscow, Russia

Outpatient register of patients who have suffered a myocardial infarction (REGATA): prospective follow-up data and outcomes

Aim To determine the factors that influence the long-term prognosis in patients after myocardial infarction (MI) as a part of the prospective REGistry of pATients after myocArdial infarction (REGATA).

Material and Methods In 2012–2013, 481 post-myocardial infarction patients were included into the REGATA registry; 247 (51.4%) were men, median age 72 [62; 78] years. The median duration of prospective follow-up after the inclusion into the registry was 6.1 [4.0–6.6] years. Data were obtained for 474 (98.5%) patients. Statistical analysis was performed with the Microsoft Excel 2010, StatsoftStatistica10.0 software and partially manually by formulas. Methods of descriptive statistics were used. For quantitative variables with normal distribution, mean values and standard deviations were calculated; intergroup differences were evaluated with Student's t-test. Differences between groups of survived and deceased patients were evaluated with a nonparametric method using the Pearson's chi-squared test with a Yates's correction, and the Fisher's exact test. When the frequency of absent data for the studied variable exceeded 20%, this variable was not included into the analysis. The 6-year survival was analyzed by the Kaplan-Meier method. Fatal outcomes were analyzed with the Cox proportional hazards regression model. Differences were considered significant at $p<0.05$.

Results During the follow-up period, there were 200 (41.6%) cases of all-cause death and 123 (25.6%) cases of cardiovascular death; 39 (8.1%) of patients had acute cerebrovascular disease (ACVD) and 36 (7.5%) had recurrent myocardial infarction. The median time from the inclusion into the registry to death was 3.4 [1.6; 5.1] years. A higher risk of all-cause death was significantly associated with factors of age (one-year relative risk, RR, 1.03; 95% confidence interval, CI, 1.02–1.05; $p<0.001$), III–IV functional class angina (RR, 1.76; 95% CI, 1.22–2.53; $p=0.003$), history of ACVD (RR, 2.12; 95% CI, 1.50–2.98; $p<0.001$), atrial fibrillation (AF) (RR, 1.52; 95% CI, 1.10–2.12; $p=0.01$), diabetes mellitus (DM) (RR, 1.53; 95% CI, 1.11–2.10; $p=0.009$), chronic obstructive pulmonary disease (COPD) (RR, 1.77; 95% CI, 1.20–2.62; $p=0.004$), and reduced hemoglobin (RR, 2.09; 95% CI, 1.31–3.33; $p=0.002$). A lower risk of death was associated with administration of antiplatelets (RR, 0.57; 95% CI, 0.37–0.89; $p=0.01$), angiotensin-converting enzyme (ACE) inhibitors/angiotensin II receptor blockers (ARB) (RR, 0.51; 95% CI, 0.33–0.78; $p=0.002$), and statins (RR, 0.48; 95% CI, 0.34–0.67; $p<0.001$). A higher risk of nonfatal stroke during the follow-up was significantly associated with age (one-year RR, 1.05; 95% CI, 1.01–1.09; $p=0.02$), history of ACVD (RR, 2.74; 95% CI, 1.33–5.63; $p=0.006$), and DM (RR, 2.43; 95% CI, 1.17–5.06; $p=0.02$), and a higher risk of nonfatal stroke was significantly associated with a history of ACVD (RR, 1.70; 95% CI, 1.44–2.01; $p<0.001$), DM (RR, 2.33; 95% CI, 1.13–4.84; $p=0.02$), and COPD (RR, 2.47; 95% CI, 1.02–6.00; $p=0.06$).

Conclusion In the outpatient REGATA registry that included patients with MI at any previous time, the death rate for 6 years of follow-up was 41.6%. In 61.5% of cases, death was caused by cardiovascular diseases. In clinical practice in long-term, a higher risk of unfavorable outcome was associated with old age, III–IV functional class angina, a history of ACVD, AF, DM, and COPD while a lower risk was associated with the administration of antiplatelets, ACE inhibitors/ARB, and statins.

Keywords Registry; drug treatment; prospective follow-up; myocardial infarction; mortality; long-term outcomes

For citations Pereverzeva K.G., Loukianov M.M., Andreenko E.Yu., Klyashtorny V.G., Pravkina E.A., Drapkina O.M. et al. Outpatient register of patients who have suffered a myocardial infarction (REGATA): prospective follow-up data and outcomes. Kardiologiia. 2022;62(2):12–19. [Russian: Переверзева К.Г., Лукьянов М.М., Андреенко Е.Ю., Кляшторный В.Г., Правкина Е.А., Драпкина О.М. и др. Амбулаторный регистр пациентов, перенесших инфаркт миокардА (РЕГАТА): данные проспективного наблюдения и исходы. Кардиология. 2022;62(2):12–19]

Corresponding author Pereverzeva K.G. E-mail: pereverzevakg@gmail.com

ISSN 0022-9040. Kardiologiia. 2022;62(2). DOI: 10.18087/cardio.2022.2.n1712

The incidence and mortality of acute myocardial infarction (MI) has been decreasing in most of the world, especially in high per capita income countries [1–5]. This is owing to significant advances in the management of patients with MI, introducing high-tech health care and a network of MI treatment centers [6]. However, patients who survive MI are at high risk of recurrent MI and other cardiovascular diseases (CVDs) such as stroke [7, 8]. Most studies of post-MI outcomes focus on the acute phase of the index event, and there are few follow-up data for patients with history of MI after the first year [9].

However, carefully and thoroughly planned disease registers are the most effective tools to keeping track of long-term outcomes, assessing the efficacy of treatment, compliance with clinical guidelines, identifying factors affecting the prognosis in such patients [10]. The available registers of patients with a history of MI are not fully effective, since the follow-up is relatively short, from 1 to 3–5 years, and the patient response reaches 90% or more within the prospective follow-up only in few studies [11, 12]. There are very few outpatient registers of MI of any age.

Thus, it is reasonable to study long-term outcomes in patients with a history of MI within the prospective register of patients with a history of myocardial infarction (REGATA) of any age, which is characterized by long-term follow-up and high patient response.

Objective

Identify the factors influencing the long-term prognosis in patients with history of MI within the REGATA prospective register.

Material and Methods

The REGATA register includes 481 patients with a history of MI and sought medical attention for any reason in one of three outpatient clinics in the Ryazan Oblast (two municipal clinics and one rural clinic) within the following time frames: patients were included in the first municipal outpatient clinic (in the order of enrollment) from March 2012 to May 2012, in the rural outpatients clinic from September 2012 to November 2012, and in the second municipal outpatient clinic (in the order of enrollment) from January 2013 to February 2013.

All patients with a history of MI were included successively during the enrollment period; when a patient revisited the clinic, he/she was not included in the register again. The history of MI was established based on the corresponding data in the outpatient record regardless of its age and the amount of additional information. The register included 247 (51.4%) male patients. The median age of all patients was 72 [62; 78] years. The median age of the last MI episode was 5 [2;9] years before inclusion in the register. Only 43 (8.9%) patients had MI within ≤1 year before inclusion in the register. We have previously described the study design [13].

Vital status (alive/dead), cases of nonfatal MI and stroke, hospitalizations for CVDs, and cardiovascular interventions were assessed during the prospective follow-up. Data on the presence or absence of such adverse events were collected in 474 (98.5%) cases during the telephone calls with patients and relatives or based on death certificates. Telephone calls directly with patients were made in 69.7% of cases (191 of 274 surviving patients). Cardiovascular deaths included all deaths in case of which CVDs were stated as the immediate cause. Data on deaths, nonfatal MI and stroke are analyzed in this article. During the telephone calls, data on follow-up drug therapy were also collected.

The study was based on the current ethical principles stipulated in the Declaration of Helsinki of the World Medical Association [14] and met the good practices in the conduct of a patient registry [15]. During the study, no additional informed consent was signed. The consent to medical assistance and processing of personal data signed in a medical facility was sufficient.

Statistical processing of the data obtained was carried out using Microsoft Excel 2010, Statsoft Statistica10.0, and partly manually using relevant formulas. We used descriptive statistics methods. Normally distributed quantitative variables are presented as the means and standard deviations ($M \pm \sigma$).

Non-normally distributed quantitative variables were described by the medians and lower and upper quartiles (Me [Q1; Q3]).

For normally distributed quantitative variables, the means and standard deviations were calculated, and the differences between the groups were estimated using the Student's t-test. Differences between the groups of surviving and deceased patients were assessed using non-parametric tests: Pearson's chi-squared test, Yates chi-squared test, and Fisher's exact test. The indicator was not included in the analysis, if a rate of the absence of data on an indicator of interest was more than 20%. The six-year survival analysis was conducted using the Kaplan-Meier method. A Cox proportional hazards regression model was used to analyze the fatal outcomes. The analysis results are presented as the odds ratios (OR) and the corresponding 95% confidence intervals (CI). The differences were statistically significant when a p value was less than 0.05.

Results

During the follow-up, 200 (41.6%) all-cause deaths and 123 (25.6%) cardiovascular deaths were reported; 39 (8.1%) patients developed cerebrovascular accident (CVA), and 36 (7.5%) patients had recurrent MI. The median time from the inclusion in the register to death was 3.4 [1.6; 5.1] years.

Figure 1 shows the results of the Kaplan–Meier survival analysis.

Deceased (n=200) and surviving (n=274) patients differed statistically significantly by sex and age. Among surviving and deceased patients, 56.9% and 43.0%, respectively, were male (p=0.003). The median age of deceased and surviving patients was 76.0 [69.8; 82.0] years and 66.0 [59.0; 74.0] years, respectively (p<0.0001).

Exertional angina functional class (FC) II was reported statistically significantly more often in the group of surviving patients compared to the group of deceased patients (p=0.0006), angina pectoris FC III–IV was reported less often (p=0.03).

Chronic heart failure (CHF) FC II (p=0.008) was reported statistically significantly more often in the group of surviving patients compared to deceased patients; the following pathologies were reported less often: CHF FC III–IV (p=0.009), CVA (p<0.0001), diabetes mellitus (DM; p=0.0001), atrial fibrillation (AF, p<0.0001), chronic obstructive pulmonary disease (COPD; p=0.001).

History of coronary artery stenting was established in 7.3% (n=20) of surviving patients and 1.0% (n=2) of deceased patients (p=0.0006). There were no statistically significant differences in the frequency of a history of coronary artery bypass grafting (CABG) between surviving and deceased patients: 3.8% (n=10) and 1.0% (n=2), respectively (p=0.06).

Table 1 provides clinical and demographic characteristics and comorbidity profile of patients of both groups.

The parameters characterizing the clinical state of patients were also evaluated. Blood pressure (BP) levels did not differ statistically significantly in the two groups: systolic BP 145.3±19.7 mm Hg and 141.7±20.9 mm Hg (p=0.054) and diastolic blood pressure 85.9±11.5 mm Hg and 84.5±11.5 mm Hg (p=0.22), respectively. Heart rate (HR) was statistically significantly higher in deceased patients compared to surviving patients (75.9±8.8 and 73.2±8.4, respectively; p=0.001) and HR ≥80 bpm was registered more often – in 28.0% (n=56) and 16.8% (n=46) of patients, respectively (p=0.003).

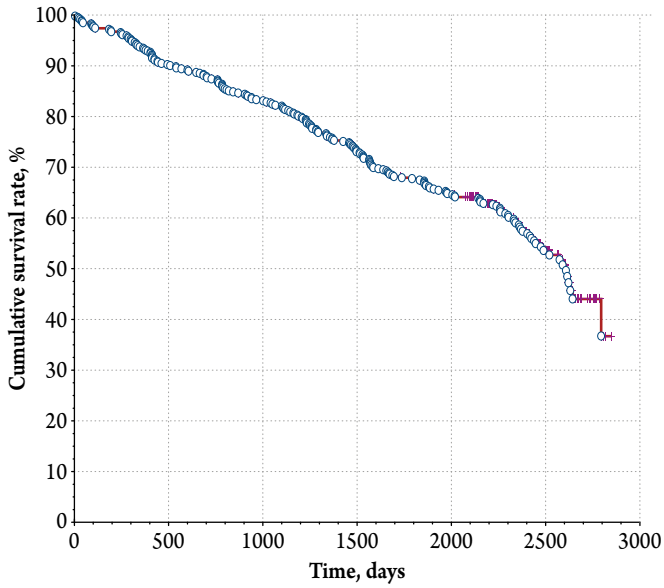
Analysis of laboratory results of the compared groups showed a decrease in hemoglobin levels<130 g/L in male patients and<120 g/L in female patients in 4.7% (n=13) of surviving patients and 14.5% (n=29) of deceased patients (p=0.0002).

Echocardiographic data, including left ventricular ejection fraction (LVEF), were available for only 56.3% (n=271) of patients, which is why they were not analyzed in detail, and LVEF was not included in the multivariate model.

The analysis of the ordered drug therapy showed that patients who died of all causes administered mineralocorticoid receptor antagonists (MCRAs), calcium antagonists, cardiac glycosides statistically significantly more often compared to surviving patients, and statins statistically significantly less often compared to surviving patients. Table 2 provides details of the drug therapy ordered during the reference visit in both groups.

In our opinion, it is not correct to analyze the influence of only drug therapy ordered at the index visit on the prognosis.

Figures 1. Six-year survival of MI patients included in the REGATTA registry (n=481)



MI, myocardial infarction.

Table 1. Clinical and demographic characteristics and comorbidities in surviving patients and patients who died of all causes

Parameter	Dead (n=200)	Alive (n=274)	p
Median age, years	76.0 [69.8; 82.0]	66.0 [59.0; 74.0]	< 0.0001
Male	86 (43.0)	156 (56.9)	0.003
Exertional angina FC II	20 (10.0)	60 (21.9)	0.0006
Exertional angina FC III-IV	157 (78.5)	191 (69.7)	0.03
History of MI ≥2	52 (26.0)	53 (19.3)	0.08
Diagnosis of CHF	193 (96.5)	261 (95.3)	0.49
CHF FC II	32 (16.0)	72 (26.3)	0.008
CHF FC III-IV	91 (45.5)	92 (33.6)	0.009
CVA	57 (28.5)	24 (8.8)	< 0.0001
DM	70 (35.0)	50 (18.2)	0.0001
Hypertensive heart disease	119 (99.5)	274 (100.0)	0.42
AF	72 (36.0)	40 (14.6)	< 0.0001
COPD	34 (17.0)	20 (7.3)	0.001
Bronchial asthma	7 (3.5)	12 (4.4)	0.41
Kidney disorders	97 (48.5)	109 (39.8)	0.06

The data are expressed as the absolute number of patients (%), unless otherwise is specified. FC, functional class; MI, myocardial infarction; CHF, chronic heart failure; CVA, cerebrovascular accident; DM, diabetes mellitus; AF, atrial fibrillation; COPD, chronic obstructive pulmonary disease.

ISSN 0022-9040. Kardiologiia. 2022;62(2). DOI: 10.18087/cardio.2022.2.n1712

Table 2. Drug treatment ordered at the reference visit in surviving patients and patients who died of all causes

Parameter	Dead (n=200)	Alive (n=274)	p
Drugs	185 (92.5)	257 (93.8)	0.58
Antihypertensive therapy	175 (87.5)	241 (88.0)	0.88
Alpha blockers	31 (15.5)	21 (7.7)	0.01
MCRAs	5 (2.5)	16 (5.8)	0.06
Diuretics	74 (37.0)	93 (33.9)	0.49
Centrally acting drugs	10 (5.0)	13 (4.7)	0.93
Calcium channel blockers	49 (24.5)	46 (16.8)	0.04
Beta-blockers	105 (52.5)	165 (60.2)	0.09
ACE inhibitors/ARBs	137 (68.5)	197 (71.9)	0.42
Statins	71 (35.5)	140 (51.1)	0.001
Anticoagulant drugs	2 (5.6)	1 (2.5)	0.38
Antiplatelet drugs	134 (67.0)	198 (72.3)	0.48
Cardiac glycosides	34 (17.0)	18 (6.6)	0.0003
Long-acting nitrates	39 (19.5)	55 (20.1)	0.88

Data are presented as the absolute number of patients (%).
MCRA, mineralocorticoid receptor antagonist;
ACE, angiotensin-converting enzyme;
ARB, angiotensin II receptor blocker.

For this reason, the analysis of the influence on prognosis includes information on drug therapy administered in the long-term follow-up period, i.e. the fact of ordering these groups of drugs was taken into consideration according to the data of the baseline visit and/or patient survey in 1, 2, and 4 years of follow-up. Data on the drug therapy of surviving patients collected in 6 after the inclusion in the register were not used, since no relevant information was available in the group of deceased patients (Table 3).

Table 3. Drug therapy ordered in the long-term follow-up period in surviving patients and patients who died of all causes

Parameter	Dead (n=200)	Alive (n=274)	p
Antihypertensive therapy	185 (92.5)	273 (99.6)	< 0.0001
MCRAs	42 (21.0)	61 (22.3)	0.74
Alpha blockers	5 (2.5)	21 (7.7)	0.03
Diuretics	78 (39.0)	122 (44.5)	0.23
Centrally acting drugs	12 (6.0)	33 (12.0)	0.03
Calcium channel blockers	64 (32.0)	108 (39.4)	0.09
Beta-blockers	134 (67.0)	226 (82.5)	0.0001
ACE inhibitors/ARBs	156 (78.0)	257 (93.8)	< 0.0001
Statins	91 (45.5)	229 (83.6)	< 0.0001
Antiplatelet drugs	160 (80.0)	259 (94.5)	< 0.0001
Cardiac glycosides	35 (17.5)	15 (5.5)	< 0.0001

Data are presented as the absolute number of patients (%).
MCRA, mineralocorticoid receptor antagonist;
ACE, angiotensin-converting enzyme;
ARB, angiotensin II receptor blocker.

Within the 6-year follow-up, CABG was performed in 3 patients from the surviving group. Coronary stenting was carried out in 8 (2.9%) surviving patients and 1 (0.5%) deceased patient (p=0.09). This intervention did not influence the mortality rate because of the small number of relevant events.

Further analysis revealed that the higher risk of all-cause death was statistically significantly associated with older age, exertional angina FC III–IV, a history of CVA, AF, DM, COPD and low hemoglobin levels, and the lower risk of death was associated with the use of antiplatelet drugs, angiotensin-converting enzyme (ACE) inhibitors/angiotensin II receptor blockers (ARBs), statins (Table 4).

Analysis of the same factors showed that the higher risk of nonfatal MI during the follow-up (Table 5) was statistically significantly associated with age (per year OR 1.05; 95% CI 1.01–1.09; p=0.02), a history of CVA (OR 2.74; 95% CI 1.33–5.63; p=0.006), and DM (OR 2.43; 95% CI 1.17–5.06; p=0.02), and the higher risk of nonfatal MI was associated with a history of CVA (OR 1.70; 95% CI 1.44–2.01; p<0.001), DM (OR 2.33; 95% CI 1.13–4.84; p=0.02), and COPD (OR 2.47; 95% CI 1.02–6.00; p=0.06).

Discussion

During the 6-year follow-up, 41.6% of patients of the REGATA registry died, 7.5% had nonfatal MI, and 8.1% had nonfatal stroke. Deceased patients were older than surviving patients, fewer patients among them were male, and more individuals had low hemoglobin levels; exertional angina FC III–IV, CHF FC III–IV, COPD, AF, a history of CVA, and DM were more common among them. In the group of deceased patients, HR was statistically significantly higher and HR ≥80 bpm was reported more often.

MCRAs, calcium channel blockers, cardiac glycosides were ordered statistically significantly more often and statins were ordered statistically significantly less often to deceased patients at the index visit. The prospective follow-up showed that deceased patients received more often cardiac glycosides and less often beta-blockers, ACE inhibitors/ARBs, antiplatelet agents and statins, centrally acting drugs, and alpha-blockers. Thus, the prospective register, which allows monitoring the implementation of the clinical guidelines, showed during the long-term follow-up of patients with history of MI that deceased patients were less likely to receive drug therapy compliant with clinical guidelines.

Slightly lower mortality rates compared to our register were observed in the register by Garganeeva et al. [11]: 5 years after the reference MI, 439 of 533 patients were followed up, of whom 153 (35%) died. The mortality rate was even lower in the Khabarovsk register, but the follow-up period was shorter,

Table 4. Factors associated with the risk of death of all causes in patients with history of MI included in the REGATA outpatient register

Factor	All-cause death (n=200) OR (95% CI)	p
Age, per year	1.03 (1.02–1.05)	< 0.001
Sex (female–ref)	0.91 (0.66–1.25)	0.56
History of recurrent MI	1.05 (1.09–1.93)	0.78
Angina FC III-IV	1.76 (1.22–2.53)	0.003
History of CVA	2.12 (1.50–2.98)	< 0.001
CHF FC III-IV	1.18 (0.87–1.60)	0.29
Atrial fibrillation	1.52 (1.10–2.12)	0.01
Diabetes mellitus	1.53 (1.11–2.10)	0.009
COPD	1.77 (1.20–2.62)	0.004
Decreased hemoglobin levels (m<130 g/L; f<120 g/L)	2.09 (1.31–3.33)	0.002
HR ≥ 80 bpm	1.09 (0.78–1.52)	0.63
Antiplatelet drugs	0.57 (0.37–0.89)	0.01
ACE inhibitors/ARBs	0.51 (0.33–0.78)	0.002
Beta-blockers	1.10 (0.77–1.55)	0.61
Statins	0.48 (0.34–0.67)	< 0.001
Calcium channel blockers	0.95 (0.68–1.32)	0.76

MI, myocardial infarction; OR, odds ratio; CI, confidence interval; m, male patients; f, female patients; FC, functional class; CVA, cerebrovascular accident; CHF, chronic heart failure; COPD, chronic obstructive pulmonary disease; HR, heart rate; ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker.

only 2.5 years, after which the vital status was established in 274 of 292 patients discharged from the hospital, and 16.4% of them died. The cause of death was various CVDs in 14.2% of cases. In that register, 30 (13.1%) of surviving patients (n=229) had recurrent MI and 12 (5.2%) patients had CVA within 2.5 years after the discharge [12].

The Lyuberetsk register (2005-2007) of patients with IM (Lyuberetsk mortality study) was similar with the Khabarovsk register in terms of the duration of follow-up; the number of patients deceased within 3 years after MI was 191 (19.9%) of 961 patients discharged from the hospital. According to the Kaplan – Meier curve, the three-year survival rate in the hospital and post-hospital stages was about 50% [16, 17]. CVDs caused death in 91% of cases (coronary heart disease in 82% and CVA in 9%), and the risk factors (RFs) of the unfavorable long-term prognosis were older age, lack of exercise, a history of MI, and DM. The Lyuberetsk mortality study clearly showed the beneficial influence on mortality rates of ACE inhibitors administered before MI, thrombolytic drugs, beta-blockers, and antiplatelet agents administered in the acute period [17].

In our study, older age, exertional angina FC III–IV, a history of CVA, AF, DM, and COPD were the factors associated with an unfavorable outcome; and the use of antiplatelet agents, ACE inhibitors/ARBs, and statins was associated with a lower risk of all-cause death. Interestingly, DM and a history of CVA were statistically significantly associated with fatal outcomes and recurrent nonfatal MI and nonfatal stroke.

The negative effect of a history of DM in patients with MI has also been shown in several international studies [18, 19], in some of which mortality increased with higher severity of hyperglycemia and more impaired renal function [20, 21]. In a large-scale study, significant all-cause death RFs in patients with MI included older age, smoking, arterial hypertension (AH), DM, peripheral artery disease, a history of stroke, chronic kidney disease, COPD, liver diseases, and a history of cancer [19]. In some other studies, the highest risk of vascular complications after MI was found in elderly patients and patients with AH, DM, peripheral artery disease and a history of CVA [9].

Statistically significant associations between the risk of recurrent MI, stroke or death were shown for DM, peripheral

Table 5. Factors associated with the risk of MI and recurrent MI in patients with a history of MI included in the REGATA outpatient register

Factor	MI (n=39)		Stroke (n=36)	
	OR (95% CI)	p	OR (95% CI)	p
Age, per year	1.05 (1.01–1.09)	0.02	0.97 (0.94–1.01)	0.17
Sex (female–ref)	0.83 (0.39–1.74)	0.62	0.81 (0.36–1.81)	0.61
History of recurrent MI (≥2)	0.61 (0.24–1.54)	0.30	1.77 (0.84–3.76)	0.13
Angina FC III-IV	1.39 (0.64–3.01)	0.40	1.01 (0.38–2.69)	0.98
History of CVA	2.74 (1.33–5.63)	0.006	1.70 (1.44–2.01)	< 0.001
CHF FC III-IV	0.74 (0.37–1.48)	0.40	0.95 (0.47–1.95)	0.89
Atrial fibrillation	1.68 (0.82–3.46)	0.16	1.21 (0.52–2.83)	0.66
Diabetes mellitus	2.43 (1.17–5.06)	0.02	2.33 (1.13–4.84)	0.02
COPD	1.09 (0.36–3.30)	0.87	2.47 (1.02–6.00)	0.04
Decreased hemoglobin levels (m<130 g/L; f<120 g/L)	0.25 (0.03–1.96)	0.19	1.26 (0.35–4.62)	0.72
HR ≥ 80 bpm	1.27 (0.57–2.83)	0.55	0.95 (0.41–2.23)	0.90
Antiplatelet drugs	0.76 (0.27–2.17)	0.61	3.29 (0.39–27.91)	0.28
ACE inhibitors/ARBs	0.60 (0.18–1.97)	0.40	0.46 (0.15–1.44)	0.18
Beta-blockers	0.66 (0.30–1.44)	0.30	0.89 (0.36–2.21)	0.81
Statins	0.82 (0.38–1.78)	0.62	1.22 (0.50–2.96)	0.66
Calcium channel blockers	1.24 (0.62–2.49)	0.55	1.13 (0.56–2.31)	0.73

MI, myocardial infarction; m, male patients; f, female patients; FC, functional class; CVA, cerebrovascular accident; CHF, chronic heart failure; COPD, chronic obstructive pulmonary disease; HR, heart rate; ACE, angiotensin-converting enzyme; ARB, angiotensin II receptor blocker.

ISSN 0022-9040. Kardiologiia. 2022;62(2). DOI: 10.18087/cardio.2022.2.n1712

arterial disease, a history of CVA, CHF, renal failure, and COPD in a major analysis that included patients from Sweden, the United States, Great Britain and France [22].

Conclusion

The 6-year follow-up mortality rate was 41.6% in the outpatient register, which included patients with a history of myocardial infarction of any age. Cardiovascular diseases caused death in 61.5% of the cases. Deceased patients were older than surviving patients; there were fewer male patients among them; they were more likely to have exertional angina of functional class III–IV, anemia, chronic heart failure of functional class III–IV, chronic obstructive pulmonary disease, atrial fibrillation, diabetes mellitus, and a history of acute cerebrovascular accident.

Statins were ordered less frequently to deceased patients at the index visit; and they received less often any drugs that improve the prognosis after myocardial infarction.

A higher risk of all-cause death was statistically significantly associated with age (per year OR 1.03; 95% CI 1.02–1.05; p<0.001), exertional angina of functional class III–IV (OR 1.76; 95% CI 1.22–2.53; p=0.003), history of cerebrovascular accident (OR 2.12; 95% CI 1.50–2.98; p<0.001), atrial fibrillation (AF 1.52; 95% CI 1.10–2.12; p=0.01), diabetes mellitus (OR 1.53; 95% CI 1.11–2.10; p=0.009), chronic obstructive pulmonary disease (OR 1.77; 95% CI 1.20–2.62; p=0.004), and decreased hemoglobin levels (OR 2.09; 95% CI 1.31–3.33; p=0.002), and a lower risk of death was associated with the administration of antiplatelet drugs (OR 0.57; 95% CI 0.037–0.89; p=0.01), angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers (OR 0.51; 95% CI 0.33; p=0.002), statins (OR 0.48; 95% CI 0.34–0.67; p<0.001).

During the follow-up period, the higher risk of nonfatal stroke was statistically significantly associated with age (per year OR 1.05; 95% CI 1.01–1.09; p=0.02), a history of cerebrovascular accident (OR 2.74; 95% CI 1.33–5.63; p=0.006), and diabetes mellitus (OR 2.43; 95% CI 1.17–5.06; p=0.02), and the higher risk of nonfatal myocardial infarction was associated with a history of cerebrovascular accident (OR 1.70; 95% CI 1.44–2.01; p<0.001), diabetes mellitus (OR 2.33; 95% CI 1.13–4.84; p=0.02), and chronic obstructive pulmonary disease (OR 2.47; 95% CI 1.02–6.00; p=0.06).

No conflict of interest is reported.

The article was received on 04/06/2021

REFERENCES

1. Moran AE, Forouzanfar MH, Roth GA, Mensah GA, Ezzati M, Flaxman A et al. The Global Burden of Ischemic Heart Disease in 1990 and 2010: The Global Burden of Disease 2010 Study. Circulation. 2014;129(14):1493–501. DOI: 10.1161/CIRCULATIONAHA.113.004046
2. Virani SS, Alonso A, Aparicio HJ, Benjamin EJ, Bittencourt MS, Callaway CW et al. Heart Disease and Stroke Statistics–2021 Update: A Report From the American Heart Association. Circulation. 2021;143(8):e254–743. DOI: 10.1161/CIR.0000000000000950
3. 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):3232–45. DOI: 10.1093/eurheartj/ehw334
4. Yakushin S.S., Filippov E.V. Analysis of mortality rate from diseases of circulatory system and cardiovascular diseases in the Ryazan region in the period 2012-2016. Eruditio Juvenium. 2018;6(3):448–61. [Russian: Якушин С.С., Филиппов Е.В. Анализ смертности от болезней системы кровообращения и сердечно-сосудистой заболеваемости в Рязанской области за период 2012-2016 гг. Наука молодых. 2018;6(3):448-61]. DOI: 10.23888/HMJ201863448-461
5. Parshikova E.N., Filippov E.V. Mortality from all causes in patients with myocardial infarction with elevation of st segment depending on the type of reperfusion therapy (data of Ryazan region, 2018-2020). I.P. Pavlov Russian Medical Biological Herald. 2020;28(4):479–87. [Russian: Паршикова Е.Н., Филиппов Е.В. Смертность от всех причин у пациентов с инфарктом миокарда с подъемом сегмента ST в зависимости от типа реперфузионной терапии (данные Рязанской области, 2018-2020 гг.). Российский медико-биологический вестник им. академика И.П. Павлова. 2020;28(4):479-87]. DOI: 10.23888/PAVLOVJ2020284479-487
6. Wallentin L, Kristensen SD, Anderson JL, Tubaro M, Sendon JLL, Granger CB et al. How can we optimize the processes of care for acute coronary syndromes to improve outcomes? American Heart Journal. 2014;168(5):622-631.e2. DOI: 10.1016/j.ahj.2014.07.006
7. Smolina K, Wright FL, Rayner M, Goldacre MJ. Long-Term Survival and Recurrence After Acute Myocardial Infarction in England, 2004 to 2010. Circulation: Cardiovascular Quality and Outcomes. 2012;5(4):532–40. DOI: 10.1161/CIRCOUTCOMES.111.964700
8. Campo G, Saia F, Guastaroba P, Marchesini J, Varani E, Manari A et al. Prognostic Impact of Hospital Readmissions After Primary Percutaneous Coronary Intervention. Archives of Internal Medicine. 2011;171(21):1948–9. DOI: 10.1001/archinternmed.2011.536
9. Johansson S, Rosengren A, Young K, Jennings E. Mortality and morbidity trends after the first year in survivors of acute myocardial infarction: a systematic review. BMC Cardiovascular Disorders. 2017;17(1):53. DOI: 10.1186/s12872-017-0482-9
10. Boytsov S.A., Pogosova N.V., Bubnova M.G., Drapkina O.M., Gavrilova N.E., Yeganyan R.A. et al. Cardiovascular prevention 2017. National guidelines. Russian Journal of Cardiology. 2018;23(6):7–122. [Russian: Бойцов С.А., Погосова Н.В., Бубнова М.Г., Драпкина О.М., Гаврилова Н.Е., Еганян Р.А. и др. Кардиоваскулярная профилактика 2017. Российские национальные рекомендации. Российский кардиологический журнал. 2018;23(6):7–122]. DOI: 10.15829/1560-4071-2018-6-7-122
11. Garganeeva A.A., Kuzheleva E.A., Tukish O.V. The role of treatment adherence after myocardial infarction (according to the acute myocardial infarction registry). Complex Issues of Cardiovascular Diseases. 2019;8(4):56–64. [Russian: Гарганеева А.А., Кужелева Е.А., Тукиш О.В. Роль приверженности лечению в клиническом течении постинфарктного периода (по данным регистра острого инфаркта миокарда). Комплексные проблемы сердечно-сосудистых заболеваний. 2019;8(4):56-64]. DOI: 10.17802/2306-1278-2019-8-4-56-64
12. Malay L.N., Davidovich I.M. Khabarovsk register of acute myocardial infarction: the analysis of long-term prognosis and long-term medical treatment compliance. Far Eastern Medical Journal. 2017;2:43–8. [Russian: Малай Л.Н., Давидович И.М. Хабаровский Регистр острого инфаркта миокарда: анализ отдаленных исходов и приверженности длительной медикаментозной терапии. Дальневосточный медицинский журнал. 2017;2:43-8]
13. Pereverzeva K.G., Yakushin S.S., Gracheva A.I., Lukyanov M.M., Drapkina O.M. Post-myocardial infarction patients: a comparison of man-

ISSN 0022-9040. Kardiologiia. 2022;62(2). DOI: 10.18087/cardio.2022.2.n1712

agement by a physician and a cardiologist according to the REGATA register. Cardiovascular Therapy and Prevention. 2020;19(3):13–9. [Russian: Переверзева К.Г., Якушин С.С., Грачева А.И., Лукьянов М.М., Драпкина О.М. Пациент с инфарктом миокарда в анамнезе: сравнение тактики ведения терапевтом и кардиологом по данным регистра РЕГАТА (РЕГистр пациентов, перенесших инфАркТ миокардА). Кардиоваскулярная терапия и профилактика. 2020;19(3):13-9]. DOI: 10.15829/1728-8800-2020-2525
14. Helsinki Declaration of the World Medical Association. Ethical principles in conducting medical research with the involvement of a person. Medical ethics. 2014;2(1):3–6. [Russian: Хельсинкская Декларация Всемирной Медицинской Ассоциации. Этические принципы при проведении медицинских исследований с привлечением человека. Медицинская этика. 2014;2(1):3-6]
15. Gliklich R. Good Practice for Patient Registries. AHRQ Annual Meeting. 2008. Av. at: https://www.powershow.com/view2b/478c80-NWQ2Z/Good_Practice_for_Patient_Registries_AHRQ_Annual_Meeting_Bethesda_MD_September_9_2008_Speaker_Richard_Gliklich_MD_Principal_Investigator_Outcome_DEcIDE_Center_President_Outcome_Cambridge_MA_powerpoint_ppt_presentation.
16. Martsevich S.Yu., Gynzburg M.L., Kutishenko N.P., Deev A.D., Smirnov V.P., Drozdova L.Yu. et al. The LIS study (Lyubertsy study on mortality rate in patients after acute myocardial infarction). evaluation of drug therapy. Part 2. Influence of previous drug treatment on long-term life prognosis. Rational Pharmacotherapy in Cardiology. 2012;8(6):738–45. [Russian: Марцевич С.Ю., Гинзбург М.Л., Кутишенко Н.П., Деев А.Д., Смирнов В.П., Дроздова Л.Ю. и др. Исследование ЛИС (Люберецкое исследование смертности больных, перенесших острый инфаркт миокарда). оценка лекарственной терапии. Часть 2. Влияние предшествующей лекарственной терапии на отдаленный прогноз жизни больных. Рациональная Фармакотерапия в Кардиологии. 2012;8(6):738-45]. DOI: 10.20996/1819-6446-2012-8-6-738-745
17. Martsevich S.Yu., Ginzburg M.L., Kutishenko N.P., Deev A.D., Smirnov V.P., Drozdova L.Yu. et al. Lyubertsy mortality study (LMS): factors influencing the long-term survival after myocardial infarction. The Russian Journal of Preventive Medicine. 2013;16(2–1):32–8. [Russian: Марцевич С.Ю., Гинзбург М.Л., Кутишенко Н.П., Деев А.Д., Смирнов В.П., Дроздова Л.Ю. и др. Люберецкое исследование смертности (исследование ЛИС): факторы, влияющие на отдаленный прогноз жизни после перенесенного инфаркта миокарда. Профилактическая Медицина 2013;16(2-1):32-8]
18. Nauta ST, Deckers JW, Akkerhuis KM, van Domburg RT. Short- and Long-Term Mortality After Myocardial Infarction in Patients With and Without Diabetes: Changes from 1985 to 2008. Diabetes Care. 2012;35(10):2043–7. DOI: 10.2337/dc11-2462
19. Rapsomaniki E, Shah A, Perel P, Denaxas S, George J, Nicholas O et al. Prognostic models for stable coronary artery disease based on electronic health record cohort of 102 023 patients. European Heart Journal. 2014;35(13):844–52. DOI: 10.1093/eurheartj/eht533
20. Deckers JW, van Domburg RT, Akkerhuis M, Nauta ST. Relation of Admission Glucose Levels, Short- and Long-Term (20-Year) Mortality After Acute Myocardial Infarction. The American Journal of Cardiology. 2013;112(9):1306–10. DOI: 10.1016/j.amjcard.2013.06.007
21. Nauta ST, van Domburg RT, Nuis R-J, Akkerhuis M, Deckers JW. Decline in 20-year mortality after myocardial infarction in patients with chronic kidney disease: evolution from the prethrombolysis to the percutaneous coronary intervention era. Kidney International. 2013;84(2):353–8. DOI: 10.1038/ki.2013.71
22. Rapsomaniki E, Thuresson M, Yang E, Blin P, Hunt P, Chung S-C et al. Using big data from health records from four countries to evaluate chronic disease outcomes: a study in 114 364 survivors of myocardial infarction. European Heart Journal - Quality of Care and Clinical Outcomes. 2016;2(3):172–83. DOI: 10.1093/ehjqcco/qcw004