Changes in Long-term Mortality in Patients with Myocardial Infarction History According to the LIS Luberetskiy registry

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Aim. The aim of the research was to study the dynamics of distant cases of the disease that underwent AMI in 2005-2007 (LIS registry) and in 2014 and 2018 (LIS-3 registry), discharged from the same hospital of the Lyubertsy District Hospital (LDH).

Material and methods. The study was conducted on the basis of two registries - a retrospective-prospective register LIS (Lyubertsy investigation of death), which was conducted in the Lyubertsy district of the Moscow region, all cases of check-ups in the AMI hospital for a 3-year period (2005-2007) and the prospective register LIS-3 (11/01/2013 – to the present), which included patients admitted to the cardiology department of the Lyubertsy District Hospital No. 2 with the correct diagnosis of Acute coronary syndrome with and without ST segment elevation. With patients discharged from the hospital, a telephone contact was established no earlier than 1 year after discharge to clarify the life status, and in case of death – to find out its causes. Search for patients who did not answer the phone call, was using by the study of the archive of the polyclinic, with database statistics. Long-term cases of the LIS were compared with LIS-3 registers, clinical demographic characteristics and risk indicators in patients in the LIS and LIS-3 registers were also compared, differences in drug therapy before the onset of AMI and after discharge from the hospital register between LIS and LIS-3 were analyzed.

Results. Out of 327 patients, the registry included 104 (31.8%) patients discharged in 2014 and 223 (68.2%) in 2018. When comparing the long-term mortality curves of the LIS and LOS-3 registers, a significant difference was noted. The LIS-3 study revealed more frequent referrals for antiplatelet agents (20% vs 16%), statins (11.6% vs 2.0%). Less commonly, diuretics began to be prescribed at the prehospital level. After discharge from the hospital in the LIS-3 registry, a decrease compared to the LIS registry, more frequent prescription of antiplatelet agents (97.5% vs 85.0%), anticoagulants (1.1% vs 0%), statins (96.5% vs 67.0%), beta-blockers (93.3% vs 81.0%). Less commonly, diuretics are prescribed at discharge from the hospital.

Conclusion. The present study of the LIS-3 registry showed a significant decrease in the incidence of those who had AMI, which occurred 15-20 years after the LIS registry was conducted.

Key words: acute myocardial infarction, acute coronary syndrome, registry, primary and secondary drug prevention.

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Introduction

Acute myocardial infarction (AMI) is one of the main complications of coronary artery disease (CAD), making a significant contribution to the problem of mortality and disability of the population [1, 2]. Recently, the life prognosis of patients after AMI has been significantly improved. The question of the long-term life prognosis of patients after AMI is less clear. The LIS registry, which included all cases of AMI confirmed in the Lyubertsy Regional Hospital, showed for the period 2005-2007 that <60% of patients survived after 4 years [3].

We are interested in studying how the parameters of the long-term life prognosis of patients have changed in recent years after the health care reforms (primarily after the emergence of vascular centers).

The aim of this study is to study the dynamics of long-term mortality in patients with acute myocardial infarction (AMI) in 2005-2007 (LIS registry) and in 2014 and 2018 (LIS-3 registry), discharged from the same hospital of the Lyubertsy Regional Hospital.

Material and methods

The study was conducted on the basis of the retrospective and prospective LIS registries (Lyubertsy investigation of mortality), which was conducted in the Lyubertsy district of the Moscow region. All cases of AMI confirmed in the hospital for a 3-year period (2005-2007) were registered, namely 1133 patients, of which 961 patients were discharged from the hospital and prospective register LIS-3 (from 11/01/2013 to the present), which included patients admitted to the cardiology department of the Lyubertsy District Hospital No. 2 with a diagnosis of Acute coronary syndrome with and without ST elevation. It's important that the comparison was carried out in the same clinic, the Lyubertsy Regional Hospital.

Data on long-term follow-up in the LIS registry were taken from relevant publications [4, 5]. The protocol of the hospital part of the LIS and LIS-3 registries was described in detail earlier [6,7].

The diagram of the post-hospital part of the LIS-3 register is shown in Figure 1.

Contact with patients discharged from the hospital was established no earlier than 1 year after discharge to determine the vital status or to determine the cause of death.

During a telephone survey, information on therapy taken and adherence to visits to medical institutions was obtained, a record of cases of cardiovascular events and invasive treatment, as well as hospitalizations due to worsening of the course of the underlying disease in the period after discharge from the hospital was carried out.

The search for patients who didn't answer the phone call was carried out by studying the archives of polyclinics using the Megaclinic statistical database, which is used to conduct accounting and reporting processes in more than 600 medical organizations in Moscow and the Moscow Region, starting from 2009, and data from an individual program for the rehabilitation of the disabled (IPR), where the Regional Bureau of Medical and Social Expertise (MSE) sends certificates of death of the population.

Statistical processing of the obtained data was performed using the IBM SPSS Statistics 23 program (IBM Corp., USA) in several stages. The main characteristics of the patients included in the registry were presented using descriptive statistics methods, including in the study groups obtained (the first group are patients discharged from the hospital with a diagnosis of AMI or unstable angina in January-September 2014, and the second group are patients discharged in January-September 2018). The terms of long-term follow-up differed in 2014 and 2018, respectively. Absolute values and percentages for qualitative scores, normality analysis of scores, and means and standard deviations for normally distributed scores were determined. The T-test for independent samples was used to compare mean values, the Mann-Whitney's test was used to compare data with non-normal distribution, the Pearson's test (Chi-square) was used to assess the statistical significance of differences between two or more relative indicators (frequencies, shares). Kaplan-Meier's curves were used for display and survival analysis. The level of statistical significance was taken at $p<0.05$.

Results

The LIS registry established the vital status of 850 people out of 961 patients discharged home from the hospital; vital status remained unknown in 111 people (11.6% of all patients included in this part of the study). 191 (19.9% of the total number of those

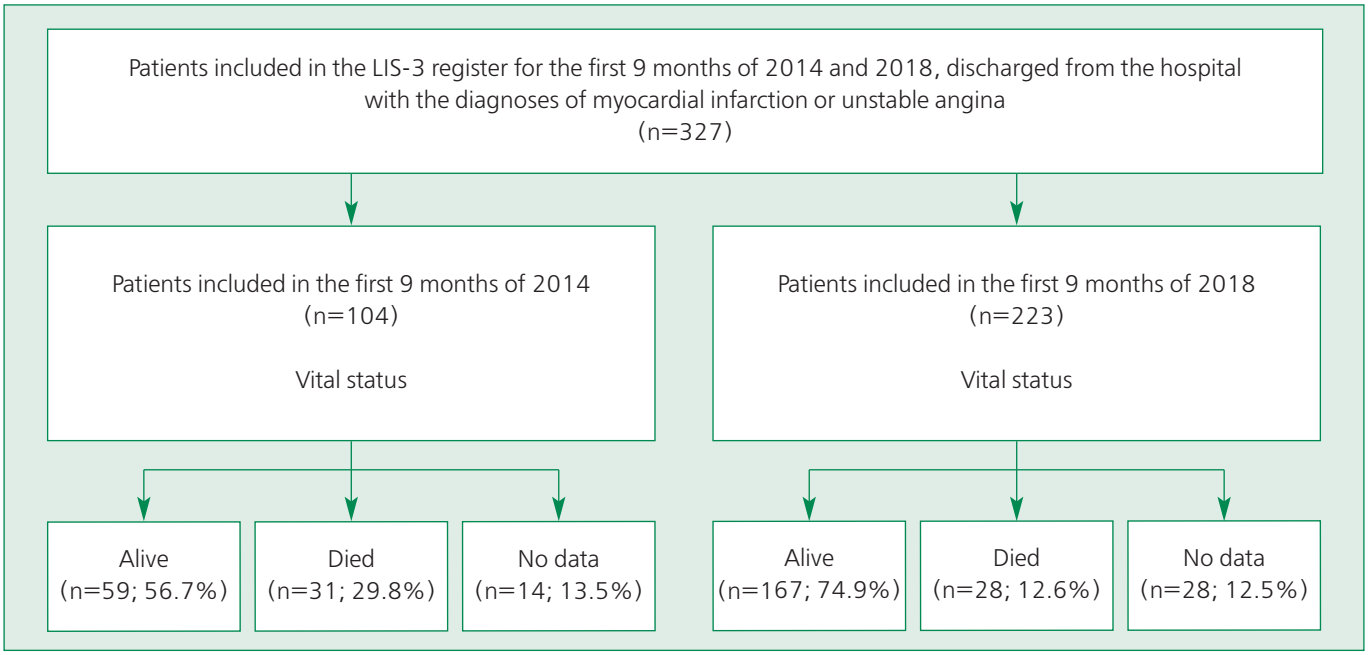

Figure 1. Study design

discharged from the hospital) died out of the indicated 850 people, the remaining 659 were invited for re-examination, 27 people couldn't come to the appointment for various reasons. Men (56.2%) predominated among patients, and their average age was less than the age of women by more than 10 years.

The LIS-3 registry determined the status in 90 (86.5%) patients (36 women and 54 men) out of 104 patients discharged in 2014, and in 195 (87.4%) patients (79 women and 116 men) out of 223 of patients discharged in 2018. According to the survey, 59 (18%) patients (31 women and 28 men) died after discharge.

Those patients whose status couldn't be established in the LIS-3 registry, apparently, couldn't significantly affect mortality rates, since they didn't differ in basic characteristics from patients whose vital status was established.

Table 1 shows the comparative characteristics of patients with whom it was possible to establish contact after discharge, and the characteristics of patients whose fate remained unknown.

Figure 1 shows baseline data for patients with known and unknown vital status. 104 (31.8%) patients out of 327 discharged in 2014 were included in the register, and 223 (68.2%) in 2018.

Figure 2 (Kaplan-Meier's curves) shows that long-term mortality was practically the same (p=0.997) also in the group of patients discharged from the hospital in 2014 and 2018.

Groups of patients discharged in 2014 and 2018 were combined for further analysis due to the absence of differences in long-term mortality.

Table 2 describes the baseline comparative characteristics of patients in the LIS and LIS-3 registries. We see that the groups didn't differ from each other or differed slightly in most indicators. Differences in the frequency of CAD seem to reflect different approaches to the diagnosis of CAD in the LIS and LIS-3 registries. Significant differences in the incidence of dyslipidemia seem to be due to the absence of these data in the majority of patients in the LIS-3 registry.

A comparison of the long-term mortality curves of the LIS and LIS-3 registries showed their significant difference. The curves began to diverge distinctly after about 2 years of follow-up.

Table 3 shows data on medicine therapy for patients in the LIS and LIS-3 registries. The LIS-3 study revealed more frequent use of antiplatelet agents and statins. Diuretics have become less frequently prescribed in the pre-hospital stage.

After discharge from the hospital, more frequent use of antiplatelet agents, anticoagulants, statins, and beta-blockers was noted in the LIS-3 registry compared to the LIS registry. Diuretics began to be

Table 1. Main characteristics of patients with/without contact after a period of at least 1 year after discharge from the hospital after myocardial infarction or unstable angina

Initial specifications	Total (n=327)	Availability of patient information after ⩾1 year		p*
		Data available (n=285; 87.2%)	Data not available (n=42; 12.8%)	
Social and demographic indicators				
Men, n (%)	202 (61.8)	170 (59.6)	32 (76.2)	0.039
Women, n (%)	125 (38.2)	115 (40.4)	10 (23.8)	
Age, years	62.0 [54.0;72.0]	64.0 [54.0;73.0]	57.0 [52.0;68.0]	0.073
• men	58.5 [49.0;66.0]	59.0 [49.0;66.0]	57.0 [50.5;65.5]	0.613
• women	70.0 [62.0;80.0]	70.0 [62.0;79.0]	65.0 [56.0;80.0]	0.509
Working, n (%)	128 (39.1)	103 (36.1)	25 (59.5)	0.011
History of risk factors				
Smoking, n (%)	101 (30.9)	88 (30.9)	13 (31.0)	0.288
Low physical activity, n (%)	145 (44.3)	130 (45.6)	15 (35.7)	0.263
Family history for CVD, n (%)	31 (9.5)	27 (9.5)	4 (9.5)	0.361
Hypertension, n (%)	236 (72.2)	207 (72.6)	29 (69.0)	0.277
Diabetes mellitus, n (%)	54 (16.5)	49 (17.2)	5 (11.9)	0. 494
Dyslipidemia, n (%)	14 (4.3)	13 (4.6)	1 (2.4)	0.593
History of cardiovascular disease				
Coronary artery disease, n (%)	91 (27.8)	85 (29.8)	6 (14.3)	0.037
Myocardial infarction, n (%)	55 (16.8)	50 (17.5)	5 (11.9)	0.200
Atrial fibrillation, n (%)	15 (4.6)	15 (5.3)	0	0.095
ACVA, n (%)	16 (4.9)	14 (4.9)	2 (4.8)	0.741
History of concomitant diseases				
Kidney diseases, n (%)	10 (3.1)	8 (2.8)	2 (4.8)	0.592
Anemia, n (%)	8 (2.4)	8 (2.8)	0	0.399
Chronic lung diseases, n (%)	17 (5.2)	16 (5.6)	1 (2.4)	0.494
Ulcer disease, n (%)	123 (37.6)	106 (37.2)	17 (40.5)	0.885
Thyroid diseases, n (%)	5 (1.5)	3 (1.1)	2 (4.8)	0.142

Data are presented as Me [25%; 75%] unless otherwise stated

* the significance of differences (by χ^2 according to Pearson) in patients with or without a sign in the groups of patients with whom there was contact (with information about it) and with no contact (information)

CVD – cardiovascular diseases, ACVA – acute cerebrovascular accident

prescribed less frequently at discharge from the hospital.

Discussion

For several decades, AMI registries (more recently acute coronary syndrome [ACS] registries) have been regularly conducted in different countries of the world, and their scale varies from individual clinics (and even departments in clinics) to large regions, entire countries and even group of countries (international registries). The existing AMI registries in our country basically simply recorded what happened to patients in the hospital. An attempt to assess the long-term survival of patients was made in the Record registry, but this remained an attempt in the Record registry, since after 6 months the fate of less than 50% of patients was identified. According to A.D. Erlich et al., specially selected clinics took part in the RECORD-3 registry, and the response of patients was no more than 60% [8].

The LIS registry is one of the few registries in Russia that studies long-term outcomes after AMI. It's im-

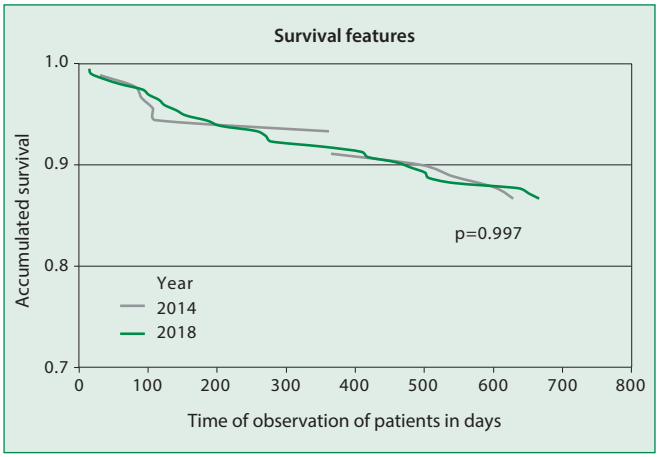

Figure 2. Risk of death depending on the year of hospitalization

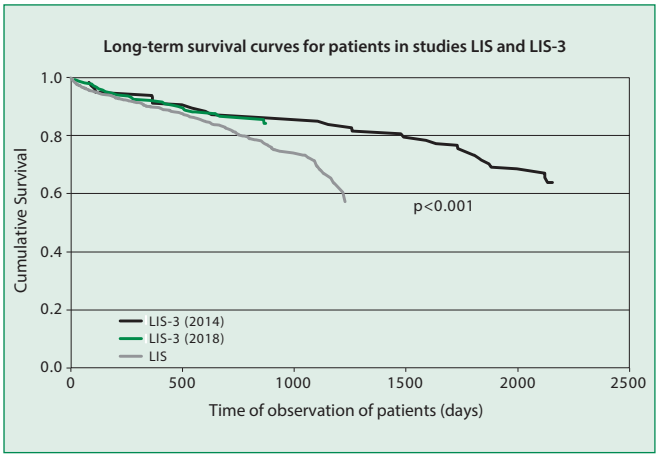

Figure 3. Long-term survival curves for patients in the LIS and LIS-3 study

portant that the LIS registry is conducted in the same district and hospital, and that the baseline characteristics of the discharged from the hospital LIS and LIS-3 patients didn't differ significantly, except for hyperlipidemia and a history of CAD, which has a very specific explanation. Most likely, the decrease in the number of CAD cases in history is associated with an improvement in the quality of CAD diagnosis.

Table 2. Main demographic characteristics of patients with acute coronary syndrome with or without ST-segment elevation

Parameter	LIS (n=961)	LIS-3 (n=327)
Age, years	63,9±0.4	62,6±12.8
Men, n (%)	540 (56.2)	202 (61.8)
Women, n (%)	421 (43.8)	125 (38.5)
Smoking, n (%)	298 (31.0)	101 (30.9)
Sedentary lifestyle, n (%)	596 (62.0)	145 (44.3)
Burdened family history for CVD, n (%)	30 (3.1)	31 (9.5)
Type 2 diabetes mellitus, n (%)	154 (16.0)	54 (16.5)
Hypertension, n (%)	731 (76.1)	236 (72.2)
Dyslipidemia, n (%)	347 (36.1)	14 (4.3)[a]
Coronary artery disease, n (%)	665 (69.2)	91 (27.8)
Myocardial infarction, n (%)	200 (20.8)	55 (16.8)
ACVA, n (%)	83 (8.6)[b]	16 (4.9)
TIA, n (%)		121 (37.0)

[a] Lipid data were missing in a significant proportion of patients

[b] ACVA + TIA

CVD – cardiovascular diseases, ACVA – acute cerebrovascular accident, TIA – transient ischemic attack

The LIS-3 registry revealed a significant reduction in long-term mortality compared to the LIS registry. This can be explained by the opening of the Vascular Center on the territory of Lyubertsy Regional Hospital No. 2 in 2015, as well as by the improvement in the quality of hospital and post-hospital care. Pre-hospital care, reflecting mainly the quality of primary prevention, has not changed very much. Post-hospital therapy, reflecting the quality of secondary prevention, has improved significantly, primarily with statins and antiplatelet agents.

Similar LIS-3 indicators of long-term mortality in patients with AMI were registered in the outpatient polyclinic PROFIL-IM registry, which was conducted at the same time as the LIS-3 registry in Moscow [9].

Table 3. The main groups of drugs received by patients before the development of AMI and recommended after discharge from the hospital

Group of medicines	Before AMI the development		After discharge	
	LIS (n=961)	LIS-3 (n=285)	LIS (n=961)	LIS-3 (n=285)
Antiplatelet agents, %	16.0	20.0	85.0	97.5
Statins, %	2.0	11.6	67.0	96.5
Anticoagulants, %	0	1.1	4.0	9.8
Diuretics, %	13,0	4.2	47.0	9.8
ACE inhibitors, %	36.0	23.2	81.0	80.7
Beta blockers, %	21.0	20.4	81.0	93.3
Calcium channel blockers, %	7.0	7.4	14.0	7.0

AMI – acute myocardial infarction, ACE – angiotensin converting enzyme

A similar positive dynamics of mortality rates over 5 years was noted in the Polish Registry of Acute Coronary Syndrome and Acute Myocardial Infarction [10].

Evidence from several studies suggests a positive effect of post-hospital therapy. For example, patients were divided into 3 categories depending on the quality of the therapy in the study [11], which included patients after ACS from the Melbourne registry, who were alive for 30 days after percutaneous coronary intervention. Of the 9375 patients included in the study, 5678 (60.6%) received optimal medical therapy, 2903 (31.0%) received near-optimal medical therapy, and 794 (8.5%) received suboptimal medical therapy. Prescribing suboptimal medicine therapy was associated with higher mortality at 3.9-2.2 years compared to optimal and near-optimal (16.8% vs. 10.5%, $p<0.001$). The study showed that the lack of optimal medical therapy after ACS is associated with an increased risk of long-term mortality.

Evaluation of specific indicators of the ACS treatment quality was carried out in Portugal on the basis of the ProACS registry [12, 13], which has been operating for the last 15 years. Since 2002, 45,141 patients have been included in the study. The invasive strategy has demonstrated a significant reduction in in-hospital mortality in ST-segment elevation myocardial infarction and non-ST-segment elevation ACS. We also saw an improvement in the use of medicines indicated in clinical guidelines, especially statins. It has been shown that recent improvements in the quality of care for ACS have led to a significant reduction in mortality.

Study limitations. Prescribing medication in the LIS and LIS-3 registries were assessed by summaries of case histories, adherence to treatment was not assessed, and there were no accurate data on the therapy taken after discharge from the hospital.

Conclusion

Thus, the present study of the LIS-3 registry showed a significant reduction in long-term mortality in patients with AMI, which occurred 15-20 years after the LIS registry. It's important that the comparison was carried out in the same clinic, the Lyubertsy Regional Hospital. The main reasons for the reduction in mortality, apparently, are the opening of the vascular center and the use of an invasive strategy associated with this event, as well as better medicine therapy for patients after discharge from the hospital, based primarily on modern clinical recommendations.

Relationships and Activities. None.

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