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ORIGINAL ARTICLE

Endovascular surgery in patients with coronary artery disease in combination with cancer

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ABSTRACT

Purpose of the study. To analyze the long-term results from various strategies of endovascular treatment for coronary artery disease (CAD) in patients concomitant with cancer.

Patients and methods. 74 patients with both CAD disease and cancer were treated in A. V. Vishnevskiy Center from 01/01/2018 to 12/31/2022. By a multidisciplinary council, patients were divided into three groups: group 1 (*n* = 39) – staged treatment: percutaneous coronary intervention (PCI) is the first stage, the second is surgical treatment of cancer; group 2 (*n* = 14) – staged treatment: the first stage was surgical treatment of cancer, and the second stage was PCI; group 3 (*n* = 21) – PCI and open surgery were performed on the same day.

Results. In the immediate period, 3 (4.0 %) deaths were observed: 2 (5.1 %) in group 1, 1 (4.8 %) in group 3, the cause of which was complications arising after oncological surgical interventions. One (2.6 %) patient from group 1 had acute myocardial infarction (AMI) due to acute stent thrombosis in the left anterior descending artery (LAD). The patient underwent successful emergency PCI. In the long-term period, 15 (25.4 %) patients died, out of which 11 (18.7 %) from progression of cancer, and 4 (6.7 %) from other causes. Among the major cardiovascular complications, the following were observed: 1 (3.2 %) AMI in group 1 and 1 (7.1 %) in group 2.

Conclusion. In the long-term follow-up period, the leading cause of death (73,3 %) was progression of cancer. There were no detected from deaths AMI, which confirms the importance and feasibility of myocardial revascularization in this severe group of patients. PCI in patients with coronary artery disease in combination with cancer allows for effective and safe surgical treatment of malignant pathology without cardiac mortality both in the immediate and long-term follow-up periods.

Keywords: coronary heart disease, oncological disease, percutaneous coronary intervention, malignant neoplasm, cancer, surgical treatment, coronary artery stenting

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Compliance with ethical standards: this research has been carried out in compliance with the ethical principles set forth by the World Medical Association Declaration of Helsinki, 1964, ed. 2013. The study was approved by the Research Ethics Committee of the A. V. Vishnevskiy National Medical Research Center of Surgery (extract from the protocol of the meeting No. 009–2021 dated 11/26/2021). Information consent was obtained from all study participants

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3.1.6. Онкология, лучевая терапия
ОРИГИНАЛЬНАЯ СТАТЬЯ

Рентгенэндоваскулярная хирургия в лечении пациентов с ишемической болезнью сердца в сочетании со злокачественными новообразованиями

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РЕЗЮМЕ

Цель исследования. Провести анализ отдаленных результатов различных стратегий рентгенэндоваскулярного лечения ишемической болезни сердца (ИБС) у пациентов с сопутствующими злокачественными новообразованиями (ЗНО).
Пациенты и методы. В ФГБУ «Национальный медицинский исследовательский центр хирургии им. А. В. Вишневского» Министерства здравоохранения Российской Федерации в период с 01.01.2018 по 31.12.2022 гг. проходили лечение 74 пациента с ИБС в сочетании с ЗНО. Мультидисциплинарным консилиумом пациенты были распределены на три группы: группа 1 (n = 39) – этапное лечение: первым этапом – выполнение чрескожного коронарного вмешательства (ЧКВ), вторым – хирургическое лечение ЗНО; группа 2 (n = 14) – этапное лечение: первым этапом выполнялось хирургическое лечение ЗНО, а вторым – ЧКВ; группа 3 (n = 21) – выполнение ЧКВ и открытого хирургического вмешательства проводилось в один день.
Результаты. На госпитальном этапе отмечено 3 (4,0 %) летальных исхода: 2 (5,1 %) – в группе 1, 1 (4,8 %) – в группе 3, причиной которых были осложнения, возникшие после онкологических хирургических вмешательств. У 1 (2,6 %) пациента из группы 1 отмечен инфаркт миокарда (ИМ) вследствие острого тромбоза стента в передней межжелудочковой ветви (ПМЖВ). Пациенту было выполнено успешное экстренное ЧКВ. В отдаленном периоде умерло 15 (25,4 %) пациентов, из которых 11 (18,7 %) – от прогрессирования ЗНО, а 4 (6,7 %) – от других причин. Среди больших сердечно-сосудистых осложнений наблюдались: 1 (3,2 %) ИМ в группе 1 и 1 (7,1 %) – в группе 2.
Заключение. В отдаленном периоде наблюдения ведущей причиной смерти (73,3 %) было прогрессирование ЗНО. Не было зафиксировано ни одного летального исхода от ИМ, что подтверждает важность и целесообразность выполнения реваскуляризации миокарда у данной группы пациентов. ЧКВ у пациентов с ИБС в сочетании с ЗНО позволяет эффективно и безопасно выполнить хирургическое лечение злокачественной патологии без кардиальной смертности как на госпитальном, так и в отдаленном периодах наблюдения.

Ключевые слова: ишемическая болезнь сердца, онкологическое заболевание, чрескожное коронарное вмешательство, злокачественное новообразование, рак, хирургическое лечение, стентирование коронарных артерий

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Соблюдение этических стандартов: в работе соблюдались этические принципы, предъявляемые Хельсинкской декларацией Всемирной медицинской ассоциации (World Medical Association Declaration of Helsinki, 1964, ред. 2013). Исследование одобрено Комитетом по этике научных исследований ФГБУ «Национальный медицинский исследовательский центр хирургии им. А. В. Вишневского» Министерства здравоохранения Российской Федерации (выписка из протокола заседания № 009–2021 от 26.11.2021 г.). Информированное согласие получено от всех участников исследования

Финансирование: финансирование данной работы не проводилось

Конфликт интересов: все авторы заявляют об отсутствии явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи

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INDRODUCTION

In the Russian Federation, primary cancers were detected in 580,415 patients in 2021: 265,039 men and 315,376 women.

The most common cancers in men were: tumors of the trachea, bronchi, lung (16.4 %), prostate (15.1 %), skin (except melanoma) (9.8 %), stomach (7.0 %), colon (7.0 %), rectum, rectosigmoid, anus (5.8 %). The main neoplasms in the females were: breast cancer (22.1 %), skin neoplasms (except melanoma) (13.4 %), uterine body (8.1 %), colon (7.2 %), cervix (4.9 %), rectum, rectosigmoid junction, anus (4.6 %), lymphatic and hematopoietic tissue (4.4 %), stomach (4.2 %), ovary (4.2 %), trachea, bronchi, lung (4.1 %). Compared with 2020, the growth of primary detected malignant neoplasms in the Russian Federation amounted to 4.4 % [1].

Morbidity and mortality from both oncological and cardiovascular diseases, including coronary artery disease (CAD), increases with age [2]. At the same time, a combination of both nosologies is often found. Thus, according to S. G. Al-Kindi et al., the incidence of coronary artery disease in patients with lung cancer is 21 %, with breast cancer – 6 %, with colorectal cancer – 12 %, and with kidney cancer – 17 %. [3].

The survival results of 3,234,256 cancer patients showed that in the long-term period 1,228,328 (33 %) patients died directly from cancer, while from cardiovascular diseases – 365,689 (11.3 %), while 76.3 % of them were occupied by heart disease [4].

50.6 % of patients underwent radical treatment among all malignant neoplasms in oncological institutions of the Russian Federation. At the same time, the surgical method was predominant and amounted to 59.5 %, and the share of combined treatment was 28.6 % [5].

Complications arising after surgical interventions, including oncological ones, lead to an increase in inpatient care, in the cost of treatment, and an increase in mortality [6].

A major paper by Ramamoorthy et al. presents the incidence of major cardiovascular complications (MACCE) in 2,854,810 patients over 40 years of age who underwent extensive surgical interventions for malignant neoplasms. The overall incidence of major cardiovascular events in the perioperative period was 2.4 % (67,316). At the same time, they accounted for 0.7–0.8 %. The highest incidence of MACCE was in patients who underwent surgery on the esophagus (6,706 per 100,000 oncological operations), followed by surgery on the liver (5,284 per 100,000 oncological operations), pancreas (4,820 per 100,000 oncological operations), colon (4,038 per 100,000 oncological operations). Of the 2,854,810 patients treated, 400,063 (14 %) had coronary artery disease, of which 31,423 (7.8 %) had a major cardiovascular event in the preoperative period [7].

The purpose of the study: to analyze the long-term results of various strategies for endovascular treatment of coronary artery disease (CAD) in patients with concomitant cancers.

PATIENTS AND METHODS

In the period from 01/01/2018 to 12/31/2022, 74 patients with severe coronary artery disease in combination with cancers were treated at the A. V. Vishnevskiy National Medical Research Center of Surgery, the Russian Federation Ministry of Health. The cardiovascular council determined PCI by revascularization in connection with direct indications for endovascular interventions, or the refusal of cardiac surgeons to perform coronary bypass surgery (CABG) due to the impossibility of myocardial revascularization or concomitant pathology. All patients were discussed at a multidisciplinary consultation with oncologists, surgeons, cardiovascular surgeons, endovascular surgeons, cardiologists, anesthesiologists and intensive care specialists. Based on the stage and degree of prevalence of the oncological process, its manifestations and complications, as well as the severity of coronary artery lesions and the clinical picture of coronary artery disease, the stages and sequence of surgical interventions were determined.

The criteria for inclusion in the study were the following: a combination of active cancer and angiographically significant (more than 75 %) coronary artery damage; consent of the patient or his legal representative to participate in the study after receiving relevant information about the study.

The criteria for exclusion from the study were: the presence of contraindications to receiving double disaggregated therapy; acute renal and hepatic

insufficiency, acute coronary syndrome (ACS) at the time of hospitalization.

Based on the chosen treatment strategy, the patients were divided into three groups:

— group 1 (39–52.7 % of patients) – stage-by-stage treatment: PCI was performed in the first place, surgical treatment of oncological disease in the second;

— group 2 (14–18.9 % of patients) – staged treatment: the first stage was surgical treatment of cancer, and the second stage – PCI;

— group 3 (21–28.4 % of patients) – PCI and open surgery were performed on the same day.

The expediency of performing an early oncological operation on the same day with PCI (group 3) was due to severe damage to the coronary arteries and a malignant process complicated by bleeding, or in a situation where it is impossible to postpone the oncological stage of treatment even for one month, since a delay in treatment could lead to the unresectability of malignant formation. On the scheduled day, patients in the catheterization laboratory first underwent endovascular myocardial revascularization, after which they were immediately transferred to the surgical operating unit to perform oncological intervention.

As a preoperative examination, all patients underwent computed tomography, electrocardiography, echocardiography, ultrasound, MRI, and selective coronary angiography.

There were 63 men (85 %) and 11 women (15 %) out of the 74 patients. The average age of the patients was 68.8 ± 7.2 years (95 % confidence interval – 95 % CI 67.1–70.5). MI in the anamnesis occurred in 29 (39.1 %) patients, angina of functional class III–IV – in 20 (27 %) patients.

As shown in Table 1, the patients of the three groups did not differ statistically in the main clinical characteristics.

All 74 patients had angiographically significant coronary artery lesions: at the same time, a single-vessel lesion occurred in 25 (33.8 %), a two-vessel lesion in 25 (33.8 %), and a three-vessel lesion in 24 (32.4 %) patients. Lesion of the left main cor-

Table 1. Clinical characteristics of patients

Parameters	Group 1 (PCI + ONCO stages) (*n* = 39)		Group 2 (ONCO + PCI stages) (*n* = 14)		Group 3 (simultaneous PCI and ONCO) (*n* = 21)		
	abs.	%	abs.	%	abs.	%	*p*
Male sex	35	89.7	11	78.6	17	81.0	0.457
Female sex	4	10.3	3	21.4	4	19.0	
Age. years old	68.08 ± 6.86	–	67.5 ± 6.51	–	71.00 ± 8.10	–	0.25
BMI	26.57 (23.59–28.56)	–	27.20 (25.90–32.81)	–	25.00 (23.25–31.38)	–	0.239
Arterial hypertension	30	76.9	12	85.7	19	90.5	0.434
Angina functional classes							
Classes III–IV	12	30.8	3	21.4	5	23.8	0.827
Painless form	19	48.7	5	35.7	13	61.9	0.329
Postinfarction cardiosclerosis	17	43.6	8	57.1	4	19.0	0.059
Arrythmia	7	18.4	0	0.0	6	28.6	0.076
Diabetes mellitus	9	23.1	5	35.7	7	33.3	0.610
Chronic Kidney Disease. GFR ≤ 59.9 ml/min/1.73 m^2	8	20.5	5	35.7	6	28.6	0.493

onary artery (LMCA) was observed in 8 (10.8 %), chronic occlusion of the coronary arteries was detected in 18 (23.3 %) patients.

The most common oncological diseases were: kidney cancer in 12 (16.2 %) patients, stomach cancer in 12 (16.2 %), prostate cancer in 11 (14.9 %), colorectal cancer in 10 (13.5 %), lung cancer in 9 (12.2 %) (Fig. 1). The distribution of patients by stages of the tumor process was as follows: stage I was detected in 18 (24.3 %) patients, stage II in 19 (25.7 %), stage III in 29 (39.2 %), stage IV in 8 (10.8 %) (Fig. 2). Distant metastases They were observed in 7 (9.5 %) patients.

In 74 patients, 150 primary surgical interventions were performed: 75 – PCI (one patient in group 1, due to the severity of the clinical condition, PCI was performed in two stages: stenting of the LAD and Circumflex Artery (CA), and then stenting of the Right Coronary Artery (RCA)) and 75 – surgical operations for cancer (one patient was treated with primary multiple cancer in two stages: the first is mastectomy, the second is kidney resection).

From the table. 2 it can be seen that in groups 1 and 3 there were patients with more severe coronary artery lesion. In group 1, 48.7 % of patients underwent two– and three-vessel PCI, and 2.6 % underwent stenting of the LMCA. While in group 3, 47.6 % of patients underwent two- and three-vessel PCI and in 9.5 % of cases PCI of the LMCA.

Of the 75 oncological surgical interventions, the

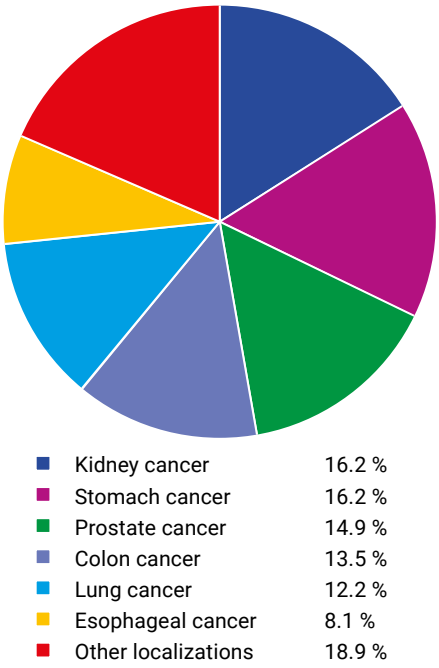

Fig. 1. Cancer localization

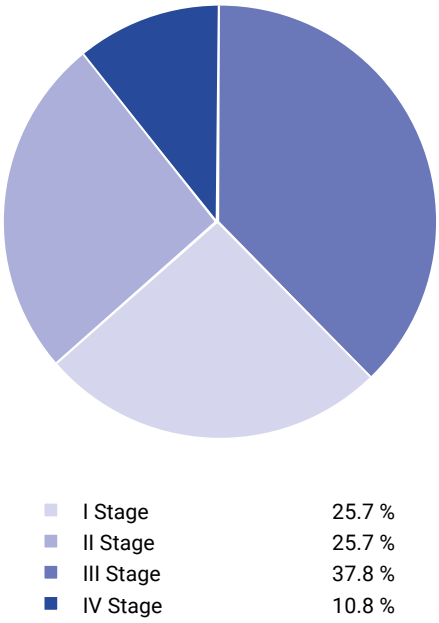

Fig. 2. Cancer stages

Table 2. Distribution of completed PCI

PCI	Group 1 (PCI + ONCO stages) (*n* = 39)		Group 2 (ONCO + PCI stages) (*n* = 14)		Group 3 (Simultaneous PCI and ONCO) (*n* = 21)	
	n	%	*n*	%	*n*	%
One vessel	20	51.3	12	85.7	11	52.4
Two vessel	17	43.6	2	14.3	8	38.1
Three vessel	2	5.1	0	0	2	9.5
LMCA	1	2.6	0	0	3	14.3

most frequent were: prostatectomy – 11 (14.9 %), gastric resection – 8 (10.8 %), lung lobectomy – 8 (10.8 %), hemicolectomy – 6 (8.1 %), gastrectomy – 6 (8.1 %), nephrectomy – 6 (8.1 %), resection kidneys – 6 (8.1 %). (Fig. 3).

The median time interval between the stage of myocardial revascularization and surgical oncological intervention was 56.0 (41.5–107.0) days in group 1 and 42.5 (29.0–76.0) days in group 2 (p = 0.338).

To describe quantitative variables, the data were combined into a series of variations and the arithmetic averages (M) and standard deviations (SD) or medians (Me) and confidence interval (CI) were calculated depending on the normality of the distribution. The normality of the distribution was calculated using the Shapiro-Wilk criterion. Nominal data were marked using absolute values and percentages. In comparing independent samples in the presence of a normal distribution, one-factor analysis of variance (ANOVA) was used, in the absence of a normal distribution, the Kruskal-Wallis criterion was used. The nominal data were compared using the χ^2-Pearson criterion or the exact Fisher criterion, depending on the number of observed phenomena less than 5. The results were evaluated as statistically significant at $p < 0.05$.

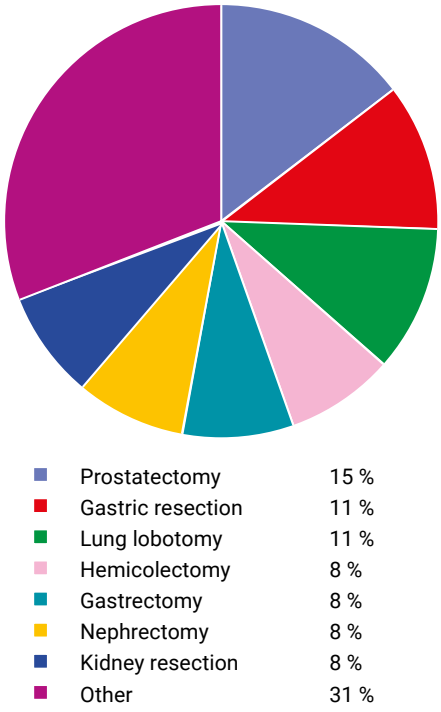

Fig. 3. The structure of oncological interventions

STUDY RESULTS

During the hospital period, when 74 patients underwent two-stage treatment (150 interventions), 3 (4.0 %) deaths were noted as follows: 2 (5.1 %) in group 1, 1 (4.8 %) in group 3, caused by complications arising after oncological surgical interventions (Table 3).

1 (2.6 %) patient of group 1 had acute coronary syndrome (ACS) with ST segment elevation on the 10th day after gastrectomy. This patient was initially scheduled for simultaneous PCI and oncological surgery. However, during the stenting of permanent residence with a bare-metal stent, pulmonary edema arose, which required the transfer of the patient to the intensive care unit. After stabilization of the condition, after 3 days, he underwent a gastrectomy on the background of dual antiplatelet therapy. After the onset of ACS, the patient was immediately transported to the catheterization laboratory, a coronary angiography was performed, the results of which revealed thrombosis of the stent of the LAD. Successful recanalization and repeated stenting of the artery was performed to achieve an optimal angiographic result [8].

Long-term treatment results were evaluated in 59 (83 %) of 71 patients discharged from the Center. The analysis was carried out on the basis of outpatient examinations, repeated hospitalizations, and survey data. The duration of the follow–up period in group 1 averaged 36.9 ± 18.7 months (median 29.3 [20.6–54.8]; 95 % CI 30.8–43.7), in group 2–42.5 ± 12.8 months (median 41.6 [34.8–53.3]; 95 % CI 35.1–49.9), in group 3–36.7 ± 14.1 months (median 31.1 [25.3–46.0]; 95 % CI 28.6–44.9), (p = 0.387).

In total, 15 (25.4 %) patients died in the long-term period (Table 4), of which 11 (18.7 %) died from the oncological process, and 4 (6.7 %) from other causes. In group 1, there were 8 (25.8 %) deaths, 5 (16.1 %) of which were from the cancer progression, 1 (3.2 %) – from acute cerebral circulatory disorders of hemorrhagic type against the background of a prolonged hypertensive crisis, 1 (3.2 %) – from complications of a new coronavirus infection, to establish the cause of death is still one patient failed.

In group 2, 2 (14.3 %) deaths from the progression of cancers were recorded. In group 3, 5 (25.4 %) deaths occurred: 4 (28.6 %) – from the progression of cancer, 1 (1.7 %) – from bleeding due to complications after surgery for urolithiasis.

Among the major cardiovascular complications, there were: 1 (3.2 %) AMI in group 1 and 1 (7.1 %) AMI in group 2. In both cases, the patients were admitted to the hospital, where they underwent successful PCI. It is worth noting that in the long-

Table 3. Hospital complications after two stages of treatment

Parameter	Group 1 (PCI + ONCO stages) (*n* = 39)		Group 2 (ONCO + PCI stages) (*n* = 14)		Group 3 (simultaneous PCI and ONCO) (*n* = 21)		*p*
	n	%	*n*	%	*n*	%	
Cardiovascular complications							
MACCE	1	2.56	0	0.0	0	0.0	–
AMI	1	2.56	0	0.0	0	0.0	–
Stroke	0	0.0	0	0.0	0	0.0	–
Surgical complications							
Bleedings	1	2.56	1	7.1	4	19.0	0.073
Organ dysfunction	2	5.1	0	0.0	3	14.3	–
Infectious complications	3	7.7	1	7.1	2	9.5	1.0
Repeated surgical intervention	2	5.1	2	14.3	3	14.3	0.365
Minor complications: arrhythmia, hypotension, bradycardia, anemia	10	25.6	2	14.3	9	42.9	0.177
Lethal outcomes	2	5.1	0	0.0	1	4.8	–

Table 4. Long-term treatment results

	Group 1 (PCI + ONCO stages) (*n* = 39)		Group 2 (ONCO + PCI stages) (*n* = 14)		Group 3 (simultaneous PCI and ONCO) (*n* = 21)		Overall *n* = 59		*p*
	n	%	*n*	%	*n*	%	*n*	%	
All-cause deaths:	**8**	25.8	**2**	14.3	**5**	35.7	**15**	25.4	0.387
AMI	**–**	–	–	–	–	–	–	–	–
Stroke	**1**	**3.2**	**–**	–	–	–	**1**	**1.7**	–
Cancer	5	16.1	2	14.3	4	28.6	**11**	**18.7**	0.667
COVID-19	**1**	**3.2**	**–**	–	**–**	–	**1**	**1.7**	–
Bleeding	**–**	–	–	–	**1**	**7.1**	**1**	**1.7**	–
Other causes	**1**	**3.2**	**–**	–	–	–	**1**	**1.7**	–
MACCE:	**2**	6.5	**1**	7.1	**1**	7.1	**4**	6.8	1.0
AMI	1	3.2	1	7.1	–	–	2	3.4	–
Stroke	1	3.2	–	–	1	7.1	2	3.4	–

term period, not a single fatal outcome from AMI was recorded.

There were no significant differences detected between the groups, when analyzing the overall survival rate with the Kaplan-Meier method (Fig. 4) and when conducting a Log-rank test (p = 0.366).

DISCUSSION

As a rule, patients with malignant neoplasms were most often excluded from most large randomized cardiac trials and registries. In view of this, there is currently insufficient information about the effect of coronary artery disease on cancer patients. Therefore, the treatment of this group of patients is based on the experience of individual specialists and clinics.

Early detection, followed by the prescribed special treatment of cancer, is a fundamental factor in increasing the survival rate of these patients [9].

However, in patients with combined severe coronary artery disease, performing surgical oncological intervention in the first stage is associated with the risk of developing cardiovascular complications. At the same time, performing early oncological surgery after percutaneous coronary intervention against the background of patients receiving dual antiplatelet therapy (DAPT) is associated with the risks of intra- and postoperative bleeding. Recent generations of stents have made it possible to solve this problem to a greater extent by safely reducing the intake of DAPT to 1 month [10, 11].

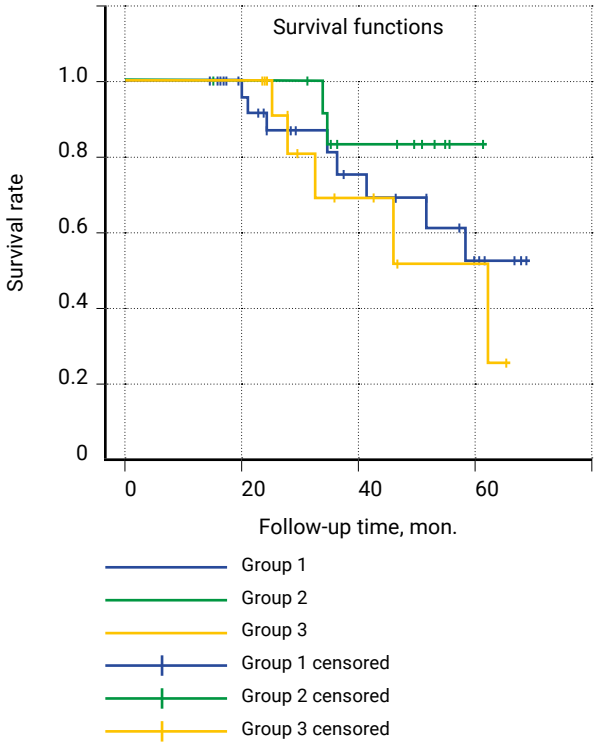

Fig. 4. Kaplan-Meier patient survival curves

A recently published study by Yun T., et al., compared the results of stage-by-stage treatment of patients with lung malignancy and combined coronary artery disease. The patients were divided into two groups according to the timing of the interventions performed: group 1 – patients who underwent PCI in the first stage, and lobectomy in the second stage for up to 3 months; group 2 – patients who underwent PCI in the first stage, and lobectomy in the second stage after 3 months. The analysis of hospital results showed that the time of surgery, hospital stay and blood loss did not significantly differ between the groups (p > 0.05). However, evaluating the long-term results, the authors found that survival for 5 years was significantly higher in patients who underwent lobectomy up to 3 months after PCI (p < 0.05). The authors concluded that lobectomy is more appropriate to perform in the early period after PCI [12].

Indeed, untimely treatment of cancer can reduce long-term survival. The results of a meta-analysis by T. P. Hanna et al., confirmed that a delay in the treatment of malignant neoplasms, even by 4 weeks, increases mortality with surgical, systemic and radiological methods of treatment [13].

In our study, the start of the planned special treatment, including surgical treatment, was carried out as early as possible. In patients with mildly aggressive forms of cancers and without complications (bleeding), who had the opportunity to delay radical treatment for 4 weeks, PCI was performed using bare-metal stents (at the initial stage of our research), and subsequently polymer-free stents of the latest generation (CRE8, CID, Italy) and stents with a bioresorbable polymer (Synergy, Boston Scientific, USA) (group 1). This made it possible to safely reduce the intake of DAPT to 1 month and shorten the time before performing oncological surgery.

In the case when a delay in performing oncological surgery was associated with the risk of rapid progression and metastasis of the tumor process,

or there was a cancer with recurrent bleeding, which in turn did not allow the appointment of DAPT, PCI and surgical treatment of cancers were performed on the same day (group 3). These patients were predominantly (84 %) implanted with standard drug-coated stents (Resolute Integrity, Xience Xpedition, Promus Premier).

Despite the differences in the timing of oncological interventions in each group for deaths from all causes, including from the progression of malignant neoplasms, there were no significant differences between the groups (p = 0.387 and p = 0.667, respectively).

In the treatment of patients with cancer in combination with coronary artery disease, it is important not only to carefully perioperative management of such patients, but also their subsequent rehabilitation and curation after surgical interventions, especially in the immediate postoperative period. In the work of Guo W. et al., the development of large cardiovascular events in the long-term period in oncological and non-oncological patients who underwent PCI was investigated. The analysis showed that AMI was more common in oncological patients over 5 years (16.1 % vs. 8.0 %; $p < 0.001$), stent thrombosis (6.0 % vs. 2.3 %; $p < 0.001$), repeated revascularization (21.2 % vs. 10.0 %; $p < 0.001$). It should be noted that late stent thrombosis occurred most often (52 %), which determines the significance of the first year after PCI in this group of patients [14].

In our study, there were two cases of AMI: the first – a patient 601 days after PCI had ACS with ST segment elevation due to thrombosis of a previously implanted drug-coated stent of the LAD against the background of a new coronavirus infection (COVID-19). As an emergency, the patient underwent recanalization and stenting of the LAD. The second patient had ACS without ST segment elevation after 867 days. This patient underwent balloon angioplasty and stenting of stenosis "de novo" of the LAD. It is important to emphasize that in our study, not a single patient died from AMI in the long term, which once again emphasizes the need for myocardial revascularization in this group of patients.

CONCLUSION

1. In the long-term follow-up, 15 (25.4 %) deaths were detected, 11 (73.3 %) of which were associated with the progression of cancer

2. In the long-term follow-up, only 1 (1.7 %) of 71 patients had a fatal outcome associated with a cardiovascular event (acute cerebral circulatory disorder of the hemorrhagic type). Acute myocardial infarction occurred in only 2 (3.4 %) patients and was successfully treated with stenting of the infarct-related artery.

3. There was no significant difference between the three groups in terms of such indicators as death from all causes (p = 0.387) and oncological mortality (p = 0.667).

4. In the long-term follow-up, no deaths from myocardial infarction were recorded, which confirms the importance and expediency of performing myocardial revascularization in patients with significant damage to the coronary arteries and concomitant cancer.

5. Percutaneous coronary intervention in patients with oncological diseases makes it possible to perform surgical treatment of cancer effectively and safely without cardiac mortality both at the hospital and in the long-term follow-ups.

6. The stage-by-stage treatment of patients with coronary artery disease in combination with cancers should be determined by the decision of a multidisciplinary team consultation.

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