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FACTORS INDICATING THE RISK OF CARDIOVASCULAR EVENTS IN PATIENTS WITH CHRONIC ISCHEMIC HEART DISEASE POST CORONARY ARTERY BYPASS GRAFTING

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Abstract: The researchers analyzed a cohort of 137 individuals with coronary artery disease who underwent coronary artery bypass graft surgery with cardiopulmonary bypass. During a follow-up period of 2-5 years, instances of cardiac-related mortality were documented, encompassing sudden death occurrences, along with the emergence of non-fatal cardiovascular complications such as myocardial infarction and stroke

Relevance. Ischemic heart disease (CHD) is the leading cause of death among people of working age. An integral part of the modern treatment of coronary artery disease is coronary bypass grafting (CS). However, despite the improvement of surgical interventions, complications in the early postoperative and long-term periods are possible with CABG. Predicting the development of adverse outcomes in patients with coronary artery disease after surgical myocardial revascularization will allow forming a group of patients with an increased risk of developing cardiovascular complications and, accordingly, will increase the effectiveness of preventive measures.

Key words: arterial hypertension, inflammation, cytokines.

Purpose of the study: in the course of prospective observation to identify independent predictors of the development of fatal and non-fatal cardiovascular complications in patients with chronic coronary artery disease who underwent surgical myocardial revascularization.

Material and methods.120 patients with IHD were examined. All patients underwent bypass surgery on the basis of cardiac surgery departments of surgery centers in Tashkent, Samarkand, and other countries: in the Russian Federation, India and Turkey. After bypass surgery, observation of patients was introduced at the Bukhara regional branch of the Republican Specialized Scientific and Practical Center for Cardiology.

The study included 120 patients with coronary artery disease who underwent CABG from October 2017 to December 2020. Before surgery, all patients, according to the study protocol, underwent a set of laboratory and instrumental research methods, including a clinical minimum, transthoracic and, if necessary, transesophageal echocardiography (EchoCG), ultrasound examination of the abdominal cavity, Doppler examination of the brachiocephalic, renal arteries, vessels of the lower extremities, selective coronary angiography (CAG).), according to the indications of ventriculography.

Criteria for inclusion in the study: exertional angina of various classes according to the classification of the Canadian Society of Cardiology against the background of optimal drug therapy, angiographic indications for CABG.

Criteria for exclusion from the study: concomitant valvular heart disease, decompensated heart failure, emergency CABG, CABG on a beating heart.

All patients underwent surgical myocardial revascularization under cardiopulmonary bypass. In dynamics, we monitored laboratory parameters, electrocardiography, echocardiography, and chest X-ray, analyzed intra- and postoperative data, and assessed the frequency of cardiac fatal outcomes and various non-fatal complications. Prospective follow-up lasted from 2 to 5 years.

In order to study the relationship of various anamnestic, clinical, laboratory, intraoperative parameters and the incidence of fatal and non-fatal cardiovascular complications after CABG, the studied patients were divided into 4 groups: the 1st group consisted of patients with fatal cardiac outcomes, the 2nd group - patients without fatal cardiac outcomes, the 3rd group consisted of patients with cardiovascular complications (both fatal and non-fatal), the 4th group - patients without cardiovascular complications. During follow-up, the first "endpoint" was death due to cardiac causes, including cases of sudden cardiac death. All cases of fatal and non-fatal cardiovascular complications (sudden death,

Results and discussions. The mean duration of follow-up was 36±3 months. During the observation period, 18 patients died: 9 due to myocardial infarction, 5 died suddenly, 3 patients died due to pneumonia. Of the non-fatal complications, myocardial infarction was registered in 5 cases, acute cerebrovascular accident - in 3 cases.

According to stepwise regression analysis, the following indicators were independent predictors of fatal cardiac complications:

1) ejection fraction less than 40% (relative risk - 5.7 with deviations within the 95% confidence interval 1.2–10.7);
2) age of patients 70 years and older (4.9; 1.4–8.4);
3) diabetes mellitus (2.3; 1.1–3.7);
4) left ventricular aneurysm (2.1; 1.04–3.8);
5) the duration of artificial lung ventilation for more than 24 hours (2.0; 1.2–2.9);
6) chronic obstructive pulmonary disease (1.9; 1.1-3.1).

Independent predictors of all cases of cardiovascular complications (both fatal and non-fatal) were:

1) age of patients 70 years and older (4.1; 1.2–8.1);
2) ejection fraction less than 40% (3.7; 1.1–6.5);
3) endarterectomy during coronary bypass surgery (2.9; 1.1–5.4);
4) duration of cardiopulmonary bypass over 100 minutes (2.2; 1.2–3.9); damage to the arteries of the brachiocephalic zone (2.1; 1.1–6.4); previous stroke (1.8; 1.1–3.8).

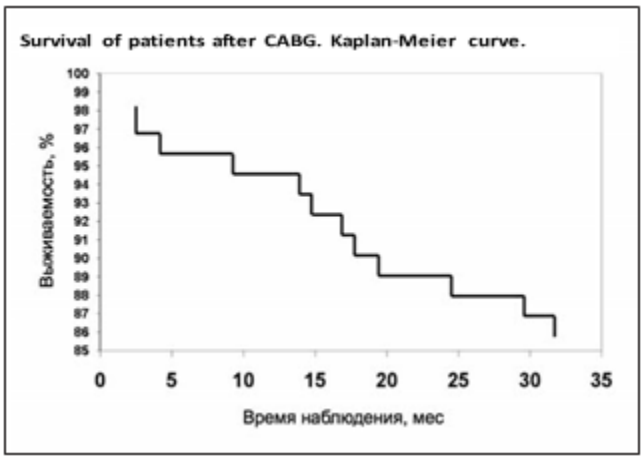
In the study group, males prevailed - 63.3% (76 people), women were 36.7% (44), the average age of patients was 55 years. Patients in the age group from 51 to 60 years old were 65%, those over 70 years old - 4.2%. All studied patients had a burdened hereditary history of cardiovascular diseases. The vast majority of patients had arterial hypertension - 105 (87.5%), postinfarction cardiosclerosis was diagnosed in 104 (86.7%) patients, 14 (11.7%) patients had a history of diabetes mellitus, chronic obstructive pulmonary disease (COPD) as a concomitant pathology - 13 (10.8%), 9 (7.5%) patients suffered from obliterating atherosclerosis of the vessels of the lower extremities, 2 (1.6%) patients had cerebrovascular accidents in the past, chronic renal failure was noted in 1 (0 ,8%).

By functional classes (FC) of heart failure, patients were divided as follows: class I in 18%, class II in 59.4%, class III in 22.6%. According to EchoCG, dilatation of the left atrial cavity was noted in 17 (14.2%) patients, dilatation of the left ventricular (LV) cavity - in 27 (22.5%) patients, the value of the ejection fraction (EF) of the LV ranged from 27 to 71% , averaged 52±8.2%, patients with LV EF<40% were 17 (14.2%). Signs of postinfarction LV aneurysm were present in 11 (9.2%). In order to verify the features of coronary lesion, CAG data were analyzed: in the majority of patients in the study group, the right type of coronary circulation prevailed - 104 (86.7%).

Morphologically, there were severe lesions of the coronary bed.

Hemodynamically significant lesions of the trunk of the left coronary artery (LCA) occurred in 12 (10%) patients. The maximum number of affected vessels (7) was noted in 1 (0.8%) patient. Damage to 4 arteries was most frequently recorded, such a number of altered vessels was observed in 51 (42.5%) patients. When distributing the revealed changes depending on their localization, it turned out that in the right descending artery (RDA) lesions occurred in 106 (88.3%) cases, in the right coronary artery (RCA), including the posterolateral and posterior diaphragmatic branches, in 104 (86 .7%), constrictions in the circumflex artery system were detected in 99 (82.5%) cases, changes in the branch of the obtuse margin - in 23 (19.2%) patients, in the diagonal artery - in 16 (13.3%), in the intermediate - in 8 (6.7%).

All patients underwent CABG under cardiopulmonary bypass using pharmaco-cold cardioplegia as myocardial protection. Isolated mammary-coronary bypass grafting using the left internal mammary artery was performed in 5 (4.2%) cases. Isolated coronary artery bypass grafting using radial arteries and autoveins was performed in 18 (15%) patients, in most patients a combination of these two methods of revascularization was performed - 84 (70%). CABG in combination with LV endoventricular plasty was performed in 5 (4.2%) patients. With diffuse changes in the distal bed of the coronary arteries in 6 (6.6%) cases, CABG was supplemented with endarterectomy from these areas. The volume of surgical intervention on average depended on the degree of coronary lesion, the average number of bypasses per patient was 2.7. In the analysis of intraoperative data, the average duration of the operation was 236±20 minutes, the duration of cardiopulmonary bypass was 82±3 minutes on average, the duration of cardiopulmonary bypass over 100 minutes was recorded in 9 (7.5%) patients. The average time of aortic occlusion was 51±17 min, the average duration of mechanical ventilation (ALV) in the postoperative period was 12±3 h, the duration of ALV more than 24 h was observed in 4 (3.3%) patients. The average stay in the intensive care unit was 17±8 hours, the average blood loss was 162±39 ml. In the immediate postoperative period (on the 3rd day), 1 (0.8%) patient was exotic, the cause of death was the development of intraoperative transmural myocardial infarction (MI). Of the complications of the early postoperative period, the development of perioperative MI was also noted - 8 (6.7%) cases, confirmed by a distinct clinical picture and characteristic changes on the electrocardiogram in combination with increases in the level of cardiospecific enzymes (MB-CK or troponin T) by more than 5 times. Atrial fibrillation was noted in 18 (15%) patients, the phenomena of diastasis of the sternum - in 5 (4.1%). Of the rather rare postoperative complications, there were phenomena of psychosis, pneumonia, mediastinitis, pneumothorax and gastrointestinal bleeding.



Prospective follow-up lasted from 2005 to 2009, on average 36±5 months, 109 patients completed and reached the end point of the study, 11 patients dropped out of the study, communication with them was lost. During the observation period (2–5 years), 12 patients died, the cause of death of one of them was pneumonia. As a result of cardiovascular events, 11 (10.1%) of 109 patients died. Death as a result of MI occurred in 8 (7.3%) cases, the cause of death in 3 (2.8%) patients was sudden death. Of the non-fatal complications, MI was registered in 7 (6.4%) patients, acute cerebrovascular accidents were noted in 2 (1.8%) patients. The figure shows the survival of patients after surgical myocardial revascularization at different stages of prospective follow-up, with the greatest number of deaths occurring in the period from 1 to 5 years to 2 years after surgery. The positive effect of surgical revascularization of the myocardium is evidenced by the following data: before the operation, patients with FC I had no exertion, in most patients - 87 (72.5%) - FC III prevailed, FC II angina occurred in 20.8%, 8 (6.7%) of patients had angina IV FC. In the process of dynamic observation, patients with angina FC IV were not registered, angina FC II was noted in 12.8% of patients, the absence of angina pectoris and FC I were registered in most patients (83.5% of patients). In order to study the relationship between various perioperative parameters and the incidence of adverse cardiac outcomes after CABG, the studied patients were divided into 2 groups depending on the presence or absence of fatal cardiovascular complications. When comparing the groups, we analyzed data related to lifestyle at the preoperative and postoperative stages, anamnesis of cardiovascular and concomitant diseases, anthropometric, hemodynamic and laboratory parameters of patients, as well as an analysis in the dynamics of EchoCG and CAG data, protocols of operations, the course of early and late postoperative periods, analysis of the frequency of fatal cardiac events during prospective follow-up (2–5 years). A total of 80 parameters were studied. For further study of correlation dependencies and establishment of significant relationships, a single as well as an analysis of the dynamics of EchoCG and CAG data, protocols of operations, the course of the early and late postoperative periods, analysis of the frequency of fatal cardiac events during prospective follow-up (2–5 years). A total of 80 parameters were studied. For further study of correlation dependencies and establishment of significant relationships, a single as well as an analysis of the dynamics of EchoCG and CAG data, protocols of operations, the course of the early and late postoperative periods, analysis of the frequency of fatal cardiac events during prospective follow-up (2–5 years). A total of 80 parameters were studied. For further study of correlation dependencies and establishment of significant relationships, a single toric regression analysis. As a result, 7 parameters were selected: LV EF <40%, age of patients 70 years and older, diabetes mellitus, LV aneurysm, ventilator time more than 24 hours, LCA lesion, COPD. It should be noted that a positive correlation was established between postoperative fatal complications and damage to the LCA trunk, but no significant relationship was found. Subsequently, independent predictors of the development of fatal cardiac outcomes were identified by binary logistic regression analysis with stepwise selection of significant features, presented in order of significance depending on the degree of relative risk (Table 1).

Table 1. Independent Predictors of Fatal Cardiac Outcomes

predictor	Relative risk (95% confidence interval)	*p*
LV EF <40%	5.7 (1.2–10.7)	0.001
Age 70 and over	4.9 (1.4–8.4)	0.03
Diabetes	2.3 (1.1–3.7)	0.003
LV aneurysm	2.1 (1.04–3.8)	0.047
Ventilation time>24 h	2.0 (1.2–2.9)	0.009
COPD	1.9 (1.1–3.1)	0.008

- ✓ LV EF <40%, which increases the risk of postoperative fatal outcomes by 5.7 times.
- ✓ The age of patients is 70 years and older, which increases the relative risk of cardiac events by 4.9 times.
- ✓ Diabetes mellitus, which increases the relative risk of fatal cardiovascular complications by 2.3 times.
- ✓ LV aneurysm, which increases the risk of fatal cardiovascular events by 2.1 times.
- ✓ The duration of mechanical ventilation for more than 24 hours increases the relative risk of death from cardiovascular causes by 2 times.
- ✓ COPD, which increases the risk of long-term fatal complications by 1.9 times.

In order to assess the predictive value of the identified predictors, sensitivity and specificity levels were determined for each of the prognostic parameters. It has been established that such a prognostic factor as LVEF <40% has the greatest sensitivity, and the age of patients 70 years and older has the greatest specificity.

The second stage of the study was to identify predictors of the development of all cardiovascular complications in the long-term period of surgical myocardial revascularization. 80 anamnestic, anthropometric, hemodynamic, laboratory and instrumental parameters of patients were analyzed, as well as an analysis of intraoperative and postoperative data was carried out, cases of cardiovascular complications were identified and recorded during prospective follow-up (2–5 years). Subsequent analysis by binary logistic regression with stepwise inclusion of significant features in the model identified independent predictors of the development of cardiovascular complications after CABG (Table 2).

Table 2. Independent predictors of cardiovascular events

predictor	Relative risk (95% CI)	*p*
Age over 70	4.1 (1.2–8.1)	0.02
LV EF<40%	3.7 (1.1–6.5)	0.004
Endarterectomy during CABG	2.9 (1.1–5.4)	0.001
Cardiopulmonary bypass time >100 min	2.2 (1.2–3.9)	0.036
Damage to the brachiocephalic arteries	2.1 (1.1–6.4)	0.001
Having a history of stroke	1.8 (1.1–3.8)	0.032

- The age of patients older than 70 years increases the relative risk of developing cardiovascular complications in the long-term period of surgical myocardial revascularization by 4.1 times.
- LV EF <40%, which increases the relative risk of developing cardiovascular complications by 3.7 times.
- Performing endarterectomy during CABG, which increases the relative risk of postoperative complications by 2.9 times.
- The duration of cardiopulmonary bypass over 100 minutes - 2.2 times.
- The initial lesion of the brachiocephalic arteries, this prognostic parameter increases the relative risk of cardiovascular complications by 2.1 times.
- A history of stroke increases the relative risk of complications by 1.8 times.

To assess the predictive value of the identified predictors for each of the prognostic parameters, sensitivity and specificity levels were also determined. It has been established that such a prognostic factor as the age of patients older than 70 years has the highest sensitivity, and the highest specificity is the performance of endarterectomy in the process of CABG.

Conclusions:

In patients with coronary artery disease who underwent surgical myocardial revascularization, all-cause mortality rates during the hospital follow-up period were 0.8% and 11% over the next 2–5 years (average 3 years). At the same time, cardiovascular complications were the cause of 91% of the observed deaths.

The overall incidence of complications after CABG was 44.9%. The percentage of non-fatal complications due to cardiovascular causes in the early postoperative period of CABG was 6.7%.

As independent predictors of fatal cardiac outcomes in the late period of surgical myocardial revascularization, the following were identified: LV EF <40% (relative risk 5.7 with deviations within the 95% confidence interval 1.2–10.7), age of patients 70 years and older (4.9; 1.4–8.4), history of diabetes mellitus (2.3; 1.1–3.7), LV aneurysm (2.1; 1.04–3.8), duration of mechanical ventilation in the postoperative period for more than 24 hours (2.1; 1.2–2.9), as well as COPD (1.9; 1.1–3.1).

Thus, predictors of cardiovascular complications after CABG are the age of patients older than 70 years (4.1; 1.2–8.1), LV EF<40% (3.7; 1.1–6.5), endarterectomy in process of revascularization (2.9; 1.1–5.4), duration of cardiopulmonary bypass over 24 h (2.2; 1.2–3.9), initial lesion of brachiocephalic arteries (2.1; 1.1–6 .4), as well as a history of stroke (1.8; 1.1–3.8).

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