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ABSTRACT

of the dissertation for the degree of Doctor of Sciences

EVALUATION OF EFFICIENCY OF INVASIVE INTERVENTION IN ACUTE FORMS OF ISCHEMIC HEART DISEASE

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Field of science:	Medicine
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GENERAL CHARACTERISTICS OF THE WORK

Relevance of the problem. Ischemic heart disease (IHD) is one of the leading causes of death in the world, and its incidence is increasing. Despite a trend in Europe over the past three decades to reduce deaths from ischemic heart disease [1], it continues to be the cause of one-third of all deaths in people over the age of 35. IHD is the cause of approximately 1.8 million deaths per year in Europe, or 20% of all deaths, with mortality rates varying by country [2]. In other European countries, it varies between 43 and 144 per 100,000 population [3]. The highest mortality rate from IHD was reported in Russia in 1995-1998 (330 per 100,000 men and 154 per 100,000 women) [4]. The incidence of the disease in the United States has been declining, from 133 cases per 100,000 population in 1999 to 50 cases per 100,000 population in 2008. However, the incidence of MI without ST elevation is either unchanged or slightly increased. STEMI is more common in young people than in older patients, in men compared to women, and in black patients compared to whites [5]. Compared to Europe and the United States, Japan has the lowest death rate from IHD. In this country, the death rate per 100,000 men

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[3] Townsend, N. Cardiovascular disease in Europe: epidemiological update 2016 / N.Townsend, L.Wilson, P.Bhatnagar [et al.] // European Heart Journal. – 2016. – Vol. 37 (42). – p. 3232–3245. DOI: https://doi.org/10.1093/eurheartj/ehw334.

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[5] Taskinen, M.R. Dual metabolic defects are required to produce hypertriglyceridemia in obese subjects / M.R. Taskinen, M. Adiels, J. Westerbacka [et al.] // Arterioscler Thromb Vasc Biol. – 2011. – Vol. 31. – p. 2144–2150.

decreased from 50 to 36 (29%), and the death rate per 100,000 women decreased from 28 to 18 (36%). In contrast, deaths from ischemic heart disease are expected to increase among developing countries (China, India, Latin America, sub-Saharan Africa, etc.). It is expected to reach 19 million by 2020, in contract to 9 million deaths recorded in 1990 [6].

Social and economic changes, sedentary lifestyle, increased life expectancy, preference of "westernized" diet, and increased smoking are among the reasons for this potential increase.

The mortality rate in STEMI patients depends on many factors, including such important indicators as age, time to treatment, availability of emergency care systems that can handle STEMI patients, treatment strategies in MI, diabetes, kidney failure, the number of involved coronary arteries, and left ventricular ejection fraction. Numerous recent studies have shown a significant reduction in mortality in the acute phase and long-term follow-up of STEMI secondary to reperfusion therapy, primary percutaneous coronary intervention, new antithrombotic therapy, and secondary protection measures [7]. Control over risk factors generally reduces mortality rates by up to 50%. For example, total cholesterol (24%), systolic blood pressure (20%), smoking (12%), and sedentary lifestyle (5%) are most important among those risk factors. An increase in body mass index and prevalence of diabetes leads to 18% increase in deaths from ischemic heart disease in developing countries. However, in-hospital mortality rate among STEMI patients in different European countries ranges from 4 to 12%. The annual mortality among STEMI patients

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[6] World health report (2000) WHO, Geneva. https://compendium.com.ua/clinical-guidelines/cardiology/section-3/glava-1-epidemiologicheskie-aspekty-serdechno-sosudistyh zabolevanij/

[7] Chacko, L. Effects of percutaneous coronary intervention on death and myocardial Infarction Stratified by Stable and Unstable Coronary Artery Disease: A Meta-Analysis of Randomized Controlled Trials / L. Chacko, J.P. Howard, C. Rajkumar [et al.] // Circ Cardiovasc Qual Outcomes. – 2020. – Vol. 13 (2). – p. e006363. doi: 10.1161/CIRCOUTCOMES.119.006363.

undergoing angiography is about 10% [8]. IHD develops in women on average 7-10 years later than in men, and MI remains the leading cause of death in women. Among patients under 60 years of age the acute coronary syndrome (ACS) is 3-4 times more common in men than women. However, the prevalence is higher among women in patients over the age of 75 years. Atypical symptoms are more common in women than in men [9], or these symptoms present later [10]. For this reason, women with potential ischemic symptoms need to be treated more carefully to avoid misdiagnosis. Bleeding complications associated with percutaneous coronary intervention are also more common in women.

Discussions are ongoing about the causes of adverse outcomes in female patients, and numerous studies have shown that older women with myocardial infarction and those with multiple comorbidities have worse outcomes [11].

Some studies have reported that women receive less invasive intervention and receive less reperfusion therapy [12]. These sources reported that female and male patients benefited equally from STEMI appropriate treatment and reperfusion strategies, and that both sexes should be treated equally.

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[8] Cutlip D.E., Fischman D.L. Mortality After Percutaneous Coronary Intervention. Circulation: Cardiovascular Interventions. – 2018. – p. 11. – p. e007008. https://doi.org/10.1161/ CIRCINTERVENTIONS.118.007008.

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[12] Strauer B.E. The concept of coronary flow reserve. J Cardiovasc Pharmacol. – 1992. – Vol. 19 (Suppl 5.). – p. S67-S80.

According to population studies, the prevalence of angina pectoris increases with age in both sexes. The incidence is 5-7% in women of 45-64 years of age, 10-12% in women of 65-74 years of age, 4-7% in men of 45-64 years of age, and 12-14% - in men of 65-74 years of age. It is noteworthy to say that the prevalence of angina in middle-aged women is higher than in men. This is most likely due to the fact that functional coronary artery disease (eg, microvascular angina) is more common in women, and vice versa later life.

According to available data, the annual incidence of uncomplicated angina in men of 45-65 years of age in the western population is 1%, while in women it is slightly higher. As we age, it increases significantly, reaching 4% between the ages of 75 and 84. The incidence of angina varies according to the expected international change in the mortality rate due to coronary artery disease [13].

Despite the decrease in ischemic heart disease, the increase in migration events and the increase in life expectancy of the general population will lead to a further increase in the incidence of ischemic heart disease. Global factors such as sedentary lifestyle, smoking, drug use, and western diet are contributors to the increase in ischemic heart disease. However, the development of conservative and invasive treatment methods for patients with acute coronary syndrome, secondary protection measures is progressively reducing mortality rate from ischemic heart disease.

Thus, the study of risk factors plays an important role in the development, prognosis, treatment and prevention of IHD. Also, the choice of treatment strategies in patients with IHD with various risk factors remains one of the main problems of modern invasive cardiology. Identifying the advantages and disadvantages of certain treatments in different groups of patients with different risk factors is crucial to assess their applicability.

The purpose of the study. All of the above makes research in this area relevant. Objective of the study was to provide a

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[13] Hemingway, H. Prevalence of Angina in Women Versus Men. A Systematic Review and Meta-Analysis of International Variations Across 31 Countries / H. Hemingway, C. Langenberg, J. Damant [et al.] // Circulation. – 2008. – Vol. 117. – p. 1526–1536. https://doi.org/10.1161/ CIRCULATIONAHA. 107.720953

comparative analysis of the long-term (5-year) results of percutaneous transluminal coronary angioplasty and coronary artery bypass grafting in patients with ischemic heart disease (CHD) and various risk factors and comorbidities helps to identify the effectiveness and shortcomings of revascularization methods in different patient groups and assess their practical implications.

Research objectives:

1. Analysis of long-term outcomes percutaneous transluminal coronary angioplasty (PTCA) in women and men with various risk factors and comorbidities in the postoperative period (within 5 years), including all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE (Basic Cardiac and Cerebrovascular) as well as assessment of survival;
2. Analysis of long-term outcomes of coronary artery bypass graft surgery (CABG) in women and men with various risk factors and comorbidities in the postoperative period (within 5 years), including all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE and assessment of survival.
3. Analysis of long-term outcomes of PTCA and CABG in women and men with various risk factors and comorbidities in the postoperative period (within 5 years), including all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE and assessment of survival.
4. Separate and comparative assessment of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in patients with diabetes mellitus in the post-PTCA and CABG period (within 5 years).
5. Separate and comparative assessment of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in non-diabetic patients after PTCA and CABG (within 5 years).
6. Analysis of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in patients with and without extracardiac arteriopathy in the post-PTCA and CABG period (5 years).

7. Analysis of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in the post-PTCA and CABG period (5 years) in patients with EF<35% and EF>35%.

8. Analysis of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in post-PTCA and post-CABG period (within 5 years) in patients with or without concomitant chronic obstructive pulmonary disease, acute ischemic heart disease.

9. Analysis of all causes of death, cardiac death, stroke, recurrent revascularization, MACCE and survival in the period after PTCA and CABG (within 5 years) in patients with acute ischemic heart disease (unstable angina and myocardial infarction without ST-elevation).

10. Analysis of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in post-PTCA and post-CABG period (within 5 years) in patients with and without concomitant arterial hypertension.

11. Separate and comparative analysis of all-cause mortality, cardiac death, stroke, recurrent revascularization, MACCE, and survival in post-PTCA and post-CABG period (within 5 years) in elderly patients (≥75 years).

Scientific novelty of the research:

– Long-term outcomes of PTCA and CABG in acute forms of coronary heart disease (MI without QSS and ST elevation) have been comprehensively studied and evaluated.

– Due to long-term follow-up of patients with acute coronary syndrome and extracardiac arteriopathy, the initial preference for myocardial revascularization should be given to CABG.

– Both PTCA and CABG is associated with high long-term mortality in patients with acute coronary syndrome and extracardiac arteriopathy.

– Shortened survival is seen in both PTCA and CABG patients with acute coronary syndrome and extracardiac arteriopathy.

– Although previous studies did reveal an advantage of CABG over PTCA in patients with heart failure (EF≤35%), our study did not find any difference between these two approaches.

– According to the outcomes of revascularization using PTCA and CABG in non-diabetic patients with multivessel acute coronary syndrome (with lesions in multiple coronary arteries), all-cause mortality and cardiac death were not statistically significant. However, during 5-year period MACCE outcomes were higher in the PTCA group.

– Based on the outcomes of revascularization using PTCA and CABG in diabetic patients with multivessel acute coronary syndrome (with lesions in multiple coronary arteries), all-cause mortality and cardiac death were not statistically significant. However, during 5-year period repeat revascularization were higher in the PTCA group.

– In elderly patients (≥75 years), the outcomes of revascularization using PTCA and CABG (all-cause mortality, cardiac mortality, and MACCE ratios) did not differ significantly. However, according to the Kaplan-Meier analysis, survival was better in the CABG group.

Practical significance of the research. Based on a comparative analysis of the long-term (5-year) outcomes of PTCA and CABG in the treatment of ischemic heart disease in different groups of patients according to age, sex, various risk factors and concomitant diseases, to identify their advantages and disadvantages and evaluate the practical implications. Based on the results of the study, the possibility of having PTCA as an optimal approach (PTCA vs CABG) in myocardial revascularization in the above-mentioned different risk groups of patients is to be of great practical importance.

Practical application. The results of the study were applied to practice at the Central Clinical Hospital and the Azerbaijan Medical University.

The key issues for the defense:

– Separate comparative analysis of 5-year all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with acute coronary heart disease with and without diabetes.

– Separate comparative analysis of 5-year all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with acute forms of coronary heart disease and extracardiac arteriopathy.

– Separate comparative analysis of 5-year all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with EF less than 35%.

– Separate comparative analysis of 5-year all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with chronic obstructive pulmonary disease.

– Separate comparative analysis of 5-year all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with arterial hypertension.

– Separate comparative analysis of all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with acute coronary syndrome (unstable angina and myocardial infarction) in the short-term (30 days) and long-term (5 years) periods.

– Separate comparative analysis of 5-year all-cause mortality, cardiac death, stroke, recurrent resuscitation, MACCE, and survival after PTCA and CABG in patients with acute coronary heart disease in elderly patients (≥75 years).

Publication.. Based on the materials of the dissertation, 39 scientific papers were published.

Volume and structure of the dissertation. The dissertation consists of 326 pages – 382.031 characters, introduction (14.328 characters), literature review (121.005 characters), 6 chapters reflecting the results of the research (29.743 + 11.341 + 17.996 + 34.872 + 45.581 characters), results, practical recommendations (12.900 characters), list of used literature. The bibliography includes 464 sources, most of which are foreign literature. The text of the dissertation is illustrated with 89 tables and 21 figures.

MATERIALS AND METHODS OF RESEARCH

The study examined 1414 patients with multivessel disease with acute coronary syndrome from among 13,622 patients seen in the cardiology department of the Central Clinical Hospital during 2006-

2014, followed by retrospective randomization. Patients were divided into two groups based on percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG).

For the purposes of the study history of arterial hypertension, use of antihypertensive drugs or blood pressure of >140 / 90 mm Hg were used as criteria of hypertension [14].

For the purposes of the study type 2 diabetes included patients on insulin or oral anti-diabetic medication at the time of visit, or with fasting blood sugar of ≥126 mg /dl and the postprandial blood sugar of ≥200 mg / dl [15].

The multidisciplinary "cardiac team" decided which of the PTCA or CABG treatment methods would be used, and the patients' signed consent was obtained. PTCA was performed in accordance with the medical recommendations of the European Society of Cardiology (ESC) [16].

All patients underwent 12-lead ECG and transthoracic echocardiography as standard pre- and post-procedure follow-up. All patients had troponin level checked. 12-lead ECG, transthoracic echocardiography, and cardiac enzymes were evaluated to differentiate between unstable angina and myocardial infarction in acute coronary syndrome.

Q-wave myocardial infarction was assessed based on the presence of typical ischemic chest pain and elevated ST segment. Unstable angina pectoris was evaluated based on anginal pain typically lasting more than 20 minutes along with presence or absence of ST depression, and / or the presence of negative T waves and no elevation of troponin levels.

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Stent thrombosis (Thrombolysis In Myocardial Infarction (TIMI)) was used in cases with a zero rate. PTCA possibility was considered in cases of provision of TIMI 3 flow and of less than 10% stenosis.

Myocardial infarction, mortality, cerebral ischemic events, and inability to target vascular revascularization were considered as MACE. Patients with kidney diseases receiving dialysis and on medications or with creatinine levels above 2 mg / dl were considered to have chronic renal failure. Patients on dialysis and those with creatinine levels above 3 mg / dl were not included in the study. Procedure-related contrast nephropathy was identified in cases of increase in in-hospital creatinine levels of greater than 0.5 mg / dl.

In terms of age, there was no difference between the two groups (average age in the CABG - 56.9 ± 8.2, and average age in the PTCA - 56.2 ± 9.1) (p = 0.632) (Table 1). Diabetes was 31% in the CABG group and 26.2% in the PTCA group.

Table 1

General characteristics of patients included in the study

Characteristics of patients	Type of operation		P
	CABG n = 715 (50.6%)	PTCA n = 699 (49.4%)	
Hypercholesterolemia	453 (63,3%)	440 (62,9%)	P=0.231
Smokers (currently)	173 (24,1%)	165 (23,7%)	P=0.781
Hypertension	270 (37,7%)	236 (33,8%)	0.061
Diabetes	222 (31%)	183 (26,2%)	0.066
Peripheral vascular disease	84 (11,7%)	6 (0,9%)	P=0.0005
Creatinine levels (150-250mg/dl)	29 (4%)	22 (3,1%)	P=0.365
Left ventricular EF	46,9%	47,8%	P=0.056

All laboratory tests were performed at the Central Clinical Hospital. Patients were followed clinically for 30 days, 1 year, and 5 years. Clinical events such as all-cause mortality, cardiac deaths, myocardial infarction, shock, revascularization, and stent thrombosis were recorded.

Patients who have previously undergone CABG or PTCA, who require cardiac or vascular intervention outside the coronary artery, and who are on dialysis have been excluded from the study. Patients who underwent minimally invasive surgery were excluded from the study.

In the study, PTCA and CABG were evaluated separately in subgroups with type 2 diabetes and acute coronary syndrome. 405 patients with type 2 diabetes were included in this evaluation. Of these, 183 (45.1%) were in the PTCA group, and 222 (54.8%) were in the CABG group. There was no difference in age ($p = 0.071$), sex ($p = 0.218$), and creatinine level ($p = 0.641$), but there was a difference between the two groups in terms of hypertension ($p = 0.00016$) and left ventricular ejection fraction ($p = 0.019$).

In another subgroup assessment, the results of PTCA and CABG operations were compared in patients with left ventricular failure with multiple coronary heart disease and acute coronary syndrome. 405 patients were included in this analysis. The study included patients with a ventricular EF of less than 35%, corresponding to left ventricular systolic dysfunction. Of the patients included in the study, 183 (45.1%) were in the PTCA group and 222 (54.8%) were in the CABG group. Between the two groups there was no difference in regards to age ($p = 0.051$), sex ($p = 0.522$), creatinine level ($p = 0.367$), hypertension ($p = 0.367$), left ventricular ejection fraction ($p = 0.922$) and Syntax score ($p = 0.632$).

In multivessel acute coronary syndrome the PTCA results were compared among patients with unstable angina pectoris (UAP) and acute myocardial infarction. The study included 434 patients with percutaneous transluminal angioplasty with unstable angina pectoris (UAP) and 265 patients with acute myocardial infarction (699 patients in total). The characteristics of the patients were as follows: average age: 56.8 in the UAP group, 55.3 in the MI group; men: 373 (85.9%) in the UAP group, 238 (89.8%) in the MI group. There were 113 patients (26%) in the UAP group and 70 (26.4%) patients in the MI group with type 2 diabetes. 58% of UAP patients and 56% of MI patients had a family history of coronary heart disease. The Syntax score was 26.3 in the UAP group and 25.1 in the MI group. Clopidrogrel was continued for 1 year.

PTCA and CABG results were compared among total of 1,011 non-diabetic patients with acute coronary syndrome and multivessel disease. Of these patients, 495 were in the CABG and 516 in the PTCA group. The average follow-up period was 60.7 months.

While there was no difference between these two groups in terms of age (p = 0.954), sex (p = 0.124), creatinine level (p = 0.152), and left ventricular ejection fraction (p = 0.057), however the hypertension (p = 0.0001) was higher in the PTCA group, and the number of patients with diabetes was higher in the CABG group.

In patients with multivessel disease acute coronary syndrome who underwent percutaneous transluminal angioplasty, 122 patients had ejection fraction (EF) below 35% and 577 patients had an EF above 35%. The mean age was 55.4 in the EF below 35% group and 55.8 in the EF above 35% group. There were 110 (90.2%) male patients in the EF below 35% group and 501 (86.8%) male patients in the EF above 35% group. There were 12 (9.8%) female patients in the EF below 35% group and 76 (13.2%) female patients in the EF above 35% group. 42 (34.4%) in EF below 35% group and 141 (24.4%) in EF above 35% group were treated with type 2 diabetes. The Syntax score was 26.8 in the EF below 35% group and 25.5 in the EF above 35% group.

To determine differences between the sexes in myocardial revascularization performed in CABG patients with acute coronary syndrome (ACS), the study included 717 patients who underwent CABG surgery, of whom 596 were men (mean age 56.3 ± 8.2) and 121 were women (mean age 60 ± 7.3).

Preparing patients for coronary angiography. Before starting coronary angiography, detailed anamnesis was collected from patients, objective examinations were performed, laboratory tests (complete blood test, coagulation panel, fasting blood sugar, creatinine, tests for infections) were performed, and peripheral pulses were palpated.

Assessment of coronary artery stenosis. Each coronary artery stenosis was assessed by quantitative and qualitative methods in at least two projections. 70% or more stenosis in LAD, CX, and RCA; and 50% or more stenosis in the proximal LMCA and LAD were considered serious ones. Ostial narrowing refers to the narrowing of the first 3 mm from the beginning of the vessel or branch.

Bifurcation injury refers to the narrowing of the junction of the main artery with the lateral branch of more than 1.5 mm in diameter. According to the AHA criteria, lesions smaller than 10 mm were assessed as spot or discrete, those between 10-20 mm as tubular, and those larger than 20 mm as diffuse narrowing. Total occlusion is the complete cessation of distal flow or its provision through antegrade / retrograde collaterals.

GE Innova 3131 IQ angiography device was used for coronary angiography and PTCA. The device is used to detect and treat atherosclerotic vascular problems, aneurysms, thrombotic changes, any rhythm changes, congenital problems using X-ray-based contrast agent.

Percutaneous coronary intervention. Depending on the urgency of the patient's condition, in some patients percutaneous coronary intervention was performed during the same procedure immediately following angiography, while in other patients it was performed as a planned intervention. In most patients, the intervention was performed through the same vessel used for initial coronary angiography vessel using the same sheath.

Catheters used in percutaneous coronary intervention. Ebu (6F) for the left system and JR catheter (6F) for the right coronary artery were commonly used during percutaneous coronary intervention. Catheters were mostly 3.5 mm in size, and in some cases, 4.0 mm catheters were used in people with large body surface areas. Judkins guiding catheters were used during the outflow anomalies of the coronary arteries.

Implementation of the procedure. 0.14-inch floppy wires were used to pass through the stenotic areas during the procedure. In rare cases, chronic total occlusion wires such as intermediate, FC, XT were used during chronic total occlusion. 2.5x20 mm, sometimes 2.0x20 mm, 2.0x15 mm balloons were usually used to widen the stenotic areas. After adequate dilation, the stent size was selected. We used medically coated, Biomatrix, Promus, Resolute stents with diameter of 2.5-4.0 mm and length of 10-38 mm. As cases when the maximum length stents of 38 mm did not suffice, we placed two and in rarer cases 3 stents back to bacl. After placement, the stents were dilated with large NC balloons corresponding to the stent’s internal size or one size larger. All patients were monitored in the coronary intensive care unit after the procedure.

Aortic-coronary shunting. In modern times, heart surgeries are performed by the cardiac team. This includes cardiac surgeons, perfusiologists, anesthesiologists and medical staff. Coronary bypass surgery is currently performed on beating heart or on pump heart.

The use of internal thoracic artery (ITA) is a gold standard in coronary surgery. The use of at least one arterial graft (usually the left internal thoracic artery) during surgery is considered mandatory. The use of large subcutaneous veins from venous conduits is considered routine. There are open (longitudinal), intermittent and endoscopic methods of venous graft removal. The potential for long-term open shunting of arterial conduits and venous conduits is higher than of venous conduits.

After the grafts are prepared, heparin is injected according to the patient's weight. 80-85% of aorto-coronary bypass surgeries are performed using heart-lung machine. The heart-lung machine temporarily performs the function of the heart by pumping the blood, and of lung by provision of gas exchange via an oxygenator.

When systemic blood pressure, heart rhythm, cardiac filling, contractility, blood gases, electrolyte levels, and acid-base balance are adequate, the patient is gradually withdrawn from heart-lung machine. After the venous cannula is removed, protamine sulfate is given to neutralize the heparin. Arterial cannual is removed the last. Thus, the patient is completely separated from the heart-lung machine. After surgical hemostasis is ensured, the opened cavities (usually the left pleural cavity and anterior mediastinum) are drained, and an epicardial electrode is inserted into the right ventricle. The chest is connected by steel threads, sewn in layers.

All analyzes were performed using SPSS 18.0 package. The average number of ± standard deviations was considered in mathematical data, and the ratio was considered in categorical data. A q-square test was used to compare categorical data. The t-test was used to compare long-term data. Logistic regression analysis was used to eliminate the effects of the indicators on each other and to adjust the risk ratios in the subgroups along with indicators. The difference between the long-term events was assessed by the long-rank test based Kaplan-Mayer analysis. P value of <0.05 was considered statistically significant. 95% confidence intervals were used for all analysis.

RESULTS OF EXAMINATIONS AND THEIR DISCUSSION

In total, the study included 1,414 patients who underwent myocardial revascularization (MR). Of these patients, 699 underwent percutaneous transluminal coronary angioplasty (PTCA) and 715 underwent coronary artery bypass grafting (CABG) and their results were compared. Patients were observed for about 5 years after myocardial revascularization (average observation period - 61.5 months).

As can be seen, 94.6% of non-diabetic patients (5.4% mortality) and 90.8% of diabetic patients (9.2% mortality) survived during post-MR follow-up period. A significant difference is found when comparing the number of patients survived in both groups, as well as the mortality rate ($p = 0.007$). The presence of diabetes increases the mortality after MR by 1.7 times.

After MR, 94.4% of male patients without diabetes survived (mortality rate - 5.6%), while survival among male patients with diabetes was only 91.9% (mortality rate - 8.1%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate ($p = 0.04$). The presence of diabetes significantly increases post-MR mortality in male patients.

While 96.1% of non-diabetic female patients survived after MR (mortality rate - 3.9%), survival among female patients with diabetes was only 87.3% (mortality rate - 12.7%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate ($p = 0.014$). The presence of diabetes increases the mortality after MR by 3.6 times in female patients.

Kaplan-Mayer survival analysis dynamically shows this difference throughout the observation period $p<0.05$

Analysis of causes of death after myocardial revascularization revealed that 54.1% was due to cardiac causes, 10.8% - extracardiac, and malignant tumors accounted for 35.1% in patients with diabetes.

In patients without diabetes, 60.7% of deaths were due to cardiac, 9.8% to extracardiac, and 29.5% to malignant tumors.

Analisis of causes of death in male and female patients after myocardial revascularization found that 60% of male patients with diabetes died from cardiac, 12% from extracardiac, and 28% from malignant tumors. 41.7% of deaths in female patients with diabetes were due to cardiac, 8.3% to extracardiac, and 50% to malignant tumors.

Thus, the analysis of post-revascularisation mortality in male and female patients with diabetes mellitus shows that post-MR deaths in men with diabetes are mainly due to cardiac causes, while post-MR cases of death in women with diabetes mellitus are mainly due to extracardiac causes.

To evaluate the effect of **extracardiac arteriopathy** on the results of myocardial revascularization, the results were compared for groups of patients with and without arteriopathy.

During the post-MR follow-up period, survival rate among patients without extracardiac arteriopathy was 94.0% (mortality rate - 6.0%), while it was 86.4% for patients with arteriopathy (mortality rate - 13.6%). A significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate ($P = 0.005$). The presence of extracardiac arteriopathy increases the mortality after MR by about 2.5 times. Kaplan-Mayer survival analysis dynamically shows that this difference is observed from the first weeks ($p = 0.007$) .

After MR, survival rate of male patients without extracardiac arteriopathy was 94.0% (mortality rate - 6.0%), while it was 90.3% among male patients with arteriopathy (mortality rate - 9.7%) (Figure 3). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found ($P = 0.264$). Although the presence of extracardiac arteriopathy increases post-MR mortality in male patients, this is not statistically significant.

After MR, the survival rate among female patients without extracardiac arteriopathy was 94.1% (mortality rate - 5.9%), while it was 76.9% for female patients with arteriopathy (mortality rate - 23.1%). A significant difference is found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.002). Presence of arteriopathy increases postoperative mortality in female patients by 3.9 times.

Analisis of causes of death after myocardial revascularization found cardiac causes accounted for 53.8%, extracardiac - for 7.7%, and malignant tumors for 38.5% cases among patients with extracardiac arteriopathy.

In patients without extracardiac arteriopathy, 58.8% of deaths were due to cardiac, 10.6% - to extracardiac reasons, and 30.6% secondary to malignant tumors.

Analisis of causes of death in male and female patients after myocardial revascularization found that among male patients with extracardiac arteriopathy had cardiac cause, 9.5% - extracardiac, and 28.4% had malignant tumors as a cause of death. In female patients with arteriopathy, 36.4% of deaths were due to cardiac, 18.2% to extracardiac, and 45.5% to malignant tumors.

Thus, the analysis of post-revascularisation deaths in male and female patients with extracardiac arteriopathy shows that post-MR deaths in men with arteriopathy are mainly due to cardiac causes, while post-MR deaths in women with extracardiac arteriopathy are mainly due to extracardiac causes, as well as due to malignant tumors.

To assess the effect of the **ejection fraction (EA)** on the results of myocardial revascularization, comparative analysis performed among groups with EF below 35% and above 36%. In patients with low and high EF for 5 years after myocardial revascularization, survival rate of 87.3% was reported among patients with EF below 35% (mortality rate - 12.7%), while it was 94.6% among patients with EF above 36% (mortality rate - 5.4%). A significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.00067). EF <35% increases post-MR mortality by 2.5 times.

Kaplan-Mayer survival analysis dynamically shows that this difference is observed from the first weeks $p<0.05$.

After MR, survival rate of 88.1% was reported for male patients with EF below 35% (mortality rate - 11.9%), and 94.9% for male patients with EF above 36% (mortality rate - 5.1%). (Figure 4). Significant difference is found when comparing the number of patients survived in both groups, as well as the mortality rate ($p = 0.000297$). EF below 35% significantly increases post-MR mortality in male patients. After MR, survival rate of 78.9% was reported among female patients with EF below 35% (mortality rate - 21.1%), while it was 92.9% among female patients with AF above 35% (mortality rate - 7.1%).

Significant difference is found when comparing the number of patients survived in both groups, as well as the mortality rate ($p = 0.036$). EF <35% increases the post-MR mortality in female patients by approximately 3 times.

Analisis of causes of death after myocardial revascularization found the cardiac causes in 75.9%, and malignant tumors in 24.1% patients with an ejection fraction below 35%.

In patients with an ejection fraction above 36%, 52.5% of deaths were due to cardiac reason, 14.8% - to extracardiac, and 32.8% to malignant tumors.

Thus, analisis of the causes of death after myocardial revascularization revealed that cardiac causes predominatele seen among the causes of death in patients with an ejection fraction below 35%. In patients with an ejection fraction above 35%, cardiac and other causes of death are almost identical.

To assess the effect of **chronic obstructive pulmonary disease (COPD)** on the outcomes of myocardial revascularization the comparative analysis was performed among groups with and without COPD. During 5 years post-MR in patients with and without COPD, survival rate was 93.5% among patients without COPD (mortality rate - 6.5%), and 90.7% among patients with COPD (death rate - 9.3%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p = 0.401). Thus, the presence of COPD does not significantly affecting survival after MRI.

Analisis of the causes of death after myocardial revascularization in patients with COPD, found that 33.3% were due to cardiac reasons, 16.7% - due to extracardiac, and 50.0% due to malignant tumors.

59.8% of deaths in patients without COPD were due to cardiac reasons, 9.8% - to extracardiac, and 30.4% - to malignant tumors.

To assess the effect of **acute coronary syndrome (ACS)** on the results of myocardial revascularization the comparative analysis was performed among groups with unstable angina pectoris (UAP) and myocardial infarction (MI). In patients with UAP and MI, the survival rate was 94.1% among patients with UAP (mortality rate - 5.9%), and 91.5% of patients with MI (death rate - 8.5%) within 5 years after myocardial revascularization. When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p = 0.096). Kaplan-Mayer survival analysis dynamically shows that this difference was not statistically significant at the beginning of observation (Figure 6).

After MRI, survival rate was 94.5% among male patients with UAP (mortality rate - 5.5%), and 91.7% among male patients with MI (mortality rate - 8.3%). No significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.08).

After MR, survival rate was 92.0% among female patients with UAP (mortality rate - 8.0%), and 89.7% among female patients with MI (mortality rate - 10.3%). No significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.0645).

Analisis of the causes of death after myocardial revascularization among patients with unstable angina revealed that 64.3% were due to cardiac causes, 11.9% - due to extracardiac, and malignant tumors accounted for 23.8% cases.

64.0% of deaths in patients with myocardial infarction were due to cardiac, 4.0% to extracardiac, and 32.0% to malignant tumors.

Kaplan-Mayer survival analysis after myocardial revascularization in patients with unstable angina ($p = 0.007$).

The analysis of mortality after revascularization in patients with unstable angina and myocardial infarction shows that deaths in both groups are mainly due to cardiac causes.

LONG-TERM RESULTS OF PERCUTANEOUS TRANSLUMINAL COORNARY ANGIOPLASTY IN PATIENTS WITH DIFFERENT RISK FACTORS

Percutaneous transluminal coronary angioplasty (PTCA) was performed in 699 out of 1414 patients who ahd myocardial revascularization and the results were analyzed during this study.

To assess the effect of **diabetes mellitus** on PTCA outcomes comparative analysis was performed among groups of patients with and without diabetes. Figure 7 shows the number of patients with or without diabetes mellitus survived for 5 years after myocardial revascularization.

As observed, in the post-PTCA follow-up period the survival rate was 93.8% among non-diabetic patients (6.2% mortality), and 90.6% among diabetic patients (mortality rate - 9.4%) (Figure 7). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found. Although the presence of diabetes slightly increases post-PTCA mortality, this was not statistically significant ($p = 0.147$).

During the post-PTCA period, the survival rate was 94.5% among male patients without diabetes (mortality rate - 5.5%), and 91.6% among men with diabetes (mortality rate - 8.4%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found.

Although the presence of diabetes slightly increases post-PTCA mortality, it was not statistically significant ($p = 0.077$).

During the post-PTCA follow-up period, survival rate was 95.3% for non-diabetic female patients (mortality rate - 4.7%), and 87.5% for females with diabetes (mortality rate - 12.5%). A significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate. The presence of diabetes increases the post-MRI mortality in female patients by approximately 3-fold (p = 0.044). Thus, the presence of diabetes is one of the factors affecting survival after PTCA in female patients.

Analisis of the causes of death after PTCA in patients with diabetes revealed that cardiac causes accounted for 57.1%, extracardiac - for 11.4%, and malignant tumors for 31.4% cases.

In patients without diabetes, 61.8% of deaths were due to cardiac, 9.1% - to extracardiac, and 29.1% to malignant tumors.

Thus, analisis of causes of death in patients after PTCA found that post-PTCA deaths in patients with and without diabetes are mainly due to cardiac causes.

No difference was found between the two groups in MACCE as a percentage (25.7% in those with DM, 20.3% in those without DM, p = 0.133), recurrent revascularization (15.4% in DM, 13.6% in non-DM, p = 0.55) and stroke frequency (1.1% in those with DM, 0.8 in those without DM) %, p = 0.689). In the analysis of the Kaplan-Mayer survival investigation in the PTCA group, the difference was not statistically significant, despite the higher incidence of deaths in patients with diabetes (p = 0.122).

To assess the effect of **extracardiac arteriopathy** on PTCA outcomes the comparative analysis was performed among patients groups with and without arteriopathy.

During the post-PTCA follow-up period, survival rate was 93.2% for patients without extracardiac arteriopathy (mortality rate - 6.8%), and 66.7% for patients with arteriopathy (mortality rate - 33.3%). A significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.011). The presence of extracardiac arteriopathy increases the mortality after PTCA by about 1.5-fold. Kaplan-Mayer survial analysis dynamically shows that this difference is observed from the first weeks (p = 0.04) (Figure 1).

The survival rate of 93.1% was found for male patients without extracardiac arteriopathy after PTCA (mortality rate - 6.9%), and it was only 75.0% for male patients with arteriopathy (mortality rate - 25.0%).

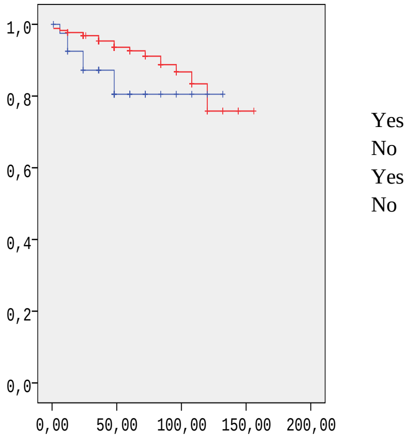

Figure 1. Kaplan-Mayer survival analysis after PTCA in patients with and without extracardiac arteriopathy. Observation period is on the abscissa (in weeks), the relative number of patients survived is on the ordinate.

When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p = 0.159). Although the presence of extracardiac arteriopathy increases post-PTCA mortality in male patients, this is not statistically significant.

After PTCA, survival rate was 94.1% for female patients without extracardiac arteriopathy (mortality rate - 5.9%), and 50.0% for female patients with arteriopathy (mortality rate - 50.0%). Significant difference is found when comparing the number of patients survived in both groups, as well as for mortality rate (p = 0.015). The presence of arteriopathy increases the mortality after PTCA in female patients by about 8-fold.

Analisis of the causes of death after PTCA in patients with extracardiac arteriopathy revealed that cardiac causes account for 53.8%, extracardiac - for 7.7%, and malignant tumors for 38.5% cases.

In patients without extracardiac arteriopathy, 60.5% of deaths were due to cardiac, 7.0% to extracardiac, and 32.6% to malignant tumors.

To assess the impact of **ejection fraction (EA)** on the outcomes of the PTCA analysis was conducted for patients groups with EF below 35% and above 35%.

During the post-PTCA follow-up, survival rate was 87.3% for patients with EF below 35% (mortality rate - 12.7%), and 94.6% for patients with EF above 36% (mortality rate - 5.4%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.00067). EF below 35% increases mortality after PTCA by 2.5-fold. Kaplan-Mayer survival analysis dynamically shows that this difference is observed from the first weeks (Figure 2).

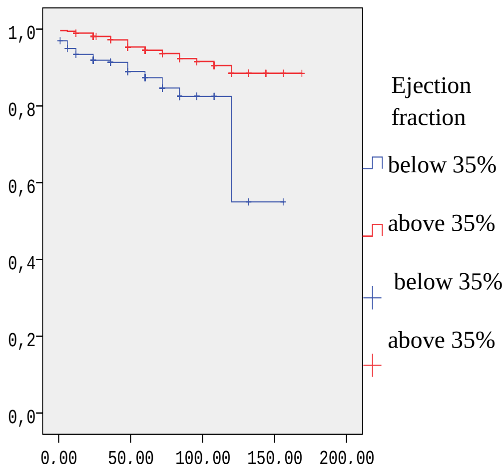

Figure 2. Kaplan-Mayer survival analysis after PTCA in patients with a ejection fraction of less than 35% and more than 35%. Observation period is on the abscissa (in weeks), the relative number of patients survived is on the ordinate.

After PTCA, survival rate was 88.1% for male patients with EF below 35% (mortality rate - 11.9%), and 94.9% for male patients with EF above 36% (mortality rate - 5.1%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.000297). EF below 35% significantly increases post-MR mortality in male patients.

After PTCA, survival rate of 78.9% was reported among female patients with EF below 35% (mortality rate - 21.1%), and 92.9% among female patients with EF above 36% (mortality rate - 7.1%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.036). EF below 35% increases the post-PTCA mortality in female patients by approximately 3-fold.

Analisis of causes of death after PTCA in patients with a fraction below 35% revealed that 75.9% were due to cardiac, and 24.1% due to malignant tumors.

In patients with ejection fraction above 35%, about 52.5% of deaths were due to cardiac, 14.8% - due to extracardiac, and 32.8% due to malignant tumors.

Thus, analisis of causes of death after PTCA revealed that cardiac causes predominated among the causes of death in patients with a ejection fraction of less than 35%. In patients with an ejection fraction greater than 35%, cardiac and other causes of death are almost identical.

To assess the effect of **chronic obstructive pulmonary disease (COPD)** on PTCA outcomes, the analysis was conducted for groups of patients with and without COPD.

During the post-PTCA follow-up period, survival rate was 93.2% among patients without COPD (mortality rate - 6.8%), and 77.8% among patients with COPD (mortality rate - 22.2%). No significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.71).

Analisis of causes of death after PTCA found that 64.4% of death among patients without COPD were due to cardiac, 6.7% - due to extracardiac, and 28.9% secondary to malignant tumors.

Analysis was conducted for groups with unstable angina pectoris (UAP) and myocardial infarction (MI) to assess the effect of **acute coronary syndrome (ACS)** on PTCA outcomes.

During the post-PTCA follow-up period, the survival rate of 94.6% was found among patients with UAP (mortality rate - 5.4%), and 90.3% among patients with MI (mortality rate - 9.7%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.034). Kaplan-Mayer surviving analysis dynamically shows that this difference is significant from the beginning of the observation (Figure 3).

While the survival rate was 94.5% for male patients with UAP after PTCA (mortality rate - 5.5%), it was 90.5% for male patients with MI (mortality rate - 9.5%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p = 0.06).

After PTCA, survival rate was 95.0% among women with UAP (death rate - 5.0%), and 88.9% among women with MI (death rate - 11.1%). No significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.29).

Analisis of the causes of death after PTCA in patients with unstable angina found that they were due to cardiac causes in 66.7%, extracardiac in 9.5%, and secondary to malignant tumors in 23.8% cases.

In patients with MI, 61.5% of deaths were due to cardiac, 3.8% to extracardiac, and 34.6% to malignant tumors.

Thus, the analysis of post-PTCA deaths in patients with unstable angina and myocardial infarction shows that in both groups, deaths are mainly due to cardiac causes.

To assess the effect of **hypertension** on PTCA outcomes the comparative analysis was performed among groups with and without hypertension.

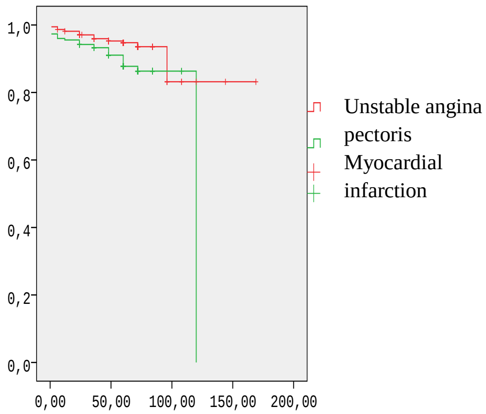

Figure 3. Kaplan-Mayer survival analysis after PTCA in patients with unstable angina and myocardial infarction. Observation period is on the abscissa (weeks), the relative number of patients survived is on the ordinate (p = 0.01).

During 5-year follow-up period after PTCA, the survival rate was 94.0% among patients without hypertension (mortality rate - 6.0%), and 91.4% among patients with hypertension (mortality rate - 8.6%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found. Although the presence of hypertension slightly increases post-PTCA mortality, this was not a statistically significant (p = 0.186).

During the post-PTCA follow-up period, survival rate was 94.0% among male patients without hypertension (mortality rate - 6.0%), and 91.1% among men with hypertension (mortality rate - 8.9%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found. Although the presence of hypertension slightly increases post-PTCA mortality, this was not statistically significant (p = 0.19).

During the post-PTCA follow-up period, the survival rate of 94.3% was reported for non-hypertensive women (mortality rate - 5.7%), and of 92.3% for women with hypertension (mortality rate - 7.7%). No significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.72).

Analisis of the causes of death after PTCA in patients with hypertension found that it was due to cardiac tumors in 77.3% and malignant tumors in 22.7%.

In patients without hypertension, 63.8% of deaths were due to cardiac, 6.4% - to extracardiac, and 29.8% - to malignant tumors.

Thus, analisis of the causes of death in patients after PTCA reveleaed that in patients with and without hypertension, deaths after PTCA are mainly due to cardiac causes.

Sex differences. Sex differences were evaluated within 5 years after myocardial revascularization with PTCA in patients with acute coronary syndrome. A total of 669 patients were retrospectively analyzed. Of these, 237 were female (33.9%) and 463 were male (66.1%) patients. Diabetes (23.6% against 44.3%, p = 0.0034), hypertension (36% against 60.2%, p = 0.00013) and chronic renal failure (15.3% - against 12.4%, p = 0.031) was more prevalent among women than men.

Heart failure was more common in men than in women (17.3% vs. 9.1%, p = 0.003).

In our study, the incidence of stent placement was almost equal in women and men. The Kaplan-Meier survival analysis also demonstrated that there was no difference between two sexes in terms of the use of next-generation drug-coated stents during 5-year follow-up (p = 0.952) (Figure 4).

Bleeding and vascular complications were more common in women. The need for in-hospital blood transfusion was more common in women (8% and 3%, p <0.001). In addition, contrast-induced nephropathy characaterised by an elevated creatinine level was more common in women (7% vs. 4%, p <0.001). The number of vessels involved in coronary angiography (1.82 ± 0.85, p <0.001 compared to 1.93 ± 0.86) and the number of vessels treated with PTCA (1.58 ± 0.8, p = 0.05 compared to 1.63 ± 1.0) were lower in women.

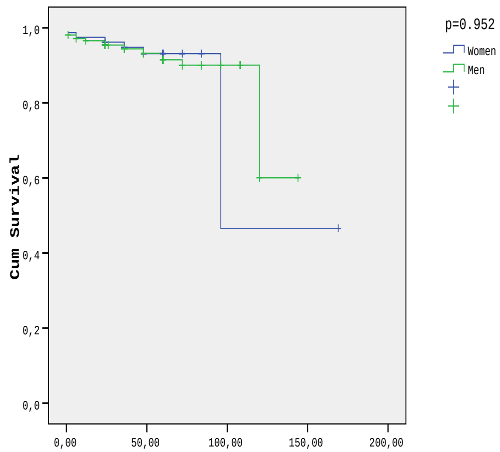

Figure 4. Kaplan-Mayer survival analysis showing differences between the sexes in terms of the use of next-generation drug-coated stents over a 5-year follow-up period after PTCA. Observation period is on abscissa (weeks), relative number of patients survived is on ordinate (p = 0.952).

In the 30 days after PTCA, all-cause mortality was higher in women (4.1% in women, 2.9% in men, p = 0.02). However, after 5 years, mortality did not differ significantly between the sexes (p = 0.959) (Table 2).

Table 2

Major cardiovascular and cerebrovascular events (MACCE) 30 days and 5 years after PTCA

Events	30-day observation (%)			5-year observation (%)		
	Women (n=237)	Men (n=463)	P	Women (n=237)	Men (n=463)	P
MACCE	9,5%	7,1%	0,01	22,7%	21,6%	0,811
Myocardial infarction	1,1%	0,7%	0,616	9,1%	5,2%	0,146
Deaths due to all causes	4,1%	2,9%	0,02	8,9%	9,2%	0,959
Stroke	0,2%	0,3%	0,704	1,8%	2,1%	0,351
Repeat revascularization	0,25%	0,46%	0,510	18,5%	16,6%	0,389
Primary endpoint	3,4%	3,9%	0,813	17,6%	15,4%	0,751

As it can be seen from the table, although the MACCE was higher in women (9.5% vs. 7.1%, p = 0.01) in the 30 days after PTCA, it did not differ between men and women in the 5-year follow-up (22.7% against 21.6%, p = 0.811).

At 30 days after PTCA, the frequency of repeat revascularization was higher in women (0.25%) than in men (0.46%) (p = 0.510). After 5 years, 18.5% of women and 16.6% of men needed re-revascularization (p = 0.389).

At 30 days after PTCA, more strokes were observed in the female group than in the male group (p = 0.704). After 5 years, no significant difference in stroke incidence was observed for both sexes (p = 0.351).

Diabeted was more common among women than in men and was found to be most common cause of MACCE in both sexes. Heart failure, which was more common in men, was also one of the most common causes of MACCE in both sexes. The observation of patients with diabetes during 5 years post-procedure found no difference in terms of MACCE (p = 0.835) and mortality (p = 0.405) among both sexes.

LONG-TERM RESULTS OF CORONARY ARTERY BYPASS GRAFTING IN PATIENTS WITH DIFFERENT RISK FACTORS

Of the 1414 patients who had myocardial revascularization, 715 underwent coronary artery bypass grafting (CABG). This section analyzes the long-term outcomes of CABG surgery in all patients including 5-year survival rate, as well as the causes of death. We analysed cardiac and extracardiac causes among all the causes of death.

To assess the impact of **diabetes mellitus** on CABG outcomes the comparison was conducted among groups with and without diabetes.

During the post-CABG follow-up period, survival rate was 95.3% for non-diabetic patients (mortality rate - 4.7%), and 90.6% for diabetic patients (mortality rate - 9.4%). Significant difference was found between groups when comparing the number of patients survived, as well as for the mortality rate. Diabetes doubles post-CABG mortality (p = 0.016). Thus, the presence of diabetes is one of the factors affecting survival after CABG.

The Kaplan-Mayer survival analysis shows that patients with diabetes have a higher mortality rate and that this difference is reported from the first weeks of observation (p = 0.018) (Figure 5).

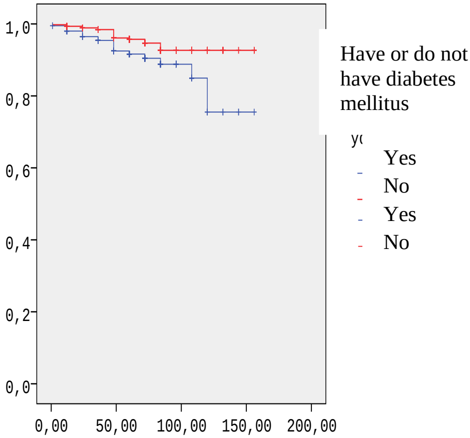

Figure 5. Kaplan-Mayer survival analysis after CABG in patients with and without diabetes. Observation period is on the abscissa (in weeks), the relative number of patients survived is on the ordinate.

During the post-CABG follow-up period, survival was 95.4% for male patients without diabetes (mortality rate - 4.6%), and 92.3% for men with diabetes (mortality rate - 7.7%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (Figure 12). Although the presence of diabetes slightly increases post-CABG mortality, this was not statistically significant (p = 0.142).

During the post-CABG follow-up period, survival rate was 94.9% among non-diabetic women (mortality rate - 5.1%), and 86% among women with diabetes (mortality rate - 14%). Although the presence of diabetes slightly increases post-CABG mortality, this was not statistically significant (p = 0.11).

Analisis of causes of death after CABG in patients with diabetes revealed that cardiac tumors accounted for 42.1%, extracardiac - for 10.5%, and malignant tumors - for 47.4% of them.

In patients without diabetes, 66.7% of deaths were due to cardiac, 16.7% to extracardiac, and 16.7% to malignant tumors.

The MACCE percentage in the CABG group (23.4% in those with DM, 14.5% in those without DM, p = 0.004) was significantly higher in patients with diabetes. There was no difference in the incidence of stroke in the CABG group (4.1% in those with DM, 2.6% in those without DM, p = 0.305) and in recurrent revascularization (11.7% in those with DM, 8.1% in those without DM, p = 0.12).

Thus, analysis of the causes of death in post-CABG patients found that post-CABG deaths in patients with and without diabetes were mainly due to cardiac causes.

To evaluate the effect of **extracardiac arteriopathy** on CABG outcomes the analysis was conducted for groups with and without arteriopathy. Survival rate was 94.7% among patients without extracardiac arteriopathy who had CABG (mortality rate - 5.3%), and only 87.3% among patients with arteriopathy (mortality rate - 12.7%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.01). The presence of extracardiac arteriopathy increases the mortality after CABG by approximately 2.5 times. Thus, the presence of extracardiac arteriopathy can be considered as a serious factor affecting survival after CABG. Kaplan-Mayer survival analysis dynamically shows that this difference is observed from the first weeks (p = 0.02) (Figure 6).

Post-CABG, the survival rate was 94.9% for male patients without extracardiac arteriopathy (mortality rate - 5.1%), and 91.1% for male patients with arteriopathy (mortality rate - 8.9%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant statistical difference was revealed (p = 0.228). Although the presence of extracardiac arteriopathy increases post-CABG mortality in male patients, this was not statistically significant.

After CABG, the survival rate was 93.5% among female patients without extracardiac arteriopathy (mortality rate - 6.5%), and 78.3% among female patients with arteriopathy (mortality rate - 21.7%).

A significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.025). The presence of arteriopathy increases the post-CABG mortality in female patients by approximately 3-fold. Thus, the presence of arteriopathy in female patients can be assessed as a specific factor affecting survival after CABG.

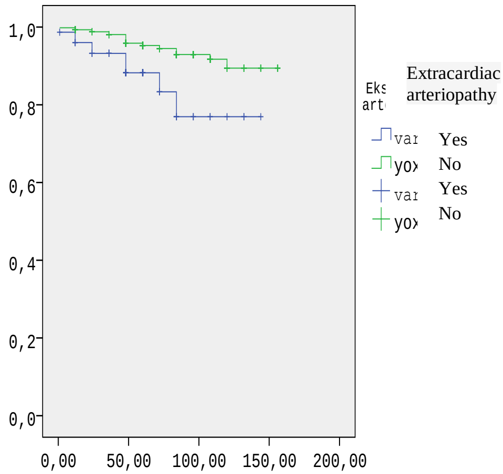

Figure 6. Kaplan-Mayer survival analysis after CABG in patients with and without extracardiac arteriopathy. Observation period is on the abscissa (in weeks), the relative number of patients survived is on the ordinate.

Analisis of causes of death after CABG in patients with extracardiac arteriopathy found that it was due to cardiac tumors in 45.5%, extracardiac tumors in 9.1%, and due to malignant tumors in 45.5% cases.

In patients without extracardiac arteriopathy, 59.4% of deaths were due to cardiac, 15.6% to extracardiac, and 25% to malignant tumors.

Thus, the analysis of post-CABG mortality in patients with and without extracardiac arteriopathy shows that while cardiac causes predominates among patients with arteriopathy, it was often due to cardiac and extracardiac causes among patients without artheriopathy.

There was no difference in MACCE percentage (p = 0.871), recurrent revascularization (p = 0.057) and stroke (p = 0.288) in the CABG group of patients with extracardiac arteriopathy compared with patients without extracardiac arteriopathy.

In the CABG group, extracardiac arteriopathy was observed in 20.7% of female patients and 9.9% of male patients (p = 0.001). Extracardiac arteriopathy was observed at almost the same frequency in COPD patients (p = 0.905). Extracardiac arteriopathy was more common in diabetic patients (17.6%) than in non-diabetic patients (9.1%) (p = 0.001). Extracardiac arteriopathy was found in 20.7% of patients with high blood creatine levels and 11.3% of those with normal creatine levels, the difference was not statistically significant (p = 0.125)

Extracardiac arteriopathy was found in 13% of patients with hypertension and in 8.8% of non-hypertensive patients (p = 0.111). Extracardiac arteriopathy was observed in 11.5% of patients with QSS and in 13% of patients with MI (p = 0.667).

Extracardiac arteriopathy was observed in 17.9% of those with ejection fraction (EF) less than 35% and in 10.6% of those with EF above 35% (p = 0.31). During the 5-year follow-up period after the CABG, the mortality rate was 33.3% for those with extracardiac arteriopathy and 6.8% for those without extracardiac arteriopathy (p = 0.011). Thus, extracardiac arteriopathy can be assessed as a factor influencing post-CABG survival.

To assess the impact of the **ejection faction (EF)** on US results, a study was conducted in groups with EF below 35% and above 35%.

In the post-CABG follow-up period, survival rate was 90.3% among patients with EF below 35% (mortality rate - 9.7%), and 94.5% among patients with EF above 36% (mortality rate - 5, 5%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p =

0.135). Though an EF below 35% slightly increases post-CABG mortality, it was not statistically significant.

In the CABG group, the percentage of MACCE (16% in EF less than 35%, 17.5% in EF more than 35%, p = 0.711), in recurrent revascularization (7.5% in EF less than 35%, 9,5% in EF more than 35%) of p = 0.522) and in stroke cases (1% in EF less than 35%, 3.4% in EF less than 35%, p = 0.169) no difference was found between the two groups.

However, when reviewing the Kaplan-Mayer survival analysis, it is noteworthy that the mortality rate was higher in the first weeks after CABG (p = 0.049) in those with EF <35% (Figure 7).

After CABG, survival rate was 92.7% among male patients with EF below 35% (mortality rate - 7.3%), and 94.9% among male patients with EF above 36% (mortality rate - 5.1%).

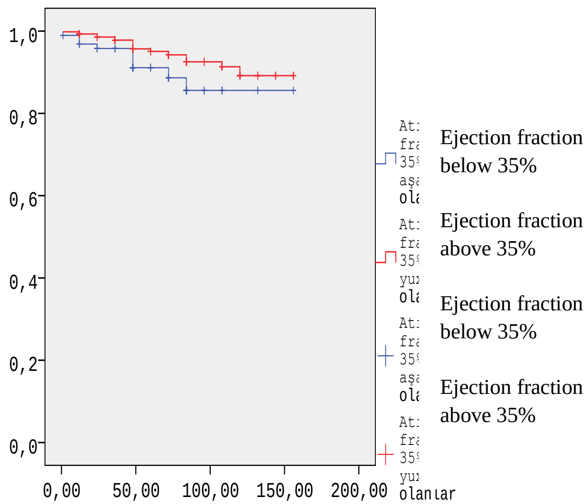

Figure 7. Kaplan-Mayer survival analysis after CABG in patients with a ejection fraction below 35% and above 35%. Observation period is on the abscissa (in weeks), the relative number of patients survived is on the ordinate.

When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p = 0.386). Although EF below 35% slightly increases post-CABG mortality, it was not statistically significant.

After CABG, survival rate was 57.1% for female patients with EF below 35% (mortality rate - 42.9%), and 92.7% for female patients with EF above 36% (mortality rate - 7.3%). Significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.002). EF <35% increases the post-CABG mortality in female patients by approximately 6-fold. Thus, the percentage of EF can be considered as a specific factor influencing post-CABG survival in female patients.

Analisis of post-CABG causes of death in patients with EF<35% revealed that this was due to cardiac tumors in 70% and due to malignant tumors in 30% of cases.

In patients with an ejection fraction above 36%, 51.5% of deaths were due to cardiac, 18.2% to extracardiac, and 30.3% to malignant tumors.

Thus, analisis of the post-CABG causes of death found that cardiac causes predominated among the causes of death in patients with an ejection fraction below 35%. In patients with an ejection fraction above 36%, cardiac and other causes of death were almost identical.

To assess the effect of **chronic obstructive pulmonary disease (COPD)** on CABG outcomes we conducted comparison among groups with and without COPD. During the post-CABG follow-up period, survival rate was 93.9% in patients without COPD (mortality rate - 6.1%), and 93.3% in patients with COPD (mortality rate - 6.7%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found (p = 0.879). Analisis of the causes of death after CABG in patients with COPD found cardiac tumors accounted for 25%, extracardiac - for 25%, and malignant tumors - for 50% of cases.

Analisis of the causes of post-CABG death in patients with COPD revealed in 69% it was due to cardiac tumors, in 12.8% due to extracardiac, and in 28.2% secondary to malignant tumors.

Thus, the analysis of post-CABG mortality in patients with and without COPD shows that while deaths in non-COPD are mainly due to cardiac causes, deaths in COPD patientes are mainly due to extracardiac causes.

Comparative analysis was performed among groups with unstable angina pectoris (UAP) and myocardial infarction (MI) to assess the impact of **acute coronary syndrome (ACS)** on CABG outcomes.

During the post-CABG follow-up period, survival rate was 93.7% in patients with UAP (mortality rate - 6.3%), and 94.8% in patients with MI (mortality rate - 5.2%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found ($p = 0.682$).

In addition, no significant difference in postoperative survival was found in male patients with UAP and MI after CABG. No significant difference in survival after CABG was found in female patients with UAP and MI. Analisis of the causes of death after CABG in patients with unstable angina revealed that in 55.3% it was due to cardiac causes, in 13.2% - extracardiac causes, and in 31.6% was due to malignant tumor.

In patients with myocardial infarction, 60% of deaths were due to cardiac, 20% to extracardiac, and 20% to malignant tumors.

Thus, the analysis of post-CABG deaths in patients with unstable angina and myocardial infarction shows that cardiac causes predominate among deaths in both groups.

To assess the effect of **hypertension** on CABG results the analysis was conducted for groups with and without hypertension.

During the post-CABG follow-up period, survival rate was 94.7% for patients without hypertension (death rate - 5.3%), and 93.5% for patients with hypertension (death rate - 6.5%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found. Although the presence of hypertension slightly increases post-CABG mortality, this was not statistically significant ($p = 0.567$).

During the post-CABG follow-up period, survival rate was 95.1% among male patients without hypertension (mortality rate - 4.9%), and 94.3% among men with hypertension (mortality rate - 5.7%). When comparing the number of patients survived in both groups, as well as the mortality rate, no significant difference was found. Although the presence of hypertension slightly increases post-CABG mortality, this was not statistically significant (p = 0.67).

During the post-CABG follow-up period, survival rate was 90.5% among female patients without hypertension (mortality rate - 9.5%), and 90.5% among women with hypertension (mortality rate - 9.5%). No significant difference was found when comparing the number of patients survived in both groups, as well as the mortality rate (p = 0.994).

Analysis of the causes of death after CABG in patients with hypertension found that in 51.5% it was due to cardiac causes, in 15.2% due to extracardiac causes, and in 33.3% were due to malignant tumors. In patients without hypertension, 70% of deaths were due to cardiac, 10% to extracardiac, and 20% to malignant tumors.

Sex differences. Sex differences in myocardial revascularization with CABG in patients with acute coronary syndrome were studied as well. We included 596 men and 121 women out of a total of 715 patients with CABG in the subgroup analysis. Age differences among sex revealed that women (60 ± 7.3) were older than men (56.3 ± 8.2) (p = 0.00012) in our study. A 30-day mortality rate was 3.4% in women and 0.5% in men (p = 0.004). In 1-year follow-up period, the mortality was significantly higher in women (3.5%) than in men (0.7%) (p = 0.012). Although the MACCE percentage was higher in women (19%) than in men (16.9%) during 5-year follow-up period, this was not statistically significant (p = 0.585).

During the 5-year follow-up period, all-cause mortality was higher in women (9.5%) than in men (5.5%) (p = 0.042). The higher age at the time of surgery does not explain the cause of early death in women.

Although strokes were more common in men (3.4%) than women (1.7%), they were not statistically significant (p = 0.322). No difference was found between the two sexes in the incidence of recurrent revascularization (8.3% in women, 9.4% in men, p =

0.695). According to the results of the Kaplan-Mayer survival analysis, the 5-year follow-up life expectancy in women tended to decrease compared to men (p = 0.050).

Diabetes was more prevalent in women (48.8%) than in men (27.3%) (p = 0.00034). 5-year follow-up in diabetic patients who had CABG showed the mortality rate of 14% in women and 7.7% in men (p = 0.048).

According to the overall endpoints, the overall risk is higher among women than men (18% women, 12% men).

Among patients with acute coronary syndrome, women are more likely to have unstable angina (80.9% in women, 73.1% in men), and men more likely to have myocardial infarction (26.9% in men, 19.1% in women) (p = 0.017). Women were older than men and had higher rate of family history of hypertension and coronary artery disease.

Male patients with heart failure (EF below 35%) accounted for 16.6% and women for 5.8% of cases (p = 0.002). The average ejection fraction was 47.7% in men and 52% in women (p = 0.00024).

Smoking was observed in 34.7% of male patients and 1.4% of female patients (p = 0.00021).

COMPARATIVE EVALUATION OF LONG-TERM RESULTS OF PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY AND CORONARY ARTERY BYPASS GRAFTING IN PATIENTS WITH DIFFERENT RISK FACTORS

In general, no difference was found between PTCA (7%) and CABG (6.1%) in all-cause deaths in the postoperative period (within 5 years) in the acute multivessel ischemic heart disease (p = 0.508). The MACCE percentage was higher in the PTCA (21.7%) than in the CABG (17.3%) (p = 0.035). Recurrent revascularization was more common in the PTCA (14.1%) group than in the CABG (9.2%) group (p = 0.004). The incidence of stroke was higher in CABG (3.1%) than in PTCA (0.9%), which was assessed as one of the leading causes of death (p = 0.003). No differences between the two groups were found during the Kaplan-Mayer survival analysis (over 5 years) ($p = 0.076$).

In women with multivessel acute coronary heart disease, no difference was found between PTCA and CABG in relation to leading causes of death (PTCA 6.9%, CABG 9.5%, $p = 0.510$), percentage of MACCE (PTCA 22.7%, CABG 19%, $p = 0.511$), stroke (PTCA 0.2%, CABG 1.7% $p = 0.226$) and in Kaplan-Mayer survival analysis ($p = 0.529$). However, the incidence of recurrent revascularization (PTCA 17%, CABG 8.3% $p = 0.05$) was higher in the PTCA group.

There was no difference in mortality from all causes (PTCA 7%. CABG 5.5%, $p = 0.264$) in men as well. However, the MACCE percentage (PTCA 21.6%. CABG 16.9%, $p = 0.04$) and recurrent revascularization (PTCA 13.6%, CABG 9.4%, $p = 0.021$) were significantly higher among men in the PTCA group when compared to the CABG group. The incidence of stroke was significantly higher in the CABG group (3.4%) compared to the PTCA group (1%) ($p = 0.005$). An analysis of the results of the Kaplan-Mayer survival analysis revealed that CABG is associated with longer life expectancy in male patients ($p = 0.022$).

All-cause deaths in acute coronary heart disease with concomitant **extracardiac arteriopathy** (EA) were more common in PTCA group (22.7%) than in CABG one (12.7%) ($p = 0.043$). Thus, the presence of arteriopathy can be assessed as a specific factor influencing the survival after PTCA and CABG.

Comparative analysis of patients with PTCA and CABG in acute ischemic heart disease accompanied with **COPD** revealed no difference in all-cause mortality (PTCA 7%, CABG 6.1%, $p = 0.142$), MACCE percentage ($p = 0.278$), recurrent revascularization ($p = 0.425$) and stroke ($p = 0.374$). In the Kaplan-Mayer survival analysis of those with and without COPD, there was no difference in life expectancy between the groups mentioned. Analysis of post-PTCA and CABG deaths in patients with and without COPD shows that deaths in non-COPD were mainly due to cardiac causes, while deaths in COPD were mainly due to extracardiac causes.

Analysis was also performed in subgroups with unstable angina pectoris (UAP) and myocardial infarction (MI) to assess the impact of **acute coronary syndrome (ACS)** on PTCA and CABG outcomes.

A comparison of PTCA and CABG in unstable angina showed no difference in all-cause mortality (PTCA 5.8%, CABG 6.3%, p = 0.558). The MACCE percentage (PTCA 23.3%, CABG 18.2%, p = 0.042) and recurrent revascularization (PTCA 17.6%, CABG 10%, p = 0.0004) were higher in the PTCA group compared to the CABG group. Stroke rates were significantly higher in the CABG (2.9%) group than in the PTCA (0.7%) group (p = 0.011). The Kaplan-Mayer survival analysis did not reveal a difference in life expectancy between the CABG and PTCA groups (p = 0.879).

Comparative analysis of PTCA and CABG in non-ST-elevated myocardial infarction showed no difference in all-cause mortality (PTCA 9.7%, CABG 5.2%, p = 0.178), MACCE percentage (PTCA 19.2%, CABG 12%, p = 0.102), recurrent revascularization (PTCA 8.3%, CABG 4%, p = 0.152) and stroke (PTCA 1.1%, CABG 4%, p = 0.075). The Kaplan-Mayer survival analysis did not reveal a difference in life expectancy between the CABG and PTCA groups (p = 0.073).

Comparative analysis of PTCA (8.6%) and CABG (6.5%) in acute ischemic coronary heart disease with concomitant **hypertension** showed no difference in all-cause mortality (p = 0.276). The MACCE percentage (PTCA 30%, CABG 16.6%, p = 0.00012) and recurrence (PTCA 20.9%, CABG 7.6%, p = 0.0007) were higher in PTCA patients when compared to CABG patients. However, the incidence of stroke in the CABG group (3.6%) was higher than in the PTCA group (1.1%) p = 0.041. In the absence of hypertension, no difference in all-cause mortality was found between the CABG (5.3%) and PTCA (6%) groups (p = 0.742). In patients with hypertension (p = 0.102) and without hypertension (p = 0.195), no difference was found between the groups on Kaplan-Mayer survival analysis. It was established that deaths in patients with and without hypertension after PTCA were mainly due to cardiac causes. However, although deaths in patients with post-

CABG hypertension from cardiac and extracardiac causes occur at almost the same frequency, post-CABG deaths in non-hypertensive patients occur mainly from cardiac causes.

Comparison of PTCA and CABG results with second-generation drug eluting stents in patients with left ventricular failure and multi-vessel acute coronary syndrome. A total of 1414 patients with acute coronary syndrome and 442 patients with left ventricular (LV) systolic dysfunction were evaluated. Of these, 198 (45.1%) were in the PTCA group and 244 (54.8%) - in the CABG group. A second-generation drug-eluting stent was used in all PTCA patients. LIMA was used in 94.9% of CABG patients. Patients were observed for an average of 5 years after surgery.

Mortality, MI, and stroke as primary endpoints were observed in 53 (21.7%) PTCA patients and in 36 (18.2%) CABG patients ($p = 0.356$). Thus, there was no difference between the two groups in terms of the primary endpoints.

All-cause mortality was 27 (11.4%) in the PTCA group and 19 (9.9%) in the CABG group ($P = 0.618$). Recurrent revascularization was required more in the PTCA group (9.8%) than in the CABG group (4.9%) ($p = 0.05$). Stroke was observed in 1.2% of patients in the PTCA group and in 4% of CABG patients ($p = 0.05$). In the group with an EF <35%, the MACCE percentage was also higher in the PTCA group (21.7%) than in the CABG group (17.3%) ($p = 0.035$).

After 30 days, the mortality rate was 3.0% in the PTCA group and 0.5% ($p = 0.064$) in the CABG group. Although the MACCE percentage was higher in the PTCA group (22.1%) than in the CABG group (18.2%), it was not statistically significant ($p = 0.305$).

The analysis of causes of death identified total of 28 deaths in the PTCA group. 18 (64.3%) of these deaths were due to cardiac causes and 10 (35.7%) were due to extracardiac causes. There were total of 19 deaths in the CABG group. 10 (52.6%) of these deaths were cardiac and 9 (47.4%) were extracardiac (cancer and others) ($p = 0.05$). Kaplan-Mayer survival analysis showed no significant difference in the PTCA (second-generation drug-eluting stent) and CABG group at 5 years of follow-up (p = 0.195) (Figure 8).

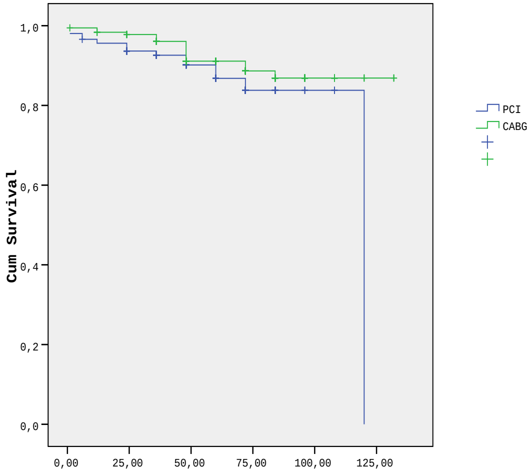

Figure 8. Kaplan-Mayer survival analysis between CABG and PTCA in patients with multivessel acute coronary syndrome and left ventricular failure. Observation period on the abscissa (in weeks), the relative number of alive patients on the ordinate.

Comparison of PTCA and CABG results with second-generation drug stents in patients with acute coronary syndrome with diabetes. 405 diabetic patients were evaluated out of 1414 patients with acute coronary syndrome. Of these, 183 (45.1%) were in the PTCA group and 222 (54.8%) were in the CABG group. A second-generation drug-coated stent was used in all PTCA patients. LIMA was used in 94.9% of CABG patients. Patients were observed for an average of 5 years after surgery.

As a primary endpoint, death occurred in 31 (16.9%) patients with MI and stroke PTCA and in 33 (14.9%) patients with CABG (p = 0.582). Thus, there was no difference between the two groups in terms of the primary endpoint.

All-cause deaths occurred in 17 patients (9.8%) in the PTCA group and 20 (9.1%) patients in the CABG group (p = 0.989).

Recurrent revascularization was reported in 18.4% of patients in the PTCA group and 10.8% of patients in the CABG group (p =

0.012). Stroke occurred in 1.1% of patients in the PTCA group and in 4.9% of CABG patients (p = 0.05).

Post-30 days mortality was reported in 3.3% patients in the PTCA group and 0.5% - in the CABG group (p = 0.034).

Although the MACCE percentage was higher in the PTCA group (25.7%) than in the CABG group (23.5%), it was not statistically significant (p = 0.616).

A total of 16 deaths were reported in the PTCA group while investigating the causes of death. 75% of these deaths were due to cardiac causes and 25% to extracardiac causes (cancer and others). Of the 19 deaths observed after CABG, 42.1% were due to cardiac causes and 57.9% were due to extracardiac (cancer and others) causes (p = 0.05).

No difference was found between two methods of treatment in relation to MACCE (p = 0.611), recurrent revascularization (p=0.630), and 5-year mortality (p = 0.661) in male patients. In male patients, stroke was 4.9% in the CABG group and 1.4% in the PTCA group (p=0.049). In the 30-day follow-up, mortality was predominantly seen in the PTCA group when compared to the CABG group (p = 0.019).

Due to the small number of female patients, these indicators were not assessed.

Kaplan-Mayer survival analysis did not reveal any significant difference between PTCA with second-generation drug eluting stents and CABG in patients with acute coronary syndrome and diabetes (p = 0.353).

Comparison of results of PTCA with second-generation drug eluting stents and CABG in patients with multivessel acute vascular coronary syndrome and without diabetes. 1011 patients, including 495 CABG and 516 PTCA, were included in the study. 89% of these patients were males and 11% were females, aged 40 to 80 years (mean age 56.4 ± 8.7). At the time of discharge from the hospital, 98.6% of patients in the PTCA group and 96.5% (p = 0.085) in the CABG group were taking aspirin. Statin intake was 96% and 94.5% (p = 0.785), respectively. Patients were observed for an average of 5 years after surgery (Figure 9).

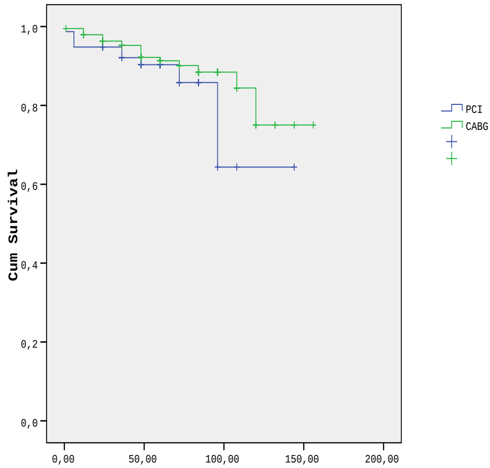

Figure 9. Kaplan-Mayer survival analysis between PTCA with second-generation drug eluting stents and CABG in patients with acute coronary syndrome and diabetes. Observation period on the abscissa (in weeks), the relative number of survived patients on the ordinate. (p=0.09)

Mortality from all causes was 4.7% of the CABG group and 6.2% in the PTCA group (p = 0.298). Mortality from cardiac causes was 66.7% in the CABG group and 58.1% in the PTCA group (p = 0.515).

During 5-year follow-up, the MACCE percentage was higher in the PTCA group (20.3%) than in the CABG group (14.5%) (p = 0.015).

After 30 days, the mortality rate was 0.2% in the CABG group and 1.6% in the PTCA group (p = 0.024). At 5-year follow-up, the recurrent revascularizations were performed significantly less in the CABG group (8.1%) than in the PTCA group (13.6%) (p = 0.005). Cerebrovascular events were reported significantly less in the PTCA group (0.8%) than in the CABG group (2.6%) (p = 0.022) (Table 3).

Table 3

Comparison of PTCA with second-generation drug eluting stents and CABG results in patients with non-diabetic acute coronary syndrome

Characteristics of patients	CABG n = 495 (49%)	PTCA n = 516 (49%)	p
All-cause mortality	22 (4,7%)	31 (6,2%)	P = 298
Cardiac death	16 (66,7%)	18 (58,1%)	P = 515
MACCE	72 (14,5%)	105 (20,3%)	P = 0,150
30-day mortality	0,2% (1)	1,6% (8)	P = 0,024
Recurrent revascularization	8,1% (40)	13,6% (70)	P = 0,005
Cerebrovascular events	2,6% (13)	0,8% (4)	P = 0,022
Aspirin	96,5%	98,6%	P = 0,085
Statin	94,5%	96%	P = 0,785

There was no statistical accuracy found in all-cause mortality (PTKA 12.7%, CABG 9.1%, p = 0.225), MACCE percentage (PTCA 23%, CABG 18.7%, p = 0.264) and recurrent revascularization (PTCA 10.1%, CABG 10.8%, p = 0.337) between the PTCA and CABG groups **in all elderly patients** (≥75 years). The incidence of stroke was higher in the CABG (4.8%) group than in the PTCA (1.3%) group (p = 0.048). The Kaplan-Meier survival analysis revealed longer life expectancy in the CABG group (p = 0.029).

RESULTS

1. Multivessel acute ischemic heart disease in the postoperative period after PTCA (within 5 years) did not show a significant difference between women and men in relation to all-cause mortality (6.9% in women, 7% in men, p = 0.959), rate of recurrent revascularizations (17% in women, 13.6% in men, p = 0.389), stroke (0.2% in women, 1% in men, p = 0.351) and MACCE percentage (22.7% in women, 21.6% in men, p = 0.811). Analysis of Kaplan-Mayer survival analysis (for 5 years) did not reveal any

difference in survival between the two sexes (p = 0.952). [10, 22,25, 26]

2. Multivessel acute coronary heart disease has a higher incidence of all-cause mortality in women (9.5%) than men (5.5%) in the post-CABG period (5 years) (p = 0.042). However, although the MACCE percentage was higher in women (19%) than in men (16.9%), it was not statistically significant (p = 0.585). Although strokes were more common in men (3.4%) than women (1.7%), they were not statistically significant (p=0.322). No difference was found between the two sexes in the rate of recurrent revascularizations (8.3% in women, 9.4% in men, p = 0.695). According to the results of the Kaplan-Mayer survival analysis, the life expectancy at 5 years of follow-up in women tended to decrease compared to men (p = 0.050). [20, 22, 25, 26]

3. In the multivessel acute coronary ischemic heart disease, no difference between PTCA (7%) and CABG (6.1%) was found in all postoperative deaths (within 5 years) (p = 0.508). The MACCE insidence rate in PTCA (21.7%) was higher than in the CABG group (17.3%) (p = 0.035). Recurrent revascularizations were more common in the PTCA (14.1%) group than in the CABG (9.2%) group (p = 0.004). The incidence of stroke was higher in the CABG (3.1%) than in PTCA (0.9%), which was considered as one of the leading causes of death (p = 0.003). No differences between the two groups were found during the Kaplan-Mayer survival analysis (over 5 years) (p = 0.076). In women with multivessel acute coronary heart disease, no difference was found in the PTCA and CABG in rate of all-cause mortality (PTKA 6.9%, USA 9.5%, p = 0.510), MACCE percentage (PTCA 22.7%, CABG 19%, p = 0.511), stroke (PTKA 0.2%, CABG 1.7% p = 0.226) and Kaplan-Mayer survival analysis (p = 0.529). However, the incidence of recurrent revascularizations (PTCA 17%, US 8.3% p = 0.05) was higher in the PTCA group. There was no difference in all-cause mortality (PTCA 7%. CABG 5.5%, p = 0.264) in men. However, the MACCE percentage (PTCA 21.6%. CABG 16.9%, p = 0.04) and rate of recurrent revascularizations (PTCA 13.6%, CABG 9.4%, p = 0.021) were significantly higher in men in the PTCA group when

compared to the CABG group. The incidence of stroke was significantly higher in the CABG group (3.4%) than in the PTCA group (1%) (p = 0.005). An inquiry of the results of the Kaplan-Mayer survival analysis revealed that CABG is associated with longer life expectancy in male patients (p = 0.022). [3, 17, 22, 26]

4. In a comparative analysis of PTCA and CABG in acute coronary heart disease and concomitant diabetes mellitus, no difference was found in all-cause mortality (PTCA 9.8%, CABG 9.1% p = 0.989) and MACCE rate (PTCA 25.7%, CABG 23.5%, p = 0.616)). Cases of recurrent revascularization were more common in the PTCA group (18.4%) than in the CABG group (10.8%) (p = 0.012). In contrast, stroke was more common in the CABG group (4.9%) than in the PTCA group (1.1%) (p = 0.05). The results of the Kaplan-Mayer survival analysis did not reveal a significant difference in life expectancy between the PTCA and CABG groups (p = 0.353). All-cause mortality in CABG patients with concomitant diabetes mellitus (9.4%) was twice as high as in non-diabetics (4.7%) (p = 0.016). The MACCE percentage (23.4% in diabetics, 14.5% in non-diabetics, p = 0.004) was significantly higher in patients with diabetes. There was no difference in the incidence of stroke in the CABG group (4.1% in diabetics, 2.6% in non-diabetics, p=0.305) and recurrent revascularization group (11.7% in diabetics, 8.1% in non-diabetics, p = 0.12). According to the results of the Kaplan-Mayer survival analysis in the CABG group, the life expectancy at 5 years of follow-up tended to decrease in diabetic patients compared to non-diabetic patients (p = 0.018). When compared PTCA results in patients with diabetes mellitus (6.2%) and non-diabetics (9.4%), no difference was found in all-cause mortality (p = 0.147), rate of MACCE (25.7% in diabetics, 20.3% in non-diabetics, p = 0.133), recurrent revascularization (15.4% in diabetics, 13.6% in non-diabetics, p = 0.55) and stroke (1.1% in diabetics, 0.8% in non-diabetics, p = 0.689). However, post-PTCA mortality in women with diabetes was on average up to 3 times higher (p = 0.044). In the analysis of the Kaplan-Mayer survival analysis in the PTCA group, the difference

was not statistically significant, despite the higher incidence of deaths in patients with diabetes (p = 0.122) [1, 2, 3, 19, 20, 23, 26]

5. There was no difference between the CABG group and the PTCA group in all-cause mortality (PTCA 6.2%, CABG 4.7%, p=0.298) in multivessel acute coronary heart disease without diabetes mellitus. However, MACCE percentages (PTCA 20.3%, CABG 14.5%, p = 0.015) and recurrent revascularization cases (PTCA 13.6%, CABG 8.1%, p = 0.005) were more common in the PTCA group than in the CABG group. Stroke cases were significantly lower in the PTCA group than in the CABG group (PTCA 0.8%, CABG 2.6%, p = 0.022). The Kaplan-Mayer survival analysis did not reveal a significant difference between PTCA and CABG (p = 0.09). [18, 25]

6. All-cause mortality in patients with concomitant extracardiac arteriopathy (EA) and acute coronary heart disease was more common in PTCA groups (22.7%) than in the CABG one (12.7%) (p = 0.043). The assessment of concomitant EA in PTCA patients (33.3% in those with EA, 6.8% in those without EA) revealed higher all-cause mortality (p = 0.011). This is also evident in the Kaplan-Mayer survival analysis in PTCA (p = 0.04). No difference was identified in the rate of MACCE (p = 0.49), recurrent revascularizations (p = 0.320) and stroke (p = 0.819). In the CABG group there was 2.5-fold increase in all-cause mortality among patients with extracardiac arteriopathy when compared to those without EA (p = 0.01). No difference was found in rate of MACCE (p = 0.871), recurrent revascularizations (p=0.057), and stroke (p=0.288). In the Kaplan-Mayer survival analysis, significant decrease in life expectancy was observed (p=0.02). [11,13]

7. In multivessel acute coronary heart disease with an EF< 35%, recurrent revascularization was more common in the PTCA group when compared to the CABG group (PTCA 9.8%, CABG 4.9%, p = 0.05). The rate of MACCE was higher in the PTCA group (21.7%) than in the CABG group (17.3%) (p = 0.035). There was no difference between the groups in relation to all-cause mortality (PTCA 11.4%, CABG 9.9%, p = 0.618). Stroke cases were less common in the PTCA group (1.2%) than in the CABG

group (p = 0.05). Based on the results of Kaplan-Mayer survival analysis, no significant difference was found between the PTCA and CABG groups (p = 0.195). When comparing the cases with EF< 35% (mortality rate 12.7%) and ones with EF> 35% (mortality rate 5.4%), the all-cause mortality after PTCA were 2.5 times higher (p = 0.00067) and was found to be a significant factor influencing life expectancy in men (p = 0.00029) and women (p = 0.036) (Kaplan-Mayer survival analysis p = 0038). Rate of MACCE (25.4% for those with EF<35%, 21% for those with EF>35%, p = 0.280), recurrent revascularizations (9.1% for those with EF lower than 35%, 15.1% for those with EF above 35%, p = 0.084) and stroke (p = 0.959) did not differ between the two groups. Although all-cause mortality in the CABG group was higher in those with EF less than 35% (mortality rate 9.7%) and in those with EF above 35% (mortality rate 5.5%), it was not statistically significant (p = 0.135). Comparing the rate of MACCE (16% for those with EF lower than 35%, 17.5% for those with EF above 35% , p = 0.711), recurrent revascularization (EF lower than 35% 7.5%, with EF above 35%, p = 0.522) and stroke (1% for those OF less than 35%, , 3.4% for those with EF less than 35%, p = 0.169), we did not find difference between the two groups. Although having EF lower than 35% did significantly increase post-CABG mortality in women (6-fold, p = 0.002), this did not differ significantly in men (p = 0.386). In the Kaplan-Mayer survival analysis, the life expectancy was shorter (p = 0.049) for those with a EF lower than 35%.[2, 25]

8. We found no difference when compared the all-cause mortality (PTCA 7%, CABG 6.1%, p = 0.142), rate of MACCE (p = 0.278), recurrent revascularization (p = 0.425) and stroke (p = 0.374) after PTCA and CABG in patients with acute ischemic heart disease and COPD. In the Kaplan-Mayer survival analysis of those with and without COPD, there was no difference in life expectancy between the groups mentioned. [7]

9. Comparison of results of PTCA (8.6%) and CABG (6.5%) in multivessel acute ischemic coronary heart disease with concomitant hypertension revealed no difference in all-cause

mortality (p = 0.276). The rate of MACCE (PTCA 30%, CABG 16.6%, p = 0.00012) and recurrent revascularization (PTCA 20.9%, CABG 7.6%, p = 0.0007) was higher among PTCA patients when compared to CABG patients. However, the incidence of stroke in the CABG group (3.6%) was higher than in the PTCA group (1.1%) p = 0.041. No difference in all-cause mortality was found between the CABG (5.3%) and PTCA (6%) groups in non-hypertensive patients (p = 0.742). No difference on the Kaplan-Mayer survival analysis was found between the groups of hypertensive (p = 0.102) and non-hypertensive (p = 0.195) patients. [1, 14, 15].

10. No difference was found in all-cause mortality (PTCA 5.8%, CABG 6.3%, p = 0.558) among patients with unstable angina in PTCA and CABG groups. The rate of MACCE (PTCA 23.3%, CABG 18.2%, p = 0.042) and recurrent revascularization (PTCA 17.6%, CABG 10%, p = 0.0004) were higher in the PTCA group when compared to the CABG group. Stroke rates were significantly higher in the CABG (2.9%) group than in the PTCA (0.7%) group (p = 0.011). The Kaplan-Mayer survival analysis did not reveal a difference in life expectancy between the CABG and PTCA groups (p = 0.879) No difference was found among patients with NSTEMI in PTCA and CABG groups in relation to all-cause mortality (PTCA 9.7%, CABG 5.2%, p = 0.178), MACCE (PTCA 19.2%, CABG 12%, p = 0.102), recurrent revascularization (PTCA 8.3%, CABG 4%, p = 0.152), and stroke (PTCA 1.1%, CABG 4%, p = 0.075). The Kaplan-Mayer survival analysis did not reveal a difference in life expectancy between the CABG and PTCA groups (p = 0.073). [14,17 ,26]

11. No difference was found in all-cause mortality (PTCA 12.7%, CABG 9.1%, p = 0.225), rate of MACCE (PTCA 23%, CABG 18.7%, p = 0.264) and recurrent revascularization among elderly patients (≥75 years) between the PTCA and CABG groups (PTCA 10.1%, CABG 10.8%, p = 0.337). The incidence of stroke was higher in the CABG (4.8%) group than in the PTCA (1.3%) group (p = 0.048). The Kaplan-Meier survival analysis revealed longer life expectancy in the CABG group (p = 0.029). [21]

PRACTICAL RECOMMENDATIONS

1. Revascularization should be performed in-time and without delay, taking into account the high mortality rate, the rate of complications and shorter life expectancy in patients with multivessel acute coronary heart disease and diabetes mellitus.

2. Based on the comparative outcomes of revascularization in patients with extracardiac arteriopathy, the CABG should considered the most appropriate.

3. As no difference in all-cause mortality and life expectancy was observed in patients acute ischemic heart disease and EF<35%, it is more appropriate to choose the PTCA in patients with potential for complete revascularization and low probability of recurrent revascularization.

4. Despite absence of difference in all-cause mortality, but higher rate of MACCE and recurrent revascularisations in the PTCA and CABG patients with acute coronary heart disease and hypertension, the CABG should be preferred in patients with higher probability of these complications. In patients at higher risk of stroke, the PTCA is more appropriate.

5. During unstable angina no difference was found between the CABG and PTCA groups of patients in relation to all-cause mortality and survival. For this reason, it is more appropriate to prefer the PTCA method in cases where the incidence of MACCE and recurrent revascularization is low, otherwise the CABG method is preferred.

6. In multivessel acute ischemic coronary heart disease without diabetes, it is more appropriate to choose CABG in cases when complete revascularisation with PTCA is not possible and when there is a higher probability of recurrent revascularization. However, in cases when the above-mentioned complications are less common and the risk of stroke is higher, it is more appropriate to give preference to the PTCA.

7. Taking into account the possible complications and life expectancy in multivessel acute coronary heart disease, the PTCA

should be preferred in female patients, while CABG - in male patients.

8. No difference was found between the PTCA and CABG groups in relation to all-cause deaths, rate of MACCE, and recurrent revascularisations in elderly patients (over 75 years of age). Life expectancy was longer in the CABG group. The appropriate revascularization method should be selected in elderly patients based on this and after taking into account all potential complications and life expectancy.

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List of abbreviations

ACS	–	acute coronary syndrome
CABG	–	coronary artery bypass graft surgery
COPD	–	chronic obstructive pulmonary disease
DM	–	diabetes mellitus
EF	–	ejection fraction
EA	–	extracardiac arteriopathy
ESC	–	European Society of Cardiology
IH D	–	Ischemic heart disease
ITA	–	internal thoracic artery
MR	–	myocardial revascularization
MACCE	–	*major cerebrovascular and cardiac adverse events*
PTCA	–	percutaneous transluminal coronary angioplasty
STEMI	–	ST elevation myocardial infarction
TIMI	–	Thrombolysis In Myocardial Infarction
UAP	–	unstable angina pectoris

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