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Results of CABG Surgeries on Working Heart in Patients with Coronary Artery Disease with Type II Diabetes Mellitus

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According to the World Health Organization (WHO), cardiovascular diseases (CVD) are the main cause of death worldwide at the present moment and over the last decade. WHO estimates that 7.4 millions of people died from coronary heart diseases in 2012, what is equal to 13.2% of all deaths in the world [1]. The part of deaths from CVD was equal to 66.3% from the quantity of total mortality in 2011 in Ukraine [2]. One of the main methods of the treatment of the most complicated severe coronary artery diseases is a surgery named coronary artery bypass grafting (CABG), which significantly improves the quality of patients' life's and make it longer [3, 4].

At the same time, there is some comorbidity which worsens the efficiency of CABG surgeries as a method of coronary artery disease treatment. The second type of diabetes mellitus (DM) is on the first place among these diseases. The number of patients with the second type of diabetes is about 15–50% among the total number of patients operated on CHD. The number is continuing to grow. [5]. The course of coronary atherosclerosis within patients with the second type of diabetes is more complicated than within patients with coronary artery disease without the concomitant second type of diabetes [6, 7]. Despite there are some significant achievements in the area of coronary surgery, the results of surgical treatment within patients with the concomitant second type of diabetes are significantly worse than within patients without concomitant diabetes. Postoperative mortality within patients with the second type of diabetes is several times higher than within patients without diabetes [8, 9]. Postoperative complications such as acute heart failure, intraoperative myocardial infarction, stroke, renal failure, septic complications occur very often within these patients [10].

That is why the study of aspects of the clinical features of coronary artery disease within patients with concomitant second type of diabetes, non-invasive and invasive examination of it, improving of surgical techniques and postoperative management of patients phased certainly is relevant and it has not only theoretical, but especially practical importance, because it can help to improve the effectiveness of CABG within patients with the concomitant second type diabetes.

The aim of the abstract is a comprehensive analysis of the immediate results of coronary bypass surgeries on a beating heart within patients with coronary artery disease and the concomitant second type of diabetes.

Materials and methods. The base of the research is the results of surgical treatments of 1312 patients with coronary heart disease in combination with the concomitant second type of diabetes, after made CABG surgeries in National Institute of CardioVascular Surgery of M.M. Amosov from 01 January 2005 to 31 December 2014. The control group included 6469 patients with coronary heart disease without concomitant diabetes who underwent CABG surgery in the same period.

There were special invasive and non-invasive tests conducted for all patients in addition to conventional clinical and laboratory methods during hospitalization. There were such compulsory parts of preoperative test as gastroscopy to identify ulcers and erosive changes in gastric mucosa and duodenal ulcers; the doppler ultrasound and duplex scanning of brachiocephalic arteries to

identify significant asymptomatic narrowing of the arteries and occlusions data; the doppler research of vessels of lower extremities.

Coronary bypass operations were performed through a median sternotomy on a beating heart. Internal thoracic artery grafts and autovenous transplantants were isolated based on methods adopted in the clinic. The main phase of the operation was performed using two traction sutures by internal mammary artery and compression type stabilizers.

The surgeries were conducted as in a planned manner as in immediate display.

By this time there is no evidence on the effect of glucose on the results of CABG within patients with concomitant second type diabetes. In this regard, we have developed the own sheet of perioperative data keeping within patients with coronary bypass surgeries.

The basis of the sheet was the strict adherence to the level of glucose in blood in perioperative period equal to 4.5–5.5 mmol/l. This was achieved by insulin injections during surgery, subcutaneous injections of insulin in the early postoperative period and course of oral hypoglycemic therapy in the recovery of enteral nutrition.

Results and discussion. There were 12.7% of patients on insulin therapy in the research group and 66.7% of patients got hypoglycemic agents. There were 66.2% of patients on regime and 21.1% of patients were ones with the newly diagnosed second type of diabetes. The level of glucose was stabilized prior the surgery within the majority of patients due to intensive hypoglycemic therapy and regime. However, 25.8% of patient had the uncompensated or subcompensated condition, what was the result of the lack of adequate treatment of diabetes. In addition, the diabetes was identified already in the our hospital within 3.3% of patients, what clarifies that there is insufficient diagnosis of the disease within the population.

The comparative analysis of preoperative characteristics of patients in both groups showed that there are no differences between various age groups. The number of patients over 60 years was almost the same (41.8% in the control group and 45.2% in the research group, $p>0.05$). As for gender differences within patients with coronary heart disease and the concomitant second type of diabetes, there were significantly more female patients (23.5% versus 12.5% in the control group, $p<0.05$). In addition, diabetes in our patients was associated with a number of conditions and diseases, among which revealed obesity (35.2% versus 9% in the control group, $p<0.05$), violations of peripheral blood (39.8% vs 22 9% in the control group, $p<0.05$), hypertension (87.8% versus 70.9% in the control group, $p<0,05$). The nature of angina patients with the second type of diabetes different from control group II-III functional class (FC) for the Canadian classification of angina (13.3% vs. 9.7% in FC II and 67.5% against 57.7% in III FC, $p<0.05$). Particular attention attracted more frequent form of silent myocardial ischemia within patients with concomitant diabetes (9.8% versus3.2% in the control group, $p<0.05$) and the presence of 2 or more IM history in the study group (20.9% vs. 15.5%, $p<0.05$). In terms of central hemodynamics and LV volumes according to echocardiography (echocardiography) groups did not differ. Ejection fraction <40% in the study group had 8.7% of patients versus 8.9% in the control group, $p>0.05$.

According to CVG within patients with concomitant diabetes it was observed more frequently triple vessel lesion of coronary artery (CA) 88.9% against 76.1% in the control group ($p<0,05$). There was also hurt of the left coronary artery >50% – 9 2% to 6,6% ($p>0,05$). The severity of coronary atherosclerosis was estimated number of affected diffusely spacecraft. According to CVG in patients with concomitant diabetes diffuse lesions observed in 31.4% versus 15.7% in the control group ($p<0.05$), while during operations such lesions detected in 69% of patients with concomitant diabetes. This indicates probability of significant underestimation of as the severity of coronary atherosclerosis in general, and the degree of atherosclerotic small lesion of in patients with DM by angiography.

In both groups, all CABG surgeries were performed on a beating heart.

When performing surgery using the principle of complete revascularization, which was achieved through the use of new, developed at the institute, methodologies coronary artery bypass surgery [11, 12]. Surgeries within patients with both second type of diabetes and without metabolic carbohydrates were held in most cases routinely – 94.5% vs. 93.9%, emergency operations were performed in 5.5% of patients with diabetes and in groups 6.1% of the control group, respectively. This suggests that the nature urgency of surgery groups did not differ in most cases for revascularization LAD used LIMA, great saphenous autovenous – for other arterial revascularization. A. mammaria in patients with diabetes used a half times more likely than those without diabetes, 74.2% versus 67.2% ($p<0.05$). Average number of distal anastomoses per patient was higher in patients with diabetes 3,3±1,0 3,1±1,0 vs patients without diabetes, corresponding to massive coronary bed in the main group.

Most in both groups performed coronary artery bypass surgery three (41.2% in the group with diabetes, and 38.7% – in the comparative group). The presence of calcification at the site of the distal anastomosis was observed almost two times more likely in patients with diabetes (8.6% vs. 5.6%, $p<0.05$). Implementation extended anastomosis observed also twice as likely in patients with diabetes (2.3% vs. 1.1%, $p<0.05$). The above data show that our proposed method can perform complete myocardial revascularization even when severe, diffusely affected complicated calcification of the wall of the spacecraft in patients with diabetes. The complexity and severity of surgical interventions in the treatment group were reflected in the intraoperative parameters. Thus, the duration of the operation in the group with diabetes was longer, 248,3±53,9 min. against 236,2±25,6 min., respectively – increased average blood loss of 100 ml (398,4±153,9 ml. vs. 292,2±67,3 ml in the control group), and a mechanical ventilation increased by an average of 30 minutes. (4,9±0,9 hod. Vs 4,5±0,9 hod.).

The applied method allows drug correction of glycemia keep blood glucose in the perioperative period within 4.5–5.5 mmol/l, which helped reduce the number of complications.

A statistically significant difference in the incidence of complications such as myocardial infarction (0.5% vs. 0.3%, $p>0.05$), neurological disorders (1.4% versus 0.9%, $p>0.05$) were found. In the early postoperative period in the group with diabetes more frequently than in the group without diabetes, observed: acute heart failure (6.5% vs. 1.7%, $p<0.05$); infectious complications (4.5% vs. 0.9%, $p<0.05$); occurrence of atrial fibrillation (25.7% vs. 19.8%, $p<0.05$). In the control group there were 43 fatal (0.7%), in patients with concomitant type 2 diabetes were 5 fatal ($p<0.05$) (table 1).

Table 1

Comparison of early postoperative period in patients with concomitant diabetes

Data	DM N=1312		Non DM N=6469		p
	n	%	n	%	
Acute heart failure	85	6,5	110	1,7	< 0.05
MI	6	0,5	19	0,3	> 0.05
Stroke	18	1,4	58	0,9	> 0.05
Atrial fibrillation	337	25,7	1281	19,8	< 0.05
Wound infection	59	4,5	58	0,9	< 0.05
Mortality	5	0,4	43	0,7	> 0.05

The results of operations convince us that the approach to surgical treatment of coronary artery disease within patients with diabetes provides good results.

Conclusions. If concomitant diabetes coronary lesion was significantly more complex than in patients without carbohydrate metabolism, making it difficult to perform coronary bypass surgery. Performing operations on a beating heart, developed and implemented techniques of different options autovenous bypass surgery and the use of the CAA, along with the strict observance of glycemic control protocol in the perioperative period, made it possible to reduce hospital mortality, and significantly reduce the number of postoperative complications.

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Результати операцій коронарного шунтування на працюючому серці у хворих ішемічною хворобою серця із супутнім цукровим діабетом 2 типу

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Представлені результати операцій ізольованого АКШ у 1312 хворих ІХС у поєднанні із супутнім ЦД 2 типу, виконаних з 2005 по 2014 р. в ДУ «НІССХ імені М.М. Амосова НАМН». Визначено, що хворі із супутнім ЦД 2 типу мають важчий передопераційний стан і достовірно складніші ураження коронарного русла, ніж пацієнти без ЦД, що ускладнює проведення операції АКШ.

Виконання операцій АКШ у пацієнтів із супутнім ЦД 2 типу на працюючому серці, застосування розроблених та удосконалених нами методик повної реваскуляризації поряд із суворим дотриманням нормоглікемії в періопераційному періоді дало змогу знизити госпітальну летальність і значно зменшити кількість післяопераційних ускладнень.

Ключові слова: *ішемічна хвороба серця, цукровий діабет 2 типу, коронарне шунтування.*

Результаты операций коронарного шунтирования на работающем сердце у больных ишемической болезнью сердца с сопутствующим сахарным диабетом 2 типа

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Представлены результаты операций изолированного АКШ у 1312 больных ИБС в сочетании с сопутствующим СД 2 типа, выполненных с 2005 по 2014 г. в ГУ «НИССХ имени Н.М. Амосова НАМН». Определено, что больные с сопутствующим СД 2 типа имеют более тяжелое предоперационное состояние и достоверно более сложные поражения коронарного русла, чем пациенты без СД, что затрудняет проведение операции АКШ.

Выполнение операций АКШ у пациентов с сопутствующим СД 2 типа на работающем сердце, применение разработанных и усовершенствованных нами методик полной реваскуляризации, наряду со строгим соблюдением нормогликемии в периоперационном периоде, позволило снизить госпитальную летальность и значительно уменьшить количество послеоперационных осложнений.

Ключевые слова: *ишемическая болезнь сердца, сахарный диабет 2 типа, коронарное шунтирование.*