**Long-term outcome of coronary artery bypass grafting in patients with left ventricular dysfunction**

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Coronary artery bypass grafting is one of the main treatments for patients with coronary artery disease (CAD) and severe left ventricular dysfunction. A limited number of books in modern literature, no completed randomized trials and high perioperative risk created considerable uncertainty about the optimal treatment strategy. This paper focuses on the results of surgical treatment of patients with CAD and severe left ventricular dysfunction.

**Keywords:** coronary heart disease, coronary bypass surgery, revascularization, viable myocardium, left ventricular ejection fraction.

**Background.**

Coronary artery bypass grafting (CABG) has been widely used for the treatment of patients with coronary artery disease. Patients with low ejection fraction (EF) are at a higher risk for postoperative complications and mortality.

**Objective.**

To evaluate long-term outcome of coronary artery bypass grafting in patients with coronary heart disease with severe left ventricular dysfunction.

**Materials and methods.**

Between 2008 and 2012, 129 patients who underwent isolated coronary artery bypass grafting using cardiopulmonary bypass and had a preoperative left ventricular ejection fraction less than or equal to 35% were included. Left ventricular ejection fraction was determined by echocardiography. Functional improvement was evaluated through echocardiography.  Patients were stratified into I of III groups: I Group - ≥ 30% of viable myocardium be SPECT scan (105 patients - CABG), II Group - < 30% of viable myocardium be SPECT scan (24 patients - CABG) and III Group (control) – medical treatment.

**Results.**

In-hospital mortality was significantly higher in Group II (12.5% versus 0.9% - I group; *P*<0.001). Group I experienced higher 3-years survival – 81%, group II – 8%, group III – 10%. The mean postoperative (3 years) LVEF improved significantly in I group, from 32.7% to 44.3% (p<0.05), and the New York Heart Association (NYHA) classification was improved in most patients (3,3 ± 0,1 to 1,7 ± 0,1, p < 0.05). The mean postoperative (3 years) LVEF not significantly changed in II group, from 28% to 29% (p > 0.05), NYHA not significantly changed (3,6 ± 0,1 to 3,5 ± 0,2, p > 0.05).

**Conclusions.**

1.Patients with more than 30% viable myocardium have good and satisfactory three-year results of coronary bypass surgery, namely the reduction of symptoms of angina, heart failure, and high three-year survival rate. These patients indicate coronary bypass surgery.

2.Patients with the number of viable myocardium at least 30% have three years poor results, even worse than the medication, high postoperative mortality, low survival rate. These patients need drug therapy and heart transplantation.

Heart failure (HF) is a major cause of morbidity and mortality among heart disease and is considered a leading public health problem. The prevalence of heart failure in the adult population in Ukraine is 1.5 - 3%, and among people over 65 years 6 - 10%. It is expected that in the next 20 - 30 years the prevalence of heart failure will increase by 40 - 60% [1]. In older age groups, especially women, life expectancy with heart failure is very low [8]. The basis of heart failure - is left ventricular systolic dysfunction (LV). In developed countries, the main cause of dysfunction is coronary heart disease (CHD) [3]. The main methods of treatment of ischemic heart failure is a medical therapy, revascularization and heart transplantation. Despite therapeutic advances, the results of drug therapy in severe heart failure remains poor [3]. Unfortunately, heart transplantation at the time due to lack of donor organs, and can not be the main treatment. A potential benefits of revascularization should be evaluated in conjunction with high perioperative risk.

Recent advances in cardiovascular surgery can successfully carry out surgical treatment of such patients. In studies of foreign authors, some patients with severe ischemic left ventricular dysfunction, the positive effect provides complete revascularization, as a result of which was observed a significant increase in LVEF, get better general clinical symptoms and decreased the symptoms of heart failure [1,5,6,7].

However, in a number of other studies observed that even after a similar surgery, 2-year survival of these patients is only 20-30% [2,4,7].

Thus, at present unresolved question of whether coronary bypass surgery in patients with coronary artery disease with low ejection fraction and a significant increase in the volume of the left ventricle. The categorization of these patients will help get the best results from surgery.

**Objective.**

To evaluate long-term outcome of coronary artery bypass grafting in patients with coronary heart disease with severe left ventricular dysfunction.

**Materials and methods.**

The object of our study were patients with coronary artery disease and left ventricular ejection fraction ≤35%, who underwent isolated coronary artery bypass grafting between 2008 to 2012 in the "Institute of Heart Health Ministry of Ukraine." To assess preoperative patient characteristics and outcomes of surgical treatment were used general clinical, laboratory methods, non-invasive instrumental investigation (ECG, echocardiography, single-photon emission computed tomography), invasive instrumental methods of examination (coronarography) and statistical methods. All patients were divided into three groups. The first and second group (129 patients) - all patients who underwent coronary artery bypass grafting, the third group (50 patients) - treated with medication. In the first group included 105 patients who had 30% or more of viable myocardium in the second group - 24 patients who had viable myocardium was less than 30% according to SPECT.

**Table 1.**

**Characteristics of patients**

|  |  |  |  |
| --- | --- | --- | --- |
| Indicators | Group 1  (N=105) | Group 2  (N=24) | Group 3  (N=50) |
| The average age, y | 62,2±6,2 | 63±5,9 | 62,9±7,5 |
| Males | 91 (87%) | 20 (83%) | 46 (92%) |
| EF, % | 32,7 ± 3 | 29,6 ± 4,4 | 28 ± 5,8 |
| NYHA | 3,3 ± 0,5 | 3,6 ± 0,5 | 3,4±0,49 |
| EDV, ml | 179,1±34,5 | 201,3±36,5 | 191,2 ± 44,2 |
| EDI, ml/m2 | 92,4 ± 17,7 | 99,7 ± 18,4 | 98 ± 25,4 |
| SI, l/(min×m2) | 2,1 ± 0,2 | 2 ± 0,2 | 2 ± 0,3 |
| Myocardial infarction | 88 (84%) | 19 (79%) | 40 (80%) |
| Hypertension | 98 (93%) | 23 (96%) | 40 (80%) |
| Cerebrovascular accidences | 15 (14%) | 3 (13%) | 8 (16%) |
| Diabetes | 32 (30%) | 11 (46%) | 12 (24%) |
| Atherosclerosis of peripheral arteries | 26 (25%) | 8 (33%) | 13 (26%) |
| Pulmonary diseases | 9 (9%) | 6 (25%) | 4 (8%) |
| Kidney diseases | 24 (23%) | 8 (33%) | 15 (30%) |

Preoperative characteristics of patients is shown in Table 1. In all three patient groups did not differ significantly by age, gender, functional status and presence of comorbidities.

**Results and discussion.**

Dynamics of average echocardiography indicators for surgery, and during the next three years is shown in Figures 1 and 2.

In patients (group 1), 30% had ˃ viable myocardial contractile function indices improved after surgery. Mortality was 0.9% (1 patient - death from acute cerebrovascular accident). In patients (group 2) had <30% viable myocardium result was unsatisfactory. Indicators contractility worse than drug treatment group (Group 3). Postoperative mortality in group 2 was 12.5% ​​(3 patients - all died of acute heart failure).

**Fig. 1. Dynamics of EF LV.**

**Fig. 2. Dynamics of EDV LV.**

Mean functional class in group I was significantly increased from 3,3 ± 0,1 to 1,7 ± 0,1, p <0.05. Thus, in Group I if the majority of patients (96.2%) before surgery was in FC III-IV, the three years after the operation - in I-II FC (80%).

The average value of functional class II in the group three years increased from 3,6 ± 0,1 to 3,5 ± 0,2, p> 0.05. So the symptoms of heart failure patients in Group II were not significantly changed.

We observed a long-term improvement of myocardial contractile function within 12-18 months after surgery in patients with viable myocardium> 30%.



Month

Survival (%)

Group

**Fig. 3. The three-year survival of patients.**

Survival of patients of all groups is shown in Figure 3. The best 3 - year survival seeing patients in the first group (patients with viable myocardium> 30%) - 81%. The worst survival rate in the second group (<30% viable myocardium) - 8%. The third group (medication) - 10%.

Among the long-term results of operations allocated good, satisfactory and unsatisfactory.

Good three-year results of surgery were observed only in the group and in 55.2% (58 patients) cases. With good results of surgical treatment of coronary artery disease with reduced left ventricular ejection fraction was observed positive dynamics of basic clinical indicators, indicating the normalization of blood flow, positive trend in heart size and increased LV ejection fraction at echocardiography.

Satisfactory results dominated and groups - 16.2% (17 patients) versus 8.3% (2 patients) cases in group II. If satisfactory results surgery experienced a steady improvement of the clinical condition of the patient, but according to echocardiography significant changes have occurred.

In poorly estimated three-year results of 91.7% (22 patients) patients in group II and 28.6% (30 patients) and cases in the group. Unsatisfactory results of surgical treatment were characterized by the lack of significant effect of the transaction (the clinical condition of these patients remained unchanged or deteriorated, echocardiographic or no change was negative dynamics) or lethal outcome.

Despite the fact that coronary bypass surgery can provide long-term good results even without restoring contractility by preventing further deterioration of the function of heart attacks, progressive LV remodeling, sudden coronary death [9], determining the presence and amount of viable myocardium reduce perioperative risk in its will decrease mortality.

**Conclusions.**

1.Patients with more than 30% viable myocardium have good and satisfactory three-year results of coronary bypass surgery, namely the reduction of symptoms of angina, heart failure, and high three-year survival rate. These patients indicate coronary bypass surgery.

2.Patients with the number of viable myocardium at least 30% have three years poor results, even worse than the medication, high postoperative mortality, low survival rate. These patients need drug therapy and heart transplantation.

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