

ESTIMATION OF THE RESULTS OF MYOCARDIAL REVASCULARIZATION ON BEATING HEART AT THE DIFFERENT COMPLICATED FORMS OF ISCHEMIC HEART DISEASE

¹Kh.G. KHALIKULOV, ²A.A. MANSUROV, ³U.B. AKHMEDOV, ⁴O.E. ILKHOMOV,
⁵S.S. MURTAZAEV, ⁶S.A. BABADJANOV

¹PhD, Senior Researcher, Department of Surgery of IHD and its Complications, State Institution RSSPMCS, Republican Specialized Scientific Practical Medical Center of Surgery, Named After Academician V. Vakhidov, Tashkent, Uzbekistan.

²DSc, Head of the Department of Surgery of IHD and its Complications, State Institution RSSPMCS named after Academician V. Vakhidov, Tashkent, Uzbekistan

³DSc, Chief Researcher, Department of Surgery of IHD and its Complications, State Institution RSSPMCS named after Academician V. Vakhidov, Tashkent, Uzbekistan

⁴Junior Researcher, Department of Surgery of IHD and its Complications, State Institution RSSPMCS named after Academician V. Vakhidov, Tashkent, Uzbekistan

⁵Junior Researcher, Department of Surgery of IHD and its Complications, State Institution RSSPMCS named after academician V. Vakhidov, Tashkent, Uzbekistan

⁶PhD, Senior Researcher, Department of Endovascular surgery, State Institution RSSPMCS named after academician V. Vakhidov, Tashkent, Uzbekistan

¹hg27@mail.ru, ²mansurov_aa@mail.ru, ³makesha71@mail.ru, ⁴cs_oybek@mail.ru, ⁵mss197402@rambler.ru
⁶doctorsanjar@mail.ru

ABSTRACT

Objective: estimation of beating heart coronary bypass operations at patients with the ischemic heart disease and its complicated forms and comparative estimation of its results with the operations performed by using cardiopulmonary bypass.

Material and methods. We have analyzed 280 patients with the ischemic heart disease and its complicated forms. These patients were divided into two groups: first group – 142 patients who undergone On-Pump coronary bypass surgery and second group – 138 patients whom performed Off-Pump coronary revascularization. The inclusion criteria were following: patients with ischemic heart disease with its complicated forms, like as, decreased contractility of myocardium, left ventricle aneurysm, ischemic mitral insufficiency.

Results. In all cases were performed coronary bypass grafting operations. 142 patients undergone coronary bypass grafting operation with the use of cardiopulmonary bypass and the rest 138 cases were performed on the beating heart. We have estimated the frequency of perioperative myocardial infarction, stroke and the clinical data of all operated patients.

Conclusion. Coronary bypass grafting operations at the patients with the ischemic heart disease and its complicated forms shows good results at the short-term postoperative follow up, which can lead to the improvement of quality of life. At the presence complications such as calcified lesions of aorta, it is better to perform coronary bypass grafting on beating heart with the use No-Touch Aorta technique, by the meaning of the minimization of various neurologic complications.

KEY WORDS: ischemic heart disease, complicated forms, surgical treatment.

INTRODUCTION

The current state of treatment of coronary heart disease with therapeutic and surgical methods shows good results, but despite this, the growth of patients with its complicated forms is noted [12].

To date, invasive interventions that provide stable favorable results of these types of treatment remain effective treatment methods [1, 7, 10].

More than ¾ patients who undergo coronary bypass surgery suffer from complicated forms of coronary artery disease [3, 5, 18]. The complicated forms of coronary heart disease include post-infarction heart failure (CHF) with severe myocardial dysfunction, left ventricular aneurysm, widespread atherosclerosis with multivascular lesions of coronary vessels, mitral valve lesions, rhythm and conduction disorders [2, 4, 19].

Today, complications of acute myocardial infarction such as left ventricular aneurysm, post-infarction defect of the interventricular septum and mitral insufficiency are of particular difficulty. Coronary mitral insufficiency develops in approximately one fifth of patients after acute myocardial infarction (AMI) and in half with congestive heart failure. Being a serious disease with an unfavorable prognosis, a medical device doubles mortality after myocardial infarction and heart failure [4, 6].

To date, indications for surgical treatment of medical devices are determined by LV contractile function and the degree of MK failure. The tactics of the coronary arteries does not differ from those with isolated coronary lesions.

The most common opinion is that in the absence of structural anomalies and grade I medical devices, surgical intervention on the mitral valve is usually not shown, and grade III and IV mitral insufficiency requires surgical correction of mitral defect simultaneously with coronary artery bypass grafting [4, 6]. However, there is still no clear definition of indications for surgery on MK during coronary artery bypass grafting (CABG) and the presence of grade II MN. Opinions on this subject are controversial and remain controversial [4, 17]. On the one hand, an increase in the volume of surgery, the duration of cardiopulmonary bypass (IR) and myocardial ischemia increase the risk of intervention. On the other hand, an uncorrected medical device is one of the reasons for the progression of heart failure in the long-term postoperative period [4, 16].

Surgical intervention in such patients may in itself turn out to be the cause of serious complications, which in some cases lead to death [2, 11].

Based on the foregoing, it can be noted that invasive treatment of coronary heart disease with its complicated forms is still a difficult task. A modern approach to the treatment of coronary heart disease, such as correction by therapeutic and surgical routes, allows to improve the prognosis of treatment of this patient population.

In patients with reduced myocardial contractility, coronary bypass surgery has advantages over drug therapy in long-term follow-ups. [13, 14]

The operation of direct myocardial revascularization in patients with reduced contractile ability of the myocardium is associated with high mortality and morbidity rates [2, 8, 14].

The issue of surgical treatment of this pathology is still being debated around the world. Most surgeons use standard methods of surgical treatment of coronary heart disease using standard cardioplegic solutions, considering this the most reliable way to maintain the necessary myocardial ischemia. In approximately 10% of all cases of surgical correction of coronary heart disease, low cardiac output syndrome is noted, regardless of the chosen solution for cardioplegia [9, 10, 15, 19].

The latest trend in coronary surgery shows that there has been increased interest in performing coronary artery bypass surgery without the use of cardiopulmonary bypass in order to reduce the negative effects of the latter on general myocardial ischemia. Comparative results of coronary artery bypass surgery performed on a working heart compared with operations performed using cardiopulmonary bypass in patients with reduced contractile ability of the myocardium demonstrate better results in the early postoperative period [15].

Recently, coronary artery bypass surgery is increasingly performed in patients with diffuse coronary artery disease using composite bypass surgery. For this reason, it is relevant to compare the initial state of patients with the results of their treatment, as well as the study of various approaches in the formation of anastomoses of such patients.

The purpose of our study is to evaluate the effectiveness of coronary artery bypass surgery (CABG) on a working heart in patients with complicated forms of coronary heart disease and a comparative assessment with the results of operations under extracorporeal circulation.

MATERIALS AND METHODS

The study group included 280 patients with coronary artery disease with various complicated forms. Patients were divided into two groups: group 1 - 142 patients who underwent coronary artery bypass grafting using cardiopulmonary bypass (On-Pump), group 2 - 138 patients who underwent coronary artery bypass grafting with a working heart (Off-Pump). All patients underwent general clinical and instrumental research methods, including ECG, echocardiography, coronary ventriculography.

General information of patients of both groups are given in table 1. There was no significant difference among the groups by age, gender and angina pectoris of a high functional class.

Table 1. General characteristics of patients in both groups.

| № | Indicators | 1-group On-Pump (142) | 2- group Off-Pump (138) |
|----------|--|--------------------------------------|--|
| 1 | The average age, years. | 59,4±4,3 | 60,8±3,45 |
| 2 | Male gender n, (%) | 124 (84,5) | 123 (89,1) |
| 3 | Angina pectoris FC III - IV n, (%) | 106 (74,6) | 113 (81,9) |
| 4 | Unstable angina n, (%) | 25 (17,6) | 24 (17,4) |
| 5 | AMI in the history n, (%) | 118 (83,1) | 121 (87,7) |
| 6 | FC III-IV according to NYHA n, (%) | 126 (88,7) | 124 (89,9) |
| 7 | Heart rhythm disturbances n, (%) * | 17 (12) | 3 (2,2) |
| 8 | Type II diabetes mellitus n, (%) | 76 (53,5) | 64 (46,8) |
| 9 | Hemodynamic significant lesions of the carotid arteries n, (%) * | 18 (12,7) | 32(23,2) |

* - p <0.05

Patients with angina pectoris included in the study are predominantly III-IV functional class in both groups. The remaining patients had unstable angina. Before surgical treatment, the most common complication of coronary heart disease was heart failure; in most patients, it corresponded to NYHA FC III-IV (88.7% and 89.9%, respectively). The vast majority of patients (85.4%) had a history of MI. Rhythm disturbances were observed in 7.15% of patients. Type II diabetes

mellitus occurred in 76 (53.5%) patients in the first group and in 64 (46.8%) patients in the second group, and in half of them it was combined with obesity. Patients with hemodynamic stenosis of the brachycephalic arteries in 18 (12.7%) in the first group and in 32 (23.2%) in the second group and more than 60% of them had a history of stroke and TIA.

The results of echocardiography are presented in table No. 2.

Table 2. Echocardiograms in patients before surgical treatment

| № | Indicators | 1st group | 2nd group |
|----------|---|-----------------------------|-----------------------------|
| 1 | The final diastolic volume of the left ventricle, ml | 183,5±12,3 | 191.7±14.2 |
| 2 | LVEF,% | 42,8±4,9 | 43,6±6,1 |
| 3 | EF<35% n, (%) | 67 (47,2) | 56 (40,6) |
| 4 | Calcification of the ascending aorta, n, (%) * | 2 (1,4) | 13 (9,4) |
| 5 | Moderate ischemic mitral regurgitation (2 nd stage) n, (%) | 35 (24,6) | 28 (20,3) |
| 6 | LV aneurysm, without thrombus n, (%) | 53 (37,3) | 64(46,4) |
| 7 | LV aneurysm with a fixed, parietal thrombus n, (%) * | 19 (13,4) | 2 (1,5) |
| 8 | LV aneurysm with loose thrombosis n, (%) * | 35 (26,6) | 9 (6,5) |
| 9 | Chronic rupture of the interventricular septum | 2 (1,4) | - |

* - p <0.05

As can be seen from table No. 2, aneurysm of the left ventricle (ALV) without a thrombus was observed in 53 and 64 patients, respectively, in both groups. In our study, these patients are conditionally divided into 2 groups, on the basis of which the tactics of surgical treatment were decided: ALV without a thrombus and ALV with a thrombus. In cases of

detecting ALV without a thrombus, an operation was performed on isolated coronary artery bypass grafting on a working heart or in conditions of parallel cardiopulmonary bypass.

The study included patients with ischemic mitral insufficiency of the 2nd degree, these patients also underwent isolated CABG without correction of

valvular pathology, subsequently, in long-term periods the dynamics of changes in valvular pathology in this category of patients was evaluated.

Two patients of the first group had a chronic rupture of the interventricular septum, correction of this complication was carried out.

The results of the study according to coronarography are presented in table No. 3.

Table 3. The severity of coronary artery lesions in the examined patients before surgical treatment (n/%)

| № | Results of coronagraphy | 1 st group | | 2 nd group | |
|----------|----------------------------------|-----------------------|--------------|-----------------------|-------------|
| | | n | % | n | % |
| 1 | trisovascular lesion and more | 94 | 66,2% | 86 | 62,3% |
| 2 | bivascular lesion | 34 | 24% | 42 | 30,4% |
| 3 | stem lesion * | 28 | 19,7% | 6 | 4,3% |
| 4 | Type of blood supply | | | | |
| | - right | 102 | 71,7% | 98 | 71% |
| | - left | 18 | 12,7% | 23 | 16,7% |
| | - balanced | 22 | 15,6% | 17 | 12,3% |
| 5 | The number of occluded vessels * | 98 | 69% | 103 | 74,6% |

* - p <0.05

As can be seen from table 3, in both groups according to the severity of the defeat of the CA significant differences were not noted. More than 60% of both groups had a multivascular lesion, indicating a severe lesion in patients with coronary artery disease included in this study.

cardiopulmonary bypass and 138 cases with a working heart.

We studied the frequency of perioperative myocardial infarction (MI), acute cerebrovascular accident (stroke) and the clinical parameters of patients in the immediate follow-up period.

The nature of the operations performed is shown in table 4.

RESULTS

All patients in both groups underwent coronary artery bypass grafting, of which 142 cases using

Table 4. The characteristic of intraoperative indicators.

| № | Parameters | 1 st group (n=142) | | 2 nd group (n=138) | |
|---|---|-------------------------------|--------------|-------------------------------|--------------|
| | | n | % | n | % |
| 1 | Surgical scope | | | | |
| | - 4 shunts | 17 | 12% | - | |
| | - 3 shunts | 48 | 33,8% | 39 | 28,3% |
| | - 2 shunts | 37 | 26% | 56 | 40,6% |
| | - 1 shunt | 40 | 28,2% | 43 | 31,1% |
| 2 | Using the left inner thoracic artery | 141 | 99,3% | 138 | 100% |
| 3 | Completeness of revascularization * | | | | |
| | - full | 118 | 83,1% | 106 | 76,8% |
| | - incomplete | 24 | 16,9% | 32 | 23,2% |
| 4 | Surgical intervention with minotom access * | 3 | 2,1% | 12 | 8,7% |
| 5 | CABG + LV thrombectomy, LV aneurysm | 37 | 26% | - | |
| 6 | Using the No-Touch Aorta technique, (%) * | 2 | 1,4% | 14 | 10,1% |
| 7 | CABG + aneurysm plastic + restrictive annuloplasty | 12 | 8,45% | | |

| | | | | | |
|-----------|--|----------------------|------|-------------------|--|
| | MR with reinforcement with a rigid support ring * | | | - | |
| 8 | Ventricular septal rupture plastic | 2 | 1,4% | - | |
| 9 | Duration of operation, min * | 220,6±18,6 | | 168,7±16,4 | |
| 10 | The average time of cardiopulmonary bypass * | 98,6±19,3 мин | | - | |

* - p <0.05

In both groups, in more than 60% of cases, the bypass of 2 and 3 coronary arteries was mainly performed. The most complete shunting was performed in the group using cardiopulmonary bypass (83.1% versus 76.8%, respectively, of both groups). Twelve patients of the second group underwent coronary artery bypass grafting of one or two coronary arteries from the minotomal access (lower L-shaped mininotomy). In the first group, mininotomy was performed in 3 patients with ALV; in these patients, the connection to the heart-lung machinewas performed through the femoral artery and vein, then one of the coronary arteries with aneurysmoplasty was bypassed. Due to the presence of pronounced ascending aortic calcification, proximal anastomoses were sutured to the left mammary artery (1.4% and 14%, respectively), which allowed to reduce neurological complications associated with brain damage in the postoperative period. In 26% of cases in the first group, CS was performed with thrombectomy

from the LV and LV aneurysm, due to the large size of the aneurysm with the presence of fresh blood clots. During intraoperative echocardiography in 12 patients of the first group, an increase in the degree of mitral insufficiency was revealed, and therefore mitral valve insufficiency was corrected.

Immediately in the early postoperative period, AMI was observed in 1.4% and 2.2% of cases, respectively, in both groups of patients. On 1 day after surgery, two patients of the first group developed acute myocardial infarction, the reason was a severe diffuse lesion of all epicardial vessels. The reason for the development of acute myocardial infarction after surgery in the second group was the initial unstable condition of the patients. Patients had a lesion of the LCA trunk, ACS clinic, and therefore were operated on an emergency basis.

The data of the immediate results of the operation are given in table No. 5.

Table 5. Immediate results

| № | Indicators | 1 st group | 2 nd group |
|----------|--|-----------------------|-----------------------|
| 1 | Perioperative myocardial infarction n, (%) | 2 (1,4) | 3 (2,2) |
| 2 | Intraoperative mortality n, (%) | 0 (0) | 0 (0) |
| 3 | Average duration of mechanical ventilation, hour * | 7,6±2,2 | 3,6±0,8 |
| 4 | Average stay in the intensive care unit, hour * | 27,3±3,4 | 18,9±2,4 |
| 5 | The rate of drainage losses (1 day) ml / kg * | 4,3±0,7 | 2,7±0,5 |
| 6 | Inotropic support n, (%) * | 98 (69) | 62 (44,9) |
| 7 | Cerebral complication n, (%) | 3 (2,8) | 3 (2,2) |
| 8 | Hospital mortality | 0 (0) | 0 (0) |

* - p <0.05

As can be seen from the table, in the group of patients who underwent surgery on a working heart, the average period of stay in the intensive care unit and on mechanical ventilation was much lower in comparison with patients of the second group. Surgery on a working heart under conditions of parallel IR was performed in 16.2% of cases of the first group. Inotropic support was needed by 45 (62.5%) patients of the first group and 18 (24.6%) patients of the second group. Neurological complications were observed only in the 1st group in 3 (2.8%) patients, in the form of transient disorders of

cerebral circulation. Hospital mortality was not observed in both groups.

CONCLUSION

CABG operations in patients with coronary artery disease with complicated forms show good results in the near postoperative period, allowing to improve the quality of life of the patient. With diffuse lesions of the coronary arteries, it is also possible to perform myocardial revascularization without cardiopulmonary bypass. The use of composite bypass

surgery is justified in patients with diffuse lesions of the coronary arteries; it is a safe and preferred technique in this category of patients. In patients with LV aneurysm without a blood clot with a mixed type, CABG can be performed on a working heart without correction of LV aneurysms.

In patients with coronary artery disease with moderate ischemic mitral regurgitation, it is possible to perform an operation of isolated coronary artery bypass grafting on a working heart, since its immediate results did not significantly differ from those in operations using IR.

In the presence of complicated forms of coronary heart disease such as calcified aortic lesions, it is preferable to perform CS operations on a working heart using the No-Touch Aorta technique to minimize the risk of various neurological complications.

REFERENCES

1. Akchurin P.C., Shiryayev A.A., Galyautdinov D.M. Indications for coronary bypass surgery in patients with different course of coronary artery disease. *Cardiology*. - 2002. No. 19. - S.
2. Belenkov Yu.N., Mareev V.Yu., Ageev F.T. Endothelial dysfunction in heart failure: treatment options with angiotensin-converting enzyme inhibitors. *Cardiology*. 2001. - T. 41, No. 5. - S. 100-104.
3. Ivanova, I.A. The state of endothelial function in patients with coronary heart disease after coronary artery bypass grafting: abstract. *dis. Cand. honey. Sciences: St. Petersburg*, 2005 .-- 26 p.
4. Nazyrov F.G., Aliev Sh.M., Ilkhomov O.E., Sharapov N.U. Modern methods of diagnosis and surgical treatment of patients with ischemic mitral regurgitation. *Surgery of Uzbekistan*, 2016, No. 4: - P. 63-68
5. Pataraya S. A., Preobrazhensky D. V., Sidorenko B. A. et al. Biochemistry and physiology of the endothelin family // *Cardiology*. 2000. - T. 40, No. 6. -C. 78-85.
6. Sukhanov S.G., Chragyan V.A., Harutyunyan V.B. Principles of Diagnosis and Surgical Treatment of Ischemic Mitral Insufficiency // *Bulletin of the NCCSSH im. A.N. Bakuleva RAMS*, Volume 16, No. 6, 2015: 41–48.
7. Allman K. C. et al. Myocardial viability testing and impact of revascularization on prognosis in patients with coronary artery disease and left ventricular dysfunction: a meta-analysis. *J. Am. Coll. Cardiol.* - 2002. - Vol. 39. - R. 1151–1158 doi: 10.1016 / s0735-1097 (02) 01726-6
8. Filsoufi F., Rahmanian P.B., Castillo J.G. et al. Diabetes is not a risk factor for hospital mortality

- following contemporary artery bypass grafting. *Interact CardioVasc Thorac Surg* 2007; 753-758 doi: 10.1510 / icvts.2007.158709
9. Flack J. E. et al. Does cardioplegia type affect outcome and survival in patients with advanced left ventricular dysfunction? Results from the CABG Patch Trial. *Circulation*. - 2000. - Vol. 102. - R. III84 — III89 doi: 10.1161 / 01.cir.102.suppl_3.iii-84
10. Gheorghide M., Teerlink J.R. Pharmacology of new agents for acute heart failure syndromes // *Am. J. Cardiol*. 2005. -Vol. 96-P. 68G-73G. doi: 10.1016 / j.amjcard.2005.07.023
11. Hoare G.S., Birks E.J., Bowles C. et al. In vitro endothelial cell activation and inflammatory responses in endstage heart failure. *J. Appl. Physiol*. 2005.-Vol. 101-P. 1466-1473. doi.org/10.1152/jappphysiol.01497.2005
12. McMurray J. J., Stewart S. Epidemiology, aetiology and prognosis of heart failure. *Heart* - 2000. - Vol. 83. - R. 596-602. doi: 10.1136 / heart.83.5.596
13. Nicolini F. et al. Myocardial protection in adult cardiac surgery: current options and future challenges. *Eur. J. Cardiothorac. Surg.* - 2003. - Vol. 24. - R. 986–993 doi: 10.1016 / s1010-7940 (03) 00475-5
14. Palmer Y., Herbert M.A., Prince L. et al. Coronary revascularization (CARE) registry: An observational study of on pump and off-pump coronary artery revascularization // *Ann. Thorac. Surg*. 2007. - Vol. 83. - P. 986-992. doi: 10.1016 / j.athoracsur.200.10.10.057
15. Selvanayagam J. B. et al. Effects of off-pump versus on-pump coronary surgery on reversible and irreversible myocardial injury: a randomized trial using cardiovascular magnetic resonance imaging and biochemical markers. *Circulation*. - 2004. - Vol. 109. - R. 345-350 doi: 10.1161 / 01.CIR.0000109489.71945.BD
16. Shumavets V., Ostrovski Y., Shket A. et al. Should moderate ischaemic mitral regurgitation be corrected at the time of coronary artery bypass grafting? Answer from a 10-year follow-up // *Interactive CardioVascular and Thoracic Surgery*.— 2012.— Vol. 15 (Suppl. 2) .— S. 86. doi: 10.1186 / s13019-016-0536-6
17. Smith P.K., Puskas J.D., et al. Surgical Treatment of Moderate Ischemic Mitral Regurgitation // *The New England Journal of Medicine*— 2015.— Vol. 10.— R. 2178–2188. doi: 10.1056 / NEJMoa1410490
18. Topkara V. K. et al. Coronary artery bypass grafting in patients with low ejection fraction // *Circulation*. - 2005. - Vol. 112. - R. 1344-350 doi: 10.1161 / CIRCULATIONAHA.104.526277
19. Yang Z., Ming X.F. Recent advances in understanding endothelial dysfunction in

atherosclerosis. Clin. Med. Res. 2006. - Vol. 4, N 1. - P.
53-65. doi: 10.3121 / cmr. 4.1.53