Еще одним из преимуществ выбранного анестезиологического пособия является возможность обеспечения эффективного обезболивания на протяжении всего раннего послеоперационного периода. Пациенты отмечали эмоциональный и физический комфорт, имели возможность глубоко дышать и адекватно кашлять, активно двигаться и рано вставать. На таком фоне у больных не наблюдались выраженные функциональные моторные расстройства кишечника. Со вторых суток после операции таким пациентам разрешали пить воду. К началу третьих суток больные начинали принимать через рот питательные смеси в должных количествах, поддерживающих суточную потребность в воде, электролитах, частично в энергетических и пластических ингредиентах. К этому времени пациенты находились в профильном отделении и полностью обслуживали себя.

В целом анестезия была адекватной и управляемой во всех клинических наблюдениях. Пробуждение проходило быстро и гладко. Продленную ИВЛ проводили только у 6,1 % больных. Посленаркозный озноб наблюдали в 21,5 % случаев. Течение раннего послеоперационного периода было гладким. В дополнительном однократном обезболивании нестероидными противовоспалительными средствами нуждались 30 (24,5 %) пациентов. Осложнений, связанных с анестезией, не было.

**Выводы**

1. При проведении оперативных вмешательств по поводу опухолей прямой кишки предпочтительным методом анестезиологического обеспечения является сочетанная анестезия.

2. Сочетание ингаляционной и эпидуральной анестезии позволяет значительно снизить дозировку опиатов, анестетиков, миорелаксантов; сократить продолжительность наркоза, обеспечить адекватное обезболивание и уменьшить частоту осложнений в послеоперационном периоде.

3. Сочетанная анестезия хорошо управляема и надежна в онкопроктологической практике.

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# PREOPERATIVE VARIATIONS ASSESSMENT IN PATIENTS WITH LOW EJECTION FRACTION

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**PREOPERATIVE VARIATIONS ASSESSMENT IN PATIENTS WITH LOW EJECTION FRACTION**

**Purpose:** preoperative assessment optimization for coronary artery bypass grafting surgery in patients with multifocal atherosclerosis with an initially low left ventricle ejection fraction.

**Materials and methods:** double blind randomized study of 91 males (59.6± ±14.6) years of age with multifocal atherosclerosis suffering from coronary artery diseases with an initially low left ventricle ejection fraction (< 42%). Intraaortic counterpulsation (n=28), dobutamine (n=19), levosimendan (n=33) the control group with placebo (n=11) in a background therapy were used in the preoperative assessment for an elective coronary artery bypass grafting surgery. The assessment efficiency was compared by the central and intracardiac hemodynamics parameters, the hydrodynamics status on the basis of the transpulmonary thermodilution and ultrasonic echocardiography with pulsed wave Doppler data and by the obtained clinical results.

**Results.** The benefits of the levosimendan administration were verified by the extravascular lung water indicators, the diastolic myocardial function improvement, reduced manifestations frequency of postoperative multiple organ dysfunction, reduced admission time in the ICU for survived patients, a relative decline in the mortality rate.

**Conclusions.** The results obtained suggest that the levosimendan administration for the preoperative assessment in patients with multifocal atherosclerosis and relative contraindications for the IABP placement, helps to improve the central hemodynamics parameters, reduce the severe diastolic dysfunction, without changes in the hydrodynamics, reduce the organ dysfunction frequency, to reduce the ICU time admission.

**Key words:** coronary bypass grafting surgery, levosimendan, low ejection fraction, multifocal atherosclerosis.

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**ВАРИАНТЫ ПРЕДОПЕРАЦИОННОЙ ПОДГОТОВКИ ПАЦИЕНТОВ С НИЗКОЙ ФРАКЦИЕЙ ИЗГНАНИЯ**

Показаны преимущества применения левосимендана по параметрам внутрилегочной гидратации, улучшению диастолической функции миокарда, снижению частоты проявлений послеоперационных органных дисфункций, сокращению длительности наблюдения в реанимации для выживших пациентов при относительном снижении летальности. Полученные результаты позволяют предполагать, что левосимендан в предоперационной подготовке у пациентов с мультифокальным атеросклерозом и относительными противопоказаниями для проведения внутриаортальной контрпульсации улучшает параметры центральной гемодинамики при снижении диастолической дисфункции (без изменений в гидродинамике), снижает частоту послеоперационной полиорганной недостаточности при сокращении времени пребывания в реанимационной палате.

**Ключевые слова:** аортокоронарное шунтирование, левосимендан, низкая фракция изгнания, мультифокальный атеросклероз.

## Background

There are 7–22% of patients with coronary artery disease (CAD) with coronary and arterial basins lesions according to the various authors' research results, who have a need for an elective surgery — coronary artery bypass grafting (CABG) [4]; 42% of whom has clinically significant lesions of extracranial arteries, 12% — infrarenal aorta lesions and lower extremity arteries lesions according to our clinics data. Herewith, 5.8% of patients had multifocal lesions associated with the chronic heart failure with low left ventricle ejection fraction (LVEF). A low EF is an independent risk factor for unfavorable prognosis in patients undergoing CABG surgery [8]. There are several approaches to this problem solving: an intraaortic balloon pump counterpulsation (IABP) placement and pharmacological effects [7]. The IABP preventive setting in patients with low LVEF during a preoperative period appeared to be more effective than its perioperative placement [11]. However, the risk of complications is extremely high referring to IABP use in patients

with infrarenal aortic atherosclerotic lesions (limb ischemia, material embolism). Therefore, a preoperative assessment by sodium-uretic peptide [14], milrenona [5] and other inotropic agents is preferable in these patients' group. Levosimendan administration is another possible solution investigated at present [15]. At the same time the information concerning the levosimendan effectiveness in a preoperative period for a CABG surgery in patients with low LVEF, as well as the intracardiac hemodynamics parameters evaluation in comparison with other preoperative assessment methods are still not well observed, that in its turn determines the study relevance.

**Purpose:** to optimize the preoperative assessment in patients with multifocal atherosclerosis with initially low left ventricle ejection fraction for a coronary artery bypass grafting surgery.

## Materials and Methods

A retrospective analysis of 28 clinical records (Group I (IABP), n=28) and a prospective double blind randomized study of 63 patients with coronary artery disease and clinically significant multifocal arterial bed lesions, consistently admitted to the clinic for an elective surgery — coronary artery bypass grafting during 2008–2010 time period. Women and patients older than 70 years were excluded. The study was approved by the local Ethics Committee, the patients signed the information agreements. The patients were randomized into 3 groups in the prospective study: calcium-sensitizing agent was given as an inotropic support in the test group (Group II (levosimendan), n=33), in the control groups: dobutamine (Group III, n=19) — or placebo (Group IV, n=11). Since 2010, the placebo study was stopped due to the ethical reasons after the exclusion of the psychoemotional aspects and their impact (intensive care unit admission, performed procedures) on hemodynamic parameters. The patients and the medical personnel participated in the studies (cardiologists, intensivists and cardiac physiologists) have not been informed of the patients group distribution. All patients were male with a mean age (59.6±14.6) years (min 40 max 69) with chronic heart failure, NYHA class III, LVEF no more than 45% (med 33.3 min 21 max 42). The groups are comparable on the clinic-based anthropometric data, $p>0.05$ is for all parameters (Table 1).

ACE inhibitors, β-blockers, calcium channel blockers, statins, potassium-sparing diuretics were administered as a background therapy in all patients. One day prior to the elective surgery the patients were admitted to the ICU for the subclavian vein left sided cannulation (double-lumen catheter Ø8F), the external jugular vein right sided cannulation with the Swan-Ganz catheter, the femoral artery cannulation with the PV2013L07 catheter and the transducer PV8115 ("PULSION PiCCOplus") performed under the aseptic conditions and standard premedication IM with the central analgesics (2% promedol — 1.0) and sedating medications (relium 10 mg) — in 24 cases (6 in each group, including the retrospective). All procedures were standard for these patients in the perioperative period. In the Group I counterpulsation was 1 : 1 in automatic synchronization mode. The levosimendan infusion (Simdax, Orion Corporation Finland) was started with the loading dose of 12.5 mg/kg, the infusion rate at (0.23±0.09) mg/kg·min, the total infusion time 8.5 to 14.5 hrs in the Group II. The dobutamine infusion (Hexal AG, Germany) with the dose of 250 mg, the infusion rate at 3–5 mg/kg·min, the total infusion time 7.5–12.2 hrs in the Group III. The placebo infusion (5% glucose solution of 400 ml) during 8–14 hrs in the Group IV. The surgeries in all patients were performed under the normothermic perfusion and the standardized anesthetic support (ketamine, fentanyl, sevorane) and the intraoperative hydrobalance (8.7±5.5) ml/kg. The continuous baseline hemodynamics monitoring was provided (HR, beats/min; MAP, mmHg; CVP, mmHg) with a repeated measurement of the central hemodynamics (PAWP, mmHg; mPAP, mmHg); calculated indexes — the cardiac index (CI, l/min·m$^2$); the pulmonary vascular resistance (PVR, dyn/(sm$^5$·m$^2$), the total peripheral resistance index (TPRI, dyn/(sm$^5$·m$^2$), the oxygen consumption ($VO_2I$, ml/min) and extraction ($O_2ER$, %) by the "Nihon Koh-

*Table 1*

**Patients' Clinical Characteristics in the Study Groups**

| | Group I, n=28 | Group II, n=33 | Group III, n=19 | Group IV, n=11 |
|---|---|---|---|---|
| Age, years | 57.4±11.9 | 58.3±14.3 | 56.9±11.7 | 57.1±12.9 |
| Body surface area, $m^2$ | 1.92±0.21 | 1.94±0.15 | 1.91±0.19 | 1.95±0.22 |
| Angina, FC: | | | | |
| 2 | 10 (35.7%) | 12 (36.4%) | 7 (36.8%) | 4 (36.4%) |
| 3 | 13 (46.4%) | 14 (42.4%) | 8 (42.1%) | 5 (45.5%) |
| 4 | 5 (17.9%) | 7 (21.2%) | 4 (21.1%) | 2 (18.2%) |
| PICS | 26 (92.9%) | 31 (93.9%) | 18 (94.7%) | 9 (81.8%) |
| LVA | 13 (46.4%) | 15 (45.45%) | 9 (47.4%) | 5 (45.5%) |
| Paroxysmal AF | 6 (21.4%) | 6 (18.2%) | 3 (15.8%) | 2 (18.2%) |
| AV-block 2gr | 3 (10.7%) | 4 (12.1%) | 2 (10.5%) | 2 (18.2%) |
| Associated: | | | | |
| Diabetes | 9 (32.1%) | 11 (33.3%) | 7 (36.8%) | 4 (36.4%) |
| COPD | 6 (21.4%) | 6 (18.2%) | 4 (21.1%) | 3 (27.3%) |
| CKD 0-I | 8 (28.6%) | 12 (36.4%) | 6 (31.6%) | 3 (27.3%) |
| Gastric/duodenum ulcer | 5 (17.9%) | 7 (21.2%) | 3 (15.8%) | 1 (9.1%) |
| Bypass surgeries | 23 (82.1%) | 28 (84.8%) | 16 (84.2%) | 9 (81.8%) |
| i.e. LVA resection | 11 (39.2%) | 13 (39.4%) | 7 (36.8%) | 4 (36.4%) |
| "of pump" surgeries | 5 (17.9%) | 5 (15.2%) | 3 (15.8%) | 2 (18.2%) |

*Note.* Group I — a IABP group; Group II — levosimendan, Group III — dobutamine, Group IV — placebo; FC — functional class of angina; PICS — postinfarction cardiosclerosis; LVA — left ventricular aneurysm; AF — atrial fibrillation, COPD — chronic obstructive pulmonary disease; CKD — chronic kidney disease. In the intergroup comparison for all values p>0,05.

eden ISM4113K" (Japan) monitor, and hydrodynamic status — the extravascular lung water index (EVLWI, ml/kg), the pulmonary vascular permeability index (PVPI, rel. units.), the global end-diastolic volume (GEDVI, ml/$m^2$) by the "Pulsion PiCCO-plus" (Germany) monitor immediately after the admission and then every 6 hrs since the drug administration to 24 hrs of the postoperative period. The echocardiographic ezamination was performed on the ultrasonic scanner "Vivid-7 Dimention"(General Electric) before the medication infusion (24 hrs) and after the infusion (24 hrs). At all examination stages the end-systolic (CSV ml), end-diastolic (EDV, ml) volumes and the LVEF (%), end-systolic (ESD, cm) and end-diastolic dimension (EDD, cm), and the right ventricular EF (RV, %), the left atrium (LA, ml) and the right atrium volumes (RA, ml). The LV and RV diastolic functions were measured by the impulsed Doppler on the mitral and tricuspid valves blood flow, analyzing the isometric relaxation time (IRT, sec), the E/A ratio. The mitral (MV) Sm, m/sec and tricuspid (TV) St, m/sec annular measurements done by the pulsed tissue Doppler were applied to assess the systolic and diastolic the LV and RV functions. The pulmonary artery systolic pressure (PA, mmHg) was estimated by the gradient of the TV regurgitation. The LV diastolic pressure (EDP, mmHg) was calculated from blood flow in the pulmonary veins, applying Kuherer et al. formula. The statistical analysis was done by the variation statistics with the Student's t-criterion. Consider the arithmetic mean (M), the standard deviation (y), the Student's t-criterion value (t) and the level of significance (p), during the data groups comparison — the correlation

coefficient (k).The nonparametric methods (Mann-Whitney, Kolmogorov-Smirnov test) were applied for the statistical hypothesis testing in a small number of observations in the groups. The reliability — at $p<0.05$ significance level. The package Statistica 6.0 software containing nonparametric statistics programs was used.

## Results

The CI (p=0.039) and the PVR (p=0.04) values significantly changed on a tendency of the PAWP to decrease (p=0.55) without the gas transport function dynamics in the intragroups hemodynamic comparison (Table 2). The EDP and the ESD did not significantly change with a tendency of the right atrium volume to decrease according to echocardiography data (Table 3). At the same time there was no reliable data (p=0.05) on the diastolic dysfunction improvement based on the blood flow velocity ratio across the mitral valve. The HR significantly increased in the Group III after the infusion, probably causing an oxygen consumption increase (p=0.0225) with its extraction tendency to increase (p=0.0533). The MAP didn't significantly change and did not require a vasopressor support and the infusion rate and volume increase. Nevertheless, the mPAP with a tendency (p=0.0555) to increase with the PAWP significant increase (p=0.0499) and, the global end-diastolic volume tendency to increase, overriding the margin normal values, were observed. There were no significant reduction in the resistance indexes according to the expectations. The tendency for the left ventricular myocardial contractility improvement by the Sm reduction (p=0.0575) and the LP volume reduction (p=0.0599) and without significant changes in other parameters were shown by the echocardiography . The MAP reduction was marked during the HR nonsignificant increase after 24 hrs from the infusion in the Group II, in 4 (12.1%) cases for its stabilization the vasopressor cardiotonics were required (epinephrine 0.01–0.03 mg/kg·min) and in all cases — short-term infusion volume and rate increase (from (8.7±4.9) to (14.2±8.9) ml/kg). However, the CVP change with a tendency to decrease (p=0.0513), and the pulmonary pressure values were significantly lower (for mPAP p=0.0188, for PWAP p=0.0355). The cardiac index significantly raised to normal values (p=0.0155) under the reliable decrease of the resistance indexes, which is not accompanied by an increase in oxygen consumption and extraction. Although the extravascular lung water was significantly higher (p=0.0259), but did not exceed the upper margin normal values, while the pulmonary vasculars and the GEDVI with a tendency to decrease, remained at the upper margin of normal values. The statistically significant increase of the LVEF from 35.1% initially to 5.1 (39.7±5.9)% (p=0.0272) was determined by the echocardiography results comparison (see table 3). In addition, the left ventricular myocardial contractility improvement was confirmed by the planimetric indicators and by the tissue Doppler investigation. The MV annular motion velocity (Sm) increased from (0.06±0.02) m/sec to (0.07±0.01) m/sec (p=0.0388). The improved left ventricular myocardial contractility verified by the significant decrease of left ventricular ESV (182.8±46.1) ml initially to (164.3±41.1) ml after the infusion, while the left ventricular EDV did not increase, but tended to decrease (p=0.0559). A significant reduction in the LV end-diastolic pressure from (14.6±4.3) to (12.8±4.3) mmHg (P=0.0169) and a significant decrease in LA volume (p=0.0303) were noted, which is an indirect sign of the LV hemodynamics improvement. The RV dimension did not change. There was a tendency to the RV EF increase from (43.9±13.8)% to (46.0±5.9)%, but due to the number of this dynamic observations is not statistically significant, as evidenced by the absence of the tissue Doppler parameters changes across the TV annular. Also, there was no systolic pressure changes observed in the pulmonary artery. However, a significant decrease of the RA volume from (65.1±27.5) ml to (54.2±22.2) ml (0.0223) is also an indirect sign of the RV hemodynamics and the pulmonary circulation improvement. In the left ventricular diastolic function analysis following results were obtained: 17 patients (51.5%) had the I (hypertonic) diastolic dysfunction type, 4 patients (12.1%)

*Table 2*

**The Change of the Central Hemodynamic Parameters. Oxygen Consumption and Hydrodynamic Status on the Study Stages**

| | Group I, n=28 | | | Group II (dobutamine), n=19 | | | Group III (levosimendan), n=33 | | | p Ls/Db | p Ls/IABP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | initially | 24 hrs | p | initially | 24 hrs | p | initially | 24 hrs | p | | |
| HRS, beat/min | 82.8±14.6 | 84.5±9.9 | 0.108 | 80.1±14.6 | 98.9±6.6 | 0.0339 | 86.3±12.1 | 93.6±10.9 | 0.0811 | 0.7445 | 0.0499* |
| MAP, mmHg | 58.7±14.1 | 56.9±10.5 | 0.066 | 59.4±10.3 | 66.6±5.9 | 0.0905 | 62.5±9.7 | 60.9±8.3 | 0.0415 | 0.0966 | 0.0511 |
| CVP, mmHg | 4.65±2.20 | 4.90±1.65 | 0.057 | 4.7±2.0 | 4.95±1.65 | 0.1633 | 4.65±2.10 | 3.67±1.70 | 0.0513* | 0.0225 | 0.0207 |
| mPAP, mmHg | 20.3±8.1 | 19.6±6.6 | 0.083 | 22.1±6.3 | 24.3±6.8 | 0.0555 | 21.7±7.5 | 13.9±5.5 | 0.0188 | 0.0165 | 0.0103 |
| PAWP, mmHg | 13.8±5.5 | 11.40±3.35 | 0.055* | 13.1±4.5 | 16.9±3.8 | 0.0499 | 12.9±4.6 | 9.3±4.1 | 0.0355 | 0.0199 | 0.0451 |
| CI, l/min·m$^2$ | 1.95±1.45 | 2.35±1.10 | 0.039 | 2.30±1.35 | 2.25±1.05 | 0.8055 | 2.12±1.15 | 3.16±1.30 | 0.0155 | 0.0311 | 0.0166 |
| PVRI, dyn·sec/(sm$^5$·m$^2$) | 276.4± ±88.3 | 266.1± ±55.1 | 0.040 | 279.1± ±92.2 | 303.3± ±87.4 | 0.0713 | 285.7± ±80.3 | 219.9± ±69.9 | 0.0315 | 0.0341 | 0.0079 |
| TPRI, dyn·sec/(sm$^5$·m$^2$) | 2311± ±605 | 2209± ±335 | 0.091 | 2290± ±701 | 2417± ±353 | 0.1691 | 2434± ±699 | 1941± ±434 | 0.0469 | 0.0208 | 0.0151 |
| $VO_2I$, ml/min | 191.9± ±55.1 | 209.3± ±29.9 | 0.104 | 182.5± ±58.3 | 251.1± ±40.7 | 0.0225 | 197.6± ±44.7 | 206.2± ±39.9 | 0.2733 | 0.0566 | 0.2404 |
| $O_2ER$, % | 40±19 | 39±12 | 0.099 | 41±25 | 51±17 | 0.0553 | 46±15 | 38±11 | 0.0612 | 0.0414 | 0.1191 |
| EVLWI, ml/kg | 3.35±1.60 | 3.6±1.1 | 0.115 | 3.3±1.7 | 3.45±1.15 | 0.0991 | 3.4±1.8 | 4.4±1.2 | 0.0259 | 0.0211 | 0.0227 |
| PVPI, rel units | 2.90±1.15 | 3.05±0.30 | 0.083 | 2.95±1.10 | 3.4±0.7 | 0.0666 | 3.15±0.90 | 2.90±0.55 | 0.0559 | 0.0359 | 0.0909 |
| GEDVI, ml/m$^2$ | 792.5± ±122.0 | 801.2± ±64.5 | 0.066 | 788.2± ±134.9 | 832.5± ±115.1 | 0.0545 | 803.3± ±112.7 | 772.3± ±96.5 | 0.0515 | 0.0447 | 0.0415 |

*Note.* p>0.05 is for all initial values; * — trend; p — in the intragroup stage comparison; p Ls/Db, Ls/IABP — the intergroup comparison of levosimendan with dobutamine and IABP groups after 24 hrs; mPAP, PAWP — mean pulmonary artery pressure and pulmonary artery wedge pressure; CI — cardiac index; PVRI — pulmonary vascular resistance index; TPRI — total peripheral resistance index; $VO_2I$ — oxygen consumption index; $O_2ER$ — oxygen extraction ratio; EVLWI — extravascular lung water index; PVPI — pulmonary vascular permeability index; GEDVI — global end-diastolic volume index.

had the II (pseudonormal) dysfunction type, 12 (36.4%) — the III (restrictive) type. After the levosimendan infusion in the first two subgroups no significant dynamics was showed, although the mean values of the E/A ratio significantly reduced. The meaningful positive changes identified in the subgroup with the restrictive dysfunction type: in 34% of cases there is a transition to pseudonormal type (more favorable), and the E/A ratio significantly decreased from 3.4±0.6 to 2.6±0.5 initially (p=0.0266) in 66% of cases, indicating the restriction degree decrease.

In the intergroup comparison of hemodynamic parameters (see table 2) after 24 h of the drugs infusion (or intra-aortic balloon installation) in the Group II vs Group III and the Group I vs Group II in the absence of significant differences in the heart rate and MAP values the EWLVI values were significantly better after the dobutamine administration, which can logically be explained by the larger infusion volume in the Group II. The intergroup comparison results of the echocardiography (p Group II/Group III, p Group II/Group I) are shown in table 3 and clearly illustrate the advantages of the preoperative levosimendan use in these patients assessment.

Considering that over 30% of patients in each group underwent the left ventricle aneurysm surgery (plasty patch reconstruction), after which it is difficult to define the surgery and medication effects contribution impact on the intracardiac hemodynamics, we consciously avoid the intergroup analysis in the postoperative period, leaving this objective subject to a separate study.

In the intergroup clinical outcomes comparison (Table 4) the critical heart failure frequency, required the IABP in the Group II was 3.03% against 10.52% in the Group III (in Group I was not assessed by the reasonable causes). The multiple organ dysfunction in the postoperative period in the Group II developed in 9.1% versus 15.8% cases in the Group III and 17.8% in the Group I (and in the last 60% of cases was primarily associated with the blood flow depletion below the balloon level). The mortality rate in the groups was comparable in absolute terms but in percentage terms was significantly lower under the levosimendan administration. For the patients, the average stay in the intensive care unit was also significantly less in the Group II — (3.6±3.3) vs. (5.7±2.9) bed/days in the Group III and 4.3±3.7 in the Group I.

## Discussion

The IABP procedure is proposed in the current international recommendations in the preoperative as well as in the perioperative periods [8]. The conducted meta-analysis of ten studies in the IABP placement (4 randomized and 6 cohort) in 2363 patients with coronary artery bypass grafting convincingly showed the hospital mortality risk reduction, which was most obvious in the randomized clinical trials (OR 0.18; 95% Cl 0.06–0.57, p=0.003) [7]. The similar results were obtained in the recent studies [3; 6; 10; 13]. In patients with low LV EF the IABP preventive setting before the surgery was more effective than its perioperative use [11], the least effective was the IABP placement in the postoperative period [12]. The IABP preventive setting methodology is adopted in our clinic in cases of the progressive angina, the artery stem lesions over 75%, although there is little positive experience (28 patients) in the preoperative IABP use in the patients with initially low fraction. In connection with the highly invasive IABP methods and the need for the patients admission in the ICU for the preoperative care, preference is given for the preoperative assessment in this patients' category. Many studies have shown the levosimendan administration in the cardiac surgery practice possesses the cardioprotective effect, which is manifested by the troponin levels reduction in the postoperative period and hospital admission time [17]. In the meta-analysis of 10 studies with 440 patients inclusion it was able to determine the postoperative mortality reduction 11/235 (4.7%) in the levosimendan group compared with the group control 26/205 (12.7%), the risk ratio was 0.35 (0.18–0.71) (p=0.003) [9]. In our study, the comparable results are obtained by

*Table 3*

**Echocardiography Parameters Change at the Study Stages**

| | Group I, n=28 | | | Group II, n=19 | | | Group III, n=33 | | | p Ls/Db | p Ls/IABP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | initially | 24 hrs | p | initially | 24 hrs | p | initially | 24 hrs p/inf | p | | |
| ESV, ml | 180.2±49.5 | 191.9±33.6 | 0.0292 | 178.2±50.1 | 182.1±58.5 | 0.0849 | 182.8±46.1 | 164.3±41.1 | 0.0311 | 0.0211 | 0.0155 |
| EDV, ml | 299.1±70.3 | 305.5±40.3 | 0.0803 | 289.5±72.3 | 281.5±45.1 | 0.1556 | 280.2±61.6 | 270.9±53.3 | 0.0559* | 0.0589* | 0.0118 |
| LV EF, % | 32.1±7.7 | 34.9±4.5 | 0.0465* | 36.7±6.4 | 37.1±5.3 | 0.0715 | 35.1±5.1 | 39.7±5.9 | 0.0272 | 0.0413 | 0.0303 |
| EDP, mmHg | 14.1±5.5 | 13.3±3.9 | 0.0455 | 12.9±5.3 | 12.6±6.1 | 0.7441 | 14.6±4.3 | 11.9±4.3 | 0.0169 | 0.0665 | 0.0199 |
| ESD, sm | 7.5±3.9 | 7.9±3.3 | 0.0622 | 8.1±3.1 | 7.8±3.9 | 0.5539 | 7.6±3.6 | 6.6±3.0 | 0.0651 | 0.0556* | 0.0111 |
| EDD, sm | 13.9±6.1 | 14.40±2.25 | 0.0661 | 14.40±3.75 | 14.2±3.9 | 0.9015 | 13.3±4.5 | 12.7±3.8 | 0.0853 | 0.0609 | 0.0495* |
| RV EF, % | 40.9±15.1 | 44.9±9.1 | 0.1055 | 41.6±15.5 | 42.5±9.9 | 0.6065 | 43.9±13.8 | 46.0±5.9 | 0.0518* | 0.0533* | 0.0585 |
| LA, ml | 88.3±22.3 | 86.3±19.8 | 0.0705 | 88.7±21.4 | 78.8±29.5 | 0.0599* | 80.8±26.5 | 66.2±25.6 | 0.0303 | 0.0275 | 0.0207 |
| RA, ml | 62.4±29.6 | 56.2±16.6 | 0.0499* | 61.5±21.9 | 60.9±17.3 | 0.0855 | 65.1±27.5 | 54.2±22.2 | 0.0223 | 0.0339 | 0.0405 |
| Sm, m/sec | 0.05± ±0.03 | 0.050± ±0.025 | 0.4182 | 0.055± ±0.020 | 0.06± ±0.01 | 0.0575* | 0.06± ±0.02 | 0.07± ±0.01 | 0.0388 | 0.0461 | 0.0155 |
| St, m/sec | 0.150± ±0.025 | 0.155± ±0.030 | 0.6055 | 0.14± ±0.02 | 0.15± ±0.02 | 0.0921 | 0.10± ±0.03 | 0.11± 0.03 | 0.1465 | 0.0709 | 0.0336 |
| PPsyst, mmHg | 31.3± ±11.0 | 30.05± ±13.40 | 0.3335 | 28.2± ±6.6 | 29.1± ±7.4 | 0.1664 | 30.4± ±9.5 | 28.8± ±10.1 | 0.0902 | 0.1116 | 0.0455* |
| IRT, sec | 0.075± ±0.010 | 0.060± ±0.015 | 0.1155 | 0.08± ±0.02 | 0.075± ±0.020 | 0.0655 | 0.090± ±0.015 | 0.105± ±0.020 | 0.0549* | 0.0533* | 0.0199 |
| E/A | 1.145± ±0.300 | 1.09± ±0.03 | 0.0501* | 1.193± ±0.350 | 1.188± ±0.250 | 0.2083 | 1.256± ±0.300 | 1.108± ±0.250 | 0.0360 | 0.0422 | 0.0551* |

*Note.* p>0.05 for all initial values; * — trend; p — in the intragroup stages comparison; p Ls/Db, Ls/IABP — the intergroup comparison of levosimendan with dobutamine and IABP groups after 24 h after the infusion; ESV, EDV — end systolic and diastolic volumes, LV EF, LV RV — left and right ventricles ejection fraction; EDP — end-diastolic pressure; ESD, EDD — end systolic and diastolic dimensions, LA, RA — right and left atria volume; Sm, St — mitral and tricuspid annular velocities, PP — pulmonary artery pressure; IRT — isometric relaxation time; E/A — ratio of blood flow velocity across the mitral annular.

*Table 4*

**Clinical Results in the Study Groups**

| | Group I, n=28 | Group II, n=33 | Group III, n=19 | p Group II/ Group I | p Group II/ Group III |
|---|---|---|---|---|---|
| Comlications: | | | | | |
| IABP, n (%) | — | 1 (3.03) | 2 (10.52) | — | 0.0171 |
| MODS, n (%) | 5 (17.8) | 3 (9.1) | 3 (15.8) | 0.0115 | 0.0125 |
| Mortality, n (%) | 3 (10.7) | 2 (6.1) | 2 (10.5) | 0.0299 | 0.0315 |
| Bed/day in the ICU (min-max) | 4.3±3.7 (2–19) | 3.6±3.3 (1–14) | 5.7±2.9 (1–18) | 0.0307 | 0.0229 |

*Note.* Group II — levosimendan administration; Group III — dobutamine administration; Group IV — placebo. IABP — heart failure frequency, required an intraaortic ballon pump counterpulsation period on the perioperative period. MODS — multiple organ dysfunction syndrome. Bed/day — the length of stay in intensive care unit (for survivors); p — in the intergroup comparison of the Group II with the Group III and the Group IV.

the smaller observations number. Moreover, the studies have noted that the earlier levosimendan administration in the perioperative period gave a significant clinical effect reducing the number of postoperative complications [1; 2; 5]. The stroke index increased at the critical operation stages, the peripheral microcirculation improved, the nutritional blood flow increased under the levosimendan administration in 2 days before the surgery as demonstrated in our study before the surgical treatment. However, some authors have reported the decrease in the resistive vessels tone during anesthesia, which could require the vasopressor support in the postperfusion period; the preload decrease under the levosimendan infusion required the relative hypovolemia infusion correction [1]. Our study demonstrates these relative disadvantages can be corrected on the anesthesia stage. In another study, 25 patients were injected with levosimendan in 3–5 days before surgery, 22 patients (control group) did not receive levosimendan. The smaller sympathomimetics doses were administered, the ICU time admission decreased, the hospital mortality decreased ($p<0.05$ for all parameters) in patients already received levosimendan [2]. These central hemodynamics changes were confirmed by the echocardiography of the intracardiac hemodynamics, a positive diastolic dysfunction change were demonstrated in our study. V. K. Topkara [16] analyzing a database of 55,515 patients undergoing CABG, has identified the following groups according to LVEF: Group I (EF<or=20%), group II (EF 21 to 30%), Group III (EF 31 to 40%), and Group IV (EF>40%). The hospital mortality in the groups was 6.5, 4.1, 2.7% and 1.4%, respectively ($p<0.001$). The incidence of postoperative respiratory failure (10.1 versus 2.9%), renal failure (2.5 versus 0.6%), and sepsis (2.5 versus 0.6%) was higher in the group I compared to group IV. In our study, the patients from Group II prevailed with EF 30 to 40%, but the mortality and the dysfunctions frequency were below these values.

**Conclusions.** The results obtained suggest that the levosimendan administration for the preoperative assessment in patients with multifocal atherosclerosis and relative contraindications for the IABP placement, helps to improve the central hemodynamics parameters, reduce the severe diastolic dysfunction, without changes in the hydrodynamics, reduce the organ dysfunction frequency, reduce the ICU time admission.

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