Results of Coronary Bypass Grafting in Treatment of Left Main Stenosis

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SUMMARY
Study comparing the results of coronary artery bypass grafting (CABG) with and without cardiopulmonary bypass (CPB) in the treatment of left main stenosis (LMS) has not yet been made in Bosnia and Herzegovina. The main aim of this study was to compare result of CABG performed on 176 patients, in Cardiovascular clinic of University Clinical Center in Tuzla from May 1999 to January 2005, by these two methods in LMS group of patients in the early and late postoperative period. The study was divided in two parts. In the first part, early postoperative period (30 days after the surgery) has been analysed, which encompasses results of CABG in 92 patients revascularised without CPB (OPCAB method) (Group A), and 84 patients with LMS revascularised with CPB method (ONCAB, CCAB) (Group B). In the second part, late postoperative period (one year after surgery) has been analysed. Patients from both groups were contacted and interviewed. Total number (276 versus 278), same as average number of grafts per patient (3.0 ± 1.45 versus 3.31 ± 0.86 p=0.096), was insignificantly higher in group B. Perioperative and postoperative results revealed significant differences between two groups in reduced mechanical ventilation time (2.9 versus 7.3 hours, p=0.039), less blood transfusion requirement (200.3 versus 419.9 ml, p=0.033) and postoperative length of stay (7.4 versus 8.3 days). Inotrop support requirement was significantly higher in group B during the surgery (14.1% versus 29.8%, p=0.019) and postoperative period longer than 12 hours (7.6 versus 22.6%, p=0.009). Significant difference for mortality was noticed in early postoperative period in group A (0.0 versus 5.9%, p=0.023). There was no significant difference for any of additional procedures (7.9 versus 7.8, p=0.802), for major complications (8.0 versus 9.1%, p=0.985) or for mortality (7.9 versus 5.2%, p=0.692). Patients' survival after CABG for period of 12, 24, 36 and 48 months after surgery was not statistically significant (97.0 versus 96.1%, p=0.802, 95.5 versus 96.1%, p=0.857; 93.2 versus 94.8%, p=0.913, 92.0 versus 94.8%, p=0.692). This study revealed that OPCAB is effective and safe method for treatment of LMS, and there are certain advantages in comparison to classical method in short term follow up, with no difference in long term results.

Keywords: coronary artery bypass grafting, LMS, early results of coronary artery bypass grafting, late results of coronary artery bypass grafting

1. INTRODUCTION
Despite the fact that the results of numerous studies published in the literature in recent years speak of the clinical, angiography and economic superiority of coronary arterial bypass grafting (CABG) without cardiopulmonary bypass (CPB)–(OPCAB) compared to the classical method with the use of CPB (ONCAB) (1, 2, 3) there is a large number of authors who say that most of these studies analyzed the low-risk patients, and that the for the good results obtained in these the major credit goes to this fact (4).

Patients with significant stenosis (≥ 50%) of the main branch of the left coronary artery (left main stenosis-LMS) are under high risk for CABG (5, 6). LMS in addition to a standard indication for CABG (7), is identified as one of the main predictors of postoperative morbidity and mortality and thus operational risk in such patients multiply increases (8). Previous CABG results in the treatment of LMS are burdened with a high rate of morbidity and mortality (9), which prompted cardio surgery to explore applicability of OPCAB surgery in the treatment of these patients (10).

The presence of LMS was for years considered as relative contraindication for OPCAB, primarily due to the hemodynamic changes that occur during movement and exposure of the heart. Reduced tolerance to manipulation of the heart in patients with LMS has restricted the use of this method in this specific high-risk group (11). However, the evolution of the methods, especially the improvement of technical aids and maneuvers as well as improved surgical and anesthesiology techniques has led to situation that this operation become technically easier and safer (12). With increasing security of the method and experience of the cardiac surgeons created the preconditions for the treatment of high-risk patients, such as those suffering from the LMS. Shortly after that started publishing of the results of first study with encouraging results of OPCAB application in the treatment of this group of patients (13). Unfortunately, the number of such studies is still very small compared with those which pose doubt on short and long-term results obtained by this method.

2. GOALS
Compare the early results of CABG in subjects with LM stenosis made with and without CPB (the duration of surgery, amount of postoperative bleeding in thoracic drainage and the amount of received blood transfusion, the time spent on the respirator, the time spent in the intensive care unit, basic postoperative complications and the total duration of hospitalization).

Compare the late results of CABG in subjects with LM stenosis made with and without CPB (recurrent angina pain, myocardial infarction, repeated catheterization, percutaneous coronary intervention, repeated CABG, death due to cardiac causes).

3. SAMPLE AND METHODOLOGY
3.1. Sample
The study was conducted in two parts. The first part included the period from surgery until one month after surgical treatment while the second part included the late post-surgical period after the first year of surgical treatment.

The first part of the study included 176 patients with LMS > 50% undergoing CABG in the Clinic of Cardiovascular Diseases, University Clinical Center Tuzla in the period from May 1999 until January 2005. Respondents were divided into two groups. In group A were 92 subjects operated with OPCAB method, and in group B there was 84 subjects operated with ONCAB method. All respondents were similar according to gender, age, values of ejection fractions and ERUOSCORE, risk factors before the surgery and the number of bypass grafts.

The second part of the study included all patients from both groups that were followed in the late postoperative period. A total of 165 respondents was followed, of whom 88 (95.7%) from group A and 77 (91.7%) from group B. The main source of data from the early postoperative period was the computer database, and the standard patient's records, while data from the late postop-
operative period is obtained by telephone survey with each respondent.

3.2. Methods

The standard approach for OPCAB was a median sternotomy. To achieve adequate exposure LIMA stitch was used (14). The left front descending artery (left anterior descending - LAD) artery was the first for grafting then followed by grafting of other coronary arteries. The problem of local myocardial stabilization was solved using the CTS stabilizer (CTS, Cupertino, CA, USA). After exposure, stabilization and preparation of coronary blood vessel started the creation of anastomosis. Proximal from the point of anastomosis, a loop around blood vessel is made with a 4–0 prolene “pladget” suture, then intraluminal is applied intracoronary shunt and distal anastomosis was created. Then was placed a partial clamp on an ascendant aorta and proximal anastomosis is created. After that started the Transit time flow (TTFM) measurements. After the obtained satisfactory values of the flow surgery was completed in usual manner.

The standard approach for ONCAB was also median sternotomy. Followed by canulation of ascendant aorta and right atrium, and then establishment of CPB. After clamping of ascendant aorta to stop the heart used was intermittent normothermal blood cardioplegic solution which is applied in antegrade or retrograde way, with the local application of ice. Left front descendent artery (LAD) was the last for grafting. After creating the distal anastomosis and a stopped hearth, the heart gradually warms up to the establishment of a normal heart rhythm (with or without defibrillator). Upon removal aortic cross clamps placed was a partial clamp on ascendant aorta and created proximal anastomosis in the previously described manner. Upon completion of proximal anastomosis further procedures were identical as in the previously described method.

3.3. Verification of bypass grafts quality during surgery

In both groups after the completion of the proximal anastomosis access is the quality and verification of bypass grafts with transit time flow measurement method (TTFM). Machine used to measure TTFM was MediStim BF2004 (MediStim, Oslo, Norway). All measurements were performed in standardized hemodynamic conditions: systolic blood pressure in the range of 100-120 mmHg, heart rate ranges from 80-100 beats per minute. Recorded and printed are best TTFM measurements for each graft. In the event of unsatisfactory findings TTFM anastomosis was revised.

3.4. Early post-surgical period

In the early post surgery period (one month from the date of surgery) in both investigated groups were analyzed and compared: the total duration of surgery, time spent on the respirator, the time spent in the intensive care unit (ICU), the amount of postoperative bleeding in thoracic drainage, the amount of blood transfusions, primary postoperative complications (bleeding, repeated surgery, myocardial infarction, rhythm disorders), repeated PTCA and CABG revascularization.

4. RESULTS

In both analyzed groups there weren’t any significant differences between the average values of age, and ejection fractions EUROSCORE. The total number (276 vs. 278) and the average number of bypass grafts (3.00 ± 1:45 versus 3.31 ± 0.86) was higher in group B but without statistical significance (p = 0.091). The frequency of revisions of bypass grafts based on TTFM findings was higher in group A, but without statistical significance compared to group B (5.1 vs. 4.1%, p = 0.820). Analysis of basic results before and after the surgery indicate significant differences between groups in time spent on the respirator (2.9 versus 7.3 hours, p = 0.039), the amount of received blood transfusion (200.3 versus 419.9 ml, p = 0.035) and duration of hospitalization (7.4 versus 8.3 days, p = 0.0019) (Table 1). There were no statistically significant differences between groups in the incidence of post operative complications. The most common post operative complication was the atrial fibrillation type of rhythm disorder (23.9 vs. 32.1%, p = 0.295) (Table 2). Analysis of the frequency of lethal outcomes in both groups showed a significantly lower mortality in group A (0.0 versus 5.95%, p = 0.023) (Table 3).

In the late postoperative period (one year after the surgery) a statistically significant differences are not recorded between the investigated groups in the frequency of recurrent angina pectoris (25.0 vs. 31.2%, p = 0.479). Analysis of subsequent procedures in both groups showed that there was somewhat more coronography after CABG in group A (6.8 vs. 5.2%, p = 0.917), one repeated PTCA and CABG revascularization in
The most common cause of death in group A (1.1 vs. 0.0%, p = 0.946) but without statistically significant differences. Comparative analysis of the most serious complications without lethal outcome showed that the most common complications in both groups was myocardial infarction (5.7 vs. 5.2%, p = 0.837) and cerebrovascular insult (2.3 vs. 3.9%, p = 0.880) but without statistically significant differences. Comparative analysis of total mortality in the late post operative period between the two groups of patients showed no statistically significant difference (7.9 vs. 5.2%, p = 0.692).

5. DISCUSSION

Lately, though still sporadic, studies occur that report encouraging preliminary results of OPCAB method in treatment of patients with LMS (15, 16, 17, 18). Although they show methods as equal, and in some parameters the superiority of OPCAB compared to ONCAB method, a small number of bypass grafts made with this method as well as the suspicion of their inferior quality (19), imply the suspicion also in worse early and late postoperative results obtained by this method.

Since its introduction into surgical practice OPCAB method is connected to somewhat lower average number of bypass grafts per patient (20, 21), which according to some authors refer to the incomplete revascularization and the possibility of more frequent postoperative complications.

However, the improvement of technical aids and surgeons experience very quickly led to a significant increase in the number grafts made with OPCAB method as is the case in this study: the average number of bypass grafts was not statistically different between groups.

Doubt in the quality of distal anastomosis and bypass grafts made with this method is the most common reason for skepticism in OPCAB (22). One indicator of the quality of distal anastomosis is the number intra operative revisions of made bypass grafts, after TTMI method finds it’s inadequate. The results of this study showed that the frequency of revised bypass grafts based on TTMI is not statistically different between groups. Comparative analysis of the number of respondents with a revised bypass grafts in both groups indicate insignificant differences between groups, despite the fact that this study also included respondents from the early stages of the learning curve of OPCAB method.

Analysis of basic peri operative and post operative results from this study indicate significant differences between groups in time spent on the respirator, the amount of received blood transfusion and duration of hospitalization, while other parameters did not show significant differences. While most authors dealing with this issue agree that the compensation of blood in post operative period is significantly lower with OPCAB method (17, 19), there are many diverse data on the duration of hospitalization. While Buffolo et all, 1985 reported significantly shorter hospitalization in OPCAB group (7 vs. 11 days) as it was the case in this study (7.4 vs. 8.3 days), Dewey et all, 2001 reported insignificant difference between the groups with the fact that the hospitalization after ONCAB was shorter (7.8 vs. 7.2 days). Probable explanation for these contradictory statements is primarily because of difference in the experience of that particular group of surgeons in the practice of OPCAB method.

Analysis of the incidence of post operative complications in both groups in-

### Table 3. Mortality and its causes, MOF-Multiple organ failure

<table>
<thead>
<tr>
<th>Causes</th>
<th>Group A</th>
<th>Group B</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
</tr>
<tr>
<td>MOF</td>
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<tr>
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</table>

### Table 4. Mortality and its causes during late post operative period, MOF-Multiple organ failure

<table>
<thead>
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<th>Causes</th>
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<th>Group B</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>5</td>
<td>5.7</td>
<td>2</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>1</td>
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<td>1</td>
</tr>
<tr>
<td>MOF</td>
<td>1</td>
<td>1.1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>7.9</td>
<td>4</td>
</tr>
</tbody>
</table>

FIGURE 1. Kaplan-Meier survival curve for group A patients

FIGURE 2. Kaplan-Meier survival curve for group B patients
6. CONCLUSION

The results of this study suggest that OPCAB is safe and effective method in the treatment of LMS, associated with a number of advantages in comparison with the classical method, and not worse long-term results. Ideally, the conclusions of this research are to increase the proportion of OPCAB in the daily treatment of these patients.

REFERENCES


23. Lu C. Y. John, Grayson AD, Pullan MD. Short- and long-term results. Ideally, the conclusions of this research are to increase the proportion of OPCAB in the daily treatment of these patients.

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