THE CHOICE OF ON- OR OFF-PUMP CORONARY BYPASS GRAFTING – A SURGEON'S DILEMMA

Marek Gwozdziejewicz^{a*}, Petr Olsak^a, Vladimir Lonsky^a, Milan Elfmark^b

^a Department of Cardiac Surgery, University Hospital, Olomouc, Czech Republic

^b Faculty of Physical Culture, Palacký University Olomouc
e-mail: gwozdziejewicz@email.cz

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Background: Off-pump coronary bypass grafting (OPCAB) is a routine method of heart revascularization. This study was designed to compare the results of OPCAB and ONCAB performed by a single surgeon at our institution over a 3-year period.

Methods: The study enrolled 345 patients undergoing elective myocardial revascularization procedures, of which 173 (50.1%) were OPCAB and 172 (49.9 %) were ONCAB. The postoperative outcomes of both groups were analyzed, retrospectively.

Results: The mean number of grafts was significantly lower in the OPCAB group (2.9) than in the ONCAB group (3.7). There were no postoperative myocardial infarctions or hospital deaths in any of the patients. The postoperative total blood loss was significantly higher in the ONCAB group. The frequencies of postoperative confused states, strokes, postoperative transfusions, reoperations for bleeding, and atrial fibrillation, and the durations of intubation, ICU stay, and hospital stay did not differ significantly between the two groups.

Conclusions: The OPCAB procedures are safe and provide good clinical outcomes, similar to those of ONCAB operations. The outcomes of this study favor neither of the compared techniques.

INTRODUCTION

Off-pump coronary bypass grafting (OPCAB) is a routine method for heart revascularization, but its superiority over conventional on-pump coronary bypass grafting (ONCAB) has not been clarified¹. One of the most important factors is whether OPCAB is safe and more effective than ONCAB in the hands of a particular surgeon.

This retrospective observational study was undertaken to compare the results of OPCAB and ONCAB performed by a single surgeon at our institution over a 3-year period.

METHODS

A total of 345 consecutive elective, primary, isolated heart revascularizations were performed between January 2004 and January 2007 by a single surgeon with experience in both ONCAB and OPCAB in our department. The preoperative characteristics of both groups are listed in Table 1.

The ONCAB technique relied on antegrade cold crystalloid cardioplegia. During OPCAB procedure the heart was immobilized with two suction based stabilizers with all peripheral anastomoses being sutured on intracoronary shunts, as described previously². The postoperative outcomes of both groups were analyzed, retrospectively.

This study was approved by the Institutional Review Board of our institution.

Statistical analysis

The recorded data were statistically analyzed using Statistica 6.0 software (StatSoft, Tulsa, OK). Dependences between variables were evaluated using contingency tables. Continuous variables were compared using the *t* test, with a *p* value less than 0.05 considered statistically significant.

RESULTS

The study enrolled 345 patients undergoing elective myocardial revascularization procedures, of which 173 (50.1 %) were OPCAB and 172 (49.9 %) were ONCAB. The mean ages of the patients undergoing OPCAB and ONCAB were 68.2 and 66.4 years, respectively, and they comprised 30.8 % and 36.4 % females. The postoperative results are listed in Table 2.

Three patients (1.7 %) in the OPCAB group needed intraoperative conversion to ONCAB owing to hemodynamic instability, and these patients were included in the OPCAB cohort. Table 3 lists separately the characteristics and outcomes of these patients.

Patients who underwent OPCAB presented preoperatively with better ejection fraction (53.4 % vs. 50.7 %) and a lower frequency of insulin-dependent diabetes mellitus (11.5 % vs. 18.6 %), and they were slightly older than ONCAB patients (68.1 vs. 66.5).

The mean number of grafts was significantly lower in the OPCAB group (2.9) than in the ONCAB group (3.7),

Table 1. The preoperative characteristics of OPCAB and ONCAB patients.

	OPCAB n (%)	ONCAB n (%)	<i>p</i> Value
Patients	173 (50.1)	172 (49.9)	> 0.9
Age	68.2 ± 9.1	66.4 ± 8.5	0.07
Female	63 (36.4)	53 (30.8)	0.27
EF	53.4 (25–65 %)	50.7 (25–65 %)	0.01
LM	42 (24.2)	50 (29)	0.32
Hypertension	142 (82)	136 (79)	0.48
Dyslipidemia	123 (71)	120 (69.8)	0.8
Diabetes mellitus ID	20 (11.5)	32 (18.6)	0.06
Diabetes mellitus NID	45 (26)	46 (26.7)	0.88
Obesity	34 (19.6)	33 (19.2)	0.93
PCI	15 (8.6)	15 (8.7)	0.97
Stroke	9 (5.2)	15 (8.7)	0.2

EF, ejection fraction; LM, left main disease (> 50 % stenosis); ID, insulin dependent; NID, non- insulin dependent; PCI, percutaneous coronary intervention

Table 2. The postoperative results of OPCAB and ONCAB patients.

	OPCAB n (%)	ONCAB n (%)	<i>p</i> Value
Patients	173 (50.1)	172 (49.9)	>0.9
Number of grafts	2.9 (1–5)	3.7 (1–5)	<0.01
ITA skeletonized	157 (90.7) 61 (35.3)	162 (94.1) 67 (38.9)	0.49
RA	18 (10.4)	8 (4.6)	<0.01
Mean total blood loss	888 ml	1010 ml	<0.01
Transfusions	44 (25)	58 (33.7)	0.08
Reoperation for bleeding	2 (1.2)	1 (0.6)	0.61
Sternotomy infection superficial with sternum dehiscence	8 (4.6) 1 (0.5)	11 (6.4) 2 (1.2)	0.46 0.47
Pleural effusion requiring puncture	8 (4.6)	7 (4)	0.78
Confused state	8 (4.6)	13 (7.6)	0.24
Stroke	1 (0.5)	2 (1.2)	0.47
Atrial fibrillation	45 (26)	38 (22)	0.38
Myocardial infarction	0	0	
Hospital mortality	0	0	
Post-op intubation (hours)	8.6 (3–29)	8.9 (2–24)	0.93
ICU length of stay (days)	1.4 (1–13)	1.4 (1–9)	0.96
Hospital length of stay (days)	9 (6–45)	9.4 (6–63)	0.11

with the OPCAB group having 6 patients with five peripheral anastomoses and 39 patients with four grafts. Figure 1 shows the distribution of the grafts in the two groups in terms of the numbers of sutured peripheral anastomoses. The internal thoracic artery (ITA) was used in 90.7 % and 94.1 % of OPCAB and ONCAB patients, respectively, and was harvested as a skeleton in 35.3 % and 37.1 % of them. When the ITA was harvested as a pedicle, the postoperative blood loss was significantly higher in the ONCAB group than in the OPCAB group. The ITA could not be used due to intraoperative injury in three (0.8 %) of the

patients. The radial artery was used as one of the conduits more often in the OPCAB group (10.4 %) than in the ONCAB group (4.6 %).

There were no postoperative myocardial infarctions or hospital deaths in any of the patients. The postoperative total blood loss was significantly higher in the ONCAB group. However, the frequencies of postoperative confused states, strokes, postoperative transfusions, reoperations for bleeding, and atrial fibrillation, and the durations of intubation, ICU stay, and hospital stay did not differ significantly between the two groups.

Table 3. Characteristics and outcomes of patients converted to ONCAB.

	Patient 1	Patient 2	Patient 3
age	52	75	76
female	yes	yes	yes
EF (%)	55	65	65
LM	0	yes	yes
Number of grafts	4	3	3
Mean total blood loss (ml)	580	1180	890
Sternal infection	0	yes	0
Confused state	0	0	yes
Post-op intubation (hours)	5	16	14
ICU length of stay (days)	1	1	1
Hospital length of stay (days)	7	41	16

DISCUSSION

According to the 2005 AHA Scientific Statement, both the OPCAB and standard CABG procedures usually result in excellent outcomes, with neither being considered inferior¹. Although this recommendation is based on scientific evidence, it appears unlikely that exposing or not exposing a patient to extracorporeal circulation makes no difference.

In daily practice, a surgeon should precede depending upon his or her own results. In this study we compared the outcomes of patients undergoing OPCAB and ONCAB procedures. The approximately equal numbers (173 vs. 172) of consecutive, elective patients were operated by a single surgeon who was experienced in both OPCAB and ONCAB procedures. Significantly fewer grafts were performed in the OPCAB group (2.9 vs. 3.7), which was due to the fact that patients with 1-2 vessel disease were

primarily indicated for the OPCAB procedure. The only significant difference between the two groups was the postoperative blood loss, which was higher in the ONCAB group. In contrast to previously published studies, we found no significant difference in the durations of intubation, ICU stay, hospitalization and mortality between the groups³⁻⁸. Also, the frequencies of postoperative episodes of neurological complications, reoperations for bleeding, atrial fibrillations, and sternum infections did not differ between the groups. From this study we can conclude that OPCAB procedures are safe and provide good clinical outcomes, similar to those of ONCAB operations, in a selected group of patients. The outcomes of this study favor neither of the compared techniques, and although the OPCAB group comprised more so called easy patients (good LV, less grafts) the dilemma remains. Should we continue to perform OPCAB in these patients, which is always technically more demanding, or should we just put a cross clamp and enjoy the bloodless and motionless operating field?

Fig. 1. The distribution of the grafts in the two groups (OPCAB and ONCAB) in terms of the number of sutured peripheral anastomoses. (grey, 1 anastomosis; white 2 anastomoses; black, 3 and more anastomoses)

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