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Early Postoperative Coronary Angiography Result in Off-pump Coronary Artery Bypass (OPCAB) Patients

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Abstract :

Objective :

The purpose of this study was to evaluate the early results of coronary artery bypass without cardiopulmonary bypass (off-pump coronary artery bypass - OPCAB) at Siriraj Hospital.

Patients and methods :

From September, 2001 to April 2002, eight selected coronary artery disease patients were operated on using the off-pump coronary artery bypass technique. Operative data were collected and postoperative coronary angiography was studied in all patients before discharge.

Results :

There were no death and no need to resort to the conventional procedure. Postoperative coronary angiography revealed good patency of all 17 grafts. Postoperative cardiac enzymes were elevated in one patient.

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Conclusion :
The early results of OPCAB in this study showed good outcomes. Early postoperative angiography demonstrated excellent anastomoses. This procedure needed fewer blood transfusions than the conventional technique. However, long-term follow up of these procedures should be evaluated.

Key words : OPCAB, coronary artery, coronary angiography

เรื่องย่อ : **ผลการฉีดสีหลอดเลือดหัวใจหลังการผ่าตัดหลอดเลือดหัวใจด้วยวิธีการที่ไม่ใช้เครื่องปอดและหัวใจเทียม**

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วัตถุประสงค์ เพื่อศึกษาผลของการผ่าตัดหลอดเลือดหัวใจโดยวิธีที่ไม่ใช้เครื่องปอดและหัวใจเทียม ด้วยการฉีดสีหลอดเลือดหัวใจภายใน 2 สัปดาห์แรกหลังการผ่าตัด

วิธีการศึกษา ศึกษาในผู้ป่วย 8 รายที่ได้รับการผ่าตัดหลอดเลือดหัวใจโดยวิธีที่ไม่ใช้เครื่องปอดและหัวใจเทียม ในระหว่างเดือนกันยายน พ.ศ. 2544 ถึงเดือนเมษายน พ.ศ. 2545 ผู้ป่วยทุกรายได้รับการฉีดสีหลอดเลือดหัวใจภายใน 2 สัปดาห์แรกหลังการผ่าตัด

ผลการศึกษา การผ่าตัดหลอดเลือดหัวใจด้วยวิธีนี้ประสบผลสำเร็จทุกราย ไม่มีผู้ป่วยรายใดเสียชีวิต ผลการฉีดสีหลอดเลือดหัวใจหลังการผ่าตัด แสดงให้เห็นว่าได้ผลดีในผู้ป่วยทุกราย มีผู้ป่วย 1 รายที่มีค่าเอนไซม์ของกล้ามเนื้อหัวใจผิดปกติชัดเจน

สรุป การศึกษานี้แสดงให้เห็นว่าการผ่าตัดหลอดเลือดหัวใจโดยวิธีที่ไม่ใช้เครื่องปอดและหัวใจเทียมในเบื้องต้นได้ผลดี ใช้เลือดน้อยกว่าการผ่าตัดด้วยวิธีที่ใช้เครื่องปอดและหัวใจเทียม อย่างไรก็ตามจำเป็นต้องศึกษาผลในระยะยาวต่อไป

INTRODUCTION

Off-pump coronary artery bypass (OPCAB) has been performed since the late 1950s. After the wide spread use of cardio-pulmonary bypass (CPB) in 1968, the number of off-pump operations declined. The benefits of OPCAB avoid the side effects of CPB such as systemic inflammatory responses, platelet dysfunction, central nervous system dysfunction, and myocardial dysfunction. OPCAB has emerged again in the last two decades with technical improvements, for example, cardiac stabilizers and intracoronary shunts.Buffolo, et al. reported a series of 160 patients operated on without CPB[1]. In 1991, Benetti and coworkers reported their experiences in 700 patients

with OPCAB[2]. However, the accuracy of revascularization under a beating heart was still questioned when it was compared to the results of the conventional technique in which the heart was arrested during surgery. At Siriraj Hospital, we studied the feasibility, benefits and results of OPCAB by collecting data from our early experiences from September, 2001 to April, 2002.

MATERIALS AND METHODS

From September, 2001 to April, 2002, eight coronary artery disease patients were revascularized using an off-pump technique. The selection criteria included patients who met the indications for CABG and had target coronary arteries bigger than 1.5 mm, and patients who were at potential risk from CPB, such as a history of stroke or renal failure. The perioperative data were recorded and postoperative coronary angiography was performed in all patients before discharge.

Technique of OPCAB

1. Median sternotomy was performed.
2. Pericardium was opened wide and pericardium traction sutures were placed posterior to the left phrenic nerve.
3. Intravenous heparin was given and the activated clotting time (ACT) was kept at > 250 seconds.
4. Octopus-II stabilizer (Medtronic Inc., Minneapolis, MN) was applied.
5. Distal anastomosis was performed first and an intracoronary shunt or vascular sling was used to control bleeding.
6. Proximal anastomosis was performed at the ascending aorta under partial occluding clamp.
7. After the distal anastomosis had been finished, the graft was perfused while the other anastomoses were performed.
8. After the procedure had been completed, protamine sulfate was infused intravenously.

RESULTS

The collected demographic data of all patients are shown in table 1. There were 6 male and 2 female patients. The mean age was 63 years (53-72 years old). Seven patients had hypertension, six patients had dyslipidemia and two patients had diabetes mellitus. One patient had a history of cerebrovascular disease, one had chronic renal failure and another had chronic obstructive pulmonary disease. We classified all patients into three groups and found four cases with stable angina, three cases with unstable angina and one case with myocardial infarction. The average ejection fraction was 58%.

Postoperative cardiac enzymes, i.e. troponin-T and CK-MB levels are shown in table 2. One patient had high pulmonary artery pressure during surgery and high levels of troponin-T and CK-MB in the postoperative period. This might indicate perioperative myocardial infarction. However, all patients recovered well with stable hemodynamics without using high doses of inotropic drugs. The mean operative time was 173 minutes. One unit of whole blood was given in one patient, but the others didn't need transfusion. The average postoperative ventilator time was 6 hours and 30 minutes, and the average ICU stay was 24 hours.

Detail of bypass grafts is shown in table 3. There was no death. Two patients (25%) developed postoperative atrial fibrillation and they were successfully converted to sinus rhythm by medication. One patient had temporary confusion and one had left pleural effusion. No complications of bleeding, stroke or acute renal failure were found in this study. Postoperative coronary angiography was done before discharge and all 17 bypass grafts which consisted of 7 left internal mammary arteries, 1 radial artery and 9 saphenous vein grafts were patent. Examples of postoperative coronary angiogram in two patients are demonstrated in figures 1 and 2.

DISCUSSION

With regard to the early results of OPCAB at Siriraj Hospital, we found that OPCAB can be done safely in selected cases without mortality and with no significant changes in hemodynamics and cardiac enzymes in almost all patients. The OPCAB procedures were successfully accomplished without need to use cardio-pulmonary bypass. Postoperative

Table 1. Demographic data.

Variable		Number of patients	Percentage
Patients		8	100
Sex :	Male	6	75.0
	Female	2	25.0
Age:	50-70 years	7	87.5
	> 70 years	1	12.5
Risk :	Hypertension	7	87.5
	Dyslipidemia	6	75.0
	Diabetes mellitus	2	25.0
	Cerebrovascular disease	1	12.5
	Chronic renal failure	1	12.5
	Chronic obstructive pulmonary disease	1	12.5
Angina :	Stable	1	12.5
	Unstable	6	75.0
	Myocardial infarction	1	12.5
Ejection fraction :	30-50%	2	25.0
	>50%	6	75.0

Table 2. Postoperative cardiac enzymes.

Cardiac enzymes (ng /ml)		Number of patients after operation		
		Immediate	24 hours	48 hours
Troponin-T :	≤ 0.5	8	7	7
	> 0.5	0	1	1
CK-MB :	≤ 50	8	7	7
	> 50	0	1	1

Table 3. Detail of bypass grafts.

Grafts	Number of patients with operated coronary artery					
	LAD	RC	OM	DG	PD	PL
LIMA	7	0	0	0	0	0
LRA	0	1	0	0	0	0
SVG	0	2	1	2	3	1

LIMA = left internal mammary artery, LRA = left radial artery, SVG = saphenous vein graft, LAD = left anterior descending artery, RC = right coronary artery, OM = obtuse marginal artery, DG = diagonal artery, PD = posterior descending artery, PL= posterolateral artery.

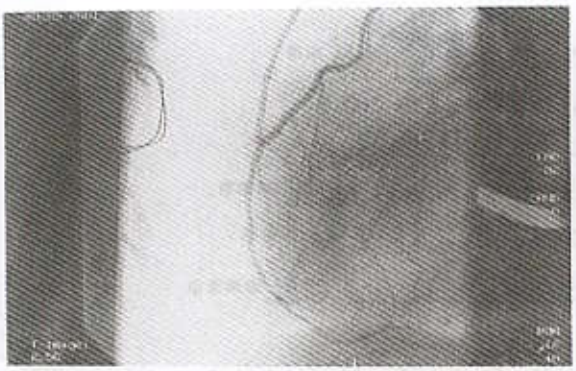


Figure 1. Postoperative coronary angiogram in lateral anterior oblique view of a 66 year old female patient with chronic renal failure demonstrating the anastomosis of the left internal mammary artery to the left anterior descending artery.

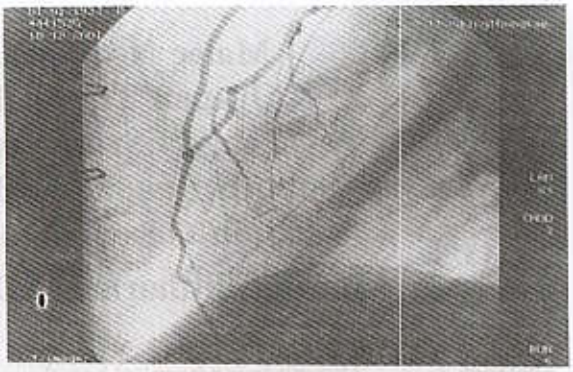


Figure 2. Postoperative coronary angiogram in lateral anterior oblique view of a 68 year old male patient with cerebrovascular disease demonstrating the anastomosis of the left internal mammary artery to left anterior descending artery.

coronary angiography revealed good results with early graft patency in all patients. Puskas, et al. reported early results in 421 OPCAB graft arteries, 93.3% were widely patent, 5.46% were stenosed to less than 50% of the diameter of the target coronary artery, and 1.18% were occluded[3]. This convinced surgeons that off-pump coronary artery bypass was feasible as they felt comfortable performing the operation even while the heart was still beating. However, we have done this in a small group of selected cases in which the target vessels were larger than 1.5 mm, so this study cannot support the results of OPCAB in smaller coronary arteries. It is still necessary to look at the long term results of OPCAB in a larger group. In addition, we have demonstrated the advantages of OPCAB in that it needs fewer blood transfusions than in conventional procedure. This result is the same as that reported by Kshettry, et al[4]. The postoperative atrial fibrillation rate does not differ from that found in on-pump CABG which has been reported to be between 15.8-21.5%[4,5].

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