

Prognosis after Off-Pump Coronary Artery Bypass in Patients Receiving Hemodialysis

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Purpose: This study was performed to evaluate the perioperative and long-term results of off-pump coronary artery bypass grafting (OPCAB) in hemodialysis (HD)-dependent patients.

Methods: We retrospectively analyzed the results of isolated OPCAB performed at Tokyo Women's University Medical Center East from February 27, 2000, to May 12, 2006. Perioperative data for patients receiving HD (group HD, $n=39$) were compared with data from patients not receiving HD (group noHD, $n=60$). The long-term results of group HD also were examined.

Results: Group HD consisted of 34 males and 5 females with a mean age of 63.2 ± 10.2 years. The percentage of patients in group HD with complete all-arterial revascularization was significantly lower than in group noHD. However, the mortality rate, number of distal anastomoses, operative time, intensive care unit (ICU) stay, hospital stay, bleeding during surgery, blood transfusions, intubation time, intra-aortic balloon pumping use, and emergency ratio were similar in the two groups. During a mean follow-up of 27.0 ± 13.7 months, the actuarial 1- and 5-year survival rates of group HD were 80% and 70%, respectively.

Conclusion: In patients receiving HD, OPCAB is safe and improves survival. (*Ann Thorac Cardiovasc Surg* 2007; 13: 396–399)

Key words: off-pump coronary artery bypass, hemodialysis, long-term result, coronary artery disease, all-arterial revascularization

Introduction

Coronary artery disease is a major cause of death in patients on hemodialysis (HD).¹⁾ It has been reported that coronary artery bypass grafting (CABG) effectively decreases cardiac deaths in patients with end-stage renal disease patients.^{2,3)} It has also been reported that cardiac

events are less frequent after CABG than after catheter-based intervention.⁴⁾ However, the morbidity and mortality of CABG for patients on chronic HD are still high.^{5–8)} Recently, the use of CABG with the off-pump coronary artery bypass grafting (OPCAB) technique has increased.⁹⁾ Decreased invasiveness and quicker recovery are the advantages of OPCAB. It also has the advantage of avoiding cardiopulmonary bypass use. As a result, OPCAB is useful in the setting of severe arterial sclerosis, as is seen in patients receiving HD.¹⁰⁾ In the present study, the use of OPCAB in HD patients was examined by reviewing perioperative data and long-term results.

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Methods

The object

We reviewed the records of 358 consecutive patients who underwent isolated OPCAB performed at Tokyo Women's University Medical Center East from February 27, 2000, to May 12, 2006. None of the surgeries was converted to on-pump CABG. Thirty-nine (10.9%) patients were on chronic HD (group HD), which was performed the day before surgery, except on patients requiring urgent surgery. In most cases, HD was performed on the day after surgery. Nafamostat mesylate, instead of heparin, was used for postoperative anticoagulation during HD. We scheduled gradual weight return within a week to the dry weight recorded before the operation.

Sixty patients without renal failure were selected as the control group (group noHD). Patient demographics, operative data, complications (age, gender, frequency of complete revascularization, frequency of complete all-arterial revascularization, mortality, the number of distal anastomoses, operation time, intensive care unit [ICU] stay, hospital stay, bleeding, blood transfusions, intubation time, need for emergency surgery, and intra-aortic balloon pumping [IABP] use) were compared between group HD and group noHD.

The long-term results in group HD were examined. Each HD institution was contacted for a follow-up survey. The mean follow-up period was 27.0 ± 13.7 months (range: 0 to 73 months). Furthermore, group HD was divided into two groups based on whether complete revascularization was performed to assess the long-term results.

Statistical analyses were performed using Student's *t*-test. The results are expressed as the mean \pm SD, and postoperative survival rates were analyzed by Kaplan-Meier methods. A *P* value of less than 0.05 was considered significant. All statistical analyses were performed using SPSS Version 14.0 (SPSS Inc., Chicago, USA).

Results

The ratio of male patients in group HD was higher than in group noHD. Group HD trended toward a lower rate of complete all-arterial revascularizations. There was a significant difference in the rates of complete all-arterial grafts between group HD and group noHD. The intubation time in group HD was longer. However, one patient who died on the fourth postoperative day after emergency surgery influenced this time. If this case is removed, the

average intubation time becomes about 7 h. Only one patient died in group HD. There were no differences between these groups with respect to other perioperative factors (Table 1).

The follow-up was complete in group HD. One- to 3-year survival rates for group HD were 80% and 70%, respectively (Fig. 1). Group HD was divided into a complete revascularization group and an incomplete revascularization group (group CR and group NCR). One- and 5-year survival rates for group CR were 90% and 80%, respectively. The 1-year survival rate for group NCR was 50% (Fig. 2).

Discussion

The morbidity and mortality rates of CABG for patients with chronic HD are still high.⁵⁻⁸⁾ Recently, the use of CABG with the OPCAB technique has increased.⁹⁾ The OPCAB technique was very effective on HD patients because there was no difference between group HD and the noHD group in perioperative results. It has been reported that OPCAB has three advantages for patients on chronic HD compared to conventional CABG.¹⁰⁾ First, less bleeding is expected.¹¹⁾ The second is an avoidance of the systemic inflammatory response syndrome (SIRS) that occurs after cardiopulmonary bypass.¹²⁾ The third is the prevention of electrolyte imbalances that usually occur after conventional on-pump CABG. This technique is good for high-risk patients such as those on chronic HD.

There was a trend toward fewer complete revascularizations in group HD. It is well known that these patients often have advanced coronary atherosclerosis with calcification of the vessel wall. There were some lesions that could not be anastomosed. Furthermore, the quality of grafts was not good. The radial artery may not be suitable for CABG in patients on chronic HD because it may be needed as a future alternate for the internal shunt. The use of the gastroepiploic artery is difficult in peritoneal dialysis patients. Complete all-arterial revascularization was difficult in group HD, and there was a tendency for the number of anastomosis decreases to be lower in this group.

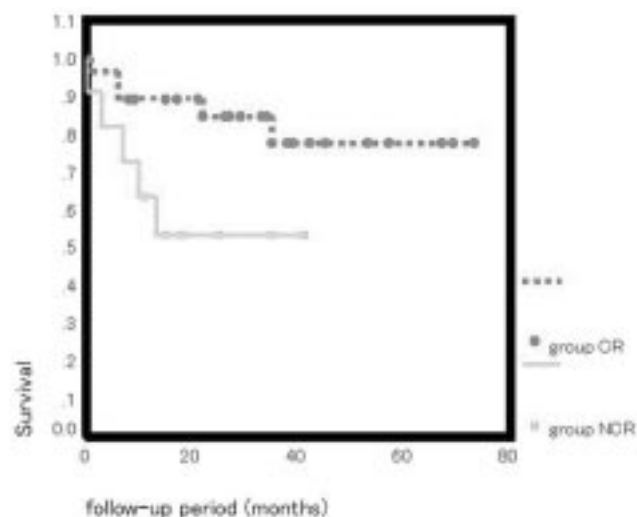
The Japanese Society for Dialysis Therapy announced in 2006 that the survival rate after the start of dialysis was 85% at 1 year, 60% at 5 years, and 40% at 10 years.

In this series, the postoperative course was satisfactory, even though patients had been on dialysis for several years.

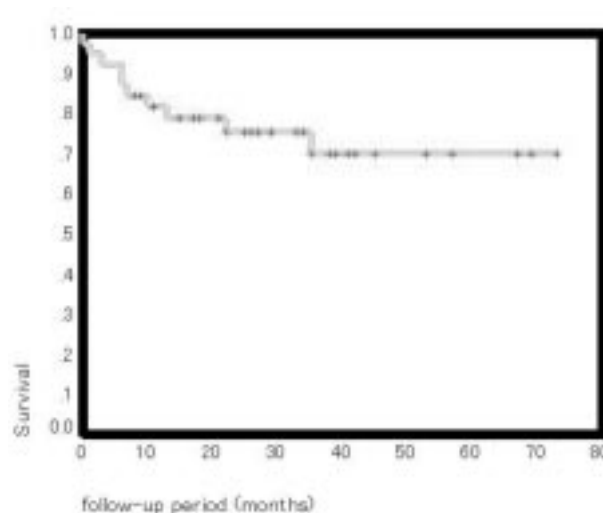
Table 1. Perioperative factors for group HD and noHD

	Group HD	Group noHD	Mean ± SD
Age (year)	63.2±10.2	67.2±7.9	Insignificant
Male:female	34:5	40:20	
Complete revascularization	71.8% (28/39)	86.7% (52/60)	Insignificant
All-arterial revascularization	48.7% (19/39)	80% (48/60)	$p=0.0024$
Hospital death	1	0	Insignificant
Number of distal anastomoses	2.77±1.56	2.98±1.37	Insignificant
Operative time (min)	299.4±110.4	315.7±106.3	Insignificant
ICU stay (day)	2.1±1.1	2.2±3.4	Insignificant
Hospital stay (day)	39.2±24.1	43.0±32.5	Insignificant
Bleeding during surgery (mL)	1,326.6±918.2	1,056.4±598.8	Insignificant
Blood transfusion	53.8% (21/39)	26.7% (16/60)	Insignificant
Intubation time (h)	25.1±102.5	8.3±24.2	Insignificant
Emergency ration	12.8% (5/39)	13.3% (8/60)	Insignificant
IABP use	12.8% (5/39)	10% (6/60)	Insignificant

HD, hemodialysis; SD, standard deviation; ICU, intensive care unit; IABP, intra-aortic balloon pumping.

**Fig. 1.** One- to 3-year survival rates for group HD.

It has been reported that a more complete revascularization is important for patients on HD.¹³⁾ No complete revascularization cases were examined in detail. The 1-year survival rate was 50%, but after the second year there were no deaths, and these causes of death were various, including carcinoma, cerebrovascular disease, infection from a leg amputation, and sudden death. Most patients underwent surgery in poor condition because their general condition was very bad and they had advanced coronary atherosclerosis with a calcification of the vessel wall. However, all operations were accomplished safely. Some patients had chest pain during HD before surgery. In the follow-up period, there was no chest pain during HD. This is a positive effect of OPCAB.

**Fig. 2.** Survival rates for groups CR and NCR.

Group HD was divided into a complete revascularization group and an incomplete revascularization group (group CR and group NCR). One- and 5-year survival rates for group CR were 90% and 80%, respectively. The 1-year survival rate for group NCR was 50%.

Conclusion

OPCAB reduces the operative risk and increases life expectancy.

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