



Impact of Dialysis on Open Cardiac Surgery

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Abstract

Background: Dialysis patients frequently have coronary artery disease but are regarded as high risk patients for coronary artery bypass grafting (CABG).

Methods: Between February 2002 and September 2006, seventeen dialysis-dependent patients underwent isolated CABG at our center. CABG was performed under cardiopulmonary bypass (CPB) for all the patients. All cases had been maintained on hemodialysis and the duration of preoperative hemodialysis ranged from 6 to 24 months (mean 13.4 ± 6.4). The patients' characteristics, clinical and operative data as well as perioperative and mid-term outcome were reviewed.

Results: All patients were men with a mean age of 53 ± 8.4 years. Mean preoperative ejection fraction was $45.5\% \pm 10.4\%$ (range 25 to 60%). One internal mammary graft was used in 16 (94.1%) patients. Cardiopulmonary bypass and aortic cross-clamp times were 71.3 ± 18.7 and 40.5 ± 8.3 minutes respectively. The more frequent complication was prolonged mechanical ventilation in 2 (11.7%), there was no perioperative mortality. In mid-term follow-up (mean time: 11.8 ± 9.5 months) the mid-term mortality rate was 20% (3 patients).

Conclusion: CABG in chronic renal dialysis patients can be accomplished with acceptable short and mid-term morbidity and mortality.

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Introduction

Dialysis treatment is one of the great technical achievements of 20th century medicine; it provides the chance of prolonged life in end-stage renal disease patients.¹ Cardiac disease is the cause of death in 44% of long-term dialysis patients.² Renal transplantation has been documented to lessen complication associated with renal failure. The underlying

coronary artery disease must frequently be addressed to allow uncomplicated dialysis. It is imperative that it be considered before kidney transplantation as well, to assure a successful result.² Although there has been tremendous advancement in the use of percutaneous transluminal coronary angioplasty (PTCA) for treatment of coronary artery disease, coronary

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artery bypass grafting (CABG) remains the gold standard for revascularization.³

The goal of this study was to describe perioperative and mid-term results of CABG in end-stage renal disease (ESRD) patients.

Methods

Seventeen patients with ESRD maintained on chronic hemodialysis who underwent elective, isolated CABG procedure at Tehran Heart Center from February 2002 through September 2006 were retrospectively analyzed.

Patients' data included the following variables: age, gender, coronary risk factors (such as hypertension, diabetes mellitus, hyperlipidemia, and cigarette smoking) as well as New York Heart Association class (NYHA), Canadian Cardiovascular Society angina class (CCS), preoperative angiographic profiles (total number of significantly diseased coronary arteries and ejection fraction). All variables were based on definitions of the Society of Thoracic Surgeons and were regularly reported to the national cardiac database.

We also reviewed operative data including number of distal anastomosis, use of internal mammary artery (IMA), cardiopulmonary bypass, aortic cross clamp time and quality of coronary arteries, as well as postoperative complications and mortality.

The mean time of preoperative hemodialysis was 13.4±6.4 months (6 to 24 months). Surgical procedure details included median sternotomy, cardiopulmonary bypass (CPB) at normothermia or mild hypothermia, with the use of a roller pump (flow rate, 1.8–2.4 L/min/m²) and membrane oxygenator. Hemofiltration was used for all cases. All patients received Cloxacillin 1.5 g every 6 hours and Ceftrizidim 1 g intravenously every 12 hours for antimicrobial prophylaxis from 30 minutes before surgery to 72 hours postoperatively. All patients underwent hemodialysis on the day prior to surgery and patients underwent their usual hemodialysis postoperatively. One internal mammary graft was used in 16 out of 17 patients. In the case of arteriovenous fistula, free IMA was used. All other grafts were saphenous vein.

All patients were evaluated for a follow-up period of 1 to 34 months (mean 11.8±9.5). Follow-up was accomplished by phone and use of the last out patient fills. Mid-term result evaluation included changes in anginal class (CCS), NYHA class, mortality, morbidity and successful kidney transplantation.

Continuous variables were expressed as mean±standard deviation. Discrete variables were presented as percentages.

Results

Patients' characteristics, risk factors and pre operative

profiles are shown in table 1.

Table 1. Demographics and preoperative factors

| Patients Characteristics | Value |
|---------------------------------|-------------|
| Age (Y) (mean±SD) | 53 ± 8.4 |
| Male sex | 17 (100%) |
| Diabetes Mellitus | 10 (58.8%) |
| Hypertension | 8 (47.1%) |
| Hyperlipidemia | 10 (58.8%) |
| Smoker | 7 (41.2%) |
| Triple vessel disease | 13 (76.5%) |
| Ejection fraction (%) (mean±SD) | 45.5 ± 10.4 |
| CCS class (mean±SD) | 2.0 ± 0.7 |
| NYHA class (mean±SD) | 1.8 ± 0.8 |

CCS, Canadian Cardiovascular Society Angina class; NYHA, New York Heart Association class

All patients were men with a mean age of 53±8.4 years. Three patients (17.6%) had documented myocardial infarction. Mean preoperative ejection fraction was 45.5%±10.4% (range 25 to 60 %).

Total number of distal anastomosis was 3.7±0.7. The qualities of coronary arteries were severely diseased in 8 (42.1%), moderate in 7 (41.2%) and good in 2 (11.8%) of the patients. Cardiopulmonary bypass time and aortic cross-clamp times were 71.3±18.7 and 40.5±8.3 minutes respectively.

The postoperative profiles are shown in table 2.

Table 2. Postoperative factors*

| Variable | Value |
|-------------------------------------|-------------|
| Mechanical ventilation time (hours) | 15.9 ± 10.1 |
| ICU stay (hours) | 69.5 ± 46.8 |
| Hospital stay (days) | 10.94 ± 3.4 |
| Perioperative mortality | 0 |
| Mid-term mortality | 3 (20%) |

* Data are stated as mean±SD

Mean duration of mechanical ventilation was 15.9±10.1 hours. Length of stay in intensive care was 69.5±46.8 hours. The complications were as follow: prolonged mechanical ventilation in two patients (11.7%), atrial fibrillation in one (5.9%) and pericardial effusion in one. Persistent bleeding or tamponade were not seen.

All postoperative patients were able to undergo dialysis on early and late follow-up without interfering angina. We did not have perioperative mortality (30 days after operation) in our group. During mid-term follow-up of 11.8±9.5 months, the mortality rate was 20% (3 patients). Two patients died 3 months after surgery because of infection and renal failure and one patient 1.5 years after surgery because of



renal failure. Mean preoperative CCS class changed from 2.0 ± 0.7 to 1.5 ± 0.7 in a mid-term follow-up but NYHA class did not show any change (1.8 ± 0.8 to 1.8 ± 0.5). Five out of seventeen patients (29.4%) underwent kidney transplantation successfully after CABG.

Discussion

Although dialysis prolongs the lifespan and life quality of patients with ESRD, dialysis still has only an overall 5-year survival rate of 55% to 60%.⁴ It is widely accepted that patients with end-stage renal disease have an accelerated rate of atherosclerosis and an increased mortality rate from CAD.¹ The higher incidence of CAD in this patient population can be attributed to the presence of comorbid conditions that include hypertension, hyperlipidemia, renal anemia and fluid overload by arteriovenous shunt, heterotopic calcification due to secondary hyperparathyroidism and abnormal carbohydrate metabolism that leads to accelerated atherosclerosis.^{1,5} Both renal dysfunction (RD) and ESRD are important risk factors for patients undergoing cardiopulmonary bypass. Despite this risk, increasing number of patients with RD and ESRD are being referred for coronary revascularization and CABG in particular.⁶

In our study, for all the patients who underwent CABG, perioperative mortality was not seen. Previous studies have suggested a survival benefit for CABG in dialysis patients.^{3,7} Cooper et al.⁶ reported operative mortality rose inversely with declining renal function, from 1.3% for those with normal renal function to 9.3% with severe RD not on dialysis and 9.0% for those who were dialysis dependent.

None of our 17 patients required a balloon pump for cardiopulmonary bypass weaning. Perioperative complications in our group were as follow: prolonged mechanical ventilation, atrial fibrillation, and pericardial effusion. There is no cerebrovascular accident (CVA) in our patients which is not paralleled in similar reports: Kaul and coworkers,⁸ 11%, Blum et al.⁹ 8% and Franga and associates,² 7%.

In previous studies actuarial overall survival at 5 years was $32.0\% \pm 12\%$ ² and the adjusted 8-year survival rates were 44.8% with CABG.¹⁰ Our mid-term mortality in mid-term follow up was 20%. Causes of death were unrelated to cardiac problems (infection and end-stage renal failure).

A frequent indication for operation was angina interfering with routine hemodialysis and the great majority of patients enjoyed excellent relief of angina immediately after operation.²

In the present study, all our patients were able to undergo dialysis on early and mid-term follow-up without interfering angina postoperatively and 29.4% of the patients underwent kidney transplantation successfully after CABG.

The low numbers of hemodialysis cases along with short

follow-up period were the study limitations.

Conclusion

Although dialysis-dependent patients are understood to be a high risk group for cardiac operative outcomes, but CABG can be performed in them with acceptable short and mid-term morbidity and mortality.

References

1. Kan CD, Yang YJ. Coronary artery bypass grafting in patients with dialysis-dependent renal failure. *Tex Heart Inst J* 2004;31:224-230.
2. Franga DL, Kratz JM, Crumbley AJ, Zellner JL, Stroud MR, Crawford FA. Early and long-term results of coronary artery bypass grafting in dialysis patients. *Ann Thorac Surg* 2000;70:813-819.
3. Rinehart AL, Herzog CA, Collines AJ, Flack JM, Ma JZ, Opsahl JA. A comparison of coronary angioplasty and coronary artery bypass grafting outcomes in chronic dialysis patients. *Am J Kidney Dis* 1995; 25: 281-290.
4. Hirose H, Amano A, Takahashi A, Ozaki S, Nagano N. Coronary artery bypass grafting in hemodialysis-dependent patients. *Artif Organs* 2001;25:239-247.
5. Gelsomino S, Da Col P, Frassini R, Morocutti G, Muzzi R, Bassi F, Cappelletto G, Livi U. Coronary artery bypass grafting in patients with dialysis-dependent renal failure: ten-year results. *Ital Heart J* 2001;2:379-383 .
6. Cooper WA, O'Brien SM, Thourani VH, Guyton RA, Bridges CR, Szczech LA, Peterson R, Peterson ED. Impact of renal dysfunction on outcomes of coronary artery bypass surgery. *Circulation* 2006;113:1063-1070.
7. Herzog CA, Ma JZ, Collines AJ. Comparative survival of dialysis patients in the United States after coronary angioplasty, coronary artery stenting, and coronary artery bypass surgery and impact of diabetes. *Circulation* 2002;106: 2207-2211.
8. Kaul TK, Fields BL, Reddy MA, Kahn DR. Cardiac operations in patients with end stage renal disease. *Ann Thorac Surg* 1994;57:691-696.
9. Blum U, Skupin M, Wagner R, Matheis G, Oppermann F, Satter P. Early and long-term results of cardiac surgery in dialysis patients. *Cardiovasc Surg* 1994;2:997-1000.
10. Hemmelgarn BR, Southern D, Culleton BF, Mitchell LB, Knudtson ML, Ghali WA. Survival after coronary revascularization among patients with kidney disease. *Circulation* 2004;110:1890-1895.