

Clinical outcome of coronary artery bypass grafting (CABG) in hemodialysis-dependent patients and comparison with non-renal failure patients

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Abstract. – BACKGROUND: Coronary artery bypass grafting (CABG) is a revascularization technique that has been reported as having satisfactory survival rates in Hemodialysis (HD) dependent patients.

AIM: The aim of this study was to determine morbidity and mortality of isolated CABG in HD-dependent patients and compare with non-renal failure (RF) patients.

PATIENTS AND METHODS: We performed a retrospective analysis of data related to all patients who underwent first time, on-pump, isolated CABG surgery between May 23, 2004 to September 22, 2012, we selected 32 CRF patients with history of chronic hemodialysis (group HD) and 32 non renal failure patients (group non-HD). The preoperative data of two groups were matched completely. We collected all data of intraoperative and postoperative. Data were analyzed by SPSS version 16.

RESULTS: the mean age of HD group and non-HD group were 52.46 ± 3.24 and 52.12 ± 3.54 years ($p = 0.68$). Low cardiac output syndrome was occurred in 4 patients (12.5%) of HD group and one patient (3.12%) of non-HD group ($p = 0.16$). 96.87% of patients in HD group and 81.25% of patient in non-HD group ($p = 0.045$) needed infusion of packed cell. 31.25% in HD group and 6.25% in non-HD group needed platelets infusion ($p = 0.010$). Infection was observed in 9.37% of HD group and 3.12% of non-HD group patients ($p = 0.30$). The hospital stay in HD group was 15.21 ± 2.63 days and in non-HD group was 5.93 ± 0.94 days ($p = 0.000$). Finally, we have 2 death (6.25%) in HD-dependent patients.

CONCLUSIONS: Isolated on-pump CABG in HD patients compared with non-HD patients was associated with high rate of morbidity and longer hospitalization.

Key Words:

Coronary artery bypass grafting, Hemodialysis, Outcome.

Introduction

Coronary artery disease (CAD) with more than 4.5 million deaths in development countries is ma-

ior causes of mortality around the world¹. The most reasonable treatment in multivessel CAD patients is coronary artery bypass grafting (CABG). This option have a good ability to improve overall health-related quality of life and survival^{2,3}. The society of Thoracic Surgeons (STS) reported five major morbidities after CABG that included renal failure, stroke, prolonged ventilation, deep sternal wound infection, and reoperation⁴.

Chronic renal failure (CRF) is a major public health problem in the worldwide with more than 1000000 renal replacement therapy⁵. One of the major causes of death in patients with CRF is cardiovascular disease. So that, mortality in dialysis-dependent patients with cardiovascular disease is 10 to 30 times higher than the general population⁶. We have two main options for treatment CAD in CRF patients that include percutaneous transluminal coronary angioplasty (PTCA) and Coronary artery bypass grafting (CABG)⁷. In the patients with CRF, PTCA associated with more acute complications and poor long-term prognosis. Comparing with PTCA, CABG has lower acute complications and more symptom-free survival in dialysis-dependent patients with CAD⁸. However, still CABG is associated with high rate of morbidity and mortality in patients with chronic hemodialysis (HD)^{9,10}. The purpose of this study was to determine morbidity and mortality of isolated CABG in HD-dependent patients and compare with non-RF patients.

Patients and Methods

We performed a retrospective analysis of data related to all isolated CABG surgeries performed at 3 hospitals in Sari, Iran (Fatemeh Zahra, Shafa and Nime-Shaban Hospitals). It included 2,153 consecutive patients who underwent first time, on-pump, isolated CABG surgery between May

23, 2004 to September 22, 2012. The exclusion criteria's were: surgeries with associated procedures, such as valve replacement and valvuloplasty, correction of aneurysms, and carotid endarterectomy. 32 patients from 2,153 patients had CRF with history of chronic hemodialysis (group HD). Demographic data (including age and sex, smoking history and health status prior to surgery), history of myocardial infarction, diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), peripheral vascular disease and ejection fraction (EF) were collected for all HD-dependent patients. The aim of this study was to determine morbidity and mortality of CABG in HD-dependent patients and compare with non-RF patients. Then, we randomly divided 32 non renal failure patients who had similar information as a control group (group non-HD). The preoperative data of two groups were matched completely. We collected all intraoperative and postoperative data's such as need to insertion of Intra-Aortic Balloon Pump (IABP), re-bleeding, need to packed cell infusion, need to platelet infusion, low cardiac output syndrome (LCOS), surgery site infection, hospital stay duration, hospital operative mortality (<30 days) and 3 month follow up mortality.

Statistical Analysis

Data were entered into computer using the SPSS version 16. Patient's characteristics were described using means, standard deviations, and percentages wherever appropriate. We used the chi-square test for comparisons of categorical variables and Student *t* test for continuous variables. *p* values < 0.05 were considered statistically significant.

Results

This study included 64 patients that divided in two groups. 32 patients in HD-dependent group (group HD) (19 males and 13 females) and 32 patients in non-renal failure group (group non-HD) (20 males and 12 females). The mean age of HD group and non-HD group were 52.46 ± 3.24 and 52.12 ± 3.54 years ($p = 0.68$). The data showed that one patient (3.12%) in HD group needed IABP insertion. Also, rebleeding observed only in a patient (3.12%) of HD group. Low cardiac output syndrome was occurred in 5 patients (7.81%), 4 patients (12.5%) in HD group and one patients (3.12%) in non-HD

group ($p = 0.16$). 96.87% patients of HD group and 81.25% patient of non-HD group ($p = 0.045$) needed packed cell infusion. furthermore, 31.25% in HD group and 6.25% in non-HD group needed to platelets infusion ($p = 0.010$). After 2 weeks observation, infection only observed in 9.37% of HD group and 3.12% of non-HD group patients ($p = 0.30$). The hospital stay duration in HD group was 15.21 ± 2.63 days (Median: 15 days) and in non-HD group was 5.93 ± 0.94 days (Median: 6 days). We observed a significant difference between 2 groups in hospital stay duration ($p = 0.000$). Finally, there was 2 deaths (6.25%) in HD-dependent patients. one death occurred before 30 days (hospital operative mortality) and another was occurred in 2 month after surgery (Table I).

Discussion

CAD is a major cause of mortality and morbidity in patients with CRF and these patients often need myocardial revascularization¹¹. CABG is a revascularization technique that has been reported as having satisfactory survival rates in CRF patients^{12,13}. However, the CABG morbidity and mortality rate in HD-dependent patients are still high^{9,10}.

We survey the clinical outcome of CABG mortality and morbidity in HD-dependent patients and compare with non-HD patients. The mean age of our patients was lower than similar previous study^{14,15}. Use of intraoperative IABP in present study was similar to Cooper et al¹⁶ work. They are reported intraoperative IABP used about 2.8% of HD-dependent patient in their study¹⁶. Nevertheless, Murai et al¹⁷ (2007) shown about 12.8% of their HD-dependent patients needs intraoperative IABP. However, the important point in these 3 studies was that no significant difference were observed between the HD and non-HD patients.

Reoperation for bleeding observed in 3.12% of our HD-dependent patients. This result was very near to other studies such as Yamauchi et al¹⁵ (3%) and Cooper et al¹⁶ (3.4%). Their reports showed significant difference in bleeding that need reoperation among HD-dependent patients. These results will be acceptable when we remember the platelet dysfunction and coagulation defects in dialysis dependent patients^{18,19}. In this paper, low cardiac output syndrome occurred in 12.5% of HD-dependent versus 3.12% of non-

Table 1. The rates of the complications after coronary artery bypass grafting in HD-dependent and non-RF patients according to demographic, clinical, and surgery characteristics.

| | HD-dependent group | Non-RF group | p value |
|------------------------------|--------------------|--------------|---------|
| Number of patients | 32 | 32 | |
| Age (mean±SD) | 52.46 ± 3.24 | 52.12 ± 3.54 | 0.68 |
| Male sex | 59.53% | 62.5% | 0.79 |
| IABP | 3.12% | 0 | 0.31 |
| Rebleeding | 3.12% | 0 | 0.31 |
| LCOS | 12.5% | 3.12% | 0.16 |
| Pack cell | 96.87% | 81.25% | 0.045 |
| Platelets | 31.25% | 6.25% | 0.010 |
| Infection | 9.37% | 3.12% | 0.30 |
| Hospital stay (mean±SD) | 15.21 ± 2.63 | 5.93 ± 0.94 | 0.000 |
| Hospital operative mortality | 3.12% | 0 | 0.31 |
| After one month death | 3.12% | 0 | 0.31 |

HD, Hemodialysis; RF, renal failure; SD, standard deviation; IABP, intra-aortic balloon pump; LCOS, low cardiac output syndrome.

HD dependent patients. Similar to this findings, Barbosa et al²⁰ reported that low cardiac output syndrome after CABG occurred in 14.4% of patients with chronic kidney disease (CKD) versus 8.5% of non-CKD patients.

In this study, similar to other researches, post-operative infection in HD-dependent patients was higher than non-HD dependent patients^{15,16,20}. This is being justifiable due to the fact that patients dependent on dialysis are an immunocompromised population²¹.

The mean hospital stay duration in HD dependent patients was 15 days and in non-HD patients was 6 days. Our data show that hospital stay after CABG in HD-dependent patients was significantly higher than non-HD dependent patients. This findings confirms the results of other studies^{16,22,23}.

We haven't any death in non-HD patients. While, the mortality rate in HD-dependent patients was 6.25%. The mortality rate in Cooper et al¹⁶ work was 1.3% among patients with normal renal function and 9.0% for patients on dialysis. This result was similar to previous reports that referred a mortality of HD dependent patients after isolated CABG is fewer than 10%^{15,16,24}. Possible mechanism for higher mortality rate in HD-dependent versus non-HD dependent patients includes previous atherosclerosis and prevalence of CAD in HD-dependent patients^{25,26}.

Conclusions

Isolated on-pump CABG in HD patients compared with non-HD patients was associated with high rate of morbidity and longer hospitalization.

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Conflict of Interest

The Authors declare that there are no conflicts of interest.

Reference

- 1) OKRAINEC K, BANERJEE DK, EISENBERG MJ. Coronary artery disease in the developing world. *Am Heart J* 2004; 148: 7-15.
- 2) RUMSFELD JS, MAGID DJ, O'BRIEN M, MCCARTHY M JR, MAWHINNEY S, SCD, SHROYER AL, MORITZ TE, HENDERSON WG, SETHI GK, GROVER FL, HAMMERMEISTER KE. Changes in health-related quality of life following coronary artery bypass graft surgery. *Ann Thorac Surg* 2001; 72: 2026-2032.
- 3) SERRUYS PW, MORICE MC, KAPPETEIN AP, COLOMBO A, HOLMES DR, MACK MJ, STÄHLE E, FELDMAN TE, VAN DEN BRAND M, BASS EJ, VAN DYCK N, LEADLEY K, DAWKINS KD, MOHR FW. Percutaneous coronary intervention versus coronary-artery bypass grafting for severe coronary artery disease. *N Engl J Med* 2009; 360: 961-972.
- 4) SHROYER AL, COOMBS LP, PETERSON ED, EIKEN MC, DE-LONG ER, CHEN A, FERGUSON TB JR, GROVER FL, EDWARDS FH. The Society of Thoracic Surgeons: 30-day operative mortality and morbidity risk models. *Ann Thorac Surg* 2003; 75: 1856-1864; discussion 1864-1865.
- 5) LYSAGHT MJ. Maintenance dialysis population dynamics: current trends and long-term implications. *J Am Soc Nephrol* 2002; 13: S37-S40.

- 6) K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis* 2002; 39: S1-S266.
- 7) RAGGI P, BOULAY A, CHASAN-TABER S, AMIN N, DILLON M, BURKE SK, CHERTOW GM. Cardiac calcification in adult hemodialysis patients. A link between end-stage renal disease and cardiovascular disease? *J Am Coll Cardiol* 2002; 39: 695-701
- 8) HIROSE H, AMANO A, TAKAHASHI A, OZAKI S, NAGANO N. Coronary artery bypass grafting for hemodialysis-dependent patients. *Artif Organs* 2001; 25: 239-247
- 9) KHAITAN L, SUTTER FP, GOLDMAN SM. Coronary artery bypass grafting in patients who require long-term dialysis. *Ann Thorac Surg* 2000; 69: 1135-1139.
- 10) NAKAYAMA Y, SAKATA R, URA M, ITOH T. Long-term results of coronary artery bypass grafting in patients with renal insufficiency. *Ann Thorac Surg* 2003; 75: 496-500.
- 11) HORST M, MEHLHORN U, HOERSTRUP SP, SUEDEKAMP M, VIVIE ER. Cardiac surgery in patients with end-stage renal disease: 10-year experience. *Ann Thorac Surg* 2000; 69: 96-101.
- 12) 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.
- 13) KINOSHITA T, ASAI T, MURAKAMI Y, SUZUKI T, KAMBARA A, MATSUBAYASHI K. Preoperative renal dysfunction and mortality after off-pump coronary artery bypass grafting in Japanese. *Circ J* 2010; 74: 1866-1872.
- 14) LIU JY, BIRKMEYER NJO, SANDERS JH, MORTON JR, HENRIQUES HF, LAHEY SJ, DOW RW, MALONEY C, DISCIPIO AW, CLOUGH R, LEAVITT BJ, O'CONNOR GT. Risks of morbidity and mortality in dialysis patients undergoing coronary artery bypass surgery. Northern New England Cardiovascular Disease Study Group. *Circulation* 2000; 102: 2973-2977.
- 15) YAMAUCHI T, MIYATA H, SAKAGUCHI T, MIYAGAWA S, YOSHIKAWA Y, TAKEDA K, MOTOMURA N, TSUKIHARA H, SAWA Y. Coronary artery bypass grafting in hemodialysis-dependent patients: analysis of japan adult cardiovascular surgery database. *Circ J* 2012; 76: 1115-1120
- 16) COOPER WA, O'BRIEN SM, THOURANI VH, GUYTON RA, BRIDGES CR, SZCZECZ LA, PETERSEN R, PETERSON ED. Impact of renal dysfunction on outcomes of coronary artery bypass surgery: results from the Society of Thoracic Surgeons National Adult Cardiac Database. *Circulation* 2006; 113: 1063-1070.
- 17) MURAI N, KODERA K, SASAKI A, ASANO R, KATAOKA G, IKEDA M, YAMAGUCHI A, SONE Y, TAKEUCHI Y. Prognosis after off-pump coronary artery bypass in patients receiving hemodialysis. *Ann Thorac Cardiovasc Surg* 2007; 13: 396-399.
- 18) OWEN CH, CUMMINGS RG, SELL TL, SCHWAB SJ, JONES RH, GLOWER DD. Coronary artery bypass grafting in patients with dialysis-dependent renal failure. *Ann Thorac Surg* 1994; 58: 1729-1733.
- 19) RAO V, WEISEL RD, BUTH KJ, COHEN G, BORGER MA, SHIONO N, BHATNAGAR G, FREMES SE, GOLDMAN BS, CHRISTAKIS GT. Coronary artery bypass grafting in patients with non-dialysis-dependent renal insufficiency. *Circulation* 1997; 96(Suppl II): II38-II45.
- 20) BARBOSA RR, CESTARI PF, CAPELETTI JT, PERES GM, IBAÑEZ TL, DA SILVA PV, FARRAN JA, AMATO VL, FARSKY PS. Impact of renal failure on in-hospital outcomes after coronary artery bypass surgery. *Arq Bras Cardiol* 2011; 97: 249-253.
- 21) JOHNSON BL, GLICKMAN MH, BANDYK DF, ESSES GE. Failure of foot salvage in patients with end-stage renal disease after surgical revascularization. *J Vasc Surg* 1995; 22: 280-286.
- 22) HILLIS GS, CROAL BL, BUCHAN KG, EL-SHAFEI H, GIBSON G, JEFFREY RR, MILLAR CG, PRESCOTT GJ, CUTHBERTSON BH. Renal function and outcome from coronary artery bypass grafting impact on mortality after a 2.3-year follow-up. *Circulation* 2006; 113: 1056-1062.
- 23) GO AS, CHERTOW GM, FAND, MCCULLOCH CE, HSU CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *N Engl J Med* 2004; 351: 1296-1305.
- 24) AKMAN B, BILGIC A, SASAK G, SEZER S, SEZGIN A, ARAT Z, OZDEMIR FN, HABERAL M. Mortality risk factors in chronic renal failure patients after coronary artery bypass grafting. *Ren Fail* 2007; 29: 823-828
- 25) FOLEY RN, MURRAY AM, LI S, HERZOG CA, McBEAN AM, EGGERS PW, COLLINS AJ. Chronic kidney disease and the risk for cardiovascular disease, renal replacement, and death in the United States Medicare population, 1998 to 1999. *J Am Soc Nephrol* 2005; 16: 489-495.
- 26) HOLZMANN MJ, HAMMAR N, AHNVE S, NORDQVIST T, PEHRSSON K, IVERT T. Renal insufficiency and long-term mortality and incidence of myocardial infarction in patients undergoing coronary artery bypass grafting. *Eur Heart J* 2007; 28: 865-871.