

Myocardial Revascularization in Dialytic Patients: In-Hospital Period Evaluation

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Abstract

Background: Coronary artery bypass grafting currently is the best treatment for dialytic patients with multivessel coronary disease, but hospital morbidity and mortality related to procedure is still high.

Objective: Evaluate results and in-hospital outcomes of coronary artery bypass grafting in dialytic patients.

Methods: Retrospective unicentric study including 50 consecutive and not selected dialytic patients, who underwent coronary artery bypass grafting in a tertiary university hospital from 2007 to 2012.

Results: High prevalence of cardiovascular risk factors was observed (100% hypertensive, 68% diabetic and 40% dyslipidemic). There was no intra-operative death and 60% of the procedures were performed off-pump. There were seven (14%) in-hospital deaths. Postoperative infection, previous heart failure, cardiopulmonary bypass, abnormal ventricular function and surgical re-exploration were associated with increased mortality.

Conclusion: Coronary artery bypass grafting is feasible to dialytic patients although high in-hospital morbidity and mortality. It is necessary better understanding about metabolic aspects to plan adequate interventions. (*Arq Bras Cardiol.* 2014; 102(2):128-133)

Keywords: Myocardial Revascularization; Patients; Dialysis; Hospitalization.

Introduction

Chronic renal failure (CRF) is an independent risk factor for the development of coronopathies and its complications, and injury severity level is inversely proportional to the glomerular^{1,2} filtration rate, which makes ischemic cardiovascular diseases the main mortality cause in this group of patients². In addition to uremia, other factors such as bad quality of distal coronary bed, hyperhomocysteinemia, increased calcium-phosphorus product, oxidative stress, chronic inflammation and exacerbated atherosclerosis are associated with the severity of coronary disease³⁻⁶. Coronary artery bypass grafting (CABG) has shown better long-term survival and lower risk of myocardial infarction and cardiovascular death when compared to coronary angioplasty with stent in patients with dialytic chronic kidney failure⁷⁻⁹, but surgery still has high morbidity and mortality in these patients¹⁰.

Objective

Analyze CABG results in dialytic patients with chronic kidney failure, as well as in-hospital complications, in order to identify its causes and define proper interventions.

Methods

We analyzed the medical records of 50 chronic renal failure on dialysis (hemodialysis), consecutive, non-selected patients enrolled in retrospective study, undergoing coronary artery bypass grafting at a public tertiary university hospital from 2007 to 2012. Patients with other concomitant procedures (valve, carotid, aortic surgery, etc.) were excluded from this study. We investigated demographic and clinical characteristics, intraoperative data and postoperative complications during the hospitalization period of these patients. The calculation of preoperative risk was performed by *European System for Cardiac Operative Risk Evaluation II* (EuroSCORE II)¹¹. Subsequently, two subgroups were created ("deaths" and "survivors") in order to identify factors that indicate higher in-hospital mortality. The study was approved by the local research ethics committee.

Surgical technique

Surgical indication for CABG was based on American and European guidelines^{12,13}. Surgical planning was carried out based on injuries found on cineangiocoronariography

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Manuscript received August 22, 2013; revised manuscript September 25, 2013; accepted September 26, 2013.

DOI: 10.5935/abc.20130231

and on the feasibility of surgical revascularization of distal coronary bed, as well as selecting the best vascular grafting for each coronary. At the surgical center, the central venous access, invasive blood pressure measurement, anesthetic monitoring, urinary catheterization and general anesthesia were performed. An incision between 12 and 14 cm is made on the pre-sternal region, followed by median sternotomy. The left internal thoracic artery is dissected and opening the pleura is avoided, and this arterial graft is for revascularization of the anterior interventricular artery (anterior descending). Another vascular graft used in this sample was the great saphenous vein, dissected through incisions on medial aspect of thigh, intended to other coronary beds.

Technique with cardiopulmonary bypass (CPB): Heparin administration is performed prior to aortic and atrial cannulation, (two stage cannula) at a dose of 4 mg/mg. CPB implantation was carried out only after the confirmation of Activated Clotting Time (ACT) above 480 seconds. During cardiac arrest with aortic clamping, myocardial protection with antegrade, intermittent and hypothermic blood cardioplegia was performed at every 15 minutes.

Technique without CPB: Heparin was administered 10 minutes before coronary occlusion, at 2 mg/kg dose. Distal anastomoses were performed with the aid of vacuum stabilizers, with tourniquet application only proximal to treated coronaries. The sequence of anastomoses consisted of prioritizing arteries with total occlusion.

Statistical Analysis

For results analysis, Cochran's Q-test was applied for the study of concomitant variables for both survivors and death groups Fisher's exact test was used to study possible associations between each variable and group analyzed. Rejection level of null hypothesis was established at 0.05 or 5%. BioEstat 5.0 software was used to carry out statistical tests.

Results

Patients' demographic data are represented in Table 1 and show high prevalence of risk factors for coronopathies. No patient had chronic obstructive pulmonary disease, hemodynamic instability, history of previous heart surgery or need for urgent or emergency surgery. Three patients were using immunosuppression therapy due to previous kidney transplant, however, they were previously hospitalized due to graft rejection, which required dialytic treatment. Laboratory data contained in Table 2 are derived from examinations conducted on the day immediately prior to surgery and show an abnormal metabolic profile, with increased creatinine and urea levels and low hemoglobin level. Intraoperative variables are presented in Table 3. No patient required intra-aortic balloon pump, there was no intraoperative death and all procedures were isolated revascularization. Twenty patients (40%) underwent surgery with CPB:

Events and variables in postoperative period are represented in Table 4. Main observed complications were atrial fibrillation, infection, postoperative acute myocardial infarction, and vasoplegic syndrome; it was also observed one case of ischemic stroke and one case of total atrioventricular block.

Table 1 - Demographic Characteristics

	N (%)	Mean
Age (years)	-	56.8
Female	15 (30)	-
Dialysis Period (months)	-	51.7
Hypertension	50 (100)	-
Diabetes	34 (68)	-
Dyslipidemia	20 (40)	-
Obesity	7 (14)	-
Smoking	5 (10)	-
COPD	0	-
Previous Stroke	8 (16)	-
Previous Angioplasty	11 (22)	-
Previous heart surgery	0	-
Heart Failure	7 (14)	-
Asymptomatic	21 (42)	-
Previous Acute Myocardial Infarction	8 (16)	-
Peripheral Arterial Disease	8 (16)	-
Stable Angina	8 (16)	-
Unstable Angina	9 (18)	-
Left Coronary Trunk Lesion	9 (18)	-
Preserved Ventricular Function (LVEF > 50%)	46 (92)	-
Previous transplant	3 (6)	-

COPD: chronic obstructive pulmonary disease; LVEF: left ventricular ejection fraction

Table 2 - Preoperative laboratory data

	Mean ± Standard Deviation
Creatinine (mg/dL)	7.5 ± 3.0
Urea (mg/dL)	108.0 ± 33.4
Hemoglobin (g/dL)	12.2 ± 1.7
Sodium (mEq/L)	136.2 ± 4.0
Potassium (mEq/L)	4.9 ± 0.8

Three surgical re-explorations were required, being two due to mediastinitis and one for review of hemostasis. There were seven in-hospital deaths, all in the postoperative period, being three cases due to septic shock, three cases due to cardiogenic shock and one case of refractory arrhythmia.

All demographic, intraoperative and postoperative characteristics studied were analyzed by dividing the patients in two groups: one containing those who survived the in-hospital period (n = 43), and another containing the deaths that occurred during hospitalization (n = 7). Cochran's Q-test showed for both deaths and survivors group statistically relevant differences between the presence of characteristics studied for each group (Table 5). The survivors group had 100% of patients with

Table 3 - Intraoperative data

	N (%)	Mean (maximum - minimum)
Number of anastomoses	-	2.2
Inotropic support	29 (58)	-
Transfusion	19 (38)	-
Intra-aortic balloon pump	0	-
Cardiopulmonary Bypass	20 (40)	-
- CPB Time (min)	-	87.8 (160 - 43)
- Aortic clamping time (min)	-	57.3 (100 - 26)
Intraoperative death	0	-

CPB: cardiopulmonary bypass.

Table 4 - Postoperative data

	N(%)	Mean (maximum - minimum)
Surgical re-exploration	3 (6)	-
Postoperative infarction	4 (8)	-
Atrial fibrillation	14 (28)	-
Use of vasoactive drug	41 (82)	-
Period of vasoactive drug use (days)	-	2.5 (10 - 0.5)
Extubation in surgery room	30 (60)	-
Ventilation for over 24 hours	6 (12)	-
Time of mechanical ventilation (hours)	-	23.8 (163 - 1)
Stroke	1 (2)	-
Infection	7 (14)	-
Rehospitalization within 30 days	1 (2)	-
Problems with incision	2 (4)	-
Vasoplegia	6 (12)	-
Paraplegia	1 (2)	-
In-hospital death	7 (14)	-
Period in ICU (days)	-	6.8 (2 - 39)
Hospitalization period (days)	-	12.3 (6 - 56)

ICU: intensive care unit

Table 5 - Analysis of concomitant data from Table 6 using Cochran's Q-test

Survivors	Deaths
$\chi^2 = 286.4$	$\chi^2 = 60.89$
$p < 0.0001$	$p < 0.0001$

hypertension, and 69.8% with diabetes, while in the group of deaths it was observed 100% of hypertensive patients, 85.7% undergoing CPB, 71.4% with postoperative infection, and 51.7% with previous heart failure or postoperative atrial fibrillation (Table 6). Fisher's Exact Test was used to compare both groups to the presence of

each characteristic investigated. Such characteristics, as well as the respective p-values obtained by Fisher's Exact Test, are represented in Table 6. Fisher's Exact Test showed statistically relevant differences for postoperative infection, previous heart failure, use of CPB, abnormal ventricular function, and need for surgical re-exploration.

Discussion

Chronic renal failure is considered an independent risk factor for coronary disease, which related to other metabolic particularities makes ischemic heart diseases the leading cause of death in this group of patients. The coronary impairment level is proportional to the severity of renal disease, which makes dialytic patients a population susceptible to higher morbimortality rate. In this sample we studied 50 patients undergoing CABG from

Table 6 - Characteristics between survivors and deaths (Fisher's Exact Test - p)

	Survivors (%)	Deaths (%)	p
Postoperative infection	4.6	71.4	0.0002*
Previous heart failure	7.0	57.1	0.0045*
Use of CPB	32.6	85.7	0.0124*
Abnormal ventricular function	9.3	42.9	0.0478*
Surgical re-exploration	2.3	28.6	0.0479*
Postoperative atrial fibrillation	26.4	57.1	0.0649
Vasoplegia	11.6	42.9	0.0713
Prolonged mechanical ventilation	11.6	42.9	0.0713
Postoperative stroke	2.3	0	0.1400
Diabetes	69.8	42.9	0.2098
Left coronary trunk lesion	18.6	0	0.3414
Previous CVA	18.6	0	0.3414
Postoperative AMI	7.0	14.3	0.4574
Stable angina	16.2	0	0.5728
Unstable angina	16.2	0	0.5728
Obesity	14.0	0	0.5760
Smoking	11.6	0	0.5923
Previous AMI	20.9	28.6	0.6371
Previous Angioplasty	25.6	28.6	0.9908
Dyslipidemia	41.9	42.9	0.9988
Age > 70 years old	9.3	0	1.0000
Female	30.2	28.6	1.0000
Systemic arterial hypertension	100	100	1.0000
Peripheral arterial disease	18.6	14.3	1.0000

*Values with significant difference demonstrating death > survival. CPB: cardiopulmonary bypass; CVA: cerebral vascular accident; AMI: acute myocardial infarction

2007 to 2012 and we observed a high prevalence of classic cardiovascular risk factors, primarily hypertension (100%), diabetes (68%), and dyslipidemia (40%). The percentages of these risk factors and history of cardiovascular disease (stroke, peripheral arterial disease, events or previous coronary interventions) are similar to those published by Longnecker et al through CHOICE (Choices for Healthy Outcomes in Caring for End-Stage Renal Disease)³ study. Other studies¹⁴⁻¹⁸ have also shown high prevalence of risk factors and previous cardiovascular diseases. In our study, 92% of patients had preserved left ventricular function, and 52% did not have symptoms like angina or dyspnea. It is worth noting that many patients were referred for surgical revascularization after confirming severe coronary lesions on pre-kidney transplant cineangiocoronariography, because myocardial revascularization reduces the risk of kidney transplant and increases immediate survival¹⁹⁻²¹.

Preoperative laboratory variables observed are consistent with metabolic characteristics of dialytic patients: elevated creatinine and urea levels and low level of hemoglobin, highly prevalent condition in this group of patients. All patients were taking erythropoietin.

Intraoperative data demonstrate a mean value of 2.2 grafted coronaries. Although patients commonly have triple-vessel diseases, the poor quality of distal coronary bed in dialytic patients in some cases prevented the grafting of all coronary arteries. The use of inotropic support was required in 58% of cases, particularly during CPB, partly due to vasoplegic component presented by these patients. The use of intra-aortic balloon pump was not necessary in any case and CPB was applied in 40% of cases. There was no intraoperative death.

The most frequent postoperative complications were atrial fibrillation, infection, prolonged ventilation, infarction and vasoplegia. A similar condition is observed in other studies with dialytic patients¹⁴⁻¹⁶, and maybe these complications are related to the metabolic particularities of these patients, such as electrolytic unbalance, atherosclerotic process, and exacerbated inflammation²¹. Seven patients (14%) died during the in-hospital period, less than in some reference centers in the country¹⁴, and similar to the percentage found in the *Society of Thoracic Surgeon*¹⁶ database.

After comparative analysis between groups of survivors and deaths, we observed a statistically relevant difference between these groups regarding the following factors: postoperative infection, heart failure, use of CPB, abnormal ventricular function, and necessity of surgical re-exploration. Possibly these factors are related to a higher mortality rate during the in-hospital period, however, due to the limited number of patients, primarily the deaths group, caution is needed when interpreting the data.

The frequent exclusion of this group of patients from large cardiac studies perhaps even collaborate to the difficulty of selecting the best approach and to results still modest when compared to patients with preserved kidney function.

Conclusion

CABG in dialytic patients with chronic renal failure has high hospital morbimortality, and must consider the particular metabolic aspects in this group of patients for better orientation of approach, perioperatively. Factors as postoperative infection, previous heart failure, use of CPB, abnormal ventricular function, and necessity of surgical re-exploration may be related to a higher mortality rate during hospitalization. CABG without CBP can be a more satisfying alternative for treating these patients.

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Conception and design of the research: Miranda M, Hossne Jr. NA, Branco JNR, Vargas GF, Fonseca JHAP, Pestana JOMA, Juliano Y, Buffolo E; Acquisition of data: Miranda M, Vargas GF; Analysis and interpretation of the data: Miranda M, Fonseca JHAP, Juliano Y, Buffolo E; Statistical analysis: Juliano Y; Writing of the manuscript: Miranda M, Hossne Jr. NA, Branco JNR, Pestana JOMA, Buffolo E; Critical revision of the manuscript for intellectual content: Hossne Jr. NA, Branco JNR, Vargas GF, Fonseca JHAP, Pestana JOMA, Juliano Y, Buffolo E.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

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