

Research Article

Coronary arteries bypass grafting in dialysis dependent end stage renal disease, results and outcome

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Received: 18 January 2016

Revised: 22 January 2016

Accepted: 11 February 2016

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ABSTRACT

Background: The objective is to assess the results and outcome of patients with dialysis dependent end stage renal failure who underwent coronary artery bypass grafting.

Methods: In this retrospective study we analyzed the medical records of dialysis dependent end stage renal failure patients who underwent isolated coronary artery bypass grafting from January 2008 till December 2012 at queen alia heart institute. The total number of patients were 62 out of 6522 (0.95%). 42 of them were male (68%), the average age was 48±12 year, the duration of dialysis was 17±7 months. The medical profile of the patients, renal condition and duration of dialysis were analyzed. Preoperative cardiac condition and risk factors were also analyzed. Operative variables and postoperative results including mortality and post-operative renal and cardiac related complications were also analyzed.

Results: Total in hospital mortality was 5 (8%), the cause of mortality was renal failure related causes in 2 patients, sepsis in 2 patients, cardiac causes in one patient. Average time for extubation, ICU stay and hospital stay was 9±2.3 hours, 27±7 hours and 7 days respectively. The average amount of blood loss postoperatively was 450±55 ml; five patients (8%) were sent to the operating theatre for exploration re-sternotomy because of bleeding. The average creatinine level 6.5±1.5 mg/dl. Six patients need dialysis in the first 24 hours of the operation (9.7%), most patients were returned to the usual protocol of dialysis, which was in average of 3 times per week.

Conclusions: Coronary artery bypass grafting is the standard treatment in patient of end stage renal disease with coronary artery disease. Surgery is the ideal treatment in three vessel and left main disease according to SYNTAX trial. Those patients are high risk candidate for surgery, but proper preoperative, intraoperative and postoperative management decrease the risk and make the procedure safe.

Keywords: Kidney, Coronary artery bypass grafting, Heart failure

INTRODUCTION

Dialysis dependent patients are at great risk for coronary artery disease, management depends on the extent of the coronary artery bypass, and the definite treatment of diffuse coronary artery disease is coronary artery bypass grafting (CABG).¹

But those patients are high risk candidates for surgery because of poor general condition at the time of surgery, poor fluid and electrolyte balance, defused of the atherosclerosis other than the coronary arteries such as internal carotid and peripheral arteries which may increase the risk of cerebrovascular accidents, limb ischemia, wound complication; in addition to that, those patients have more tendencies for bleeding post

operatively due to impaired platelet and coagulation function. Despite the high possibility for post-operative complications, the coronary artery bypass grafting still the standard treatment for diffuse coronary artery disease, post-operative fluid and electrolyte management and stuck to the protocols of dialysis and ultra-filtration can minimize the morbidity and mortality .the aim of this study is to review our experience in dealing with patients who are dialysis dependent end stage renal failure who underwent CABG.²

METHODS

This retrospective study analyzed the medical records of dialysis dependent end stage renal failure that underwent coronary artery bypass grafting from January 2008 till December 2012 at queen alia heart institute.

The total number of those patients was 62 out 6522 patients who underwent isolated CABG during the same period (0.95%). 42 of them were male (68%), the average age was 48 ± 12 year ,the duration of dialysis was 17 ± 7 months, the cause of renal failure was diabetic nephropathy in 49 patients, hypertensive nephropathy 11 patients, glomerulonephritis in 9 patients, unknown causes in 13 cases. 49 patients were diabetics, 51 hypertensive, 32 smokers and 41 patients were hyperlipidemics. 34 patients were in NAHY class I-II, while 28 of them were at class more than II ,ejection fraction for those patient was $35 \pm 5\%$, 7 patients were having left main stem stenosis more than 60%, 49 patients were having 3 vessel disease on coronary angiography. The average number of dialysis per week was 2.9 times, creatinine level was 6.91 ± 2.2 mg/dl, while the average PCV level was $28.1 \pm 2.4\%$ (Table 1).

Three patients underwent the operation as redo surgery, 2 of them were underwent previous aortic valve surgery, while one patient was with previous mitral valve surgery.

Exclusion criteria's were end stage renal failure who were not dialysis dependent, end stage renal failure who underwent valve surgery, end stage renal failure who underwent combined procedure (CABG with valve surgery or carotid endarterectomy).

Inclusion criteria's were any patient who underwent isolated CABG with dialysis dependent end stage renal failure.

Off pump CABG done in 7 patients while the surgery was performed using cardiopulmonary bypass (CPB) in 55 patients for those who underwent the operation using CPB the duration of CPB was 75 ± 15 minutes, and the average cross clamp time was 49 ± 11 minutes. Left internal mammary artery was used in 54 patients, right internal mammary artery was used in 2 cases, long saphenous vein was used in all cases (100%) and the average number of grafts was 2.3 (Table 2).

Table 1: Preoperative data.

Age	48 ± 12 years	
Males	42 (67.7%)	
Risk for coronary artery disease	Diabetes	49 (79%)
	Hypertension	51 (82%)
	Smoking	32 (52%)
	Hyperlipidemia	41 (66%)
Cardiac status	Ejection fraction	35 ± 5 %
	NYHA I-II	34 (55%)
	NYHA \geq II	28 (45%)
	Atrial fibrillation	7 (11%)
	Left main stenosis ≥ 60 %	9 (15%)
	Three vessel disease	49 (79%)
	Tow vessel disease	4 (6%)
	Previous cardiac surgery (redo)	3 (4.8%)
Renal status	Average creatinine	6.91 ± 2.2 mg/dl
	Average PCV	$28.1 \pm 2.4\%$
	Average BUN	55 ± 2.4 mg/dl
	Average dialysis per week	3 times
	Kidney transplant	3 (4.8%)
	Duration of dialysis	17 ± 7 months
Causes of ESRD	Diabetes	29 patients (47%)
	Hypertension	11 patients (19%)
	Primary renal causes	9 patients (15%)
	Unknown	13 patients (31%)

ESRD: End stage renal disease

Table 2: Intraoperative data.

On pump procedure	55 (89%)
Average number of grafts	2.2
LIMA	54 (87%)
RIMA	2 (3%)
Long saphenous vein	62 (100%)
Vein only grafts (no LIMA, no RIMA)	9 (15%)
Duration of cardiopulmonary bypass	75 ± 15 minutes
Cross clamp time	49 ± 12 minutes

LIMA: Left internal mammary artery; RIMA: Right internal mammary artery.

RESULTS

Total in hospital mortality was 5 (8%), the cause of mortality was renal failure related causes in 2 patients, sepsis in 2 patients, cardiac causes in one patient (Table 3 and 4).

The average time for extubation was 9 ± 2.3 hours from the time the patient has been transferred from the operating theatre to the intensive care unit (ICU). The

average ICU stay was 27 ± 7 hours, while the average hospital stay was 7 days. Five patients (8%) were resent to the operating theatre for exploration resternotomy because of bleeding. The cause was non-surgical in 4 patients while it was surgical in one patient in whom we found slip clip in LIMA.

Table 3: Postoperative data.

First 24 hours creatinine	6.5 \pm 1.5 mg/dl	
First 24 hours PCV	29 \pm 2 %	
Dialysis in the first 24 hours	6 (10%)	
Bleeding \geq 750 ml	13 (21%)	
Reopening for bleeding	5 (8%)	
IABP	9 (15%)	
Blood transfusion	3 units	
Time of extubation	9 \pm 2.3 hours	
ICU stay	27 \pm 7 hours	
Hospital stay	7 days	
In hospital complications :	Sternal wound infection	9 (15%)
	Leg wound infection	7 (11%)
	Atrial fibrillation	11 (18%)
	Ventricular arrhythmias	2 (3%)
Number of patients discharged from the hospital	57 (92%)	
Re admission	7 (12.3%)	
In hospital mortality	5 (8%)	

Table 4: Causes of mortality.

Renal causes	2 (40%)
Cardiac causes	1 (20%)
Sepsis	2 (40%)

The average PCV post operatively was 29 \pm 2% and the average blood transfusion was 2 units.

The average amount of blood loss postoperatively was 450 \pm 55 ml, 13 patients bled more than 750 ml in the first 24 hours (21%). The average creatinine level 6.5 \pm 1.5 mg/dl. Six patients need dialysis in the first 24 hours of the operation (9.7%), 2 of them died because of complications related to dialysis like hypotension and electrolytes disturbances. Most patients were returned to the usual protocol of dialysis, which was in average of 3 times per week.

3 patients required insertion of intra-aortic balloon pump (IABP) which was inserted intraoperatively, for those

who required IABP one patient died in the ICU because of decompensated heart failure (Table 3).

The total number of patients who were discharged from the hospital was 57 patients (92%), 7 of them were readmitted within 30 days of the discharge (12.3%).the cause for readmission was, sterna wound infection in 2 patients, pleural effusion in 3 patients, and frequent angina in 2 patients (Table 5).

Table 5: Causes of re-admission.

2 patients (28.6%)	Sterna wound infection
3 patients (42.8%)	Pleural effusion
2 patients (28.6%)	Frequent angina

DISCUSSION

Number of patients who need intervention for coronary artery disease is increasing; the number of patients with co morbidities is also increasing.³

Those who are in end stage renal disease are also increasing, for example in united states the number of patients who are managed for ESRD during 2009 was 87100 patients, the prevalence increased from 1980 to 2009 by 600%, from 290 to 1738 per million.

ESRD carries many complications, it affects almost all organs in the body, of our interest is the cardiovascular system, more prevalence of atherosclerosis, with more incidence of coronary artery disease than the normal population, one of the most interesting feature of the distribution of the coronary artery disease in patients with ESRD is more toward proximal lesions especially in non-diabetic patients.⁴

Management of those patients varies according to gaud lines of coronary artery disease, but roughly it depends on the distribution of the disease (proximal versus diffuse), number of vessels diseased, left ventricular function, and the severity of the renal disease itself, in addition to the presence of other comorbidities.⁵

For three vessel disease, according to the SYNTAX trial and score, the patients with three vessel disease and left main stenosis will benefit more by doing coronary artery bypass grafting more than percutaneous intervention, this apply also on patients other than renal disease, but in case of ESRD; the risk of overloading the heart with the contrast during intervention makes the direction toward CABG is feasible option.^{6,7}

The choice to do the operation is not an easy option; it carries great challenge to the surgeon, anesthetist, and postoperative team. Firstly the patients with ESRD are debilitating ill patients, could be malnourished, chronic anemia because of disturbances of bone marrow metabolism, hypoproteinemia, hypoalbuminemia, hormonally

disturbed, so they need to be fully evaluated and managed preoperatively.⁸

The second challenge is during doing the operation, many patients need combined procedure in addition to CABG, many of them have calcific aortic stenosis or other valve disorders, and this will extend the time of cardiopulmonary bypass and cross clamp time which will increase the risk of the operation.⁹

Those patients are overloaded with fluids but proper preoperative management and doing dialysis one day before the operation may decrease the risk of fluid overload and electrolyte disturbances intraoperatively, in addition to that, many centers do intraoperative hemofilter during cardiopulmonary bypass, this technique if used properly can be very useful for the patient, in one way it can be used to maintain acceptable level of hemoglobin which maintain acceptable organ oxygenation, and on the other way can be used to prevent fluid overload and decrease the complications of hemodilution during cardiopulmonary bypass.¹⁰

The cardiopulmonary bypass and cross clamp time is very important factor in predicting the mortality and morbidity in those patients, doing the operation in off pump technique can decrease the postoperative complications in some studies, with no extra benefits in other studies.¹¹

Liability for bleeding is thought to be more in those patients; all measures to control bleeding intraoperatively should be taken so as to decrease the probability of postoperative bleeding. We should take into consideration that those patients are already have chronic anemia so we can accept PCV around 27%.^{12,13}

Postoperative fluid and electrolyte management is also of great importance; our protocol is to keep the patient balanced with low threshold for dialysis.

CONCLUSION

Coronary artery bypass grafting is the standard treatment in patient of end stage renal disease with coronary artery disease. Surgery is the ideal treatment in three vessel and left main disease according to SYNTAX trial. Those patients are high risk candidate for surgery, but proper preoperative, intraoperative and postoperative management decrease the risk and make the procedure safe.

ACKNOWLEDGEMENTS

Author would like to thank all the staff in the intensive care unit, operating theatre and the medical records officers who helped us to collect the data and organize it.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Altaani H, Alfawares S, Alsharoo S, Obeidate M, Maloof K, Jabber S. Coronary arteries bypass grafting in dialysis dependent end stage renal disease, results and outcome. *Int J Res Med Sci* 2016;4:690-4.