

Early outcome of cardiac surgery in dialysis-dependent end-stage renal failure patients

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ABSTRACT

Introduction: Preoperative dialysis-dependent renal failure is a strong independent risk factor for in-hospital mortality and morbidity after open heart surgery. This retrospective study analyses the early outcome in dialysis-dependent renal failure patients who underwent elective open-heart surgery in the Institut Jantung Negara (IJN).

Methods: We retrospectively analyse a series of 228 consecutive postoperative patients with dialysis-dependent (end stage renal failure (ESRF)) admitted to the adult cardiothoracic ICU in IJN between January 2012 and December 2016.

Results: The overall early mortality rate included 34 patients (15.8%). Patients with ESRF underwent combined procedure recorded a very high mortality rate at 56.3%. Twenty-four patients (11.2%) needed re-sternotomy for postoperative bleeding or cardiac tamponade. Postoperative mediastinitis rate was high, involving 13 patients (6%). The neurological and gastrointestinal complications rate were recorded at 2.3% (5 patients) and 6% (13 patients) respectively. In the group of patients (n=199) with sinus rhythm during the preoperative period, 100 patients (50.3%) developed postoperative AF. 77 patients (35.8%) stayed in hospital for more than 14 days.

Conclusions: dialysis-dependent patients undergoing cardiac surgery poses higher perioperative risk of mortality and morbidity of 3-4 times higher compared to those patients with normal renal function. IJN shows acceptable perioperative risk of mortality and morbidity which is comparable to other centres

KEY WORDS:

Cardiac surgery; dialysis; ESRF; mortality

INTRODUCTION

According to the annual report of the Malaysian Dialysis and Transplant Registry, in the year 2016 alone there were 39,711 patients with end-stage renal failure (ESRF) requiring dialysis and this was estimated to increase three-folds by the year 2040.^{1,2} This is contributed by the advancement of technology in dialysis and the availability of treatments leading to increase in survival in addition to the increase in prevalence of individuals with diabetes and hypertension.^{1,3,4} The

increasing number of patients with ESRF requiring dialysis is progressing at an alarming rate and represents a major public health problem in Malaysia. Cardiovascular disease inclusive of coronary artery disease (CAD) and valvular heart disease (VHD) are commonly associated with patients with ESRF and is a leading cause of death in this group of patients accounting for 37% of all deaths.^{1,5}

Despite tremendous improvement in outcome of percutaneous transluminal coronary angioplasty (PTCA) in the treatment of CAD, coronary artery bypass grafting (CABG) remains as the mainstay for coronary revascularisation in the ESRF population,⁶ whilst valvular heart surgery remains as the treatment of choice for VHD. In view of this cardiac surgery in dialysis-dependent renal failure patients has become a normal practice in recent years.⁷ Preoperative dialysis-dependent renal failure is a strong independent risk factor for in-hospital mortality and morbidity after open heart surgery.⁸ However it has been reported that hospital mortality for these patients is at an acceptable range, i.e., between 0-36%.^{9,10}

The aim of this study is to retrospectively analyse the early outcome in dialysis-dependent renal failure patient who underwent elective open-heart surgery in Institut Jantung Negara (IJN).

MATERIALS AND METHODS

We retrospectively analysed a series of 228 consecutive postoperative patients with dialysis-dependent ESRF admitted to the adult cardiothoracic intensive care unit (ICU) in IJN between January 2012 and December 2016. Seven patients who had emergency surgery and six patients with non-open heart surgery were excluded from the analysis. The 215 patients who underwent elective open heart surgery were included in the analysis. Pre-, peri- and postoperative data was collected by review of the patient's electronic and paper medical record. Patient demographics and risk factors, operative information and postoperative data were tabulated and analysed by using Microsoft Excel and SPSS statistical software for Windows (version 24.00, SPSS Inc., Chicago, IL, USA).

The definitions of clinical outcomes are defined as follows (Table I):

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Table I: Clinical outcome definition

Outcome	Definition
Early mortality	Death within 30 postoperative days or during the same hospitalisation
Re-sternotomy	Postoperative bleeding or tamponade that required surgical re-exploration after initial departure from operating theatre
Neurological complication	New neurological events occurring postoperatively that persisted for more than 24 hours after its onset and was noted before discharge
Pulmonary complication	Prolonged ventilation more than 72 hours, reintubation, requiring non-invasive positive pressure ventilation or hospital acquired pneumonia
Mediastinitis	Sternal wound infection that requires antibiotics and return to operating theatre for wound debridement
Gastrointestinal complication	Presence of ischemic bowel, bowel perforation, bleeding gastrointestinal tract and postoperative ileus that required nil by mouth for more than 48 hours
Postoperative AF	New onset of AF in a patient who was in sinus rhythm preoperatively

Table II: Demographics of the patients and risk factors

Variables	Number of patients (n=215)
Gender	
Male	163 (78.8%)
Female	52 (21.2%)
Age (mean)	58.5±9.1
Male	58.9±8.7
Female	57.3±10.2
>70 years	27 (12.6%)
LVEF (%)	49.2±11.5
LVEF ≤35%	37 (17.2%)
NYHA III or IV	18 (8.4%)
Hypertension	190 (88.3%)
Diabetes mellitus	141 (65.6%)
Previous stroke	8 (3.7%)
Chronic AF	16 (7.4%) – 50% VHD
Previous amputation	8 (3.7%) – 100% CAD

LVEF= Left ventricular ejection fraction

NYHA = New York Heart Association Class

AF = Atrial fibrillation

Table III: Operative details

Operative procedures	Number of patients (n=215)
Isolated CABG	178 (82.8%)
On pump	159
Off pump	16
MIDCAB	3
Isolated valve	20 (9.3%)
Replacement	15 (mechanical 14, bioprosthetic 1)
Repair	5
Combined CABG plus valve	16 (7.4%) mortality 56.3%
Others (LA myxoma excision)	1 (0.5%)
LIMA harvested in CABG cases	118 (60.8%) n=194
AXC time (minutes)	71.8±30.2
CPB time (minutes)	95.6±37.2
Intra-aortic balloon pump weaning	18 (8.4%)

CABG = Coronary artery bypass grafting

MIDCAB = Minimally invasive direct coronary artery bypass

LA = Left atrium

LIMA= Left internal mammary artery

AXC = Aortic cross clamp

CPB = Cardiopulmonary bypass

Table IV: Mortality and morbidity

Complications	Number of patients (n=215)
Early mortality	34 (15.8%)
Resternotomy	24 (11.2%) mortality 45.8%
Neurological complications	5 (2.3%)
Pulmonary complications	63 (29.3%)
Mediastinitis	13 (6.0%) mortality 53.8%
Gastrointestinal complications	13 (6.0%)
Postoperative AF	100 (50.3%) n=199
Postoperative LOS >14 days	77 (35.8%)

AF = Atrial fibrillation

LOS = Length of stay

RESULTS

The baseline characteristics of the 215 patients is presented in Table II. The number of advance heart failure with New York Heart Association (NYHA) Class III or IV were 18 patients (8.4%). The number of patients with hypertension and diabetes in this cohort was 190 patients (88.3%) and 141 patients (65.6%) respectively. This is in keeping with the fact that hypertension and diabetes mellitus are the commonest cause of developing ESRF in Malaysia.¹¹ The number of patients who had stroke prior to the surgery was eight (3.7%). There are 16 patients (7.4%) with chronic atrial fibrillation (AF) prior to surgery. Fifty per cent of the chronic AF was contributed by VHD. Eight (3.7%) patients had previous history of lower limb amputation, of which all of them were associated with CAD that needed CABG surgery.

In all 178 patients (82.8%) underwent isolated CABG surgery. Twenty patients (9.3%) underwent isolated valve surgery. Sixteen patients (7.4%) underwent combined CABG plus valve surgery. A total of 194 patients (90.2%) underwent coronary revascularisation surgery, either as an isolated or combined procedure. Left internal mammary artery (LIMA) used in this group of patients was 60.8%. The operative details from the data is summarised in Table III.

The overall early mortality rate were 34 patients (15.8%). Patients with ESRF underwent combined procedure recorded a very high mortality rate at 56.3%. In all 24 patients (11.2%) needed re-sternotomy during the early postoperative period due to bleeding or cardiac tamponade. Those patients who had re-sternotomy recorded a very high mortality rate of 45.8%. Postoperative mediastinitis rate was high, involving 13 patients (6%) which was associated with high mortality rate of 53.8%. In the group of patients (n=199) with sinus rhythm during the preoperative period, 100 patients (50.3%) developed postoperative AF which was higher compared to other published data (16-25%).^{12, 13} Outcomes of mortality and morbidity is summarised in Table IV.

DISCUSSION

Preoperative dialysis-dependent renal failure is a strong independent risk factor for postoperative morbidity and mortality in cardiac surgery. Liu et al. in their multi-centre study reported that risk of mortality post CABG was three times higher comparing between dialysis-dependent patients (9.6%) and those with normal renal function.⁸ Back et al., in Copenhagen, Fernando et al., in New South Wales and Horst et al., in Cologne have reported similar outcome in terms of perioperative mortality rate in dialysis-dependent patients undergoing cardiac surgery at 14%, 13.9% and 12.5% respectively.^{4,9,14} Our experience has shown comparable results with early mortality rate in dialysis-dependent patients who underwent cardiac surgery was at 15.8% (34 of 215). Independent of the procedures done, the hospital mortality was higher in all cardiac surgeries performed. Among the categories of procedures those who underwent combined procedure has nine out of 16 patients who died giving the most mortality rate within this procedure category. This is similar to those studies done by Horst et al.⁹ and Franken et al.¹⁵ showing that highest mortality observed in those who underwent valvular surgery and combined valvular/CABG procedures.

There are several factors that possibly contribute to the increase of mortality in dialysis-dependent patients undergoing cardiac surgery. Foley et al., pointed out that ESRF can lead to LV dysfunction through the ureamic environment which is cardiotoxic.¹⁶ They have also found through their prospective 10-year study involving 433 patients with ESRF that renal transplantation improves LV dysfunction. In addition to this, hyperparathyroidism secondary to renal failure is associated with acceleration of atherosclerosis and calcification of cardiovascular organ including valves and the conduction tissue.¹⁷ Late referrals due to underestimation of cardiac valve disease is also an important contributing factor leading to high mortality among dialysis-dependent patients who underwent isolated valvular procedure or combined valvular/CABG procedure.^{5,18} The potential underestimation of cardiac valve disease is due to the obscuring effect by dialysis on typical symptoms such as congestion and effusions. On top of this, anaemia due to renal disease, hypertension, volume overload, as well as the presence of arteriovenous fistula can lead to intravascular sound phenomena concealing cardiac valve disease.

In our experience operating on dialysis-dependent patient there is an association between ESRF and major postoperative complications such as re-sternotomy in 24 patients (11.2%) which showed high mortality rate of 45.8%, and mediastinitis in 13 patients (6.0%) of which shows high mortality rate of 53.8%. The increase in perioperative infectious risk in dialysis-dependent patients can be explained by the immune compromised state resulted by uraemia, diabetes mellitus, and frequent dialysis.

LIMITATIONS

The design and data based on a retrospective archive review. In addition to this, there is no comparison of data with those patients with normal renal function who underwent cardiac surgery.

CONCLUSION

Dialysis-dependent patients undergoing cardiac surgery poses higher perioperative risk of mortality and morbidity of 3-4 times higher compared to those patients with normal renal function. IJN shows acceptable perioperative risk of mortality and morbidity which is comparable to those reports from other centres.

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