

# The Outcome of Cardiac Surgery in Dialysis-Dependent Patients

Adam D. Zimmet, BMBS, Aubrey Almeida, FRACS, Jacob Goldstein, FRACS, Gilbert C. Shardey, FRACS, Adrian W. Pick, FRACS, Cassie E. Lowe, BHIM, Damien J. Jolley, M.Sc.(Epidemiology), AStat and Julian A. Smith, MS, FRACS\*

Cardiothoracic Surgery Unit, Monash Medical Centre, Department of Surgery, Level 5, E Block, Monash University, 246 Clayton Road, Clayton, Vic. 3168, Australia

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**Background:** Patients on dialysis for end-stage renal failure (ESRF) are undergoing cardiac surgery with increasing frequency. Furthermore, ESRF is known to be an important risk factor for complications of cardiac operations performed with cardiopulmonary bypass.

**Aims:** To evaluate the outcome of dialysis-dependent patients undergoing cardiac surgery at one institution.

**Methods:** A retrospective analysis was performed on consecutive patients with ESRF dependent upon maintenance haemodialysis or peritoneal dialysis who underwent cardiac surgery from January 1998 to August 2002.

**Results:** Thirty-eight patients on dialysis underwent cardiac surgery during this time period (1.5% of total cases). The most common cause for ESRF was diabetic nephropathy ( $n = 12$ ). Operations performed included isolated coronary artery bypass grafting (CABG,  $n = 22$ ), CABG and valve surgery ( $n = 8$ ), and valve surgery alone ( $n = 6$ ).

When allowing for age, sex, surgeon and operative category, the odds ratio for mortality risk of dialysis patients, compared with all others, was 4.9 (95% confidence interval (CI): 1.7–13.9,  $p = 0.003$ ), and for morbidity risk, was 2.8 (95% CI: 1.4–5.4,  $p = 0.003$ ).

**Conclusions:** Patients on dialysis have an increased morbidity and mortality following cardiac surgery, however we believe ESRF should not be regarded as an absolute contraindication to cardiac surgery or cardiopulmonary bypass.

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## Introduction

Patients with chronic renal failure (CRF) have an increased prevalence of coronary artery disease (CAD) and cardiovascular death. Furthermore, risk factors for cardiac disease are especially common in dialysis-dependent renal failure patients.<sup>1,2</sup> Over the last 10 years, advances in renal replacement therapy (transplant, haemodialysis, and peritoneal dialysis) have improved long-term survival of patients with end-stage renal failure (ESRF), however mortality rates from CAD in this population group have not shown the same trends.<sup>3,4</sup>

Today, there is an increasing frequency of cardiac surgery in dialysis-dependent patients, as outcomes of dialysis patients after CABG have shown to be superior to percutaneous intervention.<sup>5–8</sup> Furthermore, raised serum creatinine levels are known to be an important preoperative risk factor for complications of cardiac operations

performed with cardiopulmonary bypass.<sup>9</sup> Accordingly, the purpose of this study was to evaluate the operative outcome of dialysis patients undergoing cardiac surgery at a single institution, and to clarify the association between in-hospital morbidity and mortality in both dialysis and non-dialysis patients undergoing cardiac surgery.

## Materials and Methods

### Subjects

Consecutive ESRF patients undergoing cardiac surgery were analysed. We used data from the Cardiac Surgery Database that collects information from all patients undergoing cardiac surgery at our institution. These patients were receiving either haemodialysis (HD) or continual ambulatory peritoneal dialysis (CAPD) preoperatively. These patients were compared with a normal cohort of patients who were also undergoing cardiac surgery during the study period, which was from January 1998 until August 2002.

\* Corresponding author. Tel.: +61 3 9594 5500; fax: +61 3 9594 6045. E-mail address: julian.smith@med.monash.edu.au (J.A. Smith).

### Data Collection

An audit of outcomes from cardiac surgery at Monash Medical Centre (MMC) was used as a vehicle to compare the surgical outcomes of patients on renal dialysis with those from other patients who were not receiving dialysis at the time of surgery. We used data from an audit of cardiac surgery procedures at MMC for the calendar years 1998 to 2002 inclusive. In this report, we compare mortality and morbidity experiences between dialysis and non-dialysis patients. The in-hospital postoperative morbidity events that were included consisted of prolonged ventilation (defined as mechanical ventilation  $\geq 24$  h), pneumonia (defined on clinical, radiological, or microbiological grounds), deep sternal infection (defined on clinical and microbiological grounds), atrial fibrillation (AF), post-operative bleeding (defined as bleeding requiring a re-operation for control), and neurological complication.

### Statistical Analysis

Statistical evaluation was performed using Stata V8.0 (Stata Corporation, TX, USA). Results were analysed using logistic regression to account for age, sex, surgeon and operative category,  $\chi^2$  tests were considered statistically significant at  $p < 0.05$ .

### Results

Table 1 lists the study patients' demographics and baseline variables. Dialysis patients had statistically significant higher levels of preoperative hypertension and peripheral vascular disease.

Diabetic glomerulopathy was the most common indication for dialysis (31.6%,  $n=12$ ), with other indications including hypertension (15.8%,  $n=6$ ), focal segmental glomerulosclerosis (10.5%,  $n=4$ ), glomerulonephritis (10.5%,  $n=4$ ), and unknown causes (10.5%,  $n=4$ ). Other indications included systemic lupus erythematosus, Wegeners glomerulonephropathy, obstructive uropathy, Alports syndrome, and reflux nephropathy.

2507 procedures are included in this audit, representing a rate of around 500 per year. In this series, there were 38 patients included in the "dialysis" category. These were

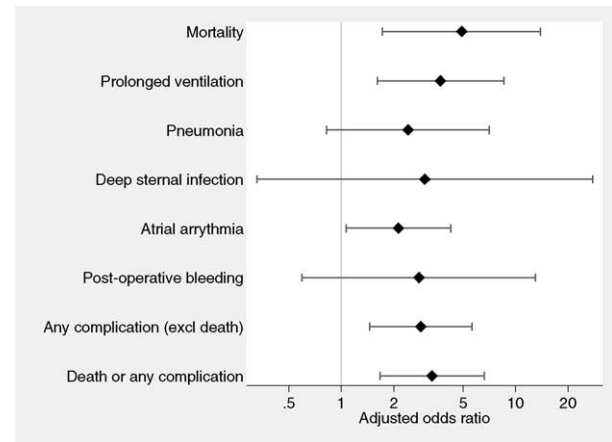


Figure 1. Adjusted morbidity and mortality odds ratios.

unevenly distributed across the 5 years of data collection, with 3 patients included in 1998 (0.7% of total caseload), 8 in 1999 (1.6%), 4 in 2000 (1.0%), 11 in 2001 (2.0%), and 12 (1.9%) in 2002. This year-to-year variation was not statistically significant ( $p = 0.37$ ).

Operations performed in the dialysis group included CABG alone ( $n = 22$ ), CABG with valve surgery ( $n = 8$ ), valve surgery alone ( $n = 6$ ), mitral valve repair ( $n = 1$ ), and aortic valve repair with mitral valve repair and repair ventricular septal defect ( $n = 1$ ).

Across all 2507 procedures, there were 94 deaths, an overall mortality rate of 3.8% (95% CI: 3.2-4.5%). Five of these deaths occurred in dialysis patients, a rate within this group of 13.2%. The ratio of mortality risk between dialysis and non-dialysis patients in this series was 4.1, with a 95% CI from 1.6 to 8.5. Using logistic regression to adjust for the covariates of age, sex, surgeon and operative category, the odds ratio for mortality risk increased to 4.9 (95% CI: 1.7-13.9).

Table 2 depicts the results of postoperative mortality and morbidities in dialysis patients compared with non-dialysis patients, before adjustments for age, sex, surgeon and operative category. Statistically significant differences were observed in the risks of prolonged ventilation in the

Table 1. Baseline Characteristics

Baseline Characteristic	Dialysis Patients ( $n = 38$ )		All Other Patients ( $n = 2469$ )		95% Confidence Interval for Difference	
	Mean	(S.D.)	Mean	(S.D.)		
Age (years)	60.8	(10.1)	63.9	(11.0)	-7.2	1.0
Gender (% female)	26.3		26.9		-15	14
Weight (kg)	73.8	(12.4)	78.2	(14.9)	-9.4	0.6
Height (cm)	168	(10.1)	169	(9.5)	-8.6	6.2
Body surface area (m <sup>2</sup> )	1.85	(0.19)	1.91	(0.22)	-0.16	0.04
Hypertension (%)	86.8		60.9		15	37
Peripheral vascular disease (%)	26.3		9.5		3	31
Respiratory complication (%)	2.6		7.3		-10	0.5
Diabetes (%)	36.8		25.9		-5	26
Elevated cholesterol (%)	68.4		69.0		-15	14
Cerebrovascular disease (%)	15.8		9.2		-5	18
Previous myocardial infarction (%)	36.8		41.1		-20	11

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