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Original Article

Does the preoperative mild renal dysfunction effect mortality and morbidity following valve cardiac surgery?

Hadi Abo Aljadayel [a,*], Hussein AlKanj [b], Salah Koja [b], Fadi Butruss [b]

[a] Postgraduate Student (MSc.), Department Of Surgery, Faculty of Medicine, University of Aleppo, Syria
[b] Department of Surgery, Faculty of Medicine, University of Aleppo, Syria

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ABSTRACT

Aims: The objective of this study was to investigate the effect of preoperative mild renal dysfunction (RD), not requiring dialysis, on mortality and morbidity after valve cardiac surgery (VCS).

Population: We studied 340 consecutive patients (2008–2012), who underwent VCS with or without coronary artery bypass graft (CABG).

Methods: Preoperative RD was calculated with the abbreviated Modification of Diet in Renal Disease formula and was defined as a glomerular filtration rate <60 ml/min/1.73 m^2. Logistic regression analysis was used to assess the effect of preoperative renal dysfunction (RD) on operative and adverse outcomes.

Results: 80 patients (30%) had preoperative mild RD. Patients with preoperative RD were older, had a higher rate of preoperative anemia (43% vs. 25%, $p < 0.001$), and more comorbidities. Patients with preoperative RD had worse outcomes with more reoperation (6.8% vs. 2.3%, $p < 0.001$).

Conclusion: Preoperative RD was significantly and independently associated with more red blood cell transfusions and longer hospital stay (median 9 vs. 8 days, $p < 0.001$). Mortality was similar in both groups (3.4% vs. 2.3%, $p = 0.43$). Preoperative mild RD in patients undergoing cardiac valve surgery is an independent marker of postoperative morbidity.

1. Introduction

Preoperative renal dysfunction (RD) not requiring dialysis is a recognized risk factor for postoperative morbidity and mortality after coronary artery bypass graft (CABG).[1–5] Outcome research in valve cardiac surgery (VCS) has been widely studied,[6,7] but the impact of preoperative RD on valve replacement outcome is not well known. In one study,[8] mild RD was independently associated with adverse outcome and most of the patients were men. The association between preoperative mild RD and adverse effects after cardiac surgery was stronger when renal function was analyzed by estimated glomerular filtration rate (GFR)[9] using serum

* Corresponding author.
E-mail address: hadyaboaljadayel@yahoo.com (H.A. Aljadayel).
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creatinine-based prediction equations than by serum creatinine level.

Preoperative anemia has been associated with a higher in-hospital mortality and morbidity after elective valve replacement.[10] An interaction exists between chronic kidney disease (CKD) and anemia that worsens outcome in congestive heart failure,[11] conditions that are also frequently present in cardiac surgery patients and might increase risk after surgery.

The aim of our study was to investigate whether preoperative RD is a risk marker for mortality and morbidity in patients who underwent VCS. A secondary objective was to examine the relationship between preoperative RD and anemia with outcomes in VCS.

2. Methods

2.1. Data

We studied 340 consecutive patients undergoing cardiac valve surgery (both repair and replacement) with or without combined CABG between January 2008 and July 2012. Patients on chronic dialysis were excluded. The study was based on data collected from routine care, and thus individual consent was waived. Our database was initiated in January 2008 coinciding with the implementation of cardiac surgery in Aleppo university hospital for cardiac surgery. The database was designed to prospectively collect data of all patients undergoing cardiac surgery. It contains detailed information of demographic data, risk factors, clinical preoperative characteristics, operative description, including location and category of operated valve, postoperative complications, operative mortality, and postoperative length of hospitalization.

2.2. Surgical and postoperative aspects

All the patients underwent cardiac surgery through medium sternotomy and standard cardiopulmonary bypass. They were operated on under passive moderate hypothermia and myocardial protection was accomplished with antegrade or antegrade–retrograde crystalloid cold cardioplegia. Antibiotic prophylaxis with first-generation cephalosporins (Cefazolin, iv) was begun just before the onset of surgical intervention and was discontinued after 24 h in the ICU. Patients were transferred to the ICU, and they were mechanically ventilated and sedated. During the postoperative period, patients were treated at the ICU following the same standard care. Extubation was done in awake and stable patients according to well-established criteria. Criteria for transfusion of red blood cells (RBCs) depended ultimately on the physician in charge of the patient, but we transfused when the hemoglobin was lower than 8 g/dl, lower than 10 g/dl in patients with myocardial or cerebral dysfunction, and during severe active bleeding. From the second postoperative day, patients were transferred to the cardiac surgery ward, considering that they did not need intensive care treatment.

2.3. Data definition

Preoperative risk factors such as age, gender, weight, body mass index, habit of smoking, hypertension, diabetes, and anemia (Hb level < 12 g/dl) were included. Associated comorbidities, such as chronic obstructive pulmonary disease (COPD), peripheral vascular disease, stroke, left ventricular dysfunction (ejection fraction $<30\%$), atrial fibrillation, previous cardiac surgery, angina, and myocardial infarction, were included. Global preoperative risk was calculated by logistic and additive EuroSCORE.

2.4. Renal function

Preoperative serum creatinine (Cr) was determined in all patients within two days of cardiac surgery. Estimated GFR was calculated following the abbreviated Modification of Diet in Renal Disease (MDRD) formula[12]

$$\mathrm{GFR} = 186.3 \times (\text{Serum creatinine})^{-1.154} \times (\text{age})^{-0.203} \times 1.212\ (\text{if black}) \times 0.742\ (\text{if female})$$

Serum creatinine is measured in mg/dl, age in years, and GFR is expressed in ml/min per 1.73 m^2. Preoperative RD was defined as an estimated GFR value <60 ml/min/1.73 m^2. Postoperative RD was defined[13] as a postoperative increase in serum creatinine level $>25\%$ from preoperative baseline value or an increase >0.5 mg/dl. Percent change in serum creatinine (% ΔCr) was calculated by: [(highest postoperative Cr)/(preoperative Cr) $-$ 1] $\times$ 100. We recorded the requirements for renal replacement therapy (RRT) during hospitalization.

2.5. Outcome

The primary outcomes of this study were mortality and hospital morbidity. Mortality was defined as death occurring during hospital stay or within 30 days after hospital discharge. Hospital morbidity was defined as mechanical ventilator support for 24 h, and postoperative renal, cardiac, neurological, pulmonary, gastrointestinal, and vascular complications. Major adverse cardiac events were defined as cardiac arrest or cardiogenic shock. Postoperative atrial arrhythmia was defined as the occurrence of a new atrial arrhythmia in the absence of preoperative arrhythmias. Perioperative acute myocardial infarction was defined as the presence of typical acute ischemic ECG changes and or a CK-MB value greater than five times the upper limit of normal. We defined postoperative stroke by the presence of a new focal neurological deficit persisting for at least 24 h confirmed by CT-scan. Postoperative bleeding was defined as any bleeding that required surgical reoperation after initial departure from the operating theatre. Criteria for diagnosing mediastinitis and pneumonia were in accordance with the guidelines published by the Centers for Disease Control and Prevention.

The length of mechanical ventilation was the time that the patient needed ventilator support after cardiac surgery from ICU admission to extubation. Postoperative hospital length of stay was the time that the patient remained in hospital since cardiac surgery to discharge and ICU length of stay was the time the patient spent in the ICU after cardiac surgery.

2.6. Statistical analysis

Continuous variables are presented as mean with standard deviation (S.D.) or median with interquartile range when