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Original article

Preoperative atrial fibrillation is an independent predictor of worse early and late outcomes after isolated coronary artery bypass graft surgery

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ABSTRACT

Objectives: To evaluate the impact of preoperative atrial fibrillation (pre-op AF) on early and late mortality after isolated coronary artery bypass graft (CABG) surgery.

Methods: Data obtained prospectively between June 2001 and December 2009 by the Australasian Society of Cardiac and Thoracic Surgeons National Cardiac Surgery Database Program were retrospectively analyzed. Patients who underwent concomitant atrial arrhythmia surgery/ablation were excluded. Demographic and operative data were compared between patients with and without pre-op AF. The independent association of pre-op AF on early mortality, perioperative complications, and late mortality was determined.

Results: Isolated CABG surgery was performed in 21,534 patients; 1312 (6.1%) presented with pre-op AF. Pre-op AF patients were older (mean age, 71 years vs. 65 years, $p < 0.001$) and had more comorbidities reflected in a higher additive EuroSCORE (8.4 ± 3.5 vs. 6.5 ± 3.2, $p = 0.001$). Even after accounting for confounding factors, however, pre-op AF was associated with a 63% increase in 30-day mortality [4.2% vs. 1.4%; hazard ratio (HR), 1.63; 95% confidence interval (CI), 1.17–2.29; $p = 0.004$] and 39% increase in late mortality (5-year survival, 78% vs. 90%; HR, 1.39; 95% CI, 1.20–1.61; $p < 0.001$).

Conclusion: Pre-op AF is an independent predictor of poor early and late outcomes. Pre-op AF should be considered, therefore, in the development or update of risk stratification models for CABG surgery.

Introduction

Atrial fibrillation (AF) is the most common sustained arrhythmia, with an estimated overall prevalence of 4% in the Australian population aged greater than 30 years [1]. The incidence of AF is reported to increase with age, with a prevalence as high as 15% in those aged older than 80 years [1,2], as well as with other cardiovascular comorbidities, such as valvular disease, ischemic heart disease, and hypertension [3,4]. The average age of patients requiring coronary artery bypass grafting (CABG) for ischemic heart disease is increasing, and as a result, preoperative AF (pre-op AF) is a common finding in surgical candidates. Data from several large studies suggest that the prevalence of AF in patients undergoing isolated CABG ranges from 5 to 22% [5–9].

While the adverse impacts of AF on general cardiovascular morbidity and mortality remain undisputed [10,11], the impact of pre-existing AF on operative outcomes in patients undergoing CABG remains equivocal. A few cohort studies have recently identified the association between preoperative AF and greater morbidity and mortality in patients undergoing surgery for ischemic heart disease [5,8,12–15], with recommendations to consider concomitant AF ablation during the surgery [8,14].

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However, the current literature remains sparse and commonly used risk calculators for cardiac surgery, such as the EuroSCORE, are yet to recognize pre-op AF as a risk modifier [16,17].

This study was designed to identify the potential impact of pre-op AF on the early and late operative outcomes in a large cohort of patients, from the Australasian Society of Cardiac and Thoracic Surgeons (ASCTS) Cardiac Surgery Database, with ischemic heart disease undergoing isolated CABG surgery.

Methods

The inclusion criterion for the study was patients undergoing isolated CABG between June 1, 2001 and December 31, 2009, at hospitals in Australia participating in the ASCTS Cardiac Surgery Database. Patients having any other concomitant cardiac surgical procedures, in particular, atrial arrhythmia surgery, were excluded. A detailed description of data collection and validation methods has been previously provided [18,19].

Pre-op AF was defined by evidence of a pre-op AF by clinical documentation that required treatment. For the purpose of this study, patients were separated into two groups based on the presence of pre-op AF or not (no pre-op AF group). Preoperative characteristics, early outcomes, and long-term survival were compared between the two groups. Late mortality was defined as death from any cause that occurred at any time after hospital discharge.

Fourteen early postoperative outcomes were analyzed. These were as follows: (a) 30-day mortality, defined as death within 30 days of operation; (b) permanent stroke, defined as a new central neurologic deficit persisting for >72 h; (c) transient stroke, defined as a transient neurologic deficit (transient ischemic attack or reversible ischemic neurologic deficit); (d) postoperative acute myocardial infarction (AMI), defined as at least two of the following: enzyme level elevation, new cardiac wall motion abnormalities, or new Q waves on serial electrocardiograms; (e) new renal failure, defined as at least two of the following: serum creatinine increased to more than 200 μmol/L, doubling or greater increase in creatinine vs. preoperative value, or new requirement for dialysis or hemofiltration; (f) prolonged ventilation (>24 h); (g) multisystem failure, defined as concurrent failure of two or more of the cardiac, respiratory, or renal systems for at least 48 h; (h) septicemia, defined as positive blood cultures supported by at least two of the following indices of clinical infection: fever, elevated granulocyte cell counts, elevated and increased C-reactive protein, and elevated and increased erythrocyte sedimentation rate, postoperatively; (i) gastrointestinal (GI) complications, defined as postoperative occurrence of any GI complication; (j) deep sternal infection involving muscle and bone as demonstrated by surgical exploration and one of the following: positive cultures or treatment with antibiotics; (k) pneumonia diagnosed by one of the following: positive cultures of sputum, blood, pleural fluid, empyema fluid, transtracheal fluid or transthoracic fluid, consistent with the diagnosis and clinical findings of pneumonia; (l) red blood cell transfusion postoperatively; (m) return to the operating theater for any cause; and (n) return to the operating theater for bleeding.

To assess the impact of pre-op AF on each outcome, logistic regression analysis was used to adjust for 21 preoperative patient variables, with the outcome as the dependent variable. Long-term survival status was obtained from the Australian National Death Index. The closing date was March 18, 2010. A Kaplan–Meier estimate of survival was obtained. Differences in long-term survival were assessed by the log-rank test. The role of pre-op AF in long-term survival was assessed by constructing a Cox proportional hazards model using pre-op AF and other preoperative patient characteristics as variables. Continuous variables are presented as mean ± one standard deviation. The independent samples *t*-test was used to compare two groups of continuous variables. The Fisher's exact test or the Chi-square test was used to compare groups of categoric variables. All calculated values of *p* were two-sided, and $p < 0.05$ was considered significant. Statistical analysis was performed using SPSS® for Windows version 17.0 (SPSS, Munich, Germany).

Results

CABG surgery was undertaken in 21,534 patients at 18 Australian institutions. Of these 1312 (6.1%) patients presented with pre-op AF. Preoperative and demographic characteristics of pre-op AF and no pre-op AF patients are provided in Table 1. There were some differences in intraoperative variables between the two groups. These are summarized in Table 2.

Overall 30-day mortality and in-hospital mortality were 1.6% and 1.8%, respectively. The unadjusted 30-day mortality rate was 1.4% in patients without pre-op AF and 4.2% in patients with pre-op AF. This difference was significant on univariate analysis ($p < 0.001$). The independent association of pre-op AF with other postoperative outcomes is summarized in Table 3. The logistic regression model predicting 30-day mortality is shown in Table 4. This model has a Hosmer–Lemeshow χ^2 statistic of 5.26 ($p = 0.73$) and demonstrates that pre-op AF was an independent predictor for 30-day mortality ($p = 0.004$). On univariate analysis, patients with pre-op AF had a significantly higher mean postoperative length of stay (11.27 ± 11.41 days vs. 8.49 ± 8.93 days, $p < 0.001$) and intensive care unit stay (61.77 ± 99.49 h vs. 42.77 ± 96.44 h, $p < 0.001$) compared to patients who did not develop pre-op AF.

The mean follow-up period for this study was 37 (range, 0–106) months. Long-term survival at 1, 3, 5, and 7 years postoperatively was significantly lower in patients who developed pre-op AF compared to those who did not (97.1% vs. 91.2%, 94.3% vs. 86.5%, 89.7% vs. 77.7%, and 84.8% vs. 68.7%, $p < 0.001$). Fig. 1 shows survival outcomes in patients with and without pre-op AF prior to adjusting for confounding variables. After adjusting for differences in patient variables, pre-op AF was independently associated with reduced long-term survival ($p < 0.001$). A Cox regression model predicting late mortality is summarized in Table 4.

Discussion

Whether pre-op AF is an independent risk factor for poorer perioperative outcomes and late survival or simply a marker of a more complex physiological milieu is controversial. Studies have consistently shown that patients with pre-op AF are sicker and have significantly more comorbidities [7,9,12,14,20]. Consistent with this, we found that patients with pre-op AF were older, had more cardiovascular risk factors, more extensive coronary artery disease, and presented more often in a critical perioperative state. These factors undoubtedly contributed to the poorer outcomes observed in patients with pre-op AF. Our large study demonstrated, however, that even after accounting for these factors, pre-op AF was associated with poorer short-term and long-term outcomes.

The overall 30-day mortality in our study was 1.6%. This is lower than that reported in many series and reflects the continuous improvements in technical aspects of cardiothoracic surgery, anesthesia, and perioperative care in the contemporary era [20–23]. The 30-day mortality was 4.2% and 1.4% in patients with and without pre-op AF, respectively. This was significant on multivariate analysis ($p = 0.004$). The association of pre-op AF with early mortality has been previously described. Attaran et al. [20] evaluated 1800 matched patients who underwent a spectrum of cardiac surgery procedures and demonstrated that pre-op AF was associated with a 51% increase in early mortality (7.4% vs. 4.9%,