Postoperative Atrial Fibrillation Impacts on Costs and One-Year Clinical Outcomes: The Veterans Affairs Randomized On/Off Bypass Trial

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Background. **New-onset postoperative atrial fibrillation (POAF) after coronary artery bypass graft surgery (CABG) is associated with worse in-hospital morbidity and mortality, extended hospital stays, and higher costs. Beyond the initial hospital discharge, the cost and outcomes of POAF have not been well studied.**

Methods. **For CABG patients with and without new-onset POAF, a retrospective propensity-matched, multivariable regression analysis was performed to compare 1-year outcomes (including health-related quality of life [HRQoL] scores and mortality rates) and costs (standardized to 2010 dollars). Regression models controlled for site and patient factors, with propensity matching used to adjust for differences in POAF versus no-POAF patients' risk profiles.**

Results. **Using the existing CABG trial database, 2,096 patient records were analyzed, including POAF patients (n = 549) versus no-POAF patients (n = 1,547). For the index CABG hospitalization, POAF patients had longer postoperative length of stay (+3.9 days) and higher discharge costs (+$13,993) than no-POAF patients. At 1 year, POAF patients had more than twice the adjusted odds of dying ($p < 0.01$), with higher 1-year total cumulative costs. This 1-year cost difference (+$15,593) was largely attributable to hospital-based costs during the index surgery hospitalization. There was no difference in 1-year HRQoL scores (or HRQoL score changes) between POAF patients and no-POAF patients.**

Conclusions. **Compared with no-POAF patients, POAF patients had higher discharge and 1-year costs along with higher 1-year mortality rates, but no differences were observed in 1-year HRQoL scores. Additional research appears warranted to improve the longer-term survival rates for POAF CABG patients, targeting future POAF-specific postdischarge interventions.**

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New-onset postoperative atrial fibrillation (POAF) is the most common arrhythmic complication after coronary artery bypass graft surgery (CABG), reportedly occurring in as many as one third of patients [1–3]. Despite a large number of reports on POAF, there has not been a change in the incidence of this rhythm disturbance, and although pharmacologic or invasive measures are recommended and commonly used, an effective prophylactic treatment remains elusive [3–5]. POAF has been shown to adversely affect patient outcomes in terms of morbidity, mortality, intensive care unit, hospital stay, and long-term outcomes, in part because of an increased risk for thromboembolic stroke [1–3, 6–9]. That, in turn, has been shown to translate into increased cost of care for patients with POAF as compared with patients who do not have POAF [10, 11].

Reports on the impact of POAF on post-CABG health-related quality of life (HRQoL) are scarce, as previous studies on the subject have primarily focused on morbidity, mortality, or resource consumption [12, 13] To address this gap in existing knowledge, the short-term

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and 1-year costs, HRQoL scores, mortality, and morbidity for post-CABG patients are compared for the subgroups of patients with and patients without new-onset POAF as part of the Department of Veterans Affairs (VA) study, the Randomized On/Off Bypass (ROOBY) trial.

Material and Methods

Funded by the VA Cooperative Studies Program (CSP#517), the ROOBY study was a randomized, single-blinded, controlled, multicenter trial conducted at 18 VA medical centers between February 2002 and May 2008 to compare on-pump versus off-pump CABG. The study enrolled 2,203 patients [14]. New-onset POAF developed in 549 patients (26.2%), compared with no POAF in 1,547 patients. The ROOBY trial protocol, including the present subanalysis, was approved by each participating VA medical center's Institutional Review Board and Research and Development Office. Informed consent was obtained and a Health Insurance Portability and Accountability Act (HIPPA) authorization was provided by each patient.

For this retrospective analysis, patient risk factors, processes of care performed, and outcomes for POAF patients were compared with no-POAF patients. Excluded were 93 patients with a history of preoperative atrial fibrillation, 7 patients with missing POAF data, and 7 patients with other missing data. Using the ROOBY trial data originally captured prospectively, POAF was defined as any abnormal atrial-originated rhythm without discernible P waves on electrocardiogram lasting more than 30 minutes. The 30-minute duration was chosen to exclude shorter-lived episodes of POAF that would not have warranted intervention. POAF prophylaxis, most commonly performed using amiodarone, beta-blockers, or a combination of these two medications, was left to the surgeon's discretion.

Short-term outcomes were defined as those occurring within the index hospitalization or within 30 days of CABG surgery. At 1-year follow-up, clinical outcomes, including mortality, repeat revascularization procedures, and acute myocardial infarction events, were assessed. Additionally, the ROOBY trial's primary short-term composite (based on either 30-day operative death or perioperative complications, ie, reoperation, new mechanical support, cardiac arrest, stroke, and renal failure) and 1-year composite (based on either 1-year mortality or repeat revascularization procedures between 30 days and 1 year, and acute nonfatal myocardial infarction events between 30 days and 1 year) were compared for this subanalysis [14].

Self-reported HRQoL assessments, including the Veterans-Specific Short Form-36 (VR-36) and Seattle Angina Questionnaire (SAQ), were assessed at baseline (before surgery), 3 months after CABG, and 12 months after CABG. The SAQ subscores were reported for the angina frequency, angina stability, disease perception, quality of life, and physical limitation subscales. For the VR-36, the physical component scale and mental component scale subscales were reported, in which scores range from 0 and 100, and a higher score indicates better HRQoL. A patient's utility score (the VR-6D) was calculated; the VR-6D integrates mortality with VR-36 self-reported quality of life survey data into a single score [15].

Using the VA decision support system (an activity-based cost accounting system), the post-CABG costs were evaluated at the time of index hospital discharge and for as long as 1-year follow-up. The components of costs that were analyzed included VA medical care, non-VA medical care, and patient-incurred travel costs. To document their non-VA costs, participants were contacted every 2 months after CABG by their local research nurse. These postdischarge telephone interviews included detailed questions about their recent VA and non-VA health care utilization. Average unit costs were used to convert non-VA utilization into comparable VA costs (eg, $2,553 per inpatient hospital day) based on national averages obtained from the VA decision support system. These VA and non-VA costs were calculated for the initial hospitalization, excluding the preoperative hospital stay, and the subsequent care received for as long as 1 year after the operation. All cost estimates were standardized to 2010 dollars using the general consumer price index.

Statistical Analysis

The differences between POAF and no-POAF patient subgroups for dichotomous outcomes (eg, mortality endpoints) were evaluated using χ^2 or Fisher exact tests. The baseline, 3-month, and 1-year HRQoL survey scores were analyzed as continuous variables using Student's *t* tests. Analyses were also performed in the POAF patient subgroup, comparing the short-term and 1-year outcomes between patients with early POAF (within 48 hours) versus patients whose POAF developed after 48 hours.

To facilitate the comparison between POAF versus no-POAF patient subgroups, propensity matching was performed, adjusting for the other baseline characteristics that may inherently influence differences in clinical outcomes including sex, age, marital status, insurance status, smoking history, depression history, use of medications for diabetes mellitus, chronic obstructive pulmonary disease, peripheral vascular disease, hypertension, aorta quality, number of bypass grafts, and medical center. Three different propensity approaches were used: matching on the propensity score, covariate adjustment using regression based upon the propensity score, and stratification on the propensity score (using quintiles). By means of these three different approaches, the systematic differences in baseline characteristics of POAF patients versus no-POAF patients were accounted for as part of the outcome comparisons performed. As no differences were found across these different propensity matching approaches, the matching patients 1:1 for the propensity score approach was reported.

For the subgroup of patients who had baseline and follow-up self-reported HRQoL data (VR-36 and SAQ), the changes in HRQoL scores from before CABG to 1 year after CABG were evaluated using models with a