Burden of preoperative atrial fibrillation in patients undergoing coronary artery bypass grafting

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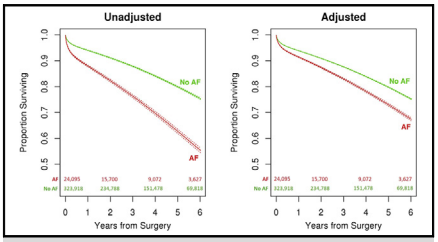
ABSTRACT

Background: This study compares early and late outcomes in patients undergoing coronary artery bypass grafting with and without preoperative atrial fibrillation in a contemporary, nationally representative Medicare cohort.

Methods: In the Medicare-Linked Society of Thoracic Surgeons database, 361,138 patients underwent isolated coronary artery bypass from 2006 to 2013, of whom 37,220 (10.3%) had preoperative atrial fibrillation; 13,161 (35.4%) were treated with surgical ablation and were excluded. Generalized estimating equations were used to compare 30-day mortality and morbidity. Long-term survival was summarized using Kaplan-Meier curves and Cox regression models. Stroke and systemic embolism incidence was modeled using the Fine-Gray model and the CHA_2DS_2-VASc score was used to analyze stroke risk. Median follow-up was 4 years.

Results: Preoperative atrial fibrillation was associated with a higher adjusted 30-day mortality (odds ratio [OR], 1.5; $P < .0001$) and combined major morbidity including stroke, renal failure, prolonged ventilation, reoperation, and deep sternal wound infection (OR, 1.32; $P < .0001$). Patients with preoperative atrial fibrillation experienced a higher adjusted long-term risk of all-cause mortality and cumulative risk of stroke and systemic embolism compared to those without atrial fibrillation. At 5 years, the survival probability in the preoperative atrial fibrillation versus no atrial fibrillation groups stratified by CHA_2DS_2-VASc scores was 74.8% versus 86.3% (score 1-3), 56.5% versus 73.2% (score 4-6), and 41.2% versus 57.2% (score 7-9; all $P < .001$).

Conclusions: Preoperative atrial fibrillation is independently associated with worse early and late postoperative outcomes. CHA_2DS_2-VASc stratifies risk, even in those without preoperative atrial fibrillation. (J Thorac Cardiovasc Surg 2018;■:1-10)



Survival is worse in patients with preoperative AF compared to those with no AF ($P < .001$).

Central Message

AF before CABG is associated with higher early and late perioperative mortality and morbidity. Survival and risk of stroke or systemic embolism are worse after adjusting for comorbidities.

Perspective

Preoperative atrial fibrillation is an independent risk factor for worse outcomes after coronary artery bypass surgery. Further analysis of the comparative effectiveness of concomitant atrial fibrillation ablation has important implications for this high-risk cohort.

See Editorial Commentary page XXX.

The incidence of atrial fibrillation in patients with coronary artery disease (CAD) requiring coronary artery bypass grafting (CABG) is approximately 6% according to a historical Society of Thoracic Surgeons (STS) report.[1] Published reports on the association between preoperative atrial fibrillation (AF) and post-CABG outcomes have shown worse perioperative mortality and long-term survival.[2-8] Previous STS database studies have shown increased perioperative mortality and stroke in patients with preoperative AF, but long-term outcomes were not studied.[9]

Scanning this QR code will take you to a supplemental figure and video for the article.

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Abbreviations and Acronyms

ASCERT = American College of Cardiology Foundation–Society of Thoracic Surgeons Collaboration on the Comparative Effectiveness of Revascularization Strategies
AF = atrial fibrillation
CABG = coronary artery bypass graft
CAD = coronary artery disease
CHA_2DS_2-VASc = Congestive heart failure, Hypertension, Age $\geq$ 75, Diabetes, Stroke, VAScular disease, Age 65-74, Sex category
CI = confidence interval
CMS = Centers for Medicare and Medicaid
HR = hazard ratio
OR = odds ratio
SSE = stroke or systemic embolism
STS = Society of Thoracic Surgeons

The STS database recent linkage to the Centers for Medicare and Medicaid Services (CMS) database allows for study of important long-term endpoints beyond perioperative outcomes provided in the STS National Cardiac Database. Using CMS-linked STS data, this study sought to examine early and late outcomes in 2 groups of first cardiac surgery CABG patients: (1) those with preoperative AF but no surgical AF treatment, and (2) those without preoperative AF.

PATIENTS AND METHODS

Data for all patients were obtained from the STS Adult Cardiac Surgery Database (versions 2.52, 2.61, and 2.73) for patients discharged between January 1, 2006, and December 31, 2013, and who could be linked to CMS data using a validated deterministic matching algorithm.[10]

Study Population

Medicare recipients age 65 years or older and undergoing CABG as a first cardiac surgery who had complete information on preoperative history of atrial arrhythmias were included. Between January 2006 and December 2013, there were 688,466 isolated CABG surgery procedures reported in the STS database in patients age 65 years or older. Of those, 119,597 patients were excluded because of prior cardiac surgery (n = 44,671), emergent/salvage status–cardiogenic shock/resuscitation (n = 25,542), preoperative intra-aortic balloon pump/inotropes (n = 44,977), history of endocarditis (n = 637), and missing or inconsistent data on arrhythmia, number of diseased vessels, gender, or any of the previous fields considered for exclusion (n = 3770). Of the resulting population, additional exclusions were made for 207,553 with unlinked CMS data, 178 had more than 1 admission on the same day, and 13,161 had surgical ablation. The resulting 347,977 patients with linked CMS data (61%) were categorized according to their preoperative AF status: (1) 89.7% (n = 323,918) no preoperative AF (No AF) or (2) 6.7% (n = 24,059) preoperative AF (AF group) and analyzed (Figure E1).

Study Outcomes

The primary outcome was all-cause mortality after CABG. This was defined using STS registry data for in-hospital deaths and the linked Medicare Denominator File for postdischarge deaths.[11]

Secondary outcomes included (1) stroke or systemic embolism (SSE; ischemic stroke, hemorrhagic stroke, transient ischemic attack, or systemic arterial embolism), (2) in-hospital mortality, and (3) a composite of in-hospital major morbidity.[12]

Incident SSE was defined by using STS registry data to account for in-hospital strokes and Medicare Part A data to identify subsequent rehospitalizations with SSE as a primary diagnosis (International Classification of Diseases, 9th revision, codes: 433.1, 434.x1, 430, 431, 432.0, 432.1, 432.9, 444,x, 435.x). The STS database does not include the exact date of in-hospital strokes; for the purpose of time-to-event analyses, we assigned the date of in-hospital stroke to be the date of the index operation.

In-hospital major morbidity, a previously defined composite,[13,14] referred to any of the following postprocedure complications: permanent stroke, new cases of renal failure, prolonged ventilation (ventilation longer than 24 hours after surgery), reoperation for cardiac reasons (graft dysfunction, bleeding, valve dysfunction or other), and deep sternal wound infection.

Statistical Methods

The overall study population and the subgroups of interest (No AF vs AF) were summarized using medians and interquartile ranges (25th and 75th percentiles) for continuous variables and frequency counts and percentages for categorical variables. Differences in distributions among patients with No AF versus AF were evaluated with Wilcoxon and Pearson chi-square tests, respectively.

Logistic regression models were developed to estimate the association between in-hospital outcomes and AF versus No AF. The generalized estimated equations method with an exchangeable correlation structure was used to compute confidence limits that account for hospital clustering of patients. Adjusted models included predictors of long-term survival after CABG identified with the validated American College of Cardiology Foundation–Society of Thoracic Surgeons Collaboration on the Comparative Effectiveness of Revascularization Strategies (ASCERT) model[15]: age, ejection fraction, year of surgery, renal failure (glomerular filtration rate <30 or dialysis), glomerular filtration rate, body mass index, height, sex, race, current smoking, chronic heart failure/New York Heart Association Class IV, urgent operative status, number of diseased vessels, diabetes, previous carotid surgery, carotid stenosis > 75%, transient ischemic attack, chronic lung disease moderate/severe, left main disease, unstable angina, peripheral vascular disease, immunosuppressant medication, hypertension, valve insufficiency (tricuspid, aortic, mitral) moderate/severe, aortic stenosis gradient, preoperative myocardial infarction (less than 6 hours before, between 6 and 24 hours, between 1 and 21 days). These variables were also used for all adjusted time-to-event analyses.

Time-to-event analysis was used to compare long-term survival and SSE occurrence by group. For survival, patient follow-up was censored at the end of study period (January 1, 2014). Product-limit Kaplan Meier survival estimates were computed for each group and comparisons were made with log-rank tests. Cox regression models were used to compute hazard ratios for the AF versus No AF, both unadjusted and adjusted by other survival predictors. A robust sandwich covariance estimation to compute 95% confidence intervals was used to account for correlation of patients' failure times within the same hospital. The proportional hazard assumption was tested using log-log survival plots (log-log survival vs log-time) for each group and the results indicated no violation of this assumption. Consistent with the validated STS risk models,[15] missing values (<3%) were imputed with relevant groups-specific medians for