



Underestimation of the incidence of new-onset post-coronary artery bypass grafting atrial fibrillation and its impact on 30-day mortality

Giovanni Filardo, PhD, MPH,^{a,b} Benjamin D. Pollock, MSPH,^a Briget da Graca, JD, MS,^a Teresa K. Phan, MS, MS,^a Danielle M. Sass, MPH, CPH,^a Gorav Ailawadi, MD,^c Vinod Thourani, MD,^d and Ralph Damiano, MD^e

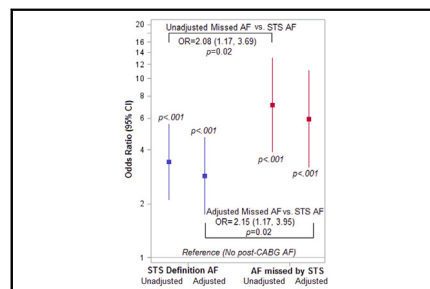
ABSTRACT

Objective: Inconsistent definitions of atrial fibrillation after coronary artery bypass grafting have caused uncertainty about its incidence and risk. We examined the extent to which limiting the definition to post-coronary artery bypass grafting atrial fibrillation events requiring treatment underestimates its incidence and impact on 30-day mortality.

Methods: We assessed in-hospital atrial fibrillation and 30-day mortality in 9268 consecutive patients without preoperative atrial fibrillation who underwent isolated coronary artery bypass grafting at 5 US hospitals (2004-2010). Patients who experienced 1 or more episode of post-coronary artery bypass grafting atrial fibrillation detected via continuous in-hospital electrocardiogram/telemetry monitoring were divided into those for whom Society of Thoracic Surgeons data (applying the definition “atrial fibrillation/flutter requiring treatment”) also indicated atrial fibrillation versus those for whom it did not. Risk-adjusted 30-day mortality was compared between these 2 groups and with patients without post-coronary artery bypass grafting atrial fibrillation.

Results: Risk-adjusted incidence of post-coronary artery bypass grafting atrial fibrillation incidence was 33.4% (27.0% recorded in Society of Thoracic Surgeons data, 6.4% missed). Patients with post-coronary artery bypass grafting atrial fibrillation missed by Society of Thoracic Surgeons data had a significantly greater risk of 30-day mortality (odds ratio, 2.08, 95% confidence interval, 1.17-3.69) than those captured. By applying the significant underestimation of post-coronary artery bypass grafting atrial fibrillation incidence we observed (odds ratio [Society of Thoracic Surgeons vs missed], 0.78; 95% confidence interval, 0.72-0.83) to the approximately 150,000 patients undergoing isolated coronary artery bypass grafting in the United States each year estimates this increased risk of mortality is carried by 9600 patients (95% confidence interval, 9420-9780) annually.

Conclusions: Defining post-coronary artery bypass grafting atrial fibrillation as episodes requiring treatment significantly underestimates incidence and misses patients at a significantly increased risk for mortality. Further research is needed to determine whether this increased risk carries over into long-term outcomes and whether it is mediated by differences in treatment and management. (*J Thorac Cardiovasc Surg* 2017;154:1260-6)



Unadjusted and adjusted* ORs for operative mortality.
*Adjusted for the STS risk of mortality and time of surgery.

Central Message

The STS definition of post-CABG AF significantly underestimates incidence, missing approximately 9600 US patients each year who are at significantly increased risk for 30-day mortality.

Perspective

The association between post-CABG AF and poor survival is well known, but the definition has not been standardized to ensure all patients at risk are identified. The STS data (AF/flutter requiring treatment) miss approximately 9600 US patients with new-onset AF after isolated CABG annually; our results show they carry an unrecognized significantly increased risk for 30-day mortality.

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From the ^aOffice of the Chief Quality Officer, Baylor Scott & White Health, Dallas, Tex; ^bThe Heart Hospital Baylor Plano, Plano, Tex; ^cDivision of Thoracic and Cardiovascular Surgery, University of Virginia, Charlottesville, Va; ^dDivision of Cardiothoracic surgery, Emory University, Atlanta, Ga; and ^eDepartment of Cardiac Surgery, Washington University School of Medicine and Barnes-Jewish Hospital, St Louis, Mo.

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Address for reprints: Giovanni Filardo, PhD, MPH, Office of the Chief Quality Officer, Baylor Scott & White Health, 8080 North Central Expressway, Suite 900, Dallas, TX 75206 (E-mail: giovanfi@baylorhealth.edu).

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Abbreviations and Acronyms

AF	= atrial fibrillation
CABG	= coronary artery bypass grafting
CI	= confidence interval
ECG	= electrocardiogram
GEE	= generalized estimating equation
OR	= odds ratio
STS	= Society of Thoracic Surgeons

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Development of atrial fibrillation (AF) after cardiac surgery was considered a minor, self-limiting complication until relatively recently.¹⁻⁵ Approximately a decade ago, however, evidence started emerging that it was independently associated with poorer survival after coronary artery bypass grafting (CABG).^{2,3,6-9} It is now recognized as a serious complication, and practice guidelines and quality measures have been introduced related to its prevention.¹⁰⁻¹³ However, no standard definition has been established to ensure all patients who carry this risk for poor outcomes are identified for follow-up and management after discharge. Research studies to date have used a wide variety of definitions and means of detecting AF,^{14,15} creating uncertainty about its true incidence and how effectively the risks it is associated with are being managed.

The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database incorporates data from approximately 95% of the cardiac surgery programs in the United States,¹⁶ making it and the regional STS-certified databases built around the same routinely collected data valuable resources for studies investigating postoperative AF,¹⁷⁻¹⁹ and therefore influential in determining the definition of postoperative AF on which the evidence base regarding its prevention and management will be built. Currently, the STS defines postoperative AF as “atrial fibrillation/flutter requiring treatment.”²⁰ Because there are no criteria for the determination of when treatment is required, this is an ambiguous definition, subject to the vagaries of differing indications for treatment between physicians and hospitals, and may substantially underestimate the incidence of postoperative AF, and, thus, the patients at risk for late mortality. Given the clinical significance, the question arises as to whether the STS definition needs to be updated and refined.

To address this question, we used data from a large, multicenter observational study to compare the risk-adjusted incidence of new-onset post-CABG AF defined according to the STS data and definition versus any episode detected via continuous in-hospital electrocardiogram (ECG)/telemetry monitoring and documented by a physician in the patient’s chart, regardless of duration or need for treatment, but not captured in the STS data. We then compared 30-day mortality between these 2 groups and patients who did not develop AF to determine whether the difference in definition is clinically meaningful.

MATERIALS AND METHODS**Patients and Setting**

This multicenter observational study was conducted in 9268 consecutive patients *without* a history of AF who underwent isolated CABG between January 1, 2004, and December 31, 2010, at Baylor University Medical Center (Dallas, Tex), The Heart Hospital Baylor Plano (Plano, Tex), Emory University (Atlanta, Ga), University of Virginia (Charlottesville, Va), or Washington University (St Louis, Mo). Patients were excluded if they had preoperative endocarditis or a ventricular assist device. The study was approved by the institutional review boards of all participating centers.

Data Collection and Outcome Measures

Data regarding patient and operative characteristics routinely collected for the STS database were augmented with detailed data regarding AF events abstracted from medical records, based on ECG findings.

The outcome measures were the adjusted incidence of new-onset post-CABG AF defined as (1) AF/flutter requiring treatment (AF identified in the STS data)²⁰ and (2) any episode detected via continuous in-hospital ECG/telemetry monitoring and documented by a physician in the patient’s chart, regardless of duration or need for treatment, but not recorded in the STS data (AF not identified in the STS data). Mortality at 30 days postsurgery was assessed using the vital status information contained within the STS data and compared between the patients with these 2 definitions of post-CABG AF and the patients without post-CABG AF.

Statistical Analysis

The overall adjusted incidence of new-onset post-CABG AF (including all patients with any episode detected via continuous in-hospital ECG/telemetry monitoring and documented by a physician in the patient’s chart, regardless of whether it was also captured in the STS data) was assessed with a generalized estimating equation (GEE) model approach to account for patient and site variability. The GEE model was adjusted for the STS risk of mortality²¹ and time of operation (incremental month starting from January 2004 [month 1] to December 2010 [month 84]). All continuous covariates were modeled with a 5-knot restricted cubic spline.^{22,23} The same model, with the addition of the interaction between AF definition and time of operation, was used to compare the adjusted incidence of new-onset post-CABG AF according to whether or not the patient’s AF was identified in the STS data. Model estimates were used to compute the adjusted new-onset post-CABG AF incidences, odds ratios (ORs), 95% confidence intervals (CIs), and *P* values.

The impact of limiting the definition of post-CABG AF to events requiring treatment on the detection of new-onset AF in the US population undergoing isolated CABG was estimated by applying the risk-adjusted difference in incidence between patients whose AF events were versus were not identified in the STS data in our study population to the total number of isolated CABG procedures performed in the United States

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