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Clinical Course of Postoperative Atrial Fibrillation After Cardiac Surgery and Long-term Outcome

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ABSTRACT

BACKGROUND New-onset postoperative atrial fibrillation (POAF) after cardiac surgery is associated with worse short- and long-term outcomes. Although the clinical presentation of POAF varies substantially, almost all studies model it with a dichotomous yes or no variable. We explored potential associations between the clinical course of POAF and long-term outcome.

METHODS This retrospective, observational, single-center study included 6435 coronary artery bypass grafting and/or valve patients between 2010 and 2018. POAF patients were grouped into spontaneous/pharmacologic conversion to sinus rhythm, sinus rhythm after electrical cardioversion, and sustained AF at discharge. Multivariable Cox regression models adjusted for age, sex, type of surgery, comorbidities, and early-initiated oral anticoagulation were used to study associations between the clinical course of POAF and long-term risk for mortality, ischemic stroke, thromboembolic events, heart failure hospitalization, and major bleeding. Median follow-up time was 3.8 years (range, 0-8.3).

RESULTS POAF occurred in 2172 patients (33.8%), 94.9% of whom converted to sinus rhythm before discharge. Of these, 73.6% converted spontaneously or with pharmacologic treatment and 26.4% after electrical cardioversion. Both sustained AF and electrical cardioversion were independently associated with an increased long-term risk for heart failure (adjusted hazard ratio for sustained AF at discharge, 2.55 [95% confidence interval, 1.65-3.93; $P < .001$]; adjusted hazard ratio for electrical cardioversion, 1.28 [95% confidence interval, 1.00-1.65; $P = .049$]) but not with increased long-term risk for death, thromboembolic complications, or bleeding.

CONCLUSIONS A more complicated POAF course is associated with increased long-term risk for heart failure hospitalization but not for all-cause mortality or thromboembolic complications.

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New-onset postoperative atrial fibrillation (POAF) is the most common adverse event after open heart surgery, with a reported incidence of 20% to 50% depending on type of procedure.[1-5] The incidence of POAF has remained stable in recent decades despite refinements in cardiac surgery and perfusion techniques and improvements in anesthesia and intensive care. POAF was historically considered a benign and transient condition, but several studies suggest it is associated with an increased risk for short- and long-term complications, including increased risk of death, thromboembolic events, heart failure, and recurrent AF.[1-5]

Previous studies exploring the association between POAF and outcome almost exclusively use a

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dichotomous yes or no variable to model POAF. However the clinical course of POAF varies considerably. Some patients have just a short period of AF that converts spontaneously to sinus rhythm, some fluctuate between AF and sinus rhythm with no or limited clinical consequences, and others have long-lasting AF periods and/or hemodynamic deterioration necessitating electrical cardioversion. Furthermore some patients with AF do not convert to sinus rhythm despite several attempts with medication and/or electrical cardioversion. In general it is not known if variation in the clinical course of POAF during the initial hospitalization is associated with short- or long-term outcomes, which would argue against handling POAF as a dichotomous variable. However 1 study reported that long-lasting POAF (>2 days) was associated with inferior long-term survival compared with shorter POAF periods.[6] Other aspects of the clinical course of POAF and long-term outcomes have not previously been investigated.

In the present study we hypothesized that the clinical course of POAF is associated with long-term outcomes after cardiac surgery. Specifically we hypothesized that sustained AF at hospital discharge despite efforts to restore sinus rhythm or the need for electrical cardioversion to regain sinus rhythm is associated with an increased risk for death and cardiovascular events. An observational cohort study was designed to test this hypothesis.

PATIENTS AND METHODS

STUDY DESIGN AND STUDY POPULATION. This was an observational, population-based, longitudinal, registry-based cohort study. All residents in the Västra Götaland Region aged ≥ 18 years who underwent first-time isolated coronary artery bypass grafting (CABG), heart valve surgery, or a combination thereof at Sahlgrenska University Hospital in Gothenburg from September 1, 2010 to December 31, 2018 were eligible. Sahlgrenska University Hospital provides cardiac surgery for all residents in the Västra Götaland Region, corresponding to approximately 17% of the Swedish population. A flowchart of included and excluded patients is shown in Figure 1. Patient characteristics are presented in Table 1. Patients were followed until death, emigration, or the end of the study period (December 31, 2018). In patients with POAF our institution's policy is to restore sinus rhythm as soon as possible, first with medication and then, if this fails, by electrical cardioversion. Patients

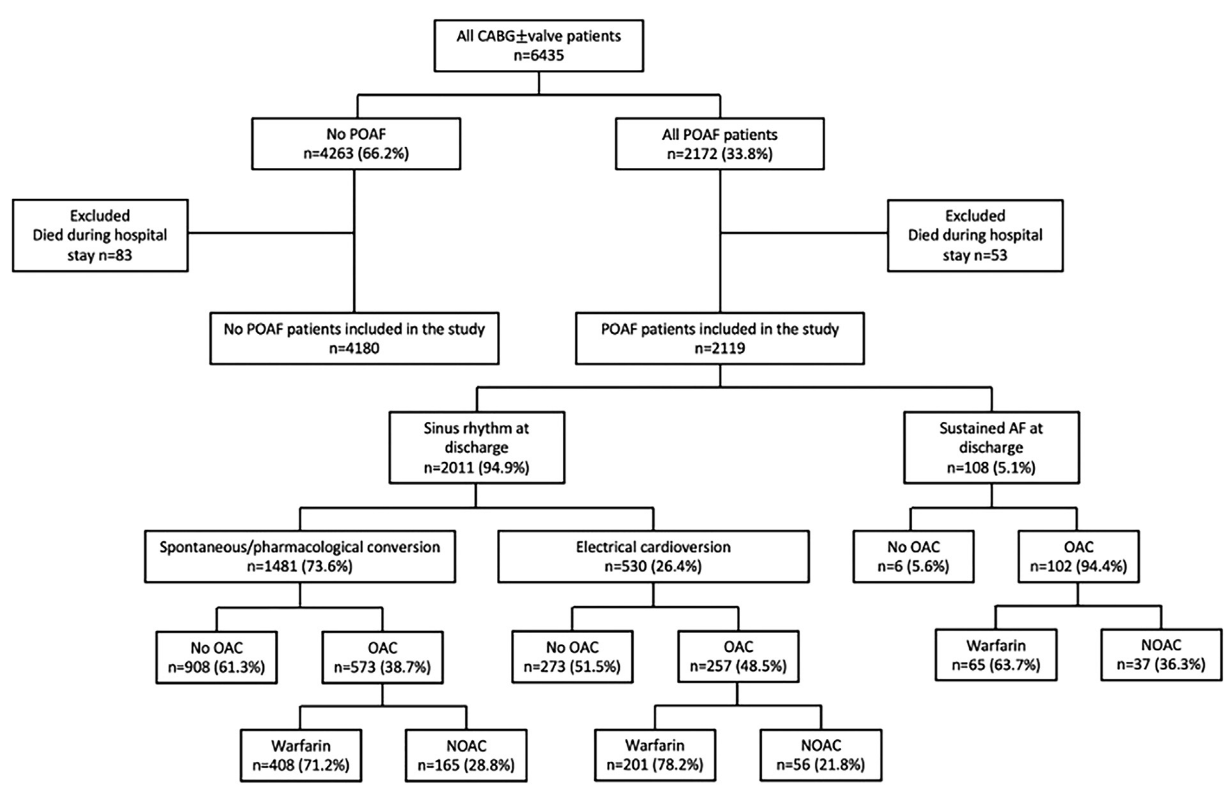

FIGURE 1 Clinical course and treatment with oral anticoagulants at discharge in 6435 cardiac surgery patients with and without postoperative atrial fibrillation. AF, atrial fibrillation; CABG, coronary artery bypass grafting; NOAC, non–vitamin K oral anticoagulant; OAC, oral anticoagulation; POAF, postoperative atrial fibrillation.

ADULT CARDIAC

TABLE 1 Patient Characteristics in 2119 Postoperative Atrial Fibrillation Patients With Spontaneous/Pharmacologic Conversion to Sinus Rhythm (Group 1), Electrical Cardioversion to Sinus Rhythm (Group 2), or Sustained Atrial Fibrillation at Discharge (Group 3)

Variable	Spontaneous/Pharmacologic Conversion (Group 1) (n = 1481)	Electrical Cardioversion (Group 2) (n = 530)	Atrial Fibrillation at Discharge (Group 3) (n = 108)	*P* (Group 1 vs Group 2)	*P* (Group 1 vs Group 3)
Female sex	364 (24.6)	139 (26.2)	28 (25.9)	.49	.83
Age, y	69.7 ± 8.6	70.3 ± 9.1	72.4 ± 7.7	.19	.002
Type of surgery				<.001	<.001
Coronary artery bypass grafting	876 (59.1)	237 (44.7)	35 (32.4)		
Valve	424 (28.6)	197 (37.2)	45 (41.7)		
Coronary artery bypass grafting and valve	181 (12.2)	96 (18.1)	28 (25.9)		
Previous myocardial infarction	573 (38.7)	172 (32.5)	29 (26.9)	.012	.017
Heart failure	342 (23.1)	179 (33.8)	37 (34.3)	<.001	.015
Hypertension	1150 (77.7)	400 (75.5)	80 (74.1)	.33	.45
Diabetes mellitus	416 (28.1)	126 (23.8)	22 (20.4)	.06	.10
Left ventricular ejection fraction				.002	.65
>50%	1127 (76.3)	373 (70.6)	80 (74.1)		
31%-50%	274 (18.5)	110 (20.8)	22 (20.4)		
<30%	77 (5.2)	45 (8.5)	6 (5.6)		
EuroSCORE II	2.6 ± 4.1	3.2 ± 4.5	3.7 ± 6.2	.027	.030
Previous stroke	128 (8.6)	51 (9.6)	12 (11.1)	.55	.47
Peripheral vascular disease	174 (11.7)	47 (8.9)	11 (10.2)	.08	.76
Renal insufficiency	168 (11.3)	71 (13.4)	14 (13.0)	.24	.70
Chronic respiratory disease	232 (15.7)	88 (16.6)	25 (23.1)	.66	.06
History of cancer	293 (19.8)	120 (22.6)	28 (25.9)	.18	.16
Anticoagulation at discharge	573 (38.7)	257 (48.5)	102 (94.4)	<.001	<.001

Values are n (%) or mean ± SD. Missing data: EuroSCORE II, 424; left ventricular ejection fraction, 5.

with compromised hemodynamics are also treated with electrical cardioversion.

POAF was defined as a new-onset POAF episode in a patient with no previous history of AF, during either the index hospitalization at the operating unit or after hospitalization at a cardiology unit. To identify patients with a more complicated clinical course, POAF patients were divided into 3 groups: patients who had a spontaneous or pharmacologic cardioversion to sinus rhythm, patients who needed 1 or more electrical cardioversion to regain sinus rhythm, and patients who had a sustained AF at discharge. Spontaneous and pharmacologic cardioversion were combined into 1 group because it was not possible to distinguish between these during the review of the patients' records. The different subgroups according to the clinical course of POAF are shown in Figure 1.

The study was performed in accordance with the 1975 Declaration of Helsinki and was approved by the Regional Human Research Ethics Committee in Gothenburg, Sweden (registration no. 2019-06277, approved Jan 15, 2020). The Ethics Committee waived the need for individual informed consent because of the retrospective, registry-based study design.

DATA SOURCES AND ENDPOINTS. POAF patients were identified in the Swedish Cardiac Surgery Registry (SCSR), which is a part of the SWEDEHEART registry.[7] Information about the surgical procedure and patient characteristics before surgery was obtained from the SCSR, which contains detailed information on all cardiac operations including comorbidity, diagnosis, length of stay, and discharge dates in Sweden since 1992. Outcome data along with comorbidities and baseline information additional to those registered in the SCSR were retrieved from the VEGA registry, which covers diagnoses from all hospital admissions and all visits to primary care facilities in Region Västra Götaland. Mortality in the VEGA registry is collected from the Total Population Register, which is handled by Statistics Sweden. The population register contains complete information about mortality except for individuals who die after they have emigrated.

Reported endpoints were all-cause mortality, thromboembolic events (ischemic stroke, transient ischemic attack, or arterial embolization), ischemic stroke, a combination of death and ischemic stroke, hospitalization for heart failure, and major bleeding. An endpoint event was accounted for when it was reported for the first time in the VEGA database and met all the following criteria: occurred after the discharge from the index hospitalization, was associated with hospitalization, and was reported as the principal or secondary diagnosis for that hospitalization. All information on baseline and outcome variables in VEGA is reported according to the International Classification of Diseases, 10th revision codes; the codes that were used are listed in Supplemental Table 1.

The SCSR and VEGA registry were merged by use of the personal identification number that all Swedish residents are given at birth or shortly after immigration. Information about the clinical course of POAF and treatment with oral anticoagulation (OAC) at discharge was collected manually from the electronic patient record system used in Västra Götaland Region.

STATISTICS. No sample size calculation was performed in this exploratory study because no data were available before the start of the study from subgroups of POAF patients on which to base this calculation. The distribution of all continuous variables was tested using the Shapiro-Wilk test. Normally distributed continuous variables are presented as mean with SD and nonnormally distributed continuous variables as median and interquartile range. Fisher's nonparametric permutation test was used to compare continuous variables between groups. All categorical variables are presented as number and percentage and compared between groups with the Mantel-Haenszel χ^2 test or Fisher's exact test where appropriate. Crude event rates were calculated as the number of events divided by the number of years of follow-up and are presented per 100 person-years. The unadjusted cumulative incidences of outcome variables in the different groups were estimated using Kaplan-Meier curves. The cumulative incidence curves for ischemic stroke, thromboembolism, heart failure hospitalization, and major bleeding were adjusted to account for death as competing risk. Multivariable Cox proportional hazard regression models were used to study the associations between clinical course of POAF and outcome variables. The proportional hazard assumption was tested by including the interaction of the log of time with the analyzed covariate in a separate model. The first Cox model was adjusted for age and sex, and the second model was additionally adjusted for type of surgery, comorbidities at baseline (previous myocardial infarction, heart failure, hypertension, diabetes mellitus, renal failure, previous stroke, history of cancer, peripheral vascular disease, left ventricle ejection fraction), and treatment with OAC at discharge. These factors were selected a priori based on the literature because they have been shown to influence long-term mortality risk after cardiac surgery.

All statistical analyses were performed using version 9.4 of the SAS software package (SAS Institute Inc, Cary, NC). A $P < .05$ was considered to be statistically significant in all data analyses.

RESULTS

STUDY POPULATION. Of the 6435 patients eligible for inclusion, 6299 remained after exclusion of those who died during the index hospitalization (136, 2.0%). The final study population comprised 3733 CABG (59.3%), 1849 valve surgery (29.4%), and 717 CABG + valve surgery patients (11.4%) (Supplementary Table 2).

POAF was reported in 2172 of 6435 initially eligible patients (33.8%) and in 2119 of 6299 of the final study population (33.6%). POAF occurred in 1148 of 3733 CABG patients (30.8%), 666 of 1849 valve surgery patients (36.0%), and 305 of 717 CABG + valve surgery patients (42.5%).

POAF VS NO POAF. In total 2119 POAF patients were included in the final study population. Compared with 4180 patients with no POAF, POAF patients were older; were more likely to have undergone valve surgery; were more likely to have hypertension, hyperlipidemia, peripheral vascular disease, renal insufficiency, and a history of cancer; and had a higher CHA_2DS_2-VASc score. OAC was prescribed at discharge to 932 of 2119 POAF patients (44.0%) and was significantly more likely to be prescribed to patients who were routinely transferred to a cardiology clinic before final discharge (47.6% vs 27.2%, $P < .001$). The baseline characteristics for patients with and without POAF are presented in Supplemental Table 2.

The associations between POAF and outcome variables in our study population are presented in Supplemental Table 3. There was a significant association between POAF and the adjusted long-term risk for thromboembolic events but not with mortality, ischemic stroke, death or ischemic stroke, heart failure hospitalization, or major bleeding.

SUSTAINED AF AT DISCHARGE VS SPONTANEOUS/PHARMACOLOGIC CONVERSION. Among 2119 POAF patients, 2011 (94.9%) were in sinus rhythm at discharge and 108 (5.1%) had sustained AF (Figure 1). Patients with sustained AF were older, were more likely to have undergone valve surgery or CABG + valve surgery, were more likely to have preoperative chronic respiratory disease and heart failure, had higher EuroSCORE II values, but were less likely to have had a previous myocardial infarction when compared with patients with spontaneous/pharmacologic conversion. OAC was prescribed at discharge to 573 of 1481 patients (38.7%) with spontaneous or pharmacologic conversion and to 102 of 108 patients (94.4%) with AF at discharge. Patient characteristics for POAF patients with sinus rhythm vs AF at discharge are presented in Table 1.

The cumulative incidences of all-cause mortality, ischemic stroke, death or ischemic stroke, thromboembolism, heart failure hospitalization, and major bleeding during follow-up between the spontaneous/

pharmacologic conversion and no-conversion group are illustrated in Supplemental Figure 1. Table 2 shows the number of events, crude event rates, adjusted hazard ratios for age and sex (model 1), and hazard ratios additionally adjusted for type of surgery, comorbidities, and OAC treatment at discharge (model 2). After adjustment there were no significant associations between sustained AF at discharge and increased long-term risk for all-cause mortality, ischemic stroke, stroke or death, thromboembolic complications, or major bleeding. Sustained AF at discharge was associated with increased long-term risk for heart failure hospitalizations (adjusted hazard ratio, 2.55; 95% confidence interval, 1.65-3.93; $P < .001$).

ELECTRICAL CARDIOVERSION VS SPONTANEOUS/PHARMACOLOGIC CONVERSION. Of 2011 POAF patients, 1481 (73.6%) with sinus rhythm at discharge had a spontaneous or pharmacologic cardioversion, whereas 530 (26.4%) were treated with 1 or more electrical cardioversions (Figure 1). Characteristics of the patients with spontaneous/pharmacologic and electrical cardioversion are presented in Table 1. Patients who needed electrical cardioversion to regain sinus rhythm were more likely to have undergone valve surgery, to have had preoperative heart failure, to have a reduced left ventricle ejection fraction, and to have higher EuroSCORE II values but were less likely to have experienced myocardial infarction compared with patients with a spontaneous or pharmacologic cardioversion to sinus rhythm. An OAC at discharge was prescribed to 573 of 1481 patients (38.7%) who converted spontaneously or pharmacologically and to 257 of 530 patients (48.5%) who were electrically cardioverted ($P < .001$).

The cumulative incidences of all-cause mortality, ischemic stroke, death or ischemic stroke, thromboembolism, heart failure hospitalization, and major bleeding during follow-up in the spontaneous/pharmacologic cardioversion and electrically cardioverted groups are shown in Supplemental Figure 1. The number of events, crude event rates, and adjusted hazard ratios for the outcome variables at the end of follow-up are presented in Table 2. After adjustment, electrical cardioversion was associated with a significantly increased long-term risk for heart failure hospitalizations (adjusted hazard ratio, 1.28; 95% confidence interval, 1.00-1.65; $P = .049$) but not for all-cause mortality, ischemic stroke, death or ischemic stroke, thromboembolic events, or major bleeding.

TABLE 2 Comparison of Event Rates in Patients With Electrical Cardioversion of Postoperative AF and AF at Discharge, Both vs Patients With Spontaneous or Pharmacologic Conversion of Postoperative AF

Endpoint	Spontaneous/Pharmacologic Conversion	Electrical Cardioversion	AF at Discharge	Electrical Cardioversion vs Spontaneous/Pharmacologic Conversion		AF at Discharge vs Spontaneous/Pharmacologic Conversion	
	No. (%) Events and Event Rate per 100 PY (95% CI)	No. (%) Events and Event Rate per 100 PY (95% CI)	No. (%) Events and Event Rate per 100 PY (95% CI)	Model 1 aHR (95% CI)	Model 2 aHR (95% CI)	Model 1 aHR (95% CI)	Model 2 aHR (95% CI)
All-cause mortality	178 (12.0) 3.0 (2.6-3.4)	86 (16.2) 3.9 (3.1-4.8)	8 (7.4) 2.1 (0.9-4.1)	1.26 (0.97-1.63) $P = .08$	1.12 (0.86-1.45) $P = .41$	0.64 (0.32-1.31) $P = .22$	0.47 (0.23-0.97) $P = .040$
Ischemic stroke	81 (5.5) 1.4 (1.1-1.7)	36 (6.8) 1.7 (1.2-2.4)	7 (6.5) 1.9 (0.8-3.9)	1.21 (0.81-1.79) $P = .35$	1.14 (0.76-1.71) $P = .52$	1.32 (0.61-2.85) $P = .49$	1.28 (0.57-2.88) $P = .55$
Death/ischemic stroke	230 (15.5) 4.0 (3.5-4.5)	109 (20.6) 5.2 (4.2-6.2)	14 (13.0) 3.8 (2.1-6.4)	1.26 (1.01-1.59) $P = .044$	1.12 (0.89-1.41) $P = .34$	0.90 (0.52-1.54) $P = .69$	0.70 (0.40-1.22) $P = .20$
Heart failure	185 (12.5) 3.3 (2.9-3.9)	102 (19.2) 5.3 (4.3-6.4)	26 (24.1) 8.6 (5.6-12.7)	1.54 (1.21-1.96) $P < .001$	1.28 (1.00-1.65) $P = .049$	2.31 (1.53-3.49) $P < .001$	2.55 (1.65-3.93) $P < .001$
Thromboembolism	129 (8.7) 2.3 (1.9-2.7)	56 (10.6) 2.7 (2.1-3.5)	8 (7.4) 2.2 (0.9-4.3)	1.18 (0.86-1.62) $P = .30$	1.13 (0.82-1.55) $P = .47$	0.92 (0.45-1.89) $P = .83$	0.88 (0.42-1.84) $P = .74$
Major bleeding	133 (9.0) 2.3 (2.0-2.8)	45 (8.5) 2.1 (1.5-2.8)	12 (11.1) 3.3 (1.7-5.8)	0.89 (0.63-1.25) $P = .50$	0.86 (0.61-1.21) $P = .40$	1.29 (0.71-2.33) $P = .40$	1.07 (0.58-1.98) $P = .83$

Model 1 (missing data, 0): Adjusted for age and sex. Model 2 (missing data, 5): additionally adjusted for oral anticoagulation treatment at discharge, myocardial infarction, heart failure, hypertension, diabetes mellitus, previous stroke, type of surgery, history of cancer, peripheral vascular disease, renal insufficiency, and left ventricle ejection fraction. AF, atrial fibrillation; aHR, adjusted hazard ratio; CI, confidence interval; PY, person-years.

COMMENT

The main new finding of this retrospective population-based cohort study is that electrical cardioversion and sustained AF at discharge were associated with increased long-term risk for heart failure hospitalization but not for all-cause mortality or thromboembolic complications. In the present study the overall incidence of POAF after CABG and/or valve surgery (33.8%) was comparable with earlier results.[1-5] Most POAF patients converted to sinus rhythm before discharge (94.9%), which is a higher or comparable rate with those reported in previous studies. The high conversion rate may reflect our institution's policy, which aims to restore sinus rhythm as soon as possible, first with medication and then, if this fails, by electrical cardioversion before discharge.

This strategy of restoring sinus rhythm can be questioned, given that the only large, randomized study comparing rhythm control vs rate control as the initial strategy in POAF did not show any difference between the 2 alternatives.[8] Most patients in the present study converted to sinus rhythm spontaneously or pharmacologically, whereas electrical cardioversion was less common. Patients in AF at discharge or who needed electrical cardioversion to regain sinus rhythm were older, had more comorbidities, and were more likely to have undergone valve surgery than those who converted spontaneously or with pharmacologic intervention. Thus the results suggest that preoperative status, underlying cardiac disease, and type of procedure appear to influence the chance to convert to sinus rhythm in patients with POAF after cardiac surgery.

Previous studies have shown that both AF unrelated to surgery and POAF are associated with increased long-term risk of heart failure compared with patients without AF or POAF.[2,9] The present study showed that in POAF patients, AF at discharge and electrical cardioversion were both independently associated with higher long-term risk for heart failure hospitalizations compared with patients who converted spontaneously or pharmacologically. This suggests that a more complicated clinical course of POAF is a marker of increased risk for heart failure in the years after cardiac surgery, compared with patients with less complicated POAF. This increased risk is independent of preoperatively existing heart failure, which was adjusted for in the statistical models. AF and heart failure are closely related and share common pathophysiologic pathways and risk factors,[10] and so it is often difficult to determine which condition exacerbates the other. The prevalence of AF in patients with heart failure exceeds 50% regardless of the ejection fraction, but it is difficult to separate cause and effect. However despite adequate rate control AF can still cause heart failure, presumably partly because of irregular rhythm and lack of atrial contribution to diastolic filling (so-called AF-induced cardiomyopathy), or worsen already existing heart failure.[11,12] It has even been speculated that AF and heart failure are 2 different expressions of the same underlying pathology.[13]

Because the results of the present study show that the clinical course of POAF is associated with long-term outcome after cardiac surgery, it is worth questioning whether future studies should regard POAF as 1 entity independently of the clinical presentation. This is also supported by Sigurdsson et al,[6] whose study showed that POAF with a duration of 2 days or more had a 2-fold increase in mortality compared with no POAF, whereas mortality did not differ between POAF patients with shorter duration and no POAF patients.

The present study has important limitations. First, to identify patients with a more complicated clinical course, we arbitrarily divided patients into those with sustained AF or sinus rhythm at discharge and those who were electrically converted or not to regain sinus rhythm. It was not possible during the chart review process to distinguish between patients who converted spontaneously or by pharmacologic treatment. We acknowledge that our classification reflects a simplification of the clinical course of POAF and does not take other potentially important aspects of POAF into consideration, such as the total time with AF or hemodynamic alterations. However given the primary aim of the study, which was to investigate whether it is reasonable to handle all kinds of POAF similarly in studies (ie, as a dichotomous variable), we believe the presentation of our classification can be justified. Nevertheless grouping POAF patients differently may yield other results. A classification based on total AF burden was not possible, because the registries lack information about the duration of the AF episodes.

Other limitations are that information about prophylactic medications such as amiodarone is lacking in the database, readmissions to hospitals outside the Western Sweden may not have been captured, and the observational study design, which carries a risk for selection bias and residual confounding. The results should therefore be interpreted as hypothesis-generating rather than conclusive. Although we included more POAF patients than in most previous studies, we may still have had limited statistical power, due to few patients with sustained AF at discharge and few adverse events. This is particularly true for the subgroup of 108 patients with sustained AF at discharge. Notably we found that the adjusted mortality during follow-up was lower in POAF patients with sustained AF at discharge compared with patients with spontaneous or pharmacological conversion to sinus rhythm. This finding is most likely a chance finding, related to the limited number of patients with sustained AF at discharge and few deaths during follow-up. The strengths of this study are the complete follow-up, use of validated registries, and collection of information about the clinical course of POAF from both the operating unit and any immediately after hospitalizations.

In conclusion this retrospective study showed that the incidence of POAF remained high after cardiac surgery, but most POAF patients were discharged in sinus rhythm. The clinical course of POAF was associated with increased long-term risk for heart failure hospitalizations, indicating that it may not always be valid to consider POAF as 1 entity. A complicated POAF course was associated with increased long-term risk for heart failure but not for death or thromboembolic complications. More studies examining long-term complications in relation to different types of clinical presentations of POAF are warranted.

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DISCLOSURES

Dr Jeppsson discloses a financial relationship with Boehringer-Ingelheim, XVIVO, Portola, Baxter, and LFB; Dr Taha with Bayer; Dr Bergfeldt with Bayer, Boehringer Ingelheim, and Sanofi.

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The Never-Ending Battle With a Perpetual Enemy—Atrial Fibrillation

INVITED COMMENTARY:

People experience atrial fibrillation (AF) from anxiety, drinking alcohol, inflammation, or cardiac surgical procedures (postoperative AF). Lifetime AF risk can be >1 in 3 with risk factors.[1] Once AF occurs, it can again. Difficulty in restoring sinus rhythm signals progressive atrial substrate changes and atriopathy, correlating to more heart failure (HF), stroke, and risk of earlier death.[2] AF is a spectrum. In this issue of *The Annals of Thoracic Surgery*, Rezk and colleagues[3] attempt to define AF risk by its tenacity to withstand sinus rhythm restoration.

HF and AF are coconspirators. Significantly more study patients who required or failed electrical cardioversion had preoperative HF. Elevated left ventricular (LV) end-diastolic pressure leads to increased left atrial pressure and fibrosis, precipitating AF. Patients with challenging AF were more likely to develop HF during