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Atrial Fibrillation Recurrence in Patients With Transient New-Onset Atrial Fibrillation Detected During Hospitalization for Noncardiac Surgery or Medical Illness

A Matched Cohort Study

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Background: Atrial fibrillation (AF) is often detected for the first time in patients who are hospitalized for another reason. Long-term risks for AF recurrence in these patients are unclear.

Objective: To estimate risk for AF recurrence in patients with new-onset AF during a hospitalization for noncardiac surgery or medical illness compared with a matched population without AF.

Design: Matched cohort study. (ClinicalTrials.gov: NCT03221777)

Setting: Three academic hospitals in Hamilton, Ontario, Canada.

Participants: The study enrolled patients hospitalized for noncardiac surgery or medical illness who had transient new-onset AF. For each participant, an age- and sex-matched control participant with no history of AF from the same hospital ward was recruited. All participants left the hospital in sinus rhythm.

Measurements: 14-day electrocardiographic (ECG) monitor at 1 and 6 months and telephone assessment at 1, 6, and 12 months. The primary outcome was AF lasting at least 30 seconds on the monitor or captured by ECG 12-lead during routine care at 12 months.

Results: Among 139 participants with transient new-onset AF (70 patients with medical illness and 69 surgical patients) and 139 matched control participants, the mean age was 71 years (SD, 10), the mean CHA_2DS_2-VASc score was 3.0 (SD, 1.5), and 59% were male. The median duration of AF during the index hospitalization was 15.8 hours (IQR, 6.4 to 49.6 hours). After 1 year, recurrent AF was detected in 33.1% (95% CI, 25.3% to 40.9%) of participants in the transient new-onset AF group and 5.0% (CI, 1.4% to 8.7%) of matched control participants; after adjustment for the number of ECG monitors worn and for baseline clinical differences, the adjusted relative risk was 6.6 (CI, 3.2 to 13.7). After exclusion of participants who had electrical or pharmacologic cardioversion during the index hospitalization ($n = 40$) and their matched control participants and limiting to AF events detected by the patch ECG monitor, recurrent AF was detected in 32.3% (CI, 23.1% to 41.5%) of participants with transient new-onset AF and 3.0% (CI, 0% to 6.4%) of matched control participants.

Limitations: Generalizability is limited, and the study was underpowered to evaluate subgroups and clinical predictors.

Conclusion: Among patients who have transient new-onset AF during a hospitalization for noncardiac surgery or medical illness, approximately 1 in 3 will have recurrent AF within 1 year.

Primary Funding Source: Peer-reviewed grants.

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For author, article, and disclosure information, see end of text.
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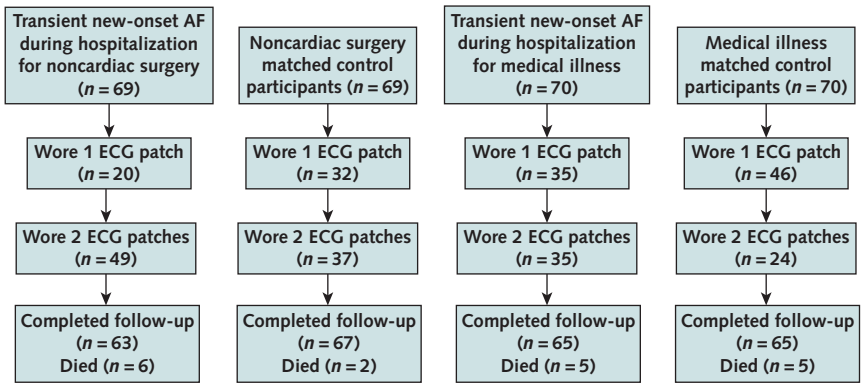
Atrial fibrillation (AF) is the most common arrhythmia, affecting millions of patients worldwide (1). It is associated with increased risk for stroke, heart failure, and death (2). Clinical practice guidelines recommend a structured approach to risk assessment for patients with AF, including management of risk factors and oral anticoagulation for patients who are at risk for stroke (3–5). However, it remains uncertain whether long-term anticoagulation is necessary when AF occurs in the setting of a reversible physiologic stressor, such as surgery or medical illness (6–12).

Atrial fibrillation occurring transiently with stress (AFOTS) refers to AF that is detected for the first time in patients who are hospitalized for another medical or surgical illness (10). The effect of AFOTS on patients' long-term stroke risk is uncertain. If surgery or medical illness is a reversible cause of AF, patients with AFOTS should not have increased long-term stroke risk and their postdischarge risk for AF should be similar to that of the general population with similar AF risk factors. Alternatively, AFOTS may represent paroxysmal AF that is detected for the first time by in-hospital monitoring or may identify persons with a propensity to develop clinical AF (3). In these instances, AFOTS would be associated with increased risk for stroke and with a risk for postdischarge AF that is higher than among age-matched control patients without AF and similar to the risk in patients with established paroxysmal AF (10, 13). This distinction is important because patients with paroxysmal AF benefit from several evidence-based therapies, including oral anticoagulation, to reduce their risk for stroke. Capturing recurrent episodes of AF after hospital discharge in patients with AFOTS may

See also:

Web-Only
Supplement

Figure 1. Study flow diagram.



AF = atrial fibrillation.

help identify those who can benefit from these therapies. Several published studies have shown higher risk for AF recurrence and worse clinical outcomes in patients with AFOTS (7, 8, 14–18). However, the risk for AF recurrence in patients with transient new-onset AF that is concurrent with another illness has not been systematically assessed in a prospective study using continuous electrocardiographic (ECG) monitors.

This study aimed to estimate the risk for AF recurrence after hospital discharge among patients with transient new-onset AF during a hospitalization for noncardiac surgery or medical illness and to compare it with the risk for AF detected in a matched population with no history of AF.

METHODS

Study Design

The rationale and design of the Atrial Fibrillation Occurring Transiently with Stress (AFOTS) study have been described previously (19). We systematically screened intensive care units, surgical wards, and medical wards at 3 academic hospitals in Hamilton, Ontario, Canada, for patients with no history of AF who had AF detected during hospitalization for a noncardiac reason. Patients who returned to sinus rhythm (either spontaneously or via electrical or pharmacologic cardioversion) before hospital discharge were approached for participation in the study. For each "exposed" patient with AF who wore a study patch, we screened their hospital ward for a matched "control" patient of the same sex and within 10 years in age. We enrolled one cohort of participants with noncardiac surgery as their primary reason for hospitalization and a second cohort with medical illness as their primary reason for hospitalization.

Candidacy for oral anticoagulation based on the Canadian Cardiovascular Society guidelines (a $CHADS_2$ score ≥1 or age ≥65 years) was an inclusion criterion for all participants (3). The main exclusion criteria were a documented history of AF before hospitalization; presence of an implanted pacemaker or defibrillator; or an admission diagnosis of stroke, myocardial infarction, heart failure, pericarditis, or arrhythmia.

Participants were followed systematically for 1 year. The 3 scheduled telephone assessments occurred at 1, 6, and 12 months. During these assessments, study personnel interviewed participants; reviewed their medical records; and collected data on medications, new occurrence of AF (outside the study protocol), death, stroke, bleeding, embolism, and hospitalization for heart failure or myocardial infarction. Study personnel sought source documents for all events. At the 1- and 6-month assessments, participants were asked to wear a continuous ECG patch monitor (Zio XT [iRhythm Technologies]) for 14 days (20–23). Participants who were unable or unwilling to wear the study patch underwent all other follow-up procedures. The Hamilton Integrated Research Ethics Board and Health Canada approved the study protocol. All participants provided written informed consent.

Outcomes

The primary outcome was detection of AF lasting at least 30 seconds on the study device or another continuous ECG monitor during routine clinical care, or AF detected on a 12-lead ECG performed as part of routine clinical care. Physicians who were blinded to the patient's history (including exposed vs. control status) adjudicated all AF events. We chose 30 seconds of AF as the primary end point and evaluated several other episode durations. The minimum duration of AF that corresponds to elevated risk for stroke is not known. We chose a 30-second threshold because it has been used in contemporary AF studies and in stroke prevention guidelines (4, 24–26).

Secondary outcomes included time to AF recurrence; daily and total AF burden (defined as time in AF divided by the total analyzable time of the study monitor and expressed as a percentage); total duration of all AF episodes; and longest AF episode; and other adverse events, including death, stroke, bleeding, embolism, and hospitalization for heart failure or myocardial infarction occurring within 12 months after enrollment. We also documented use of oral anticoagulation.

Statistical Analysis

We prespecified a statistical analysis plan before unblinding study data. The statistical analysis plan was revised at the recommendation of the journal's editorial staff, and the results presented in this article are the results from the revised analyses.

For our sample size calculation, we estimated that 40% of participants with transient new-onset AF during hospitalization would have AF detected during follow-up, compared with 20% of control participants (8, 27, 28). This required 69 exposed patients and matched control patients in the noncardiac surgery cohort and an equal number in the medical illness cohort to detect an effect with 80% power at the 5% significance level using a 2-tailed McNemar χ^2 test, resulting in a total of 276 participants.

For our primary analysis, we compared the incidence of the primary end points between the participants with transient new-onset AF during their index hospitalization and matched control patients who wore at least 1 ECG patch monitor. We used PROC GENMOD in SAS and specified a binomial distribution with logit link and a stratum variable to account for matching pairs to estimate relative risks (RRs) (29, 30). We performed unadjusted analyses and, in our primary sample, conducted analyses adjusted for the number of patches worn; age; β-blocker use at discharge; history of heart failure; and history of coronary artery disease, peripheral artery disease, or known aortic plaque. We hypothesized that exposed participants who had transient new-onset AF detected in the hospital would have higher risk for AF captured during follow-up than matched control patients with no history of AF. In secondary analyses, we compared the proportion of participants who had the primary outcome in the individual noncardiac surgery and medical illness cohorts, testing for differences in the RRs using an interaction test. We performed the following subgroup analyses: 1) among participants who wore only 1 patch, 2) among participants who wore both patches, 3) in the overall population while limiting to AF events detected by the patch ECG monitor, 4) excluding participants who had electrical or pharmacologic cardioversion during the index hospitalization (and their matched controls) and including AF events detected by patch ECG monitor or in clinical follow-up, and 5) excluding participants who had electrical or pharmacologic cardioversion during the index hospitalization (and their matched controls) and limiting to AF events detected by the patch ECG monitor.

Table 1. Baseline Characteristics of Participants

Characteristic	Transient New-Onset AF During Index Hospitalization ($n = 139$)	Matched Control Participants ($n = 139$)	Standardized Mean Difference
Noncardiac surgery			
Patients, *n*	69	69	–
Emergency surgery, *n (%)*	25 (36.2)	17 (24.6)	–
Elective surgery, *n (%)*	44 (63.8)	52 (75.4)	–
Medical illness			
Patients, *n*	70	70	–
Infectious admission diagnosis, *n (%)*	37 (52.9)	32 (45.7)	–
Noninfectious admission diagnosis, *n (%)*	33 (47.1)	38 (54.3)	–
Mean age (SD), *y*	71.7 (10.6)	70.9 (9.3)	0.09
Female, *n (%)*	57 (41.0)	57 (41.0)	0.00
White race, *n (%)*	136 (97.8)	130 (93.5)	0.21
Median body mass index (IQR), kg/m^2	27.7 (23.8–31.3)	26.7 (24.0–30.4)	0.13
Median left atrial diameter (IQR), *mm**	37 (29.0–42.0)	36 (32.0–42.0)	0.21
Mean ejection fraction (SD), %	57 (9.8)	60 (7.9)	0.37
Received vasopressors or inotropes, *n (%)*	21 (15.1)	12 (8.6)	0.20
Median peak high-sensitivity troponin I level (IQR), *ng/L*†	40 (15.0–188.5)	10 (5.0–30.0)	0.26
Positive blood culture result, *n (%)*	31 (22.3)	16 (11.5)	0.29
Sleep apnea, *n (%)*	28 (20.1)	21 (15.1)	0.13
Median CHA_2DS_2-VASc score (IQR)	3 (2.0–4.0)	3 (2.0–4.0)	0.02
Heart failure/left ventricular dysfunction, *n (%)*	14 (10.1)	6 (4.3)	0.22
Hypertension, *n (%)*	94 (67.6)	101 (72.7)	0.11
Diabetes mellitus, *n (%)*	37 (26.6)	50 (36.0)	0.20
Prior stroke, TIA, or systemic embolism, *n (%)*	14 (10.1)	16 (11.5)	0.05
Coronary artery disease, *n (%)*	25 (18.0)	35 (25.2)	0.18
Peripheral artery disease or aortic plaque, *n (%)*	16 (11.5)	7 (5.0)	0.24
Medications at hospital discharge, *n (%)*			
β-Blocker	87 (64.4)	45 (34.1)	0.64
Amiodarone or flecainide	17 (12.6)	0 (0.0)	0.54
Aspirin	43 (31.9)	62 (47.0)	0.31
Oral anticoagulant	67 (48.2)	12 (8.6)	0.99
Warfarin	9 (6.7)	2 (1.5)	0.26
Dabigatran	4 (3.0)	0 (0.0)	Not estimable
Apixaban	38 (28.1)	4 (3.0)	0.74
Rivaroxaban	15 (11.1)	4 (3.0)	0.32
Edoxaban	1 (0.7)	2 (1.5)	0.07

AF = atrial fibrillation; TIA = transient ischemic attack.
* Data were available for 155 participants.
† Data were available for 147 participants.

Table 2. Characteristics of Qualifying AF Episodes in Participants With Transient New-Onset AF During Index Hospitalization ($n = 139$)

Characteristic	Value
Median duration of longest AF episode (IQR), *h**	15.8 (6.4–49.6)
Patient was on telemetry in hospital, *n (%)*	130 (93.5)
Mean heart rate when AF was detected (SD), *beats/min*†	129.0 (30.2)
Location of patient when first AF episode was detected, *n (%)*	
Emergency department	16 (11.5)
Intensive care unit	27 (19.4)
Ward	58 (41.7)
Step-down unit	38 (27.3)
Symptomatic AF, *n (%)*	
Yes	33 (23.7)
No	82 (59.0)
Unknown	24 (17.3)
Method of cardioversion, *n (%)*‡	
Spontaneous	93 (69.9)
Electrical	6 (4.5)
Pharmacologic§	34 (25.6)

AF = atrial fibrillation.
* Data were available for 136 participants. For participants who were not on telemetry at the time of conversion to sinus rhythm, we assumed that conversion occurred at the time point halfway between their last electrocardiogram showing AF and their first electrocardiogram showing sinus rhythm.
† Data were available for 131 participants.
‡ Data were available for 133 participants.
§ Defined as receipt of ≥1 dose of a class I or III antiarrhythmic drug.

In a sensitivity analysis, we accounted for differences in rates of wearing the second patch by assuming that missing participants would have had the same risk for AF detection as exposed participants. In 2 additional sensitivity analyses to address participants who were discharged on an antiarrhythmic medication, we alternately excluded them or assumed they all had AF recurrence.

We prespecified subgroups of exposed participants with transient new-onset AF during the index hospitalization who we expected to have higher risks for the primary outcome: older age (highest tertile), larger left atrial size (highest tertile), in-hospital cardioversion (pharmacologic or electrical), and thoracic versus other surgery. We also hypothesized that we would observe higher risk for AF among patients with a CHA_2DS_2-VASc score of 4 to 9 versus those with a score of 0 to 3, those with a history of hypertension, those with a longer duration of the index in-hospital AF episode (by quartiles), and those with a lower peak troponin level (dichotomized at the median). We report unadjusted AF risks in these subgroups and RRs adjusted for the number of patches worn; age; β-blocker use at discharge; history of heart failure; and history of coronary artery disease, peripheral artery disease, or known aortic plaque.

All statistical analyses were performed using SAS, version 9.4 (SAS Institute), and figures were created using R, version 4.1.1 (R Foundation for Statistical Computing).

Role of the Funding Source

This study was funded exclusively by peer-reviewed grants. The granting bodies provided input on the design through peer review but had no direct role in the conduct or analysis of the study or the decision to submit the manuscript for publication.

RESULTS

Study Population

Figure 1 describes participant flow in the study. Baseline characteristics (captured at hospital discharge) are shown in Tables 1 and 2 and in Supplement Table 1 (available at Annals.org), including admission diagnosis or type of noncardiac surgery, medical history, clinical parameters, characteristics of the index AF episode, and medications. There were important differences in characteristics between the groups, including mean ejection fraction, peak concentrations of high-sensitivity troponin level, and rate of positive blood culture results. There were also important differences in rates of prescription of β-blockers, oral anticoagulants, and aspirin at discharge.

We enrolled a total of 336 participants. Consistent with the analysis plan, the results in this article focus on the 278 matched noncardiac surgery and medical illness pairs who wore at least 1 patch. An additional 56 participants with transient new-onset AF were enrolled in the study but were subsequently unable or unwilling to wear a study patch; all but 1 were followed through the duration of the study, and 2 other participants were unable to be matched. Supplement Figure 1 and Supplement Tables 2 to 5 (available at Annals.org) describe baseline characteristics and primary results for these participants who did not wear at least 1 ECG patch. There were no appreciable differences between these participants and those who completed the study.

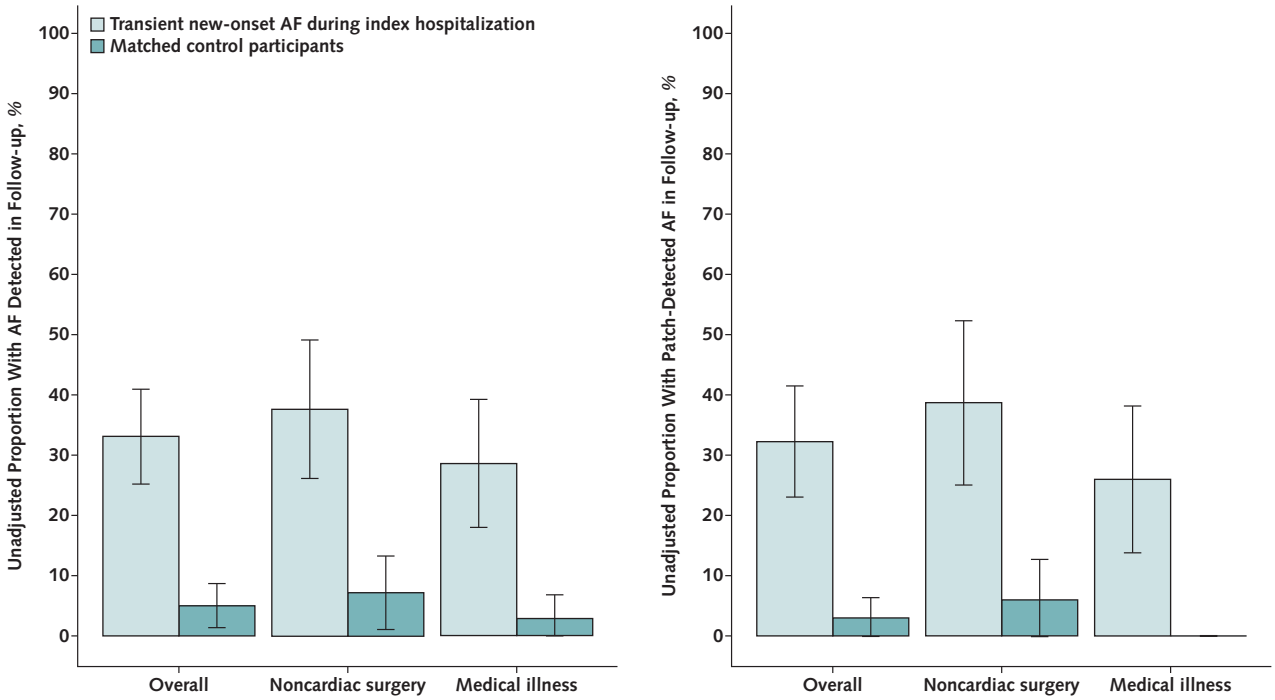
AF Detected in Follow-up

After 1 year of follow-up, AF was detected in 33.1% (95% CI, 25.3% to 40.9%) of participants with transient new-onset AF during initial hospitalization and 5.0% (CI, 1.4% to 8.7%) of matched control participants. After adjustment for the number of ECG monitoring measurements and for baseline clinical characteristics, the RR was 6.6 (CI, 3.2 to 13.7). Unadjusted results were consistent in the noncardiac surgery and medical illness subpopulations (Figure 2, *left*). The AF risks were 32.3% (CI, 23.1% to 41.5%) and 3.0% (CI, 0% to 6.4%) for exposed and control patients, respectively, when the analysis was limited to patch-detected AF events and participants who had electrical or pharmacologic cardioversion during the index hospitalization (and the matched control participants) were excluded (Figure 2, *right*). Results were consistent in subgroup analyses (Supplement Figure 2 and Supplement Tables 6 to 8, available at Annals.org).

Duration and Burden of AF, Method of AF Detection, and Correlates of Recurrence

Table 3 compares the durations of AF in follow-up between participants with transient new-onset AF during the index hospitalization and matched control participants. A higher proportion of participants with AF during the index hospitalization had episodes of any given length, whereas the longest episodes and total AF duration were similar between groups.

Figure 2. Proportion of study participants with AF detected in follow-up.



Left. Analyses that included AF events detected by patch ECG monitor or in clinical follow-up. Unadjusted relative risks were 6.6 (95% CI, 3.2 to 13.4) for the overall population, 5.2 (CI, 2.3 to 12.4) for the noncardiac surgery subpopulation, and 10.0 (CI, 2.8 to 36.0) for the medical illness subpopulation ($P = 0.59$ for the test for difference between the noncardiac surgery and medical illness subpopulations). The adjusted relative risk for the overall population was 6.6 (CI, 3.2 to 13.7). **Right.** Analyses that excluded participants who had electrical or pharmacologic cardioversion during the index hospitalization (and their matched control participants) and that were limited to AF events detected by the patch ECG monitor. The unadjusted relative risk for the overall population was 10.1 (CI, 3.6 to 31.9). Adjusted analyses were adjusted for number of patches worn; age; β-blocker use at discharge; history of heart failure; and history of coronary artery disease, peripheral artery disease, or known aortic plaque. Cardioversion was defined as electrical cardioversion or pharmacologic cardioversion (receipt of ≥1 dose of a class I or III antiarrhythmic drug). Exact proportions are presented in **Supplement Tables 7** and **8** (available at Annals.org). AF = atrial fibrillation; ECG = electrocardiographic.

Of the 46 participants with transient new-onset AF during the initial hospitalization who had AF detected during follow-up, 32 (69.6%) had AF detected by the ECG patch monitor only, 8 (17.7%) had AF detected by both the patch monitor and usual clinical follow-up, and 6 (13.0%) had AF detected by clinical follow-up only.

The unadjusted risks and adjusted RRs of AF recurrence in prespecified subgroups of patients with transient new-onset AF during the index hospitalization are shown in **Figure 3**. Compared with the lowest tertile of left atrial volume, the highest tertile was associated with a substantially higher adjusted RR for AF detection in follow-up in our primary subsample.

Clinical Events and Use of Oral Anticoagulation

During follow-up, 11 participants who had transient new-onset AF during their initial hospitalization had a visit to the emergency department, and 12 had a repeated hospitalization; 113 saw their family physician, and 55 saw a specialist for AF management. One participant had a stroke, 2 had a systemic embolism, 3 had heart failure events, 3 had a myocardial infarction, 6 had a bleeding event, and 11 died. Among matched control participants, 5 had a visit to the emergency department and 6 had a

Table 3. Duration of AF Detected by Patch ECG Monitor During Follow-up*

Variable	Transient New-Onset AF During Index Hospitalization ($n = 139$)	Matched Control Participants ($n = 139$)
Longest single AF episode		
≥30 s	40 (28.8)	4 (2.9)
≥5 min	34 (24.5)	4 (2.9)
≥5 h	21 (15.1)	3 (2.2)
≥24 h	12 (8.6)	1 (0.7)
Median duration (IQR), h†	7.93 (1.82–45.00)	9.83 (3.46–65.53)
Total AF duration during follow-up		
≥30 s	40 (28.8)	4 (2.9)
≥5 min	35 (25.2)	4 (2.9)
≥5 h	25 (18.0)	3 (2.2)
≥24 h	13 (9.4)	1 (0.7)
100% of monitoring time	5 (3.6)	1 (0.7)
Median duration (IQR), h†	8.98 (2.05–59.22)	9.83 (3.46–65.53)

AF = atrial fibrillation; ECG = electrocardiographic.
* Data are numbers (percentages) unless otherwise indicated.
† Includes only participants who had AF detected in follow-up.

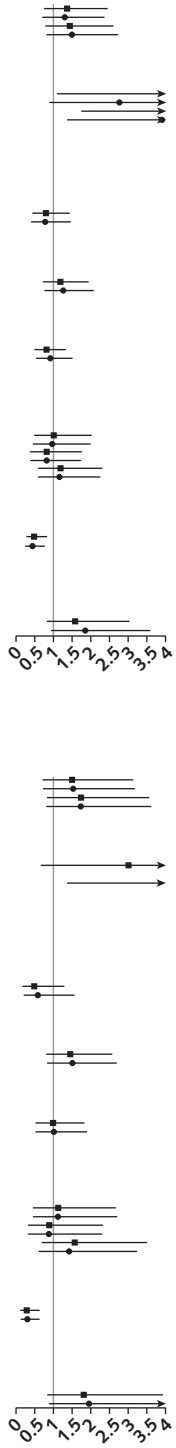
Figure 3. Predictors of AF recurrence in patients with transient new-onset AF detected during an initial hospitalization.

AF Detected Clinically or by ECG Patch

Subgroup	Events/ Participants, *n/N*	Unadjusted Proportion (95% CI)	Unadjusted RR (95% CI)	Adjusted RR (95% CI)
Age (years)				
Lowest tertile	15/56	26.8 (15.2–38.4)	1.00	1.00
Middle tertile	16/44	36.4 (22.1–50.6)	1.36 (0.76–2.43)	1.30 (0.72–2.35)
Highest tertile	15/39	38.5 (23.2–53.7)	1.44 (0.80–2.58)	1.49 (0.82–2.71)
Left atrial volume (mL)				
Lowest tertile	2/28	7.1 (0.0–16.7)	1.00	1.00
Middle tertile	9/27	33.3 (15.6–51.1)	4.67 (1.11–19.66)	2.77 (0.91–8.45)
Highest tertile	15/30	50.0 (32.1–67.9)	7.00 (1.76–27.90)	3.90 (1.37–11.08)
Cardioversion during index hospitalization				
Spontaneous cardioversion	32/93	34.4 (24.8–44.1)	1.00	1.00
Electrical or pharmacologic cardioversion	11/40	27.5 (13.7–41.3)	0.80 (0.45–1.42)	0.77 (0.41–1.45)
CHA_2DS_2-VASc score				
0–3	29/93	31.2 (21.8–40.6)	1.00	1.00
4–8	17/46	37.0 (23.0–50.9)	1.19 (0.73–1.92)	1.26 (0.77–2.06)
History of hypertension				
No	17/45	37.8 (23.6–51.9)	1.00	1.00
Yes	29/94	30.9 (21.5–40.2)	0.82 (0.50–1.32)	0.91 (0.55–1.50)
Duration of longest AF episode during index hospitalization				
Lowest quartile	10/31	32.3 (15.8–48.7)	1.00	1.00
Lower middle quartile	12/37	32.4 (17.3–47.5)	1.01 (0.50–2.01)	0.96 (0.47–1.97)
Upper middle quartile	9/34	26.5 (11.6–41.3)	0.82 (0.38–1.75)	0.82 (0.38–1.73)
Highest quartile	13/34	38.2 (21.9–54.6)	1.19 (0.61–2.31)	1.16 (0.60–2.24)
High-sensitivity troponin I level				
Below median	32/71	45.1 (33.5–56.6)	1.00	1.00
Above median	14/64	21.9 (11.7–32.0)	0.49 (0.29–0.82)	0.44 (0.25–0.76)
Surgery type (surgical patients only)				
All others	20/58	34.5 (22.3–46.7)	1.00	1.00
Thoracic	6/11	54.5 (25.1–84.0)	1.58 (0.83–3.02)	1.83 (0.96–3.58)

AF Detected by ECG Patch Only, Excluding Patients Who Were Prescribed Antiarrhythmics at Hospital Discharge

Subgroup	Events/ Participants, *n/N*	Unadjusted Proportion (95% CI)	Unadjusted RR (95% CI)	Adjusted RR (95% CI)
Age (years)				
Lowest tertile	10/49	20.4 (9.1–31.7)	1.00	1.00
Middle tertile	12/39	30.8 (16.3–45.3)	1.51 (0.73–3.12)	1.53 (0.74–3.16)
Highest tertile	12/34	35.3 (19.2–51.4)	1.73 (0.85–3.54)	1.73 (0.83–3.60)
Left atrial volume (mL)				
Lowest tertile	2/23	8.7 (0.0–20.2)	1.00	–
Middle tertile	6/23	26.1 (8.1–44.0)	3.00 (0.67–13.34)	–
Highest tertile	12/25	48.0 (28.4–67.6)	5.52 (1.38–22.07)	–
Cardioversion during index hospitalization				
Spontaneous cardioversion	27/89	30.3 (20.8–39.9)	1.00	1.00
Electrical or pharmacologic cardioversion	4/27	14.8 (1.4–28.2)	0.49 (0.19–1.27)	0.58 (0.22–1.56)
CHA_2DS_2-VASc score				
0–3	19/79	24.1 (14.6–33.5)	1.00	1.00
4–8	15/43	34.9 (20.6–49.1)	1.45 (0.82–2.55)	1.51 (0.85–2.67)
History of hypertension				
No	11/39	28.2 (14.1–42.3)	1.00	1.00
Yes	23/83	27.7 (18.1–37.3)	0.98 (0.53–1.81)	1.01 (0.54–1.88)
Duration of longest AF episode during index hospitalization				
Lowest quartile	7/29	24.1 (8.6–39.7)	1.00	1.00
Lower middle quartile	9/33	27.3 (12.1–42.5)	1.13 (0.48–2.65)	1.12 (0.47–2.68)
Upper middle quartile	6/28	21.4 (6.2–36.6)	0.89 (0.34–2.32)	0.88 (0.34–2.28)
Highest quartile	11/29	37.9 (20.3–55.6)	1.57 (0.71–3.48)	1.42 (0.63–3.21)
High-sensitivity troponin I level				
Below median	28/67	41.8 (30.0–53.6)	1.00	1.00
Above median	6/51	11.8 (2.9–20.6)	0.28 (0.13–0.63)	0.30 (0.14–0.63)
Surgery type (surgical patients only)				
All others	14/51	27.5 (15.2–39.7)	1.00	1.00
Thoracic	5/10	50.0 (19.0–81.0)	1.82 (0.85–3.91)	1.95 (0.90–4.24)



Adjusted analyses were adjusted for β-blocker use at discharge and the CHA2DS2-VASc score; hypertension, age, and heart failure were omitted from the CHA2DS2-VASc score in the respective analyses. Cardioversion was defined as electrical cardioversion or pharmacologic cardioversion (receipt of ≥1 dose of a class I or III antiarrhythmic drug). Reference groups are denoted with an RR of 1.00. AF = atrial fibrillation; NE = not estimable; RR = relative risk.

repeated hospitalization; 107 saw their family physician, and 10 saw a specialist for AF management (after a new diagnosis of AF during follow-up). One participant had a stroke, 1 had a heart failure event, 4 had a bleeding event, and 7 died.

The proportion of participants with new-onset AF during their initial hospitalization who were taking oral anticoagulants was 47.1% at 6 months and 49.2% at 12 months. This included 73% of participants with AF detected during follow-up and 39% who did not have AF detected during follow-up.

Discussion

Our study found that among patients who have new-onset transient AF detected during a hospitalization for noncardiac surgery or medical illness and are discharged in sinus rhythm, approximately 1 in 3 have AF detected in the year after hospital discharge. This risk for AF recurrence was approximately 7 times higher than in matched control participants. Our results were consistent when we limited the analysis to participants who had electrical or pharmacologic cardioversion during the index hospitalization and to AF events detected by the patch ECG monitor, as well as across the subpopulations of participants who were hospitalized for noncardiac surgery or medical illness. These results may mean that an important subset of patients with transient new-onset AF detected during a hospitalization for another reason have paroxysmal AF that can be detected through systematic clinical follow-up.

We previously conducted systematic reviews searching for studies that reported on the rate of AF recurrence after an episode of new-onset AF detected during hospitalization for noncardiac surgery or medical illness (31, 32). Two studies reported the rate of AF recurrence in patients with medical illness. A retrospective study using administrative data documented an AF recurrence rate of 44% in the first year after discharge from a hospitalization for sepsis (16). The Framingham Heart Study reported a rate of AF recurrence of 44% within the first 5 years after hospitalization in a heterogeneous group of medical and surgical patients (8). Rates of AF recurrence for noncardiac surgery patients ranged from 0% to 37.3% (31). Included studies were limited by retrospective designs, nonsystematic ECG monitoring, or lack of a control group. A retrospective study using administrative data found an AF recurrence rate of 37% at 1 year after discharge from a hospitalization for noncardiac surgery (7). A single-group prospective study of patients with new-onset AF during an admission for cancer surgery found that 24 of 77 participants (31%) had AF documented on an event recorder that was worn for a median of 19 days (IQR, 12 to 30 days) (33). The risk for AF recurrence in our study (33.1%) is similar to the risks in these studies.

This study has important implications for management of patients who have a first presentation of AF that is concurrent with a reversible physiologic stressor. An AF recurrence risk of 33.1% at 1 year is neither low enough to conclude that transient new-onset AF in the setting of another illness is benign nor high enough that all such transient new-onset AF can be assumed to be paroxysmal AF. Instead, these results call for risk stratification and follow-up in these patients. Among the characteristics we studied, only increased left atrial size was associated with a substantially higher risk for detection of AF recurrence in follow-up. This finding is consistent with findings in other AF populations and merits further study (34, 35).

Participants with recurrent AF in the study had a median total AF burden of 9.0 hours (IQR, 2.1 to 59.2 hours). This far exceeds the cutoff of 6 minutes that was established as being associated with stroke using simulated AF screening in patients with implanted continuous monitors (36). Moreover, this AF burden is similar to those seen before ablation in contemporary randomized trials (37, 38). These results suggest that the patients in our study who had AF detected in follow-up are similar to contemporary patients with AF for whom evidence-based therapies, including oral anticoagulation, are warranted.

Although this study included well-characterized exposed and control groups, enrolled patients discharged in sinus rhythm, and systematically captured postdischarge incidence using continuous monitoring, it also has important limitations. This was a relatively small observational study that is subject to bias and residual confounding. The results might not be generalizable to health care settings nor to the entirety of the heterogeneous population we enrolled. The study was not powered to evaluate subgroups and clinical predictors of AF recurrence. Finally, ECG monitoring was limited to a total of 28 days at the 1- and 6-month visits; thus, we may have underestimated the true incidence of AF recurrence at 1 year after hospitalization.

This study did not assess the efficacy of oral anticoagulation for stroke prevention in the study population. A randomized trial testing oral anticoagulation versus no anticoagulation in noncardiac surgery patients with new-onset postoperative AF is ongoing (ASPIRE-AF [Anticoagulation for Stroke Prevention In Patients With Recent Episodes of Perioperative AF After Noncardiac Surgery]; NCT03968393). A similar randomized study in patients with medical illness may be warranted.

Among patients who experience new-onset AF during a hospitalization for noncardiac surgery or medical illness and are discharged in sinus rhythm, approximately 1 in 3 will have AF in the year after hospital discharge when assessed systematically. The risk for having AF detected is markedly higher than in matched control participants. Future studies are required to assess the efficacy of oral anticoagulation for stroke prevention in this population.

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