Use and Outcomes Associated With Bridging During Anticoagulation Interruptions in Patients With Atrial Fibrillation

Findings From the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF)

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**Background**—Temporary interruption of oral anticoagulation for procedures is often required, and some propose using bridging anticoagulation. However, the use and outcomes of bridging during oral anticoagulation interruptions in clinical practice are unknown.

**Methods and Results**—The Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) registry is a prospective, observational registry study of US outpatients with atrial fibrillation. We recorded incident temporary interruptions of oral anticoagulation for a procedure, including the use and type of bridging therapy. Outcomes included multivariable-adjusted rates of myocardial infarction, stroke or systemic embolism, major bleeding, cause-specific hospitalization, and death within 30 days. Of 7372 patients treated with oral anticoagulation, 2803 overall interruption events occurred in 2200 patients (30%) at a median follow-up of 2 years. Bridging anticoagulants were used in 24% (n=665), predominantly low-molecular-weight heparin (73%, n=487) and unfractionated heparin (15%, n=97). Bridged patients were more likely to have had prior cerebrovascular events (22% versus 15%; \( P = 0.0003 \)) and mechanical valve replacements (9.6% versus 2.4%; \( P < 0.0001 \)); however, there was no difference in CHA2DS2-VASc scores (scores ≥2 in 94% versus 95%; \( P = 0.5 \)). Bleeding events were more common in bridged than nonbridged patients (5.0% versus 1.3%; adjusted odds ratio, 3.84; \( P < 0.0001 \)). The incidence of myocardial infarction, stroke or systemic embolism, major bleeding, hospitalization, or death within 30 days was also significantly higher in patients receiving bridging (13% versus 6.3%; adjusted odds ratio, 1.94; \( P = 0.0001 \)).

**Conclusions**—Bridging anticoagulation is used in one quarter of anticoagulation interruptions and is associated with higher risk for bleeding and adverse events. These data do not support the use of routine bridging, and additional data are needed to identify best practices concerning anticoagulation interruptions.

**Clinical Trial Registration**—URL: http://www.clinicaltrials.gov. Unique identifier: NCT01165710.

**Key Words:** anticoagulants ■ atrial fibrillation ■ outcome assessment (health care)
of embolic events during the interruption. Although guidelines have been published on when and how to initiate bridging therapy, they are based on limited data. Thus, it remains unclear whether patients who temporarily interrupt their anticoagulation should receive bridging anticoagulation.

We assessed the incidence of temporary interruption of OAC for procedures among a national outpatient AF registry. We specifically examined causes for the interruption of anticoagulation, the patterns of use of bridging anticoagulation agents (relative to underlying risk and current guidelines), and the outcomes among patients who were bridged compared with patients who were not bridged.

Methods

The Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) is a national, community-based registry of outpatients with AF. Eligible patients were enrolled by a nationally representative sample of primary care, cardiology, or electrophysiology sites. An adaptive design was used to ensure heterogeneity of practice type and geography. Study coordination was managed by the Duke Clinical Research Institute. Major inclusion criteria were age of ≥18 years and ECG-documented AF that was not attributable to a reversible cause, and follow-up was to a maximum of 3 years. The ORBIT-AF registry has been described in detail previously. The present analysis includes patient data out to 2 years of follow-up. Data collection was derived primarily from the patients’ medical records and included demographics, medical history, and AF history at baseline. Additionally, at baseline and every 6 months, investigators recorded medical and surgical therapies, vital signs, laboratory measurements, and echocardiographic data. The collection of medication data included the use and monitoring of OAC therapies. Sites were also instructed to enter which OAC treatment was used, as well as values for international normalized ratio monitoring when applicable. At each follow-up, investigators were queried as to whether the patient temporarily interrupted OAC to undergo a procedure. Only interruptions for procedures were recorded; interruptions as a result of bleeding or other reasons are not captured. All medical management around the procedure was guided entirely by the patient’s treatment team. For such interruptions, we collected the date and type of procedure, use of bridging anticoagulant (defined as an anticoagulant temporarily administered in place of long-term therapy for the purpose of stroke prevention before, during, or after the periprocedural period), and adverse events occurring during the interruption (bleeding event, thrombotic event, or other event; no further specification was reported). Type of procedure was categorized as cardiac catheterization, catheter ablation, endoscopy (gastrointestinal, bronchoscopic, or genitorinary), cardiac surgery, noncardiac surgery (not further specified), device implantation, dental procedures, or other (not further specified). Bridging anticoagulant was categorized as low-molecular-weight heparin (LMWH), unfractionated heparin (UFH), fondaparinux, or other (not further specified).

Separately at each follow-up, investigators recorded the incidence and dates of any adverse events, including death, cause-specific hospitalization (cardiovascular, bleeding, or other, as determined by the investigator), incident heart failure, myocardial infarction, stroke or systemic embolism (adjudicated by the coordinating center from primary source documentation), or major bleeding as defined by the International Society of Thrombosis and Haemostasis criteria.

Analyzing Temporary Interruptions

The present analysis included only patients on OAC at baseline who had at least 1 follow-up visit. The study population was subsequently divided by incidence of interruption during follow-up: none versus any (≥1). The baseline characteristics of these patients were compared. Subsequently, all interruption events were queried for the type of procedure requiring interruption and the use of bridging anticoagulant. Additionally, the use of bridging anticoagulation was compared among high-risk subgroups. Among patients using warfarin, time to resumption of therapeutic international normalized ratio (INR ≥ 2) was calculated. The use of bridging anticoagulation in the subgroup of patients receiving dabigatran was also described.

Adverse events occurring during the interruption of long-term anticoagulation (bleeding, thrombotic, or other [not further detailed]) are described and stratified by the use of any bridging anticoagulant versus none. The incidence and timing of adverse events occurring within 30 days after the date of the procedure for which there was an interruption are also described (and may overlap with those occurring during interruption); these include cause-specific hospitalization and the composite of myocardial infarction, stroke, major bleeding, hospitalization, or death. The association of bridging with adverse events was assessed in a multivariable model of the composite outcome.

Statistical Methods

Comparisons between groups with no interruption and groups with any interruption are performed at the patient level. Comparisons between procedure types, bridging use, and adverse events are performed at the interruption level (a patient may have had >1 interruption during follow-up). In univariate analyses, categorical variables are presented as frequencies and percentages, and differences between 2 groups are assessed by the χ2 test. Continuous variables are presented as median (quartiles 1–3) or mean (standard deviation), and differences between 2 groups are assessed by the Wilcoxon rank-sum test.

In analysis of adverse events within 30 days after interruption, multiple interruption events from the same patient were included unless the interruptions occurred within 30 days of a prior interruption. However, interruption events were excluded if the date was missing. To identify the association between the use of any bridging anticoagulant and adverse events, a multivariable model was developed. Covariates included age, estimated glomerular filtration rate, sex, prior cerebrovascular events, the presence of significant valvular disease or prior mechanical valve replacement, prior gastrointestinal bleeding, the presence of congestive heart failure, type of AF at baseline (new onset, paroxysmal, persistent, longstanding persistent), left atrial diameter size, patient level of education, CHADS2 score, the procedure requiring interruption (with noncardiac surgery as the referent), and type of OAC at baseline (warfarin versus dabigatran; neither rivaroxaban nor apixaban was used in this cohort). The outcomes examined included any bleeding events (major bleeding or bleeding hospitalization); cardiovascular events (stroke, systemic embolism, myocardial infarction, or cardiovascular hospitalization); and the composite of any myocardial infarction, stroke or systemic embolism, any hospitalization, or death, all within 30 days after the date of the procedure requiring interruption. Adjusted odds ratios (ORs) were calculated from logistic regression with the generalized estimating equation, which also accounted for correlations within the same patient.

The ORBIT-AF registry was approved by the institutional review board of Duke University, and each site received institutional review board approval subject to local requirements. All patients signed written, informed consent, and analyses of the aggregate, deidentified data were performed by the Duke Clinical Research Institute using SAS software (version 9.3, SAS Institute, Cary, NC).

Results

The overall ORBIT-AF population included 10132 patients from 176 sites; 9642 patients had at least 1 follow-up visit. Excluding patients not on OAC at baseline (n=2270) yielded a final study cohort of 7372 patients. The median follow-up duration was 24 months. Overall, there were 2803 reported interruptions, the majority in noncardiac surgery (n=746, 27%), other procedures (n=712, 25%), and endoscopy (n=504 18%). Overall, 2138 interruptions (76%) did not use bridging anticoagulation, whereas 665 (24%) did. Distribution of bridging use by procedure is shown in the Figure.

Among the 665 interruption events that involved bridging anticoagulation, LMWH was used in 487 (73%), UFH in 97 (15%), fondaparinux in 7 (1.1%), and another anticoagulant in...
Outcomes

Unadjusted rates of individual outcomes during and after interruption are shown in Table 2. Events during interruption were relatively infrequent overall. Event rates were higher for interruptions in which bridging anticoagulation was used, including any adverse event during interruption (5.3% versus 2.8%; P=0.01), major bleeding (3.6% versus 1.2%; P=0.0007), bleeding hospitalization (2.2% versus 0.7%; P=0.006), and cardiovascular hospitalization (4.2% versus 2.2%; P=0.02). Event counts and rates across different procedure types stratified by bridging are shown in Table 3.

The association between bridging and adverse events persisted in multivariate-adjusted analysis (Table 4): The use of bridging anticoagulation during interruption was significantly associated with an increase in bleeding events (adjusted OR, 3.84 for major bleeding or bleeding hospitalization; 95% confidence interval, 2.07–7.14; P<0.0001) and showed a trend toward increased cardiovascular events (adjusted OR, 1.62; 95% confidence interval, 0.95–2.78; P=0.07). Overall, bridging was associated with an increased risk of adverse events, including the composite of myocardial infarction, bleeding, stroke or systemic embolism, hospitalization, or death within 30 days (adjusted OR 1.94; 95% confidence interval, 1.38–2.71; P=0.0001). The procedure for which the patient required interruption appeared to minimally influence composite adverse outcomes (P=0.2 across all procedures); however, adverse events were significantly less common for dental procedures (adjusted OR, 0.19 versus noncardiac surgery; 95% confidence interval, 0.06–0.63; P<0.0001). Baseline anticoagulant (warfarin versus dabigatran) was not significantly associated with outcomes after temporary interruption in the adjusted model.

In a sensitivity analysis that included baseline concomitant antiplatelet use (none, single, double), a consistent, significant association remained between bridging and adverse outcome.

Discussion

There are 3 major findings from this study. First, interruptions of OAC are common in contemporary patients with AF in clinical practice, often for cardiac procedures and noncardiac surgery, as well as for minimally invasive procedures. Second, in those temporary interruptions, bridging anticoagulation was used in approximately one quarter of patients, and the decision to use bridging appears to be guided by patient factors related to bleeding or thromboembolic risk. Finally, we found that the use of bridging anticoagulation was significantly associated with higher overall bleeding and adverse event rates.

The rate of bridging anticoagulation was higher than that reported in contemporary trials. Patients with prior cerebrovascular events, those with mechanical valves, and patients receiving warfarin (compared with dabigatran) were more likely to receive bridging anticoagulation, as would be expected. Additionally, bridging varied by type of procedure. These data generally reflect the limited guideline support for bridging, specifically that the decision for bridging in moderate- or high-risk patients should be patient and procedure specific and that bridging in patients at low risk of thromboembolism should be avoided. Furthermore, the guidelines recommend more conservative management of bridging medications and call attention to scenarios in which OAC could be continued without...
interruption (eg, dental procedures). Although this appears to demonstrate improvement in the previously described practice variability,10 room for further improvement remains, as indicated by the data in this study. Bridging anticoagulation appeared to be used more commonly than the guidelines would suggest. For example, we observed that a significant number of OAC interruptions were for dental procedures (n=239, 9% of all interruptions), and 8% of these temporary interruptions

Table 1. Baseline Demographics, Medical History, and Laboratory Studies by Incidence of Temporary Interruption

|                          | No Temporary Interruption (n=5172) | ≥1 Temporary Interruptions (n=2200) |
|--------------------------|-----------------------------------|-----------------------------------|
|                          | Patients With ≥1 Interruptions, None With Bridging (n=1608) | Patients With ≥1 Interruptions With Bridging (n=592) | P Value, No Bridging Versus Bridging |
| Age, y                   | 76 (68–82)                        | 75 (68–81)                        | 74 (67–80) | 0.009 |
| Female, %                | 43                                | 41                                | 42         | 0.7   |
| Race/ethnicity, %        |                                   |                                   |            | 0.1   |
| White                    | 89                                | 92                                | 91         |       |
| Black                    | 5.0                               | 3.5                               | 5          |       |
| Hispanic                 | 4.6                               | 3.7                               | 2.7        |       |
| Other                    | 1.5                               | 1.2                               | 0.5        |       |
| AF type, %               |                                   |                                   |            | 0.5   |
| New onset                | 4.3                               | 2.7                               | 2.2        |       |
| Paroxysmal               | 46                                | 46                                | 48         |       |
| Persistent               | 19                                | 16                                | 17         |       |
| Long-standing persistent | 31                                | 35                                | 32         |       |
| CHADS2 score, mean (SD)  | 2.4 (1.3)                         | 2.34 (1.21)                       | 2.53 (1.31) | 0.004 |
| CHA2DS2-VASc score, mean (SD) | 4.0 (1.7)                     | 4.03 (1.62)                       | 4.25 (1.74) | 0.01  |
| ATRIA score, mean (SD)   | 2.78 (1.89)                       | 2.74 (1.94)                       | 2.72 (1.95) | 0.9   |
| Prior cerebrovascular event, % | 17                             | 15                                | 22         | 0.0003|
| Coronary artery disease, % | 36                             | 36                                | 41         | 0.05  |
| Congestive heart failure, % | 34                             | 34                                | 44         | <0.0001|
| Significant valve disease, % | 27                             | 27                                | 34         | 0.0006|
| Moderate/severe mitral stenosis, % | 1.7                            | 1.1                                | 2.5        | 0.01  |
| Prior mechanical valve replacement, % | 3.6                          | 2.4                                | 9.6        | <0.0001|
| Prior GI bleeding, %     |                                   |                                   |            | 0.97  |
| Never                    | 92                                | 91                                | 91         |       |
| >6 mo prior              | 6.9                               | 1.4                               | 1.5        |       |
| ≤6 mo prior              | 0.8                               | 7.3                               | 7.1        |       |
| Baseline oral anticoagulant, % | 93                             | 93                                | 96         |       |
| Warfarin                 | 6.5                               | 6.8                               | 3.7        |       |
| Dabigatran               |                                   |                                   |            | 0.02  |
| Most recent INR before the procedure, mean (SD) | ...                         | 2.34 (0.76)                       | 2.28 (0.71) | 0.3  |
| Percentage of time with INR 2–3 before the procedure, %* | ...                             | 67                                | 62         | 0.0002|
| Concomitant antiplatelet, %† |                               |                                   |            |       |
| Aspirin                  | 36                                | 36                                | 38         | 0.4   |
| Clopidogrel              | 4.5                               | 4.2                               | 6.9        | 0.01  |
| Prasugrel                | 0.03                              | 0.06                              | 0          | 0.5   |
| Calculated creatinine clearance, mL·min⁻¹·1.73 m⁻²‡ | 69 (49–95)               | 71 (54–97)                        | 70 (51–96) | 0.3   |
| LVEF, %                  | 55 (50–60)                        | 55 (50–60)                        | 55 (45–60) | <0.001|

Values are presented as median (interquartile range) when appropriate. AF indicates atrial fibrillation; ATRIA, Anticoagulation and Risk Factors in Atrial Fibrillation; GI, gastrointestinal; INR, international normalized ratio; and LVEF, left ventricular ejection fraction.

*As calculated using the Rosendaal et al method.
†Including aspirin, clopidogrel, or prasugrel; no patient was on ticagrelor.
‡As calculated by the Cockcroft-Gault formula.
TABLE 2. Unadjusted Outcomes During and After Temporary Interruption of OAC

| Event                        | Overall (n=2280), % (n) | No Bridging (n=1766), % (n) | Bridging (n=514), % (n) | P Value |
|------------------------------|-------------------------|-----------------------------|-------------------------|---------|
| Any adverse event during interruption | 3.4 (77)                | 2.8 (50)                    | 5.3 (27)                | 0.01    |
| Bleeding event               | 2.2 (50)                | 1.8 (31)                    | 3.7 (19)                | 0.02    |
| Thrombotic event             | 0.6 (13)                | 0.5 (9)                     | 0.8 (4)                 | 0.5     |
| Other adverse event          | 0.6 (14)                | 0.6 (10)                    | 0.8 (4)                 | 0.6     |
| Events within 30 d after the procedure requiring interruption* |                          |                             |                         |         |
| Myocardial infarction        | 0.2 (5)                 | 0.2 (4)                     | 0.2 (1)                 | 0.9     |
| Stroke or systemic embolism  | 0.4 (8)                 | 0.3 (5)                     | 0.6 (3)                 | 0.3     |
| Major bleeding               | 1.7 (38)                | 1.2 (20)                    | 3.6 (18)                | 0.0007  |
| Hospitalization              |                         |                             |                         |         |
| Cardiovascular               | 2.7 (59)                | 2.2 (38)                    | 4.2 (21)                | 0.02    |
| Bleeding                     | 1.0 (23)                | 0.7 (12)                    | 2.2 (11)                | 0.006   |
| Other                        | 3.1 (69)                | 2.8 (49)                    | 4.0 (20)                | 0.2     |
| Death                        | 0.2 (4)                 | 0.2 (3)                     | 0.2 (1)                 | 0.9     |

OAC indicates oral anticoagulation.

*Denominators exclude interruptions missing date or those that occurred within 30 days of a previous interruption (n=2227 overall, 1724 without bridging, 503 with bridging). Events within 30 days of the procedure requiring interruption may overlap with those during interruption.

Our data show that the risks associated with interruptions and the risk of bridging during them are not limited to the periprocedural period. Adverse events in patients interrupting OAC persist as late as 30 days and include bleeding events, thrombotic events, and recurrent hospitalizations. Although the use of bridging has been shown to be safe in closely controlled clinical trials, outcomes in the community, where protocols are often absent or inconsistent, have been more limited. They included heterogeneous patient cohorts anticoagulated for a variety of indications, and only bleeding and thromboembolic outcomes were reported.12

The most recent US national guidelines highlight the dearth of evidence for the practice13; furthermore, there is mounting evidence that certain procedures may be performed more safely with anticoagulation uninterrupted.13,14 Importantly, there is less experience with uninterrupted, direct-acting OACs in this setting.15,16 The risks of bridging likely highlight the challenges in managing patients on OAC in the periprocedural period. In the patient receiving bridging agents, both of the most common drugs (UFH and LMWH) require attention to dosing to prevent bleeding and to provide anticoagulant effect (UFH on a continuous basis; LMWH with changes in weight, kidney function, or in pregnancy). Additionally, many patients require transitions in anticoagulants at the same time they are experiencing a transition in care (eg, on admission, from the intensive care unit to the floor, or during discharge to another facility or home). Such circumstances likely contribute to an increased risk associated with the use of short-term anticoagulants. Close attention to anticoagulant transitions and dosing is vital to minimizing risk.17 Properly identifying the group of patients, involved the use of a bridging anticoagulant. Furthermore, there were excess adverse events in bridged patients undergoing specific procedures (eg, catheter ablation, endoscopy), indicating particularly unfavorable risk in these cases. Such management may contribute to worse clinical outcomes overall, and our data do not support the routine use of bridging in AF patients requiring temporary interruption of anticoagulation.

Table 3. Adverse Events Within 30 Days by Procedure Type and Bridging Anticoagulation

| Procedure          | No Bridging (n=1724) | Bridging (n=503) | No Bridging (n=1724) | Bridging (n=503) |
|--------------------|----------------------|------------------|----------------------|------------------|
| Catheterization/PCI| 9/139 (6.5)          | 3/65 (4.6)       | 2/139 (1.4)          | 1/65 (1.5)       |
| Catheter ablation  | 1/66 (1.5)           | 5/41 (12.2)      | 1/66 (1.5)           | 0/41 (0)         |
| Endoscopic procedure| 9/343 (2.6)         | 2/64 (3.1)       | 5/343 (1.5)          | 5/64 (7.8)       |
| Cardiac surgery    | 3/48 (6.3)           | 2/28 (7.1)       | 2/48 (4.2)           | 2/28 (7.1)       |
| Noncardiac surgery | 6/410 (1.5)          | 2/149 (1.3)      | 5/410 (1.2)          | 12/149 (8.1)     |
| Device implantation| 9/139 (6.5)          | 2/38 (5.3)       | 0/139 (0)            | 0/38 (0)         |
| Dental work        | 1/166 (0.6)          | 0/16 (0)         | 0/166 (0)            | 0/16 (0)         |
| Other              | 5/413 (1.2)          | 7/102 (6.9)      | 7/413 (1.7)          | 5/102 (4.9)      |

Excluding interruptions missing a date or those that occurred within 30 days of a previous interruption. PCI indicates percutaneous coronary intervention.

*Includes stroke, systemic embolism, myocardial infarction, or cardiovascular hospitalization within 30 days of the procedure requiring interruption.

†Includes major bleeding or bleeding hospitalization within 30 days of the procedure requiring interruption.

Table 4. Adjusted 30-Day Outcomes by Use of Bridging Anticoagulation

| Event                        | Unadjusted, % (n) | Adjusted OR (95% CI) |
|------------------------------|-------------------|----------------------|
| Cardiovascular events†       | 2.5 (43)          | 1.62 (0.95–2.78)     |
| Bleeding events‡             | 1.3 (22)          | 3.84 (2.07–7.14)     |
| Overall composite§           | 6.3 (108)         | 1.94 (1.38–2.71)     |

Denominators exclude interruptions missing a date or those that occurred within 30 days of a previous interruption. Events within 30 days of the procedure requiring interruption may overlap with those during interruption. CI indicates confidence interval; and OR, odds ratio.

†Includes stroke, systemic embolism, myocardial infarction, or cardiovascular hospitalization within 30 days of the procedure requiring interruption.

‡Includes major bleeding or bleeding hospitalization within 30 days of the procedure requiring interruption.

§Includes the composite of stroke, myocardial infarction, major bleeding, hospitalization, or death within 30 days of the procedure requiring interruption.
if any, in whom the risk of these pitfalls is outweighed by the benefit of OAC interruption and bridging remains a challenge. They are likely to include patients at extremely high risk of periprocedural thromboembolic events (eg, those with mechanical mitral valve prostheses) undergoing procedures for which uninterrupted, periprocedural anticoagulation is prohibitively dangerous (eg, neurological procedures).

Some have speculated that, in patients at lower risk of bleeding, bridging may be worthwhile. However, in our cohort of AF patients, most of whom had low-risk Anticoagulation and Risk Factors in Atrial Fibrillation (ATRIA) bleeding scores, we found that bridging anticoagulation was still significantly associated with worse clinical events at 30 days, particularly bleeding and bleeding hospitalizations. This said, the results here are observational, and we cannot rule out the beneficial role of bridging in select circumstances. The ongoing Effectiveness of Bridging Anticoagulation for Surgery (BRIDGE) study, which randomized nearly 2500 warfarin-treated patients undergoing surgery to either LMWH or placebo during the perioperative period, will provide additional insight (http://www.clinicaltrials.gov; NCT00786474). Importantly, we also observed the use of bridging anticoagulation in patients receiving the oral direct thrombin inhibitor dabigatran. Although guidelines on the use of novel OACs in the setting of procedures are limited, their pharmacokinetics are such that bridging is likely redundant (although this remains to be proven in patients at high risk of thromboembolic events). In contrast to warfarin, which requires several days both to take effect and to wash out, direct-acting anticoagulants demonstrate short time to onset and are cleared relatively quickly, similar to LMWHs. Thus, the use of bridging anticoagulants in such patients has been cautioned; however, additional studies are needed.9

Limitations
This analysis is derived from the ORBIT-AF registry, which is an observational study of real-world patients in community, clinical practice. Limitations of such a study include enrollment or sampling biases and reporting bias. Because patients were not randomized either to the occurrence of an interruption or to the use of bridging, a causal relationship between these events and adverse outcomes cannot be confirmed. Furthermore, it is possible that postprocedure parenteral anticoagulation is a requirement of the procedure; thus, use of such an agent would occur regardless of whether a patient is on long-term OAC. Data for patients who undergo procedures without interruption and for those who interrupt anticoagulation for reasons other than procedures are not available; thus, we cannot comment on the implications of our findings for these groups. Finally, despite statistical methods aimed at adjusting for baseline differences in the population, we cannot exclude residual or unmeasured confounding of the results.

Conclusions
Temporary interruptions are common in patients receiving OAC for AF and occur even for minimally invasive procedures. Many patients receive bridging anticoagulation, and its use varies by procedure type and certain patient characteristics. Use of bridging anticoagulation was associated with an increased risk of bleeding and adverse events after interruption. These data do not support the use of routine bridging in anticoagulated patients with AF, and additional data are needed to identify best practices concerning anticoagulation interruptions.

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Use and Outcomes Associated With Bridging During Anticoagulation Interruptions in Patients With Atrial Fibrillation: Findings From the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF)

Benjamin A. Steinberg, Eric D. Peterson, Sunghee Kim, Laine Thomas, Bernard J. Gersh, Gregg C. Fonarow, Peter R. Kowey, Kenneth W. Mahaffey, Matthew W. Sherwood, Paul Chang, Jonathan P. Piccini and Jack Ansell on behalf of the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) Investigators and Patients*

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