

Usefulness of Long-Term Anticoagulation After Catheter Ablation of Atrial Fibrillation



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Although atrial fibrillation (AF) is strongly associated with stroke, previous studies have shown suboptimal use of anticoagulation (AC). In particular, there is a lack of data on the long-term use of AC after AF catheter ablation. We followed up patients 1 to 5 years out from catheter ablation at the Johns Hopkins Hospital (JHH) to assess their long-term use of AC. We sent a survey to patients from the JHH AF database who underwent an AF catheter ablation between 01/01/2014 and 03/31/2018. Patients were asked whether they were still on AC, if they thought the ablation was successful in controlling AF symptoms and whether they had follow-up rhythm monitoring. Replies were compared with risk scores and demographic data from the electronic medical record. We sent the survey to 628 patients in the database meeting our inclusion criteria, and we received 289 responses. The average age of patients was 67 ± 10 with a median CHA₂DS₂-VASC of 2 and a median follow-up of 3.6 years. Overall, 81.6% of patients with a CHA₂DS₂-VASC > 2 reported taking AC. Use of AC was positively correlated with a higher CHA₂DS₂-VASC score ($p = 0.012$) and older age ($p = 0.028$), but negatively correlated with a successful ablation ($p = 0.040$). The most common reason (50.0%) for not being on AC was that doctors were recommending stopping it after a successful ablation. In general, higher risk patients (older, higher CHA₂DS₂-VASC score) were more likely to remain on AC. However, patients who self-reported a successful ablation were less likely to remain on AC. There may be many patients who can tolerate AC, but are recommended to stop due to a successful ablation. It is still debated how successful AF ablation affects stroke risk. In conclusion, there is considerable variation in the long-term management of AC after an ablation, but for the present, it seems prudent to continue AC based on stroke risk scores until more definite data are available. © 2020 Elsevier Inc. All rights reserved. (Am J Cardiol 2020;128:12–15)

Although atrial fibrillation (AF) is strongly associated with an increased risk for stroke and systemic embolization, previous studies have often shown under-utilization of anticoagulation (AC).¹ In particular, there are limited data describing the long-term use of AC after AF ablation. Catheter ablation has been shown to be an effective treatment for symptomatic AF, but it remains unclear whether ablation has an impact on AF stroke risk, and current guidelines do not recommend discontinuing AC based on a perceived successful ablation.^{2,3} There is considerable disagreement in the literature about how catheter ablation of AF actually affects stroke risk,^{4–11} and there are significant risks to making an error in either direction: underuse of AC risks increasing death and disability from stroke and systemic embolization, but overuse of AC will also place many patients at increased risk for bleeding. There is a compelling need to define best practices in this area. This study

will examine the long-term use of AC after AF catheter ablation among Johns Hopkins patients to help to define current practice variation and inform future prospective studies.

Methods

We followed up patients 1 to 5 years out from an AF ablation procedure at the Johns Hopkins Health system to assess their use of AC. In the study, we aimed to investigate 3 things: (1) rates of adherence to AC during long-term follow-up after catheter ablation, (2) patient reported reasons for discontinuation of AC, and (3) association between continued AC use after ablation and other patient characteristics.

Eligible study subjects included all patients from the Johns Hopkins AF Ablation Registry who were documented to have undergone catheter AF ablation from January 1, 2014 to March 31, 2018 at the Johns Hopkins Hospital and had agreed to participate in our registry. This included both first-time ablations and re-ablation. Patients were excluded if they were documented in the electronic medical record at the time of the study as deceased, or if they lived outside of the United States. Patients did not have to have their long-term cardiology follow-up at Johns Hopkins in order to be included in the study.

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Members of the Johns Hopkins Hospital, Division of Cardiology with expertise in cardiac electrophysiology developed a quantitative and qualitative questionnaire to assess the long-term use of AC in patients with AF who had previously undergone an ablation. The questionnaire consisted of 8 multiple choice and short answer questions (Table 1). The questions were written to elucidate information about whether patients were still taking AC, how successful they thought their procedure had been, and whether/how often they were having follow-up rhythm monitoring. For the patients who were no longer taking AC, we also asked about the reason for this decision.

The questionnaire was sent by US Mail to all eligible patients from May 2019 to July 2019. Return questionnaires were accepted from May 2019 to August 2019. Other baseline characteristics and patient variables (age, gender, history of hypertension and other risk factors, etc.) were obtained from the electronic medical record.

Table 1
Patient follow-up questionnaire

1. Would you consider your atrial fibrillation ablation procedure to be:
 - ☐ Completely successful
 - ☐ Partly successful
 - ☐ Unsuccessful in eliminating your AF symptoms?
2. Have you had a stroke since your atrial fibrillation ablation procedure?
 - ☐ Yes
 - ☐ No
3. Other than an ECG, have any of your physicians performed additional tests to monitor your heart rhythm to look for recurrences of atrial fibrillation (like a Holter or 30 day monitor)?
 - ☐ Yes
 - ☐ No
 If so, how often and what the duration of monitoring each time?
4. Are you still taking anticoagulation (strong blood thinners like Coumadin (warfarin), Pradaxa (dabigatran), Xarelto (rivaroxaban), or Eliquis (apixaban))?
 - ☐ Yes: Which one? ☐ Warfarin ☐ Pradaxa ☐ Xarelto ☐ Eliquis
 - ☐ No
5. Are you taking aspirin?
 - ☐ Yes
 - ☐ No
6. If you are not taking anticoagulation any more, why was it stopped?
 - ☐ My doctor told me I was low risk for stroke
 - ☐ My doctor told me I did not need it since I was not having any more atrial fibrillation
 - ☐ My doctor took me off it because of problems with bleeding
 - ☐ I did not think I needed it because I was not having any more atrial fibrillation
 - ☐ I had concerns about taking blood thinners long-term
 - ☐ Another reason (please explain): _____
7. Is the doctor who managed your anticoagulation:
 - ☐ Your primary care physician
 - ☐ A cardiologist
 - ☐ A cardiac electrophysiologist (a cardiologist specializing in heart rhythm problems like atrial fibrillation)?
8. If you are still taking anticoagulation, what percentage of the time do you remember to take the medication?
 - ☐ Less than 25% of the time
 - ☐ More than 25% but less than 50% of the time
 - ☐ More than 50% of the time, but less than 75% of the time
 - ☐ More than 75% of the time

AF = atrial fibrillation; ECG = electrocardiogram.

Table 2
Patient baseline characteristics

Variable	289 responses out of 628
Body mass index (kg/m ²)	29.6 ± 5.9
CHADS ₂ -VASC score	2 [1-3]
Follow-up (years)	3.6 [2.2-4.3]
Age (years)	67 ± 10
White	259 (89%)
Men	185 (64%)
Congestive heart failure	23 (8%)
Hypertension	169 (58%)
Diabetes mellitus	47 (16%)
Stroke/TIA	24 (8%)
Coronary artery disease/peripheral vascular disease	44 (15%)
Paroxysmal atrial fibrillation	183 (63%)

Continuous data are represented as either mean ± standard deviation or median and interquartile range as appropriate. Comparisons between groups were made with Student's *t* tests and summarized with means and standard deviations for independent samples if normally distributed, or if not normally distributed, with the Mann-Whitney U test and summarized with medians and quartiles. Nominal values were expressed as n (%) and compared with chi-square tests.

Results

We received 289 patient responses out of 628 questionnaires that were mailed out to patients meeting inclusion criteria (46.0% response rate). Patient baseline characteristics are shown in Table 2. Average age was 67 years with a median CHA₂DS₂-VASC score of 2 and a median follow-up duration of 3.6 years. The baseline characteristics of the patients who responded to the survey were overall similar to those who did not. Survey responders were slightly older (average age 64 ± 10 vs 62 ± 11, *p* = 0.006), more female (36% vs 31%, *p* < 0.001), and with slight lower body mass index (29.6 ± 5.9 vs 31.0 ± 7.1, *p* = 0.008) and less congestive heart failure (5% vs 12%, *p* = 0.003) compared with the nonresponders. There was no significant difference between survey responders and nonresponders in CHA₂DS₂-VASC score, race, hypertension, diabetes, stroke, coronary disease, or rates of paroxysmal/persistent AF.

Table 3 shows the number of patients who were taking AC stratified by their CHA₂DS₂-VASC score. As CHA₂DS₂-VASC score increased, the percentage of patients

Table 3
Use of anticoagulation by CHA₂DS₂-VASC score

CHA ₂ DS ₂ -VASC score	Number of patients	Number of patients on anticoagulation
0	48	6 (13%)
1	51	27 (53%)
2	78	56 (72%)
3	61	53 (87%)
≥ 4	51	46 (90%)
2 and above	190	155 (82%)

Table 4

Patient-reported procedural success and use of anticoagulation

Reported success	Number of patients	Number of patients on anticoagulation
Completely successful	114	88 (77%)
Partly/unsuccessful	73	65 (89%)

taking AC also increased, up to 90% in patients with CHA₂DS₂-VASC score of 4 and above. The majority of patients (84%) reported that they were taking NOACs rather than warfarin.

Table 4 shows the number of patients who remained on AC, based on their self-reported procedural success. A self-reported completely successful ablation was associated with a significantly increased rate of discontinuing AC. Table 5 shows the relation between other patient characteristics and use of AC. The patient characteristics that were correlated with a greater likelihood of maintaining AC were older age, increasing CHA₂DS₂-VASC score, and non-paroxysmal AF.

Out of 190 patients with a CHA₂DS₂-VASC score ≥ 2 , 35 patients reported not taking AC, and 34 (97%) reported a reason for doing so (Table 6). The most common reason for

Table 5

Correlation between patient characteristics and anticoagulation use

Variable	On AC (n = 155)	Off AC (n = 35)	p Value
Body mass index (kg/m ²)	30.2 \pm 6.6	28.2 \pm 5.0	0.051
CHA ₂ DS ₂ -VASC score	3 [2-4]	2 [2-3]	0.012
Age (years)	72.0 \pm 7.3	68.0 \pm 9.7	0.028
White	90%	91%	0.84
Men	50%	60%	0.27
Congestive heart failure	10%	14%	0.42
Hypertension	78%	80%	0.80
Diabetes mellitus	25%	23%	0.78
Stroke/TIA	13%	11%	0.81
Coronary artery disease/peripheral vascular disease	21%	20%	0.87
Paroxysmal atrial fibrillation	55%	91%	<0.001
Involvement of EP	71%	70%	0.93

Bolded values were significant at p < 0.05.

Table 6

Patient-reported reasons for being off anticoagulation

Reason for being off anticoagulation	Number of patients*
My doctor told me I was low risk for stroke.	5 (15%)
My doctor told me I did not need it since I was not having any more atrial fibrillation	17 (50%)
My doctor took me off it because of problems with bleeding.	5 (15%)
I did not think I needed it because I was not having any more atrial fibrillation.	5 (15%)
I had concerns about taking blood thinners long-term	6 (18%)
Another reason	5 (15%)

* Some patients reported multiple reasons, so these do not sum to 100%.

not taking AC was, “My doctor told me I did not need it since I was not having any more atrial fibrillation” (50.0%). Actual bleeding complications were a less common reason for discontinuing AC (14.7%). There were 17 patients who reported that their doctor recommended discontinuing AC because they were not having any more AF, but only 8 of them (47.1%) reported any rhythm monitoring during follow-up.

Stroke and Transient ischemic attack events were infrequently reported among our cohort. Of the patients with CHA₂DS₂-VASC score ≥ 2 , 4 patients in the “on AC” group reported a stroke since the ablation procedure (2.6%), compared with 1 patient in the “off AC” group (2.9%).

Discussion

In this study, we investigated the long-term use of AC in patients who had undergone catheter ablation of AF at the Johns Hopkins Hospital. We report 2 main findings: first, most patients (81.6%) with a CHA₂DS₂-VASC score ≥ 2 remained on AC at a median of 3.6 years postablation, with higher risk patients (older, higher CHA₂DS₂-VASC) more likely to continue AC. Nonparoxysmal AF patients were also more likely to continue AC, which may reflect perceptions that paroxysmal AF is lower risk for stroke, or that ablation is more likely to be successful in paroxysmal AF. Second, there was a significant relation between perceived procedural success and discontinuation of AC.

Our finding that the sizable majority of patients remained on AC is in keeping with current guidelines^{2,3} that recommend continuing AC long-term after ablation based on CHA₂DS₂-VASC score. However, roughly 1 in 5 patients stopped AC, and this was often based on an impression that the ablation was successful in eliminating AF and stroke risk. When the patients reported the reasons they were no longer taking AC, “My doctor told me I did not need it since I was not having any more atrial fibrillation” was the most common reason (~50%). It seems likely that there are many AF patients who can tolerate AC, but are recommended to stop due to a successful ablation procedure that eliminates their AF symptoms. It also seems likely that this decision is often being made *only* based on symptoms, since less than half of these patients reporting rhythm monitoring to assess for asymptomatic recurrences. Symptoms are known to be a poor determinant of actual rhythm control, and asymptomatic recurrences are common after ablation,¹²⁻¹⁴ so *at a minimum* some ambulatory rhythm monitoring should be performed before discontinuing AC on the premise of a successful ablation.

Whether AC can be safely discontinued if AF is eliminated is an area of active research, and the lack of consensus is reflected in the practice variation reported here. Within this small sample, there was a numerically higher risk of stroke in the “off AC” group; however, due to low event rate, further analysis is not possible. Larger, well-designed studies should be pursued in the future to resolve these important questions. Until there are better data showing that AC can be safely stopped after a successful ablation, patients should generally remain on AC if indicated based on stroke risk factor analysis.

This is an observational study, based on patients' responses to a questionnaire, and therefore is inherently susceptible to self-selection bias among the patients who chose to respond. One would expect patient satisfaction with their experience to be the largest factor influencing whether they responded to our survey—patients who are unhappy about less successful procedures may be less likely to respond. Accordingly, the reported procedural success rates may not reflect the general population. However, their responses to the questions about AC use, stroke, reasons for AC discontinuation, etc. seem less likely to be affected by self-selection bias.

Another limitation of our study is that it was performed in a single center. However, although our patients all had their ablation procedures at the Johns Hopkins Hospital, they are followed long term in many different practice settings, not just the academic tertiary care hospital of JHH. This helps to capture the range of practice variation and may make our sample more reflective of the general population.

Last, it is also possible that some patients' answers may be less reliable due to limited medical literacy. Although we wrote the survey questions to be as easily understood as possible to someone with no medical background, this is an unavoidable issue with any patient survey. Further studies to look at *physician* attitudes about AC after AF ablation would also be interesting and offer a complementary perspective.

In conclusion, there is considerable practice variation in the management of AC over the long term after an AF ablation. Most patients remain on AC long term after ablation. Patients who have symptomatically successful ablation, however, are more likely to be taken off AC. Currently there are conflicting data about stroke risk after AF. In light of the ever-growing AF population, and the increasing rates of catheter ablation, it will be important to precisely define how ablation procedures affect stroke risk. For the present, continuing or discontinuing AC based on stroke risk scores seems prudent.

Author Contribution

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