ATRIAL FIBRILLATION

REVIEW ARTICLE

Cardioversion and Catheter Ablation of Atrial Fibrillation Using Novel Oral Anticoagulants

ABHISHEK MANN, MD, JEREMY RUSKIN, MD and E. KEVIN HEIST, MD, PhD

Harvard Medical School, Massachusetts General Hospital, Boston, MA

ABSTRACT. Novel oral anticoagulants (NOACs) have emerged as important agents for thromboprophylaxis in the patients with atrial fibrillation (AF). Both cardioversion and catheter ablation carry the risk of thromboembolic complications, and ablation is also associated with a risk of procedural bleeding. An uninterrupted warfarin regimen during catheter ablation has been shown to decrease the overall risks of thromboembolic complications and bleeding compared to warfarin discontinuation with heparin bridging. Due to the lack of robust data on NOAC use in the setting of cardioversion and catheter ablation, an optimal strategy regarding their use in patients undergoing these procedures remains controversial. In this review, we aim to discuss the considerations regarding NOAC use in the setting of cardioversion and catheter ablation based on the currently available data.

KEYWORDS. atrial fibrillation, cardioversion, catheter ablation, novel oral anticoagulants.

Introduction

Oral anticoagulation with warfarin has been the mainstay for thromboprophylaxis for stroke prevention in patients with atrial fibrillation (AF). Although effective, the limitations of warfarin including a narrow therapeutic window, multiple drug and food interactions, and the need for a regular international normalized ratio (INR) monitoring have posed significant challenges in its use in clinical practice. Recently three novel oral anticoagulants (NOACs; dabigatran, rivaroxaban, and apixaban) have become available as alternative agents to warfarin for thromboprophylaxis in patients with AF, with overall effectiveness and safety that is non-inferior, and for some endpoints superior, to warfarin. Although the use of NOACs offers the advantage of fewer drug and food interactions and obviates the need for regular monitoring, the data are much more limited for the use of NOACs compared to warfarin in the setting of cardioversion and ablation. In this review, we will discuss the available data and practical approaches to cardioversion and ablation for patients taking NOACs.

Cardioversion in patients on NOACs

Cardioversion in patients with AF is associated with an increased risk of thromboembolic events due to a prothrombotic state in the left atrium, which is mediated in part by procedure-induced myocardial stunning. Therefore, adequate anticoagulation both prior to and after cardioversion is recommended to decrease this risk of systemic embolism in patients with AF. Current guidelines recommend (Class IIa) that “for patients with AF greater than 48 hour duration or unknown duration, anticoagulation with one of NOACs is reasonable for at least 3
weeks prior to and 4 weeks after cardioversion."1 However, the level of evidence (C) acknowledges that this recommendation is not based on extensive clinical trial data.

Dabigatran for cardioversion
The RE-LY (Randomized Evaluation of Long-term anticoagulation therapy) trial provided the opportunity to assess the safety and efficacy of cardioversion in patients on dabigatran.3 Nagarkanti et al reported a posthoc analysis based on the RE-LY trial. A total of 1,983 cardioversions were performed in 1,270 patients during the course of the trial (647, 672, and 664 in the dabigatran 110 mg bid, dabigatran 150 mg bid, and warfarin arms, respectively). Precedioversion transesophageal echocardiogram (TEE) was performed more frequently in the patients in the dabigatran arm than those in the warfarin arm (25.5% of patients in the dabigatran 110 mg bid and 24.1% in dabigatran 150 mg bid arms versus 13.3% of patients assigned to warfarin arm, p<0.001 for both dabigatran arms versus warfarin). No statistically significant differences were reported in the incidence of stroke and systemic embolism at the 30-day follow-up in the 3 groups (0.77%, 0.30%, and 0.60%) in the dabigatran 110 mg and 150 mg and warfarin arms, respectively; p=0.71 for warfarin versus dabigatran 110 mg and p=0.45 for warfarin versus dabigatran 150 mg). The use of precardioversion TEE did not have any impact on the incidence of stroke/systemic embolism in patients who underwent cardioversion in the dabigatran arm.3 Although reassuring, it is worth noting that due to a low absolute risk of embolism in the patients undergoing cardioversion, the RE-LY trial design was not powered to detect differences in this outcome. These findings suggest that dabigatran may be a reasonable alternative to warfarin in patients undergoing cardioversion. Considering that dabigatran achieves therapeutic blood levels within 2 h and reaches a steady-state concentration in 2–3 days,6 dabigatran might prove to be both more practical and cost-effective compared to warfarin by shortening the pretreatment time needed for adequate anticoagulation and obviating the need for heparin bridging.

Rivaroxaban for cardioversion
The safety and efficacy of rivaroxaban in the patients undergoing cardioversion are derived from posthoc analysis of the ROCKET-AF (Rivaroxaban Once-daily oral direct Factor Xa inhibition Compared with vitamin K antagonism for prevention of stroke and Embolism Trial in Atrial Fibrillation).7,8 A total of 160 patients in the rivaroxaban arm and 161 patients in the warfarin arm underwent cardioversion (of note, the investigators also included a minority of patients who underwent catheter ablation in their reported analyses). After a 30-day follow-up period, the rate of stroke/systemic embolism was similar in both groups (1.88% in the rivaroxaban arm versus 1.86% in the warfarin arm, p=NS). Similarly, no statistically significant difference was observed in the incidence of major and non-major clinically relevant bleeding when comparing the two drug groups (18.75% in the rivaroxaban arm versus 13.04% in the warfarin arm, p=NS).8 Although these results with rivaroxaban are based on a smaller number of patients undergoing cardioversion compared to the RE-LY analysis, they suggest that rivaroxaban can be a reasonable alternative to warfarin in patients undergoing cardioversion. Overall, a relatively small proportion (1.45 per 100 patient-years) of patients enrolled in the ROCKET-AF trial underwent cardioversion. In the future, the results from the X-VERT (xplor the efficacy and safety of once-daily oral rIvaroxaban for the prEvntion of cardiovascular events in patients nonvalvular atrial fibrillation scheduled for cardioversion) trial, which is a prospective, randomized, open-label, parallel-group comparison between rivaroxaban and warfarin in AF patients with a planned cardioversion, will yield further data about the safety and efficacy of rivaroxaban in the setting of cardioversion. The design of the X-VERT trial will also allow for the comparison of two different cardioversion (early versus late) strategies according to the precardioversion treatment duration of anticoagulation (1–5 days pretreatment in the early cardioversion arm versus a minimum of 3 weeks to <8 weeks of pretreatment with an anticoagulant in the delayed cardioversion arm).9

Apixaban for cardioversion
A posthoc analysis was performed on the ARISTOTLE study (Apixaban for Reduction In StTroke and Other ThromboemboLic Events in atrial fibrillation)10 of patients who underwent cardioversion during the study period.11 During the study, a total of 743 cardioversions were performed in 540 patients; 265 in the apixaban group and 275 in the warfarin group. After a 30-day follow-up period after cardioversion, no stroke/systemic embolism was observed in either of the study arms. The incidence rates of death (0.6% in the apixaban arm versus 0.5% in the warfarin arm, p=NS) and major bleeding (0.3% in the apixaban arm versus 0.2% in the warfarin arm, p=NS) were also similar between the two groups.

Overall conclusions regarding cardioversion on NOACs
Although the available data are supportive of the safety of NOACs for cardioversion, there are still some important areas in which data are lacking. In a clinical scenario, where a patient is newly diagnosed with AF and cardioversion is anticipated, current studies remain limited to direct the choice between warfarin versus one of the NOACs. The optimal duration of the use of an NOAC prior to cardioversion and the necessity of a TEE prior to cardioversion in a patient with newly diagnosed AF also remain unclear. Additionally, there are no head-to-head studies comparing the use of NOACs for cardioversion, and the lack of blood testing makes determination of compliance with anticoagulation medications prior to cardioversion more challenging. The overall results for cardioversion with the NOACs versus warfarin are presented (Table 1).
Increasing data are now available for catheter ablation using the NOACs, which will be presented below.

**Catheter ablation in patients on NOACs**

Catheter ablation has become the standard of care for symptomatic AF patients in whom antiarrhythmic therapy has failed. Catheter ablation is associated with a low but definite risk of thromboembolism and bleeding. The risk of thromboembolism in this setting is attributed to multiple factors such as the inherent prothrombotic state in AF, thrombus generation at the ablation site, and local endothelial damage that could be further increased by inadequate anticoagulation during the periablation period. An optimal anticoagulation strategy is imperative to minimize this risk of thromboembolism associated with catheter ablation. Current data supports the use of an "uninterrupted" warfarin regimen (dose adjusted for a target INR of 2.0 to 3.0) as an anticoagulation strategy that has been demonstrated to be superior in regard to overall bleeding and thromboembolic complications when compared to warfarin discontinuation with heparin bridging. Increasing data are now available for catheter ablation using the NOACs, which will be presented below.

**Dabigatran in patients undergoing catheter ablation**

Lakkireddy et al performed a multicenter prospective study that compared the incidence of bleeding and thromboembolic complications in patients undergoing catheter ablation on dabigatran with an age-, sex-, and AF type-matched control population undergoing catheter ablation on an "uninterrupted" warfarin regimen. In the dabigatran arm, the dose of dabigatran was held on the morning of the procedure and was resumed 3 h after hemostasis was achieved after ablation. Patients in the dabigatran arm also underwent a TEE prior to the procedure, whereas no preablation TEE was performed in the control group. During the postablation 30-day follow-up period, patients in the dabigatran arm had a significantly higher rate of bleeding than patients on warfarin (6% versus 1%, p=0.019). The composite of bleeding and thromboembolic complications (16% in the dabigatran arm versus 6% in the warfarin arm, p=0.009) was also significantly greater in the patients on dabigatran. Bassiouney et al reported an experience based on a total of 999 consecutive patients undergoing AF ablation on dabigatran (n=376) or warfarin (n=623). The patients in the dabigatran arm had 1–2 doses withheld prior to ablation and it was resumed as soon as the patients were transferred to the nursing floor after the procedure. The investigators did not observe any significant differences in the incidence of bleeding/thromboembolic complications in the two groups of patients (3.2% in the dabigatran arm versus 3.9% in the warfarin arm, p=0.59) during a 3-month postablation follow-up period. Another relatively larger single center-based study by Kim et al on a total of 763 patients (dabigatran, n=191 compared with uninterrupted warfarin regimen, n = 572) also did not observe any significant differences in the incidence of major bleeding complications in the two groups (2.1% in each group, p=1.0).

The safety and efficacy of dabigatran was further supported by another single center study by Winkle et al, which compared a control arm of patients who underwent ablation on preablation warfarin bridged with a weight-based dose of enoxaparin with the patients who were on dabigatran prior to the procedure. The patients in dabigatran arm had their preablation dose held 36–60 h prior to the ablation according to a glomerular filtration rate (GFR)-based algorithm. The postablation dose of dabigatran was administered 22 h after the procedure. After a 30-day follow-up period, no thromboembolic
and/bleeding events were reported in either study arm.\textsuperscript{22} Further findings by Haines et al\textsuperscript{23} and Maddox et al\textsuperscript{24} in their respective retrospective studies also found dabigatran to be comparable to warfarin in patients undergoing catheter ablation for AF (Table 2). It is not clear why one study\textsuperscript{19} reported worse outcomes for ablation with dabigatran versus warfarin while several other studies demonstrated comparable outcomes, but it should be noted that there were important differences between the studies with regard to the anticoagulation protocols, particularly for dabigatran discontinuation prior to ablation.

**Findings from meta-analyses**

Considering the lack of large randomized trials aimed to address the comparison of safety of dabigatran versus warfarin, several meta-analyses have attempted to investigate this further by combining the data from the available studies. A recently published meta-analysis of

<table>
<thead>
<tr>
<th>Study and preablation anticoagulant</th>
<th>Anticoagulation regimen</th>
<th>Bleeding complications</th>
<th>Thromboembolic complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakkireddy et al\textsuperscript{19}</td>
<td>• Discontinuation of dabigatran: morning dose held on the day of ablation</td>
<td>6% in warfarin arm versus 14% in dabigatran arm, ( p = 0.031 ) (total bleeding)</td>
<td>• 0% in warfarin arm versus 2% in dabigatran arm, ( p = 0.25 )</td>
</tr>
<tr>
<td>• Warfarin, ( n = 145 )</td>
<td>• TEE: performed in all patients on dabigatran</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dabigatran, ( n = 145 )</td>
<td>• Postablation dose: resumed 3 h after hemostasis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bassiouny et al\textsuperscript{20}</td>
<td>• Discontinuation of dabigatran: 1–2 doses prior to PVI</td>
<td>• 1.6% in warfarin arm versus 1.1% in dabigatran arm, ( p = 0.48 ) (major bleeding)</td>
<td>• 1 patient each in the warfarin and dabigatran arms, ( p = NS )</td>
</tr>
<tr>
<td>• Warfarin, ( n = 623 )</td>
<td>• TEE: only in patients with possible lack of compliance on dabigatran/patients with subtherapeutic INR on warfarin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dabigatran, ( n = 376 )</td>
<td>• Postablation dose: resumed at the time of transfer to the nursing floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim et al</td>
<td>• Discontinuation of dabigatran:</td>
<td>• 2.1% in each study arm, ( p = 1.00 ) (major bleeding)</td>
<td>• None in either study arm</td>
</tr>
<tr>
<td>• Warfarin, ( n = 572 )</td>
<td>• Evening dose prior to the day of the PVI held</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dabigatran, ( n = 191 )</td>
<td>• TEE: performed in all patients on dabigatran</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ref. ( 2 \textsuperscript{1} )</td>
<td>• Post-ablation dose: resumed 4 hours after hemostasis following sheath removal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winkle et al\textsuperscript{22}</td>
<td>• Post-ablation dose: resumed 36–60 hours prior to PVI\textsuperscript{6}</td>
<td>• None in each study arm</td>
<td>• None in either study arm</td>
</tr>
<tr>
<td>• Warfarin, ( n = 56 )</td>
<td>• TEE: only performed in patients deemed at high risk for LA thrombus</td>
<td>(major bleeding)</td>
<td></td>
</tr>
<tr>
<td>• Dabigatran, ( n = 34 )</td>
<td>• Post-ablation dose: resumed 22 hours after ablation</td>
<td>• 1% in each study arm, ( p = NS ) (Major bleeding)</td>
<td>• 0% in warfarin arm vs. 1% in dabigatran arm, ( p = NS )</td>
</tr>
<tr>
<td>Haines et al\textsuperscript{23}</td>
<td>• Post-ablation dose: resumed 6–24 h after ablation\textsuperscript{7}</td>
<td>• 2.3% in warfarin arm versus 0.9% in dabigatran arm, ( p = 0.23 ) (total bleeding)</td>
<td>• 0% in warfarin arm versus 0.4% in dabigatran arm, ( p = 0.28 )</td>
</tr>
<tr>
<td>• Warfarin, ( n = 202 )</td>
<td>• Post-ablation dose: resumed on the evening of ablation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dabigatran, ( n = 202 )</td>
<td>• Uninterrupted regimen used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maddox et al\textsuperscript{24}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Warfarin, ( n = 251 )</td>
<td>• TEE: performed in all patients undergoing ablation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dabigatran, ( n = 212 )</td>
<td>• Post-ablation dose: resumed on the evening of ablation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{6}Duration of discontinuation of dabigatran prior to PVI was decided according to the renal function (assessed by measuring glomerular filtration rate).

\textsuperscript{7}Timing of post-ablation dose of dabigatran was decided by renal function (assessed by measuring creatinine clearance (CrCl)).
5,513 patients by Sardar et al reported an increased risk of stroke/transient ischemic attack with the periablation use of dabigatran as compared to warfarin (Peto odds ratio (OR) of 3.94, 95% confidence interval (CI) 1.54 to 10.08, number need to harm=284 patients). The investigators did not observe a difference in the incidence of major bleeding between the two groups of patients (OR: 0.99, 95% CI: 0.55 to 1.78). CONTRARY to these results, other meta-analyses on this topic by Providência et al (0.55% with dabigatran versus 0.17% with warfarin, risk ratio: 1.77, 95% CI: 0.66 to 4.80, p=0.26) and Bin Abdulhak et al (0.4% with dabigatran versus 0.1% OR: 2.15, 95% CI: 0.58 to 7.98, p=0.54) did not observe a significantly increased risk of thromboembolism with the use of dabigatran in the setting of catheter ablation. 26,27 Although these results are confirmatory overall, certain limitations inherent to the meta-analyses (e.g. heterogeneity in the design of various studies, different anticoagulation strategies of warfarin (i.e. bridging versus continuous) used for comparison, and variability in statistical methods) are also important to consider while interpreting their results.

**Rivaroxaban in patients undergoing catheter ablation**

There are fewer published studies regarding the use of rivaroxaban in patients undergoing catheter ablation compared to the use of dabigatran. A multicenter, prospective observational study by Lakireddy and colleagues reported the experience based on a comparison of rivaroxaban (n=321) and warfarin (n=321) in patients undergoing catheter ablation for AF. The patients in the rivaroxaban arm were instructed to take the evening dose of rivaroxaban prior to the procedure and also underwent TEE prior to the ablation. The dose of rivaroxaban was resumed on the evening of the procedure, allowing a minimum post-ablation hemostasis period of 3 h. In the warfarin arm, the ablation was performed on an “interrupted” warfarin regimen (dose adjusted to maintain an INR of 2.0 to 3.0) without the use of heparin bridging and a screening TEE. After a 30-day follow-up period, no differences in the incidences of major bleeding (1.6% in rivaroxaban arm versus 2.2% in warfarin arm, p=0.77) or minor bleeding (5.0% in rivaroxaban arm versus 5.9% in warfarin arm, p=0.60) complications were observed between the two subgroups. Similarly, the incidence of embolic complications (0.3% in each arm, p=1.0) also did not differ between the two groups. 29 Further experience of catheter ablation on an “interrupted” rivaroxaban regimen was reported in a recently published study by Dillier et al; the patients in rivaroxaban arm (n=272) were compared with age-, gender-, and AF type-matched patients who underwent ablation on an “interrupted” warfarin regimen (n=272). The incidence rates of minor bleeding (7% versus 12%, p=0.08) and major bleeding (1 event in each) were similar in both the rivaroxaban and warfarin arms, respectively. 29

The safety and efficacy of rivaroxaban was further supported by the results of a prospective, non-randomized, single-center-based study by Providência et al that compared three groups of patients (Vitamin K Antagonist (VKA), n=192; dabigatran, n=176; and rivaroxaban, n=188) undergoing catheter ablation. The investigators held the dose of rivaroxaban 24–48 h prior to the procedure, and subcutaneous heparin was used 24 h after rivaroxaban interruption. A similarly “interrupted” anticoagulation regimen was also used in the VKA (held 5 days prior to ablation and bridged with heparin 48 h after the last dose) and the dabigatran arm (held 24–36 h prior to ablation and bridged with heparin 12 h after last dose). No statistically significant differences in the incidence rates of thromboembolic (2.1% in the VKA arm versus 1.1% in the rivaroxaban arm versus 0.6% in the dabigatran arm, p=0.41) or major bleeding complications (4.2% in VKA arm versus 1.6% in rivaroxaban arm versus 1.1% in the dabigatran arm, p=0.11) were observed in the three patient subgroups after a 30-day follow-up period (Table 3). 30

Further data on the safety and efficacy of rivaroxaban will become available after the completion of the VENTURE AF study. This multicenter, open-label trial is aimed to perform a direct comparison between “uninterrupted” regimens of both warfarin and rivaroxaban in their respective arms. 31,32

**Considerations regarding the use of NOACs in the setting of catheter ablation**

Preablation: In this period, it is imperative to determine the compliance of patients taking NOACs who are scheduled to undergo catheter ablation, which is clearly more challenging than warfarin patients with documented INR values. In the absence of a clinically approved and reliable blood assay to monitor the anticoagulation effect of NOACs, the use of TEE can be considered to rule out left atrial thrombus prior to ablation, although there are not currently robust data to guide whether patients undergoing ablation on NOACS should undergo a TEE. Although safe overall, the use of TEE might entail additive cost and prolongation of the procedure time. However, its use can be helpful in a subset of patients with higher CHADS2/CHA2DS2-Vasc (CHADS2-vascular disease, age 65–74 years, sex) scores and poor compliance to anticoagulation therapy. Conversely, the use of NOACs in a truly “uninterrupted” manner might obviate the need of a preablation TEE and offer a cost-effective option. When the last dose of a NOAC should be taken prior to ablation has not been firmly established and will be impacted by the drug’s biologic half-life and the availability (or lack thereof) of a reversal agent in the setting of procedural bleeding.

For patients switching from NOACs to warfarin, so that ablation can be performed on a relatively well-validated “uninterrupted” warfarin preablation regimen, particular attention should be paid during the transition period from NOACs to warfarin. It is possible that some of these patients could be warfarin-naïve and might have a greater risk of bleeding during the initial phase of drug-transition as opposed to an overall risk of bleeding during long-term warfarin therapy. 33
Intraprocedural
Current guidelines recommend maintenance of an activated clotting time (ACT) of 300–400 s by administration of heparin prior to or immediately after transseptal puncture during AF ablation. The interaction between heparin and NOACs during the procedure remains to be fully elucidated. A single-center study by Snipelisky et al reported that patients on dabigatran prior to ablation achieved an overall low level of ACT despite having received similar doses of intraprocedural heparin as compared to the patients on warfarin (412.7 s versus 431.8 s, p<0.03).34 Although the investigators did not observe any correlation between ACT levels and complication risk, further studies will be helpful to clarify the interactions of heparin products and NOACs.

Postprocedural
Adopting a truly “uninterrupted” regimen with the use of NOACs might also reduce the thrombotic risk resulting from protamine use after ablation. In general, it seems reasonable to resume a NOAC several hours after an ablation procedure is completed if there is no evidence of ongoing procedural bleeding, with the expectation that therapeutic anticoagulation will be present within hours of resumption of the drug.

Conclusions
Based on strong clinical trial data, NOACS are now widely used for stroke prevention in AF patients. Data are more limited for NOACs (in comparison to warfarin) used during cardioversion and catheter ablation procedures, but the available data (with the exception of one published study of dabigatran versus warfarin for ablation) generally suggest that NOACS have similar safety profiles to warfarin for these procedures. It does not appear to be necessary to stop a NOAC and transition to warfarin when planning cardioversion or ablation, and a growing body of data is helping to clarify issues such as the timing of NOAC administration in relation to the procedure and protocols to minimize the risks of thrombosis and bleeding when using these agents.

Acknowledgement
Supported in part by the Deane Institute for Integrative Research in Atrial Fibrillation at Massachusetts General Hospital

Table 3: Results from the studies comparing the outcomes of rivaroxaban versus warfarin in patients undergoing catheter ablation for AF

<table>
<thead>
<tr>
<th>Study comparison arms</th>
<th>Anticoagulation regimen</th>
<th>Bleeding complications</th>
<th>Thromboembolic complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakkireddy et al28</td>
<td>• Rivaroxaban: uninterrupted regimen used</td>
<td>• 2.2% in warfarin arm versus 1.6% in rivaroxaban arm, p=0.77 (major bleeding)</td>
<td>• 0.3% in each study arm, p=1.0</td>
</tr>
<tr>
<td>• Warfarin, n=321</td>
<td>• TEE: performed in all patients in rivaroxaban arm</td>
<td>• 0.37% in each study arm, p=NS</td>
<td>None in either study arm</td>
</tr>
<tr>
<td>• Rivaroxaban, n=321</td>
<td>• Postablation dose: resumed after a minimum of 3 h after hemostasis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dillier et al29</td>
<td>• Rivaroxaban: uninterrupted regimen used</td>
<td>• 4.2% in warfarin arm versus 1.6% in rivaroxaban arm, p=0.11 (major bleeding)</td>
<td>• 2.1% in warfarin arm versus 1.1% in rivaroxaban arm, p=0.41</td>
</tr>
<tr>
<td>• Warfarin, n=272</td>
<td>• Postablation dose: resumed on the evening of ablation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rivaroxaban, n=272</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providência et al30</td>
<td>• Rivaroxaban: Discontinued 24–36 h prior to the procedure</td>
<td>• 4.2% in warfarin arm versus 1.6% in rivaroxaban arm, p=0.11 (major bleeding)</td>
<td>• 2.1% in warfarin arm versus 1.1% in rivaroxaban arm, p=0.41</td>
</tr>
<tr>
<td>• Warfarin, n=192</td>
<td>• All patients underwent CT scan prior to ablation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rivaroxaban, n=188</td>
<td>• Postablation dose: resumed 4–6 h after ablation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cardioversion and Catheter Ablation of AF using NOACs


