Atrial Fibrillation Ablation and Stroke

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KEYWORDS

• Anticoagulation • Atrial fibrillation • Silent cerebral ischemia • Stroke

KEY POINTS

- Catheter ablation has become a widely available and accepted treatment to restore sinus rhythm (SR) in patients with atrial fibrillation (AF) who fail antiarrhythmic drug therapy.
- Although generally safe, the procedure carries a non-negligible risk of complications, including a small risk of periprocedural stroke and transient ischemic attack (TIA) as well as risk of silent cerebral ischemia (SCI).
- Embolic events cluster in the first 24 hours after ablation, although the high-risk period extends to at least 2 weeks postablation.
- Large thromboembolic events mainly relate to dislodgement of pre-formed thrombus. The mechanisms of SCI, on the other hand, are less well understood and may include small thrombotic, tissue, char, and/or air emboli.
- Uninterrupted anticoagulation, maintenance of an adequate ACT during the procedure, and measures to avoid and detect thrombus build-up on sheaths and catheters during the procedure appears useful to reduce the risk of embolic events.
- Although a majority of acute SCI lesions regress at medium-term follow-up, it appears prudent to use techniques that minimize SCI until conclusive data are available.

INTRODUCTION

Catheter ablation offers the opportunity to restore SR without the adverse effects of antiarrhythmic drugs. In the past decade, catheter ablation has become a widely available and accepted treatment modality to restore SR in patients with AF who have failed antiarrhythmic drug therapy. Although generally safe, the procedure involves hardware introduction into the systemic circulation

Disclosures: Dr P. Aagaard reports that he has no conflicts of interest. Dr L. Di Biase is a consultant for Biosense Webster, Stereotaxis, and St Jude Medical and has received speaker honoraria/travel from Pfizer, Janssen, EpiEP, Biotronik, and Boston Scintific. Dr A. Natale is a consultant for Biosense Webster and St Jude Medical and has received speaker honoraria/travel from Medtronic, Boston Scientific, Biotronik, and Janssen.

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Cardiol Clin 34 (2016) 307–316
http://dx.doi.org/10.1016/j.ccl.2015.12.012

and left atrium as well as energy application to the myocardial tissues. Consequently, the procedure carries a non-negligible risk of complications, including a risk of periprocedural stroke and TIA, as well as SCI. This is a review of the mechanisms, incidence, and impact as well as methods to reduce catheter ablation–related cerebral insults.

CEREBROVASCULAR COMPLICATIONS OF CATHETER ABLATION

Stroke and Transient Ischemic Attack

Periprocedural thromboembolic events cluster during the first 24 hours after catheter ablation, although the high-risk period extends to at least 2 weeks after the procedure.[1] The reported incidence of periprocedural events varies largely between studies. In single-center studies, the reported incidence of stroke is as low as 0%[2] and as high as 5%.[3] A meta-analysis, including 6936 patients, reported incidences of TIA and stroke of 0.2% and 0.3%, respectively.[4]

The incidence of periprocedural thromboembolic events does not seem to vary according to center experience. For example, in a high-volume center study, the overall complication rate decreased from 11.1% to 1.6% during a 10-year period, whereas the incidence of stroke and TIA remained stable.[5] Potential explanations include changes over time in procedure (more extensive lesion sets) and patient selection (indication for ablation expanded to higher risk patients), which are both factors that may have an impact on periprocedural embolic risk.

In a large international survey reporting on periprocedural complications, including 162 centers and 32,569 patients, 5 of 32 deaths were due to stroke.[6] Therefore, although the long-term prognosis seems favorable in most patients who survive a periprocedural stroke, with complete neurologic recovery in most cases,[7] stroke and TIA remain a significant and feared complications of AF ablation.

Silent Cerebral Ischemia

Although clinically overt stroke and TIA are among the most feared catheter ablation complications, SCI may also have adverse effects. It is well known that brain MRI–detected SCI is associated with dementia and cognitive decline in the general population.[8,9] For example, the presence of SCI was associated with a 2-fold risk of dementia in a population-based study (n = 15,000).[8] Factors that seem to affect the onset and severity of dementia include patient age and lesion size.[10] Elderly patients might be at particularly high risk of cognitive decline even from minor lesions due to their smaller reserve (eg, less cortical volume).

It is well established that AF patients have a high burden of MRI-detected SCI, with a prevalence between 6% and 28%.[8,9,11] It is plausible that such silent brain infarcts, accumulated over time, may be responsible for the adverse impacts of AF on neurocognitive function.[12] In a large population study, AF was associated with a 2-fold increase in cognitive dysfunction and dementia, even in patients without overt clinical strokes or TIAs.[12]

Brain MRI has identified a high incidence of new ischemic embolic lesions after catheter ablation of AF (**Table 1**).[13–17] To date, however, no clear link has been established between post-ablation SCI and long-term cognitive decline, and the histopathological significance of MRI-detected brain lesions remains largely unknown. In 1 study, AF ablation was associated with mild dysfunction in some domains on cognitive function testing, which persisted at 90 days postprocedure in up to 20% of patients.[18] The clinical significance of these changes remain unclear. Another study compared neurocognitive function testing in 21 patients undergoing AF ablation with 23 non-AF controls.[19] Overall, 57% of patients who underwent ablation deteriorated from baseline on the verbal memory tests compared with 17% of controls. The study found no association, however, between cognitive decline and SCI, raising the possibility that post-ablation cognitive decline may be multifactorial rather than related to microembolic events per se. This concept is further supported by several other studies that also failed to establish a correlation between SCI and cognitive decline.[6,7,17,20] One study found that postprocedural cognitive decline only occurred in patients who suffered additional non–procedure-related SCI during follow-up.[8]

A majority of acute MRI lesions observed after AF ablation regress without evidence of chronic glial scar when reassessed at short-term follow-up.[20,21] Therefore, it is possible that successful ablation and restoration of SR, although acutely associated with an increase in SCI, may actually decrease the SCI burden in these patients over time, by reducing the risk of subsequent insults. This concept is supported by findings from a large database (n = 24,244) of patients undergoing catheter ablation and cardioversion.[22] In a propensity-matched analysis, ablation was associated with a significantly higher risk of stroke/TIA within the first 30 days postprocedure (relative risk [RR] 1.53; P = .05). Ablation was also associated, however, with a lower risk of non-TIA stroke during long-term follow-up (RR 0.78; P = .03). Furthermore, several other