Effectiveness of integrating delayed computed tomography angiography imaging for left atrial appendage thrombus exclusion into the care of patients undergoing ablation of atrial fibrillation

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BACKGROUND Computed tomography angiography (CTA) can identify and rule out left atrial appendage (LAA) thrombus when delayed imaging is also performed.

OBJECTIVE In patients referred for CTA to evaluate pulmonary vein anatomy before the ablation of atrial fibrillation (AF) or left atrial flutter (LAFL), we sought to determine the effectiveness of a novel clinical protocol for integrating results of CTA delayed LAA imaging into preprocedure care.

METHODS After making delayed imaging of the LAA part of our routine preablation CTA protocol, we integrated early reporting of preablation CTA LAA imaging results into clinical practice as part of a formal protocol in June 2013. We then analyzed the effectiveness of this protocol by evaluating 320 AF/LAFL ablation patients with CTA imaging during the time period 2012–2014.

RESULTS In CTA patients with delayed LAA imaging, the sensitivity and negative predictive values for LAA thrombus using intracardiac echocardiography or transesophageal echocardiography (TEE) as the reference standard were both 100%. Intracardiac echocardiography during ablation confirmed the absence of thrombus in patients with negative CTA or negative TEE results. No patients with either negative CTA results or equivocal CTA results combined with negative TEE results had strokes or transient ischemic attacks. Overall, the need for TEE procedures decreased from 57.5% to 24.0% during the 3-year period because of the CTA protocol.

CONCLUSION Clinical integration of CTA with delayed LAA imaging into the care of patients having catheter ablation of AF or LAFL is feasible, safe, and effective. Such a protocol could be used broadly to improve patient care.

KEYWORDS Atrial fibrillation; Catheter ablation; Computed tomography angiography; Transesophageal echocardiography; Stroke

ABBREVIATIONS **AF** = atrial fibrillation or left atrial flutter; **CTA** = computed tomography angiography/angiogram; **ICE** = intracardiac echocardiography/echocardiogram; **LAA** = left atrial appendage; **LAFL** = left atrial flutter; **TEE** = transesophageal echocardiography/echocardiogram; **TIA** = transient ischemic attack

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Introduction

The prevalence of paroxysmal or persistent atrial fibrillation (AF) has recently been estimated to be 2.2 million in the United States,[1] and the prevalence of stroke in patients with nonvalvular AF has been estimated to be 5%–8%.[2] Although catheter ablation for AF[3–5] is indicated for most patients with symptomatic paroxysmal and persistent arrhythmia,[6] the optimal strategy for ruling out thrombus in the left atrial appendage (LAA) before catheter ablation is unclear. Although transesophageal echocardiography (TEE) is currently considered the criterion standard,[7] it is a semi-invasive procedure associated with patient discomfort and a small risk of complications. Computed tomography angiography (CTA) is commonly used to evaluate pulmonary vein anatomy before left atrial ablation for AF. There is growing evidence suggesting that CTA could be a noninvasive alternative to TEE for the evaluation of LAA thrombus in patients who are already having a CTA to evaluate pulmonary vein anatomy before ablation, particularly if delayed LAA imaging is performed as part of the CTA imaging protocol.[8–18] With these considerations in mind, we hypothesized that in patients undergoing a clinically ordered CTA study for preprocedure evaluation of pulmonary vein anatomy before AF ablation, a clinical protocol with early reporting of the CTA delayed LAA imaging results before the procedure and confirmatory intracardiac echocardiography (ICE) evaluation of the LAA during the procedure could improve clinical efficiency, maintain patient safety, and reduce the need for TEE procedures and their corresponding costs before the catheter ablation of AF or LAFL.

Methods

Cohort selection

The study was approved by the Institutional Review Board for Human Subjects Research at the University of Virginia. Patients with ablation of AF or left atrial flutter (LAFL) and CTA imaging before ablation during the years 2012–2014 at the University of Virginia Health System were identified using a query of the electronic medical record. Patients with TEE procedures during this period were identified in a similar fashion. The data on these procedures were then merged on the basis of the medical record number using statistical software (SAS 9.4, SAS Institute Inc., Carey, NC).

CTA clinical protocol

Before the study period, preprocedural imaging with CTA or cardiac magnetic resonance had become the standard clinical practice for most of our patients undergoing catheter ablation of AF or LAFL in order to evaluate pulmonary vein anatomy. In October 2012, we began to perform delayed LAA imaging as part of our routine preablation CTA protocol. In June 2013, we integrated prompt reporting of these results into clinical practice according to the clinical protocol described in Figure 1. The choice to use the clinical protocol was left to the discretion of the attending electrophysiologist who would be performing the ablation procedure, and patient characteristics including CHA_2DS_2-VASc scores[19] were also integrated as shown in the figure.

According to the clinical protocol, an outpatient preprocedure visit was scheduled before 9:00 AM on the preprocedure day and CTA was performed at 9:00 AM to

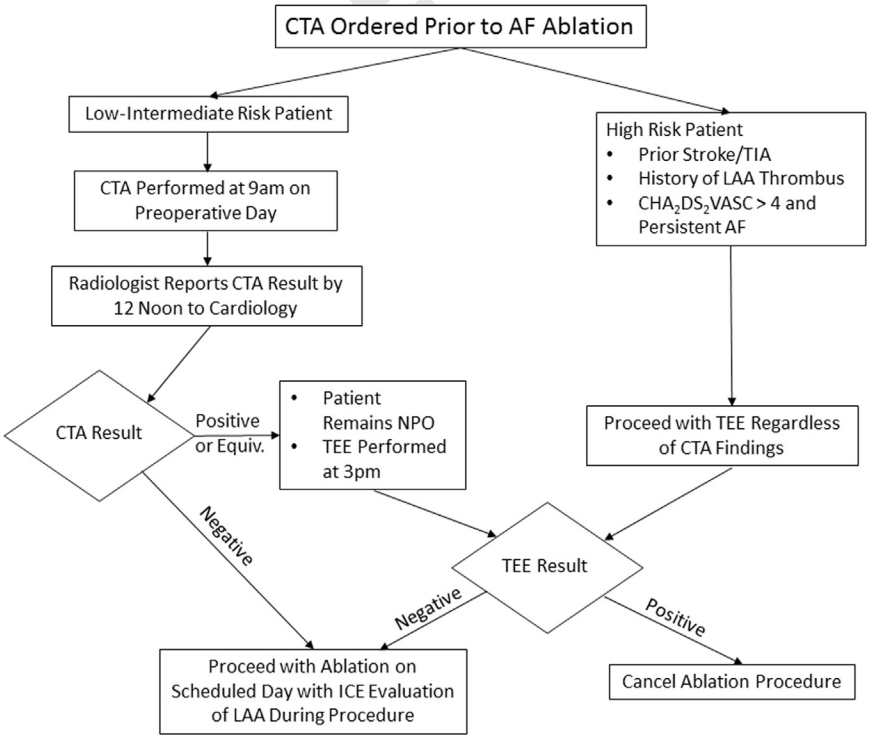

Figure 1 CTA protocol for patients undergoing catheter ablation of AF or LAFL. A flowchart demonstrating the clinical protocol for preprocedural imaging is shown. AF = atrial fibrillation; CTA = computed tomography angiography; ICE = intracardiac echocardiography; LAA = left atrial appendage; NPO = non per os; TEE = transesophageal echocardiography; TIA = transient ischemic attack.