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EDITORIAL COMMENT

Atrial Fibrillation and Transcatheter Aortic Valve Replacement

Implications of Pre-Procedural Identification of Left Atrial Appendage Thrombus for Stroke Prevention*

Samir R. Kapadia, MD,[a] Amar Krishnaswamy, MD,[a] E. Murat Tuzcu, MD[b]

As we apply transcatheter aortic valve replacement (TAVR) to larger patient populations, it is imperative that we remain vigilant in our search for opportunities to further improve our results. Although declining in frequency, stroke remains a highly morbid and potentially mortal complication (1,2). Various studies have demonstrated that one-half or more strokes occur periprocedurally (within 72 h), though up to one-half of strokes may happen beyond that time-frame and are often related to pre-existent atrial fibrillation (AF), new-onset AF, or potentially, valve thrombosis (3–5).

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In this issue of *JACC: Cardiovascular Interventions*, Palmer et al. (6) sought to identify the incidence of left atrial appendage (LAA) thrombus (LAAT) by using delayed-phase computed tomography (CT) imaging among patients undergoing evaluation for TAVR. CT scanning demonstrated LAAT in 22 patients (11%) and an even greater incidence among those patients with a known history of AF (20 of 63; 32%). Interestingly, 2 patients with LAAT did not have a known history of AF. Among the group of patients who underwent TAVR, 6 (4.8%) had a stroke.

The study is relevant because most operators now rely on CT imaging to plan TAVR valve sizing and assess the vascular system to identify the appropriate point of access. Importantly, the authors used delayed-phased imaging (images obtained 1 to 2 min after contrast administration) in all patients, which is imperative to minimize the risk of "false-positive" scans due to inadequate contrast mixing in the LAA, especially in patients with AF (7). Additionally, contemporary scanners that employ prospective gating and dose modulation techniques result in only marginally increased radiation exposure for delayed-phase imaging.

The study also raises some interesting questions: 1) How can we alter periprocedural management among the highest risk patients?; 2) What is the utility of screening for AF before TAVR?; and 3) How can we minimize post-TAVR stroke risk? (**Figure 1**).

PERIPROCEDURAL MANAGEMENT

The 2 patients in the current study who had AF and LAAT, and experienced a stroke, had their anticoagulation discontinued 5 days before TAVR. In routine clinical practice, the "daily" stroke risk of AF is relatively low, and we routinely hold anticoagulation for these patients with planned invasive testing or treatment. On the other hand, in patients with high stroke risk undergoing TAVR, there may be some utility to maintaining an anticoagulant "bridge," such as those patients with LAAT identified on pre-procedural imaging. Furthermore, although it is customary to provide protamine to reverse procedural anticoagulation, it may be reasonable to avoid this among these higher-risk patients, given the routine use of vascular closure devices.

Another potential intervention is the use of transcatheter embolic protection (TEP) filters in patients at

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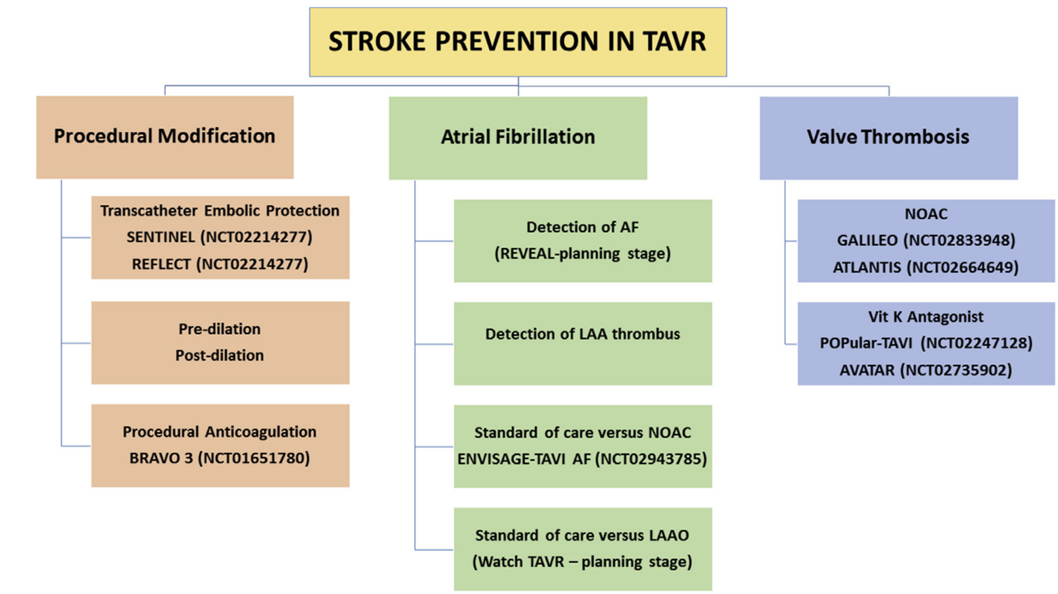
From the [a]Department of Cardiovascular Medicine, Heart and Vascular Institute, Cleveland Clinic, Cleveland, Ohio; and the [b]Division of Cardiology, Cleveland Clinic, Abu Dhabi, United Arab Emirates. The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

FIGURE 1 Considerations to Mitigate Stroke Risk With TAVR



AF = atrial fibrillation; ATLANTIS = Anti-Thrombotic Strategy After Trans-Aortic Valve Implantation for Aortic Stenosis; AVATAR = Anti-coagulation Alone Versus Anticoagulation and Aspirin Following Transcatheter Aortic Valve Interventions; BRAVO-3 = Effect of Bivalirudin on Aortic Valve Intervention Outcomes-3; ENVISAGE-TAVI AF = Edoxaban Compared to Standard Care After Heart Valve Replacement Using a Catheter in Patients With Atrial Fibrillation; GALILEO = Global Study Comparing a Rivaroxaban-Based Antithrombotic Strategy to an Antiplatelet-Based Strategy After Transcatheter Aortic Valve Replacement to Optimize Clinical Outcomes; LAA = left atrial appendage; LAAO = left atrial appendage Occlusion; NOAC = novel oral anticoagulant; POPular-TAVI = Antiplatelet Therapy for Patients Undergoing Transcatheter Aortic Valve Implantation; REFLECT = A Randomized Evaluation of the TriGuard Embolic Deflection Device to Reduce the Impact of Cerebral Embolic Lesions After Transcatheter Aortic Valve Implantation; REVEAL = Assessment of Arrhythmias in Patients Undergoing Transcatheter Aortic Valve Implantation Using a Small Insertable Cardiac Monitoring Device; SENTINEL = Cerebral Protection in Transcatheter Aortic Valve Replacement—The SENTINEL Study; TAVR = transcatheter aortic valve replacement; WATCH TAVR = Watchman in Patients With Atrial Fibrillation Undergoing TAVR.

higher risk for stroke. The recently published trial using the Sentinel device (Claret Medical, Santa Rosa, California) confirmed the safety of this strategy and stroke risk of 5.6% with TEP compared to 9.1% in control group ($p = 0.33$) (8). Importantly, 99% of filters demonstrated captured debris. Another trial (Cerebral Protection to Reduce Cerebral Embolic Lesions After Transcatheter Aortic Valve Implantation [REFLECT]; NCT02536196) with an emboli deflection device, the TriGuard (Keystone Heart, Caesarea, Israel) is ongoing to evaluate the role of TEP during TAVR.

Antithrombotic management after TAVR is also currently under investigation to determine whether routine anticoagulation using warfarin or a novel oral anticoagulant may be beneficial compared with dual antiplatelet therapy in the post-TAVR period. This may help with the prevention of stroke that may result from new-onset AF after TAVR (9). Furthermore, although the clinical significance of "subclinical" valve thrombosis is thus far unclear, stroke prevention and increased valve durability are presumed benefits of routine short-term anticoagulation after TAVR (5).

UNCOVERING PAROXYSMAL AF

In a different context, among 572 patients experiencing a "cryptogenic" stroke at an average age of 73 years, only 2.2% demonstrated AF on 24-h rhythm monitoring, although 14.8% were found to have AF when monitored for 4 weeks (10) When Urena et al. (11) studied 435 patients undergoing TAVR with 24-h Holter monitoring before the procedure, paroxysmal AF was seen in 6.4%. It is conceivable that longer-term monitors would uncover more patients with unrecognized AF before TAVR. Because almost all patients in the major TAVR trials have a CHA_2DS_2-VASc score of 4 or greater, this may explain the presence of LAAT seen among patients without documented AF in the current paper (6). Because pre-TAVR monitoring may additionally uncover conduction disease that would also better inform the risk of post-TAVR pacemaker implantation, there may be many pieces of important information that can be gleaned from such an evaluation (12).

AF AND STROKE PREVENTION

In the current study, 42 patients who underwent TAVR had a documented history of AF. Despite the fact that these patients were seen as clinically fit to undergo a major valve replacement procedure, 31% (13 of 42) of them were not on anticoagulation. This is understandable, because many of the same risk factors that contribute to high CHA_2DS_2-VASc scores overlap to provide high HAS-BLED scores. Furthermore, up to one-third of patients undergoing TAVR have prior coronary stents that may require prolonged dual-antiplatelet therapy, and these patients are often at substantial risk for bleeding with triple therapy.

Left atrial appendage occlusion (LAAO) using the WATCHMAN device was recently approved in the United States for carefully selected patients with AF. In an analysis of patients with aortic stenosis and AF at our institution, we demonstrated that all patients with documented thrombus in the left atrium were isolated to the left atrial appendage (13). Therefore, the group of patients with aortic stenosis and AF who cannot tolerate long-term anticoagulation may benefit from LAAO. Watch-TAVR, a trial in planning stage, will compare outcomes of LAAO or standard therapy in AF patients undergoing TAVR.

The risk of stroke among patients undergoing TAVR is related to both procedural and patient-specific factors. The current study demonstrates the utility of delayed-phase CT in assessing left-atrial appendage thrombus. A systematic approach to investigate different strategies for stroke prevention including procedural modifications like TEP, diagnosis and prevention of AF-related strokes, and post-procedural pharmacotherapy will help to further improve outcomes of patients undergoing TAVR (**Figure 1**).

REPRINT REQUESTS AND CORRESPONDENCE: Dr. Samir R. Kapadia, Department of Cardiovascular Medicine, Heart and Vascular Institute, Cleveland Clinic, 9500 Euclid Avenue, Desk J2-3, Cleveland, Ohio 44195. E-mail: kapadis@ccf.org.

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