Left Atrial Appendage Exclusion for Atrial Fibrillation

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KEYWORDS

• Left atrial appendage • Percutaneous appendage closure • Stroke prevention • Atrial fibrillation

KEY POINTS

- Given that the left atrial appendage is the predominant site of thrombus formation in patients with nonvalvular atrial fibrillation, resecting or closing it is an attractive alternative strategy to prevent strokes in patients who cannot tolerate anticoagulation therapy.
- Current approaches to left atrial appendage closure are surgical or percutaneous.
- Percutaneous approaches can be classified as endocardial occlusion, epicardial ligation, or hybrid epiendocardial ligation, with an increasing number of devices becoming available for clinical use.
- Percutaneous endovascular occlusion of the left atrial appendage has been shown to be equivalent to warfarin in preventing stroke in atrial fibrillation and is associated with a lower bleeding risk.

INTRODUCTION

Patients with atrial fibrillation (AF) may have left atrial appendage (LAA)-dependent (LAA thromboembolism)[1,2] and LAA-independent (aortic arch, carotid, and intracerebral artery disease) stroke mechanisms (**Fig. 1**).[3,4] Most strokes in AF are associated with left atrial thrombi, found in approximately 15% of patients with nonvalvular AF, with 90% located in the LAA (**Figs. 2** and **3**).[2,5] Given that warfarin does not significantly affect atheroembolic or arterial occlusive disease, and yet it dramatically reduces stroke in AF, it is reasonable to expect that an LAA occlusion strategy prevents most warfarin-sensitive strokes in AF.[6,7] Evidence of the noninferiority of LAA exclusion compared with warfarin therapy in the PROTECT-AF (Percutaneous Closure of the Left Atrial Appendage versus Warfarin Therapy for Prevention of Stroke in Patients with Atrial Fibrillation) randomized controlled trial[8] provides proof for this concept. Further evidence comes from a randomized trial[9] reporting similar event rates after electrical cardioversion when transesophageal echocardiography (TEE) was used to exclude LAA thrombus compared with conventional anticoagulation.

Several techniques at obliterating the LAA have emerged[10,11] as a strategy to simultaneously reduce stroke risk, the need for anticoagulation, and hemorrhagic complications.[12,13] In this article, the published studies on surgical and percutaneous approaches to LAA closure are reviewed, focusing on stroke mechanisms in AF, LAA structure and function relevant to stroke prevention, practical differences in procedural approach, and clinical considerations surrounding management.

Disclosures: None.

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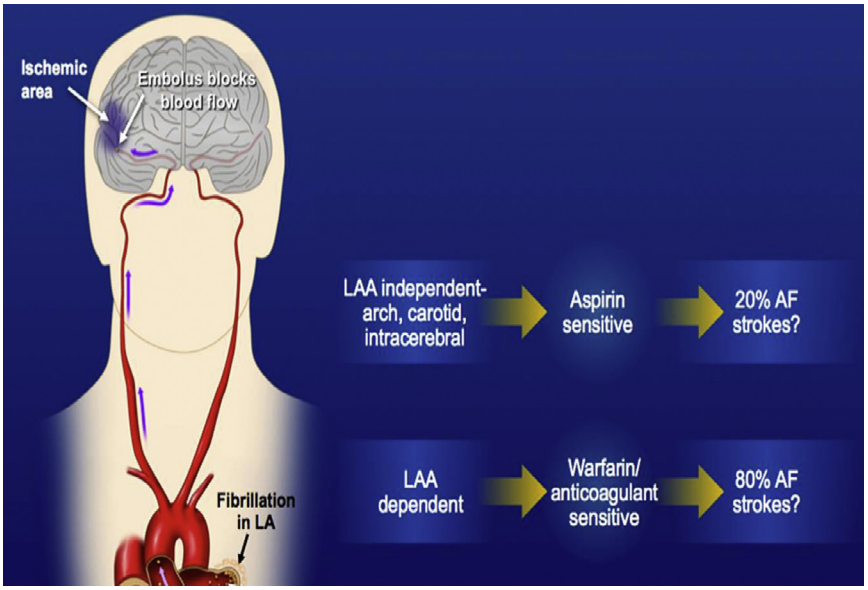

Fig. 1. Left atrial appendage (LAA)-dependent and LAA-independent stroke in AF. (*From* Syed FF, Friedman PA. Left atrial appendage closure for stroke prevention emerging technologies. Cardiac Electrophysiol Clin 2014;6(1): 141–60; with permission.)

LAA STRUCTURE AND FUNCTION

Morphology

The LAA is the remnant of the embryonic left atrium, which forms during the third week of gestation and derives a blood supply from the left circumflex and right coronary arteries at the atrioventricular groove.[14,15] In postnatal life, it is an irregular, tubular diverticulum, which continues to grow until the end of the second decade of life, with an ostium, which is wider in taller individuals. It is differentiated from the pulmonary vein-derived smooth-walled cavity of the remaining left atrium by rich endocardial trabeculations (see **Fig. 3**) formed by parallel-running muscle bars, termed pectinate muscles.[15] The LAA ostium is separated from the left superior pulmonary vein by a narrow tissue invagination (the left lateral ridge),[16] in which lies the ligament of Marshall, a developmental remnant of the left-sided vena cava of importance in AF arrhythmogenesis.[17,18] The left lateral ridge is seen as a q-tip on echocardiography (see **Fig. 2**) and clearly defines the superoposterior border of the LAA ostium endocardially, with the other borders being less well defined.[19] The ostial

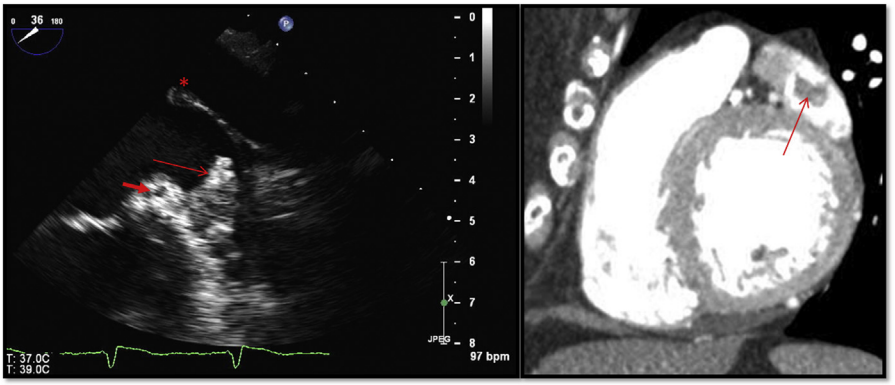

Fig. 2. Appearance of LAA thrombus on TEE (*left, slim arrow*) and CT imaging with intravenous radiopaque contrast (*right, arrow*). Red asterisk marks the left lateral ridge, which separates the left superior pulmonary vein above and the appendage below. Thick arrow marks left circumflex artery.