Catheter-based Epicardial Closure of the Left Atrial Appendage

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KEYWORDS

• Endo-epicardial closure device • Epicardial closure device • Left atrial appendage • Stroke prevention

KEY POINTS

- The left atrial appendage (LAA) is a trabeculated, tubular structure, in direct continuity with the left atrial cavity. Its anatomy could predispose to in situ thrombus formation, especially in patients with atrial fibrillation.
- Different technologies have been developed for LAA closure, including surgical and percutaneous techniques. Both types have shown several limits.
- A novel technique based on an endo-epicardial approach, the LARIAT system (SentreHeart, Palo Alto, CA, USA), recently has become available. It consists of snaring the LAA with an epicardial device, correctly positioned through connection of the epicardial and endocardial magnet-tipped guidewires.
- Little clinical data are present in the literature about this new approach. Some additional considerations are reported based on our early clinical experience.

INTRODUCTION

Atrial fibrillation (AF) is the most common cardiac arrhythmia,[1] affecting an estimated 6 million individuals in the United States.[1] Because AF mainly affects elderly people, its prevalence is expected to increase in parallel with the increasing age of the population, with a predicted 15.9 million cases by 2050.[2]

Stroke, the most serious complication of AF, occurs in 5% of non-anticoagulated patients every year. The risk of stroke increases substantially with age, from 1.5% in individuals aged 50 to 59 years to 23.5% for those aged 80 to 89 years.[3] In

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addition, AF-associated strokes have the worst outcomes.[4]

Stroke is the third most frequent cause of death in the United States and the leading cause of serious disability. Therefore, stroke prophylaxis is a crucial component of management of AF. Although antiarrhythmic drugs and catheter ablation provide symptomatic relief for patients with AF, neither method is sufficiently reliable in preventing thromboembolic events, and long-term oral anticoagulation therapy is recommended ,irrespective of the rhythm management strategy.[5] Furthermore, data from Stroke Prevention in Nonrheumatic Atrial Fibrillation suggest that 15% of patients with AF suffer silent cerebral infarcts, the implications of which are not known.[6]

Stroke prevention in patients with AF has largely been based on the use of anticoagulation with warfarin, which reduces the risk of stroke by 60%,[7] and in some more recent patients stroke prevention has been based on the use of novel anticoagulants, such as the direct thrombin inhibitor, dabigatran.[8] Therapy with warfarin or the novel oral anticoagulants (eg, dabigatran or the selective factor Xa inhibitors apixaban and rivaroxaban) comes with a significant lifetime risk of major bleeding ranging from 1.4% to 3% per year in clinical trials,[9–11] which have excluded patients with a high risk of bleeding.

The cumulative incidence of major hemorrhage for patients 80 years of age or older has been estimated to be as high as 13.1 per 100 person-years, and these patients are not often enrolled in randomized clinical trials.[12] A significant proportion of patients with AF, ranging from 30% to 50%, does not receive anticoagulation because of relative or absolute contraindications or because of patient- and/or physician-pertinent barriers limiting the use of anticoagulation in clinical practice, including the perceived risk or fear of treatment-induced bleedings.[13]

For these reasons, different therapeutic approaches are currently being developed for stroke prevention in nonvalvular AF and potentially offer an alternative to anticoagulation therapy.

EPICARDIAL APPROACH

This recent strategy combines endocardial and epicardial approaches or uses an epicardial approach only. The endo-epicardial procedure requires 4 basic steps:

1. Pericardial and transseptal access.
2. Placement of 2 magnet-tipped guidewires, the first at the endocardial surface of the left atrial appendage (LAA) apex, via a femoral venous access and transseptal puncture. The second is percutaneously introduced into the pericardium overlying the LAA apex.
3. Connection of the epicardial and endocardial magnet-tipped guidewires for stabilization of the LAA.
4. Snare capture of the LAA with closure confirmation and release of the pretied suture for LAA ligation. The main components of this system are illustrated in **Fig. 1**.

Pericardial access is obtained through a transthoracic puncture, done after proper asepsis of the subxiphoid area. Epicardial puncture is performed with the goal of achieving access only to the anterior surface of the heart to obtain the proper orientation to deliver the snare over the LAA. An inferior epicardial access is never recommended and in the case of an accidental inferior epicardial access it is advisable to re-access the epicardium rather than reposition the snare via the inferior orientation. A 17-G epidural needle is used for this procedure. The needle is introduced at a 45° angle toward the left scapula. Guided by fluoroscopy through anterior-posterior and lateral views, the operator gently advances the needle until it is close to the cardiac silhouette, where a light negative pressure is felt. The needle angle is adjusted according to the region the operator wishes to evaluate. This region is most frequently the medial third of the right ventricle, where no major coronary vessels can be found. To demonstrate the site of the needle tip precisely, 2 mL of contrast is injected as the needle approaches the heart silhouette. If the needle is outside the pericardial space, contrast media accumulate in the mediastinum. However, when the needle tip is inside the pericardial space, the contrast outlines the cardiac silhouette. This thin layer of contrast in the pericardial space confirms that the needle is correctly positioned. A lateral radiograph view, showing the anterior and posterior contours of the heart, represents the best view to ensure correct needle position. Indeed, through this view, anterior access can be confirmed and needle direction is clearly shown.

Finally, a 0.35-inch guidewire is introduced in the pericardial space through the puncture needle. The guidewire is also monitored with fluoroscopy and left in the pericardial space while the transseptal catheterization is performed.

Once the transseptal catheterization is completed, an 8.5-F SL1 catheter is directed anteriorly in the left atrium toward the LAA. To delineate the ostium and body of the LAA, a left atriagram is performed (**Fig. 2**). The 15-mm occlusion balloon catheter is back-loaded with a magnet-tipped 0.025-inch endocardial guidewire and inserted into the end of the SL1 transseptal catheter. The