NEW TECHNOLOGY

Percutaneous left atrial appendage closure in the patient with spontaneous echocardiographic contrast: a new occluder and protocol

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The left atrial appendage (LAA) was regarded as the devil of thromboembolic stroke in the patients with non-valvular atrial fibrillation [1, 2]. The transcatheter LAA closure has significantly advanced in the past two decades and been proved noninferiorly or even superiorly to warfarin in terms of stroke prevention [3-6]. However, as the limitations of occluders' designs and operational procedures, it is not currently available for all LAA, i.e. the LAA with a definite thrombus. Whether the presence of dense spontaneous echocardiographic contrast (SEC) should be regarded equivalently as a thrombus is still controversial [7]. The patients with dense SEC within the LAA have a higher stroke risk of 18.2% per year if they are not treated with warfarin, or have a 4.5% per year stroke rate with adjusted-dose warfarin [8]. Up to now, the percutaneous closure of the LAA with dense SEC should also be cautious for the current widely-used LAA closure systems.

LAmbre is a newly-designed LAA closure system[9, 10], which is now evaluated by the phase 3 clinical trial both in Europe and China. The LAmbre implantor has two main composes, the fixed umbrella used to fix in the internal wall of LAA and the sealing disc to cover the orifice of LAA (Figure 1.A). Unlike the operational protocol of Watchman device, the LAmbre could be unsheathed outside of the LAA (Figure 1.B), then advanced to depress the umbrella slowly (Figure 1.C) and fixed in the landing zone (Figure 1.D). Subsequently the unsheathment of the sealing disc (Figure 1.E) and depressure completely (Figure 1.F) was conducted to cover the LAA ostium.

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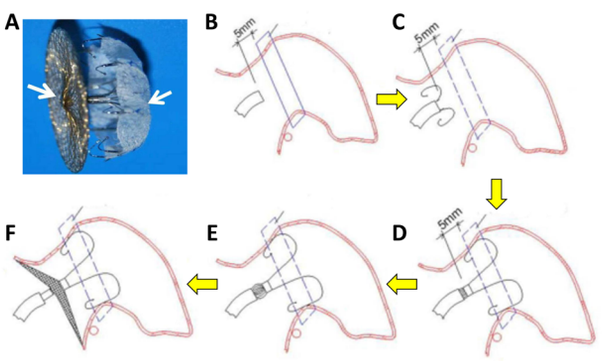
FIG1. The new occluder and schematic diagrams of protocol for closure the left atrial appendage with SEC



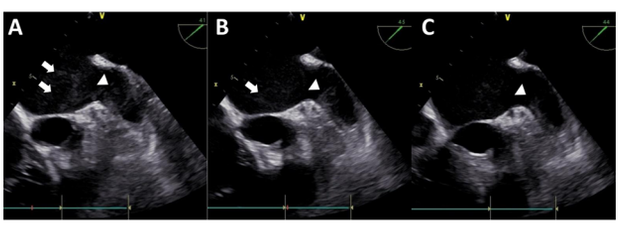
Caption: A: The LAmbre device: a new-designed two-disc LAA closure system. The white arrow indicated the fixed umbrella and the sealing disc.; **B–D:** the schematic diagrams of the protocol for closing the LAA with SEC; **B:** The delivery sheath should be outside of the LAA orifice; **C:** The delivery sheath was advanced to release the fixed umbrella while keeping the outer sheath still; **D:** The fixed umbrella was advanced and anchored in the landing zone; **E:** The outer sheath was droped out slowly to release the sealing disc while keeping the delivery sheath still; **F:** The sealing disc was released completely to seal the orifice of LAA.
(LAA left atrial appendage; SEC: spontaneous echocardiographic contrast)

CASE PRESENTATION

A 49-year-old Chinese male with persistent atrial fibrillation was referred to our center for percutaneous LAA closure. The patient had a history of hypertension, type-2 diabetes mellitus and one event of previous ischemic stroke. A route trans-esophageal echocardiography (TEE) showed an enlarger left

atrium (LA) with a internal diameter of 59 mm and a windsock-like LAA. The dense SECs (Figure 2.A, arrows) were exitted in both the LA (Figure 2.A, arrows) and LAA, in the latter there is a undefinited aggregation (Figure 2.A, triangle). He was given adjusted-dose warfarin, which was replaced by dabigatran 150mg bid, after one event of potentially warfarin-associated gastrorrhagia. After 3 months, the patient received a second TEE to show that the present of SEC in the LA (Figure 2.B, arrow) and LAA (Figure 2.B, triangle, Video 2) were reduced. After another 3 months, the third TEE illustrated just isolated SEC within the middle of LAA (Figure 2.C, triangle, Video 3).

FIG 2. Three episodes of TEE before the procedure of LAA closure

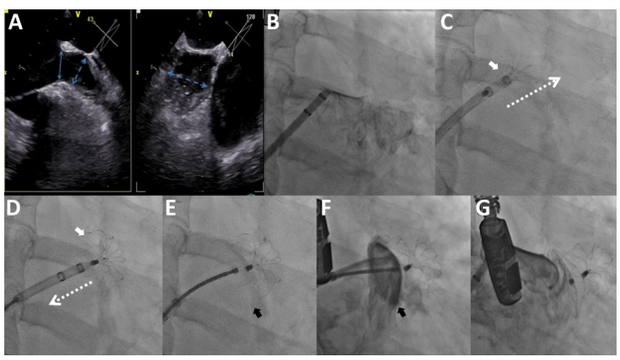


Caption: A: A route TEE showed the present of dense SECs (arrows) both in the LA and LAA, in the latter there is a undefinited aggregation (triangle). **B:** After given 3-month anticoaglutions, another TEE show that the present of SEC in the LA (arrows) and LAA (triangle) were reduced. **C:** After another 3-month anticoaglution, the third TEE illustrated just isolated SEC within the middle of LAA (triangle).
(LA left atrium; LAA left atrial appendage; SEC: spontaneous echocardiographic contrast)

After route laboratory tests on admission, there weren't any contraindications for LAA closure,. The route radiofrequency ablation was refused, thus the LAA closure should be conducted directly. Before the procedure of LAA closure, both the long-axis and the short-axis views of TEE images were measured to illustrate the maximal LAA orifice diameter of 20 mm (Figure 3.A, full line) and landing zone of 22mm (Figure 3.A, dotted lines). Thus, a size of 26mm (diameter of fixed umbrella) plus 32mm (diameter of sealing disc) was designated, according to the manufacturer's advice [10].

The LAA closure was conducted with the guidance of TEE in general anesthesia. Following trans-septal puncture inferoposteriorly, a very small quantity of contrast was injected through the outer sheath to show just the direction of LAA (Figure 3.B, Video 4). Then the outer sheath was adjusted to be co-axial with the long diameter of LAA and the delivery sheath containing the compressed occluder, was advanced slowly to release the fixed umbrella (Figure 3.C, Video 5) and fixed in the landing zone (Figure 3.D，Video 5). After a slight pulling to make sure the good fixation of fixed umbrella, the delivery sheath was kept still while the outer sheath was dropped out to depress the sealing disc (Figure 3.E, Video 5) to cover the orifice of LAA. Before and after the releasement with counterclockwise rotation of the core wire, cineangiographies showed there were no obvious residual flow around the device (Figure F, Video 6; Figure G, Video 6). Monitoring TEE also showed well closure of LAA and no extension to left upper pulmonary vein and mitrial valve.

FIG 3. The precedure of the LAA closure in the patient with SEC



Caption: A: Before the procedure of LAA closure, both the long-axis and the short-axis views of TEE images were measured to illustrate the maximal LAA orifice diameter of 20 mm (full line) and landing zone of 22mm (dotted lines). **B.** After trans-septal punctur, a very small quantity of contrast was injected through the outer sheath to show the direction of LAA. **C.**Adjust the sheath's direction to be co-axial with the long diameter of LAA and advance the delivery sheath slowly to release the fixed umbrella (arrow). The dotted line showed the motion trail of the delivery sheath. **D.** Advance the fixed umbrella to the landing zone. **E.** Keep the delivery sheath still and drop out the outer sheath to depress the sealing disc. **F.** Before the releasement with counterclockwise rotation of the core wire, cineangiographies showed there was no obvious residual flow around the device. **E.** After the releasement with counterclockwise rotation of the core wire, cineangiographies showed there was no obvious residual flow around the device.
(LAA left atrial appendage; SEC: spontaneous echocardiographic contrast)

The total-time cost of the operation was 45 minutes and the time of in-to-out sheath was just 15 minutes. The total cost of contrast used was about 30ml. The patient underwent a uneventfal recovery and discharged 3 days after the operation. He would receive dual-antiplatelet therapies with aspirin 100mg per day and clopidogrel 75mg per day for 6 months. There was no severe adverse event after 3-month follow-ups.

Acknowledgments

There is no conflict of interest.

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