**CASE REPORT**

Watch out for the Thrombus Adhering to the Puncture Site of the Atrial Septum during Left Atrial Appendage Closure

Xuechao Tang,1,2 MD, Xudong Xu,1 MD, Hongwei Dou,1 MD, Yuan Bai,1 MD, Ni Zhu,1 MD, Pan Li,1 MD, Wenfeng Xiong,1 MD, Yongwen Qin,1 MD, Xianxian Zhao,1 MD and Hong Wu,1 MD

**Summary**

We present a rare case of thrombus adhering to the puncture site of the atrial septum during left atrial appendage closure. By discussing the case, we suggest that some preventive measurements be taken during left atrial appendage closure and that conventional transesophageal echocardiography for the atrial septal puncture site be performed after the delivery sheath is removed.

**Key words:** Stroke, Atrial fibrillation, Complication, Interventional therapy

Left atrial appendage closure (LAAC) has been proven to be an alternative to anticoagulation therapy with warfarin for stroke prevention in patients with nonvalvular atrial fibrillation (NVAF).1-3 Since the development of LAAC, its safety has been widely concerned. Many complications have been reported, such as pericardial effusion, thrombus formation on the surface of LAA occluder, device-related thrombi, and pulmonary artery perforation.4-6

**Case Report**

A 74-year-old male was admitted for recurrent palpitations for 2 years and was diagnosed with paroxysmal atrial fibrillation. He had a history of hypertension, diabetes mellitus, coronary artery disease, and cerebral infarction and had undergone pacemaker implantation for a third-degree ativoventricular block in December 2014. Physical examination revealed the following: blood pressure, 130/70 mmHg; heart rate, 60 beats/minute; and no specific heart or lung anomalies. The patient had a CHADS2 score of 4, CHA2DS2-Vasc score of 6, and HAS-BLED score of 4. He was referred to undergo LAAC due to the high risk of stroke and contraindications to oral anticoagulation therapy because of his high HAS-BLED score and history of previous hemorrhages in mucous membranes and skin after warfarin administration for stroke prevention. Transesophageal echocardiography, chest radiography, coagulation function tests, and other related preoperative examinations were performed before LAAC, and there were no procedural contraindications.

**Surgical procedure:** After administration of general anesthesia, an esophageal ultrasound probe was inserted. After obtaining trans-septal access, a single dose of heparin sodium (100 IU/kg) was injected through the sheath. Active whole-blood clotting time was tested every half hour, and it was stable within 200-300 seconds during the 55-minute procedural time. Then, an extra stiff wire was inserted into the left superior pulmonary vein (LSPV), and a 12-French double curved delivery sheath was placed in the LSPV, after which a pigtail catheter was placed inside LAA. Left atrial appendage angiography revealed a cactus LAA with 2 lobes, and the diameter of landing area was 20 mm (Figure 1). A 22-mm LACBES occluder (Shanghai Pushmed Co., Shanghai, China) was applied to LAA, but it failed due to the shallowness of the landing area. Then, an 18-mm LACBES occluder was used to occlude the main lobe of LAA. Left atrial angiography and transesophageal echocardiography revealed forcefully fixed occluder without a residual shunt (Figure 2). After the delivery sheath was withdrawn and figure 8 sutures were immediately inserted at the femoral vein puncture site, TEE revealed a 5-cm-long thrombus adhering to the right atrial septum, arising from the atrial septal puncture site (Figure 3A). Intravenous antithrombotic therapy with heparin (5 mg/hour) was continuously injected for 50 hours following the procedure while checking activated partial thromboplastin time every 12 hours, and the data were 59.6 seconds, 45.2 seconds, 52.8 seconds, and 72.4 seconds, respectively. Dual antiplatelet therapy with aspirin (100 mg/day) and clopidogrel (75 mg/day) was then prescribed. Repeated TEE revealed the disappearance of right atrial thrombus (Figure 3B).
thrombus (Figure 3B), and there were no pulmonary embolism symptoms, such as chest tightness and dyspnea. No cardiovascular events occurred during the 6-month follow-up period, and TEE revealed good occluder position with no thrombosis at the occluder surface and atrial septal puncture site.

### Discussion

Atrial fibrillation is a common form of arrhythmia, and oral anticoagulant (OAC) treatment is the standard protocol for preventing strokes. Triple therapy with OACs combined with aspirin and P2Y12 inhibitors is necessary in some special situations, such as atrial fibrillation with acute coronary syndrome. Some studies have demonstrated that dual therapy with direct oral coagulant plus aspirin or P2Y12 inhibitors was not inferior to triple therapy with warfarin in terms of major bleeding, benefit outcomes, and thromboembolism. However, bleeding events with triple therapy cannot be ignored. Over the past decade, significant progress has been made in the use of

**Figure 1.** Left atrial angiography revealed a cactus LAA with two lobes. The diameter of landing area (×1) was 20 mm, and the diameter of orifice (×2) was 21 mm.

**Figure 2.** An 18-mm LACBES occluder (blue arrow) was used to occlude the main lobe of the LAA. Left atrial angiography (A) revealed the occluder forcefully fixed with no residual shunt. Transesophageal echocardiography (B) confirmed that the occluder did not affect the adjacent mitral valve and left superior pulmonary vein.

**Figure 3.** TEE revealed a 5-cm-long thrombus adhering to the right atrial septum (red arrow) arising from the atrial septal puncture site (A); After 50 hours of anticoagulation therapy with heparin, the thrombus adhering to puncture site of atrial septum disappeared (B).
LAAC for preventing NVAF in patients at a high risk of stroke. Especially since the WATCHMAN Device (Boston Science) was approved by FDA in 2015, LAAC has been gradually accepted by the majority of cardiovascular physicians and patients. An increasing number of cardiovascular centers and experts have performed LAAC. Recent studies have shown that LAAC was not inferior to oral anticoagulant therapy with warfarin in high-risk patients with NVAF and that total stroke incidences and mortality rates for the LAAC group became gradually lower than those for the oral anticoagulant therapy group at the follow-up time extension.1-10

With the increased popularity of LAAC, peri- and postprocedural complications have become a major concern. These complications mainly include pericardial effusion and cardiac tamponade, blood vessel injury, air embolism, device embolization, and device-related thrombosis (DRT) among many others.8,9 Device-associated thrombus formation and pericardial effusion after WATCHMAN implantation have been described in 4.2% and 5.2% of patients in the PROTECT AF trial.9 In addition, some rare complications, such as pulmonary perforation and occluder displacement, have been reported.10

There have been previous reports that thrombi adhering to atrial septal can be observed following some interventional procedures, and most of these are thrombi-in-transit. The cause was considered to be the breakoff of deep venous thrombi. Large sheaths and longer procedural times are the main risk factors for the formation of deep venous thrombosis.11 Wallenborn, et al12 have reported a case of postoperative thrombus-in-transit originating from deep vein thrombosis, which led to pulmonary embolism, and they have advised vigilance to the occurrence of such incidents after LAAC, particularly when using large bore introducers during the surgery. To the best of our knowledge, thrombi adhering to the puncture site of the right atrial septum formed during LAAC without causing severe thromboembolic events are rarely reported, and this may be the first such case to be reported.

Due to the timely detection of thrombosis at the atrial septal puncture site and continued postprocedural anticoagulant therapy, there were no severe cardiovascular complications, such as pulmonary embolism and deep vein thrombosis. We did not perform CT to exclude these for unrelated symptoms. However, specific cause underlying the formation of thrombus adhering to the puncture site of the atrial septum remains unknown. Previous reports have considered the breakoff of deep venous thrombi to be the most likely reason for the formation of thrombus-in-transit. However, the thrombus adhering to the puncture site of the atrial septum in this case was found just after the sheath was removed. Ultrasound examination of the femoral and iliac veins was immediately performed, and no thrombus was found; thus, the possibility of thrombi formed in situ at the atrial septal puncture site cannot be ruled out. During LAAC, we should only take notice of inner sheath thrombosis, but we also need to pay attention to outer sheath thrombosis. At the end of LAAC, conventional TEE for the atrial septal puncture site to determine whether thrombi have adhered to the puncture site of the atrial septum is recommended. If thrombi occur, continued anticoagulation therapy might be effective. In this case, repeated TEE revealed thrombus disappearance after continued anticoagulant therapy with heparin for 50 hours postoperatively. In addition, oxygen saturation should be monitored after LAAC. Once oxygen saturation declines, thrombus-related pulmonary embolisms should be considered. Actively preventing thrombosis during the procedure is apparently more important than treating thrombus-related complications after the procedure. Complete heparinizing, along with cleaning and flushing the sheath with heparin diluent, can effectively reduce the formation of thrombi.

This case is worth learning from and thinking about. We suggest that conventional TEE for the atrial septal puncture site when the sheath is removed during LAAC can timely detect and handle thrombi adhering to the puncture site of the atrial septum, thereby preventing severe complications.

Disclosures

Conflicts of interest: All authors have no conflict of interest.

References