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Device-related thrombosis on atrial septal defect occluder after simultaneous closure of left atrial appendage and atrial septal defect: a case report

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An atrial septal defect (ASD) may cause right heart dysfunction, pulmonary hypertension and atrial fibrillation (AF), and atrial septal defect occlusion (ASDO) is the first choice for treating secundum defects when the morphology permits. ASD and AF frequently coexist, and the risk of AF and stroke persists after ASDO.[1] In recent years, left atrial appendage occlusion (LAAO) has been recognized as an effective treatment for stroke prevention in nonvalvular AF patients with a high risk of stroke, systemic embolism and bleeding who are unwilling to take oral anticoagulants or cannot tolerate them.[2] At the same time, for ASD patients with AF and hemodynamic disorders, "one-stop" treatment with ASDO plus LAAO can simplify the operation, shorten the operative time and avoid transseptal puncture after ASDO. Device-related thrombosis (DRT) occurs when a thrombus develops on a medical device, as indicated by various examinations during the follow-up period. Currently, the clinical diagnosis of occluder thrombosis is mainly based on transesophageal echocardiography (TEE). The characteristic of occluder thrombosis on TEE is a new, non-planar abnormal echo on the surface of the occluder, which can float along with the blood flow. Its incidence varies greatly due to the different types of occluders. Herein, we report a case of DRT on an ASD occluder after simultaneous LAAO and ASDO. To the best of our knowledge, this is also the first report of DRT on an ASD occluder after simultaneous ASDO and LAAO.

An 85-year-old woman with an extensive past medical history, including an ASD, AF, congestive heart failure, hypertension, previous transient ischemic attack (TIA) and multiple lacunar infarctions on computed tomography, was referred for ASD closure. Due to her inability to tolerate long-term anticoagulation therapy, her high CHA_2DS_2-VASc score of 7 (congestive heart failure = 1, hypertension = 1, age = 2, prior TIA = 2, female = 1) and her high HAS-BLED score of 5 [hypertension = 1, prior TIA = 1, history of labile international normalized ratio (INR) = 1, age = 1, concomitant aspirin = 1], simultaneous LAAO was considered a potential option to prevent stroke, which could be a problem after ASD closure. A previous TEE examination demonstrated a 12 mm secundum ASD located posteriorly and inferiorly with a deficient posterior rim, enlargement of the right atrium, continuous left-to-right shunting across the ASD and moderate pulmonary artery hypertension (50 mmHg) (Figure 1). The left atrial appendage (LAA) was a single lobe similar to a chicken wing in shape, and no thrombus was detected in the left atrium or LAA. The maximum ostial diameters of the LAA were 22 mm at 45°, 22 mm at 90°, and 23 mm at 135° (Figure 2). Given the secundum ASD with right heart overload, the high CHA_2DS_2-VASc score, the high HAS-BLED score and the need to prevent stroke, the patient underwent percutaneous closure of the ASD and LAA simultaneously. The proce-

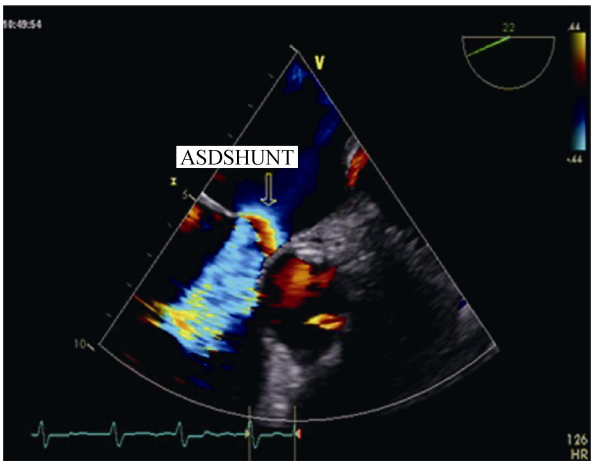

Figure 1. Color Doppler image of the left-to-right shunting (yellow arrow) across the atrial septal defect with a size of approximately 12 mm.

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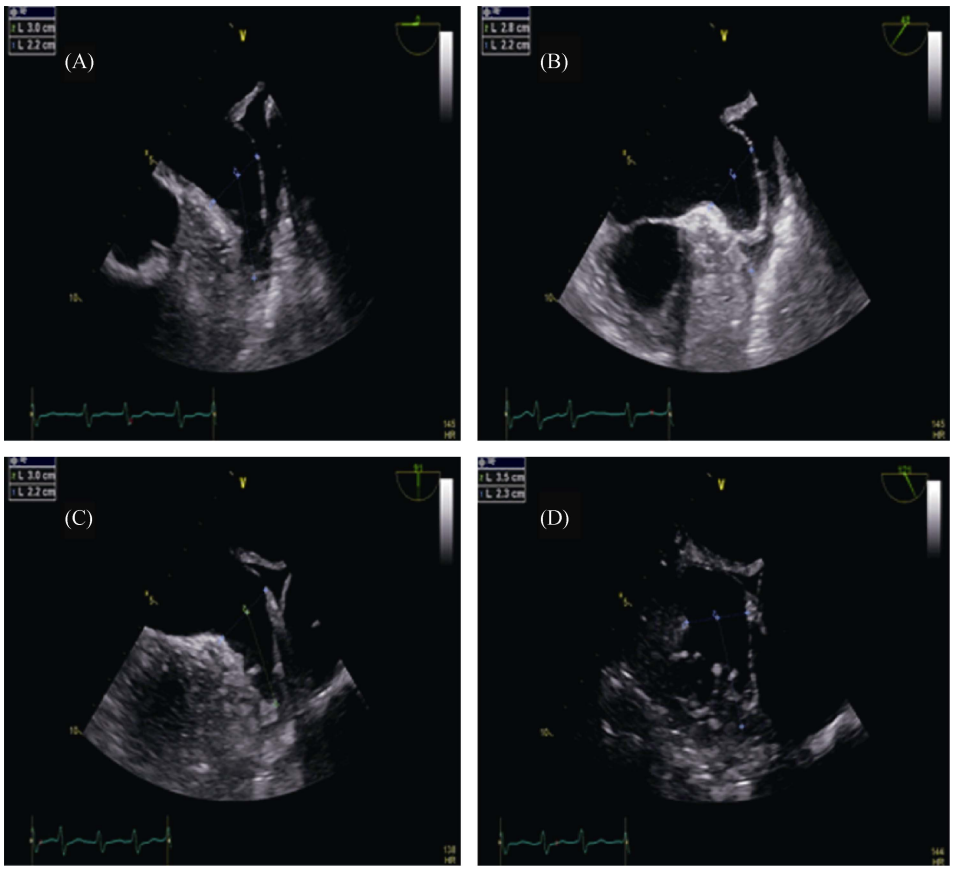

Figure 2. 2D transesophageal echocardiography image at 0° (A), 45° (B), 90° (C) and 135° (D) angles showing the single lobe of the left atrial appendage, which was similar to a chicken wing in shape. No thrombus was detected in the left atrium or left atrial appendage.

dure was performed under general anesthesia and TEE guidance. Cardiac catheterization revealed a Qp/Qs ratio of 2.8: 1 with mild pulmonary artery hypertension (sPAP = 31 mmHg). Because the LAA was directed anterio-superiorly and the anatomy was not complex, the ASD could be used for atrial septal access in LAAO. A 27 mm Watchman device (Atritech, Boston Scientific, Natick, Massachusetts) and a 20 mm Amplatzer ASD occluder (St. Jude Medical, Minneapolis, Minnesota) were deployed with no complications and no residual flow (Figure 3). Then, the patient was instructed to take warfarin (INR = 2–2.5) daily for 45 days and dual antiplatelet therapy with aspirin 100 mg plus clopidogrel 75 mg daily thereafter.

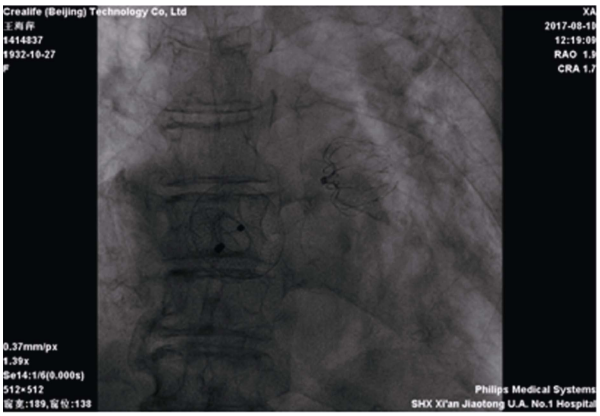

Figure 3. A 27 mm Watchman device and a 20 mm Amplatzer atrial septal defect occluder were deployed.

Two months after the interventional occlusion, a TEE examination was performed to confirm the location of the occluder and the status of the thrombus and shunting. An apparently well-positioned device that occupied most of the LAA and the interatrial septum was confirmed. Nonetheless, 2D and 3D TEE showed a floating thrombus attached to the left atrial surface of the ASD occluder (Figure 4), and no thrombus was detected on the Watchman device (Figure 5). The antithrombotic regimen was switched from dual antiplatelet therapy to warfarin 3.75 mg daily, and the amount of warfarin was adjusted to keep the INR between 2 and 2.5. Two months later, TEE revealed complete DRT resolution (Figure 6). Warfarin was stopped, and the patient resumed dual antiplatelet therapy for six more months followed by life-long aspirin. No bleeding-related complications have occurred since implantation of the Amplatzer ASD occluder

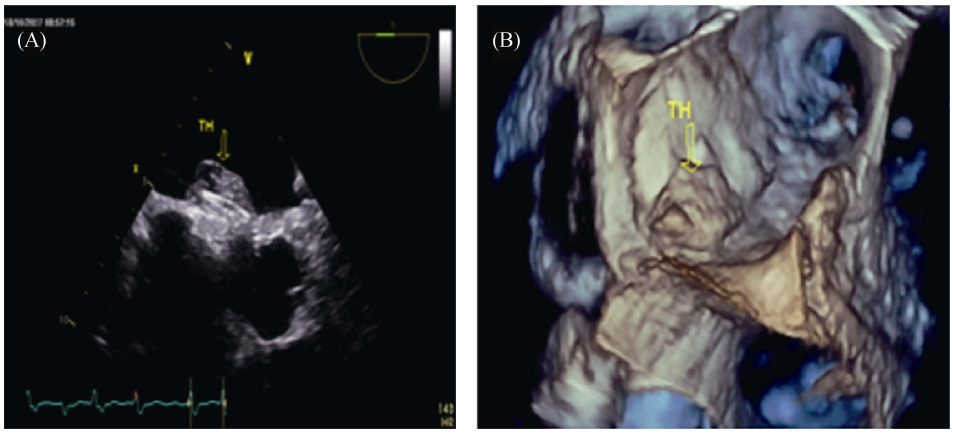

Figure 4. 2D transesophageal echocardiograph (A) and 3D transesophageal echocardiograph (B) showing a thrombotic layer (yellow arrow) approximately 0.6 cm thick over the left atrial surface of the atrial septal defect occluder.

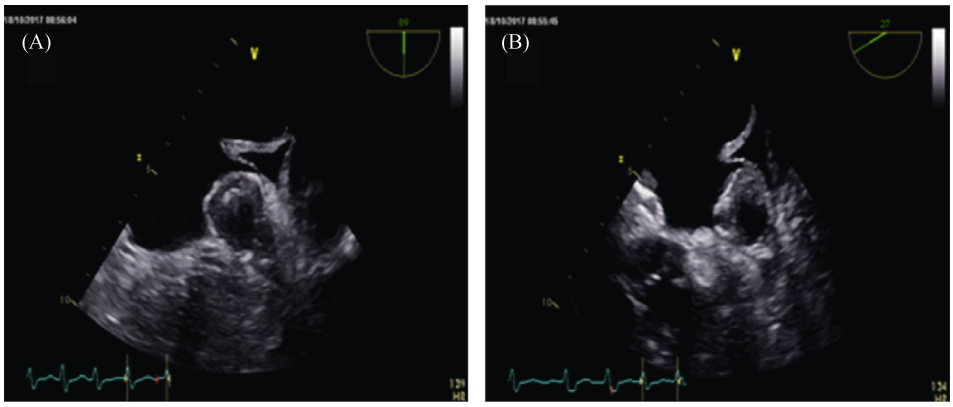

Figure 5. 2D transesophageal echocardiographs at 90° (A) and 45° (B) angles showing no thrombus on the Watchman device.

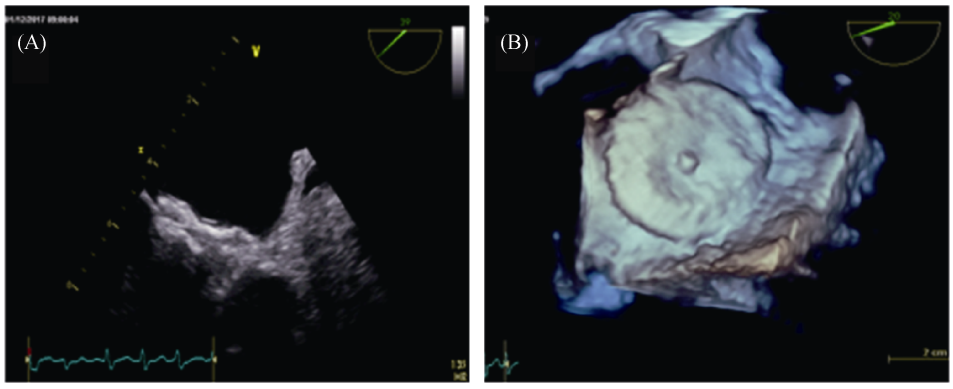

Figure 6. 2D transesophageal echocardiograph (A) and 3D transesophageal echocardiograph (B) showing no mural thrombus on the surface of the atrial septal defect occluder.

and the Watchman device.

In ASD patients, the electrophysiological characteristics of atrial tissue are greatly affected by the increased volume load, atrial enlargement and interstitial fibrosis. Atrial arrhythmias, especially AF, are common in adult ASD patients. The incidence of AF in adult patients with a secundum ASD has been reported to be 10.5%. Furthermore, the incidence of AF ranges from 13% to 52% and increases

with age in untreated secundum ASD patients older than 40 years.[3] In recent years, among AF patients with a high risk of bleeding, LAAO has emerged as an alternative to long-term oral anticoagulation therapy for stroke prevention. In patients with AF and ASD, occlusion of both LAA and ASD at the same time could be a possible strategy for effectively preventing stroke and right heart failure. Appropriate anticoagulation after transcatheter device placement remains a matter of debate. For patients with a history of stroke or AF, there are no established guidelines for postprocedural anticoagulation therapy. Most patients receive warfarin, antiplatelet therapy, or different combinations of the two. After transcatheter closure, DRT remains a major concern because it may result in recurrent embolic events. There is currently no consensus regarding the optimal method for treating DRT. DRT after ASDO or LAAO has been reported as a complication, but the true incidence may be underestimated, and there have been no randomized trials assessing independent predictors of DRT. The incidence of DRT after ASDO and LAAO varies according to the type of occluder.[4–22] Although there have been many foreign reports on DRT, reports from China on DRT are rare, possibly because of the use of transthoracic echocardiography instead of TEE for follow-up examinations after closure at most hospitals in China. Previous studies have found that the main cause of DRT after ASDO is mainly related to paroxysmal AF and larger atrial septal aneurysm.[10] Moreover, the causes of DRT after LAAO are mainly related to high CHA_2DS_2-VASc scores, high preoperative platelet counts, lower left ventricular ejection fractions, postoperative anticoagulant therapy, and the selection of an inappropriate occluder.[23] To the best of our knowledge, according to previous reports, the incidence of DRT formation after LAAO is significantly higher than that after ASDO. After an analysis of the causes of DRT, we believe that the reported differences in the incidence of DRT may be due to differences in the study populations. The majority of patients who undergo ASDO are young, while the majority of those who undergo LAAO are over 65 years of age; therefore, differences in the population distribution result in different risks of postoperative thrombosis. In this case, after two months, TEE showed that a thrombus had formed on the left atrial surface of the ASD occluder, while no thrombus was detected on the Watchman device. After another two months of anticoagulation therapy, the thrombosis on the occluder disappeared. Thus, in elderly patients, even those regularly taking anticoagulants, the high risk of DRT cannot be ignored. After transcatheter closure, regular anticoagulant therapy is required, and individualized anticoagulation regimens should be established on a regular basis to minimize the risk of DRT. Further randomized controlled trials are required to determine the choice and duration of drug therapy for DRT, taking into account the risks of cardioembolism, DRT recurrence and bleeding.

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