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The Treatment of Left Atrial Appendage Aneurysm by a Minimally Invasive Approach

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Left atrial appendage (LAA) aneurysm is a rare, pathologic condition that may lead to atrial tachyarrhythmia or thromboembolic events. A 49-year-old man presented with aggravated palpitation and dizziness. He suffered from refractory atrial fibrillation despite a previous history of radiofrequency catheter ablation. Echocardiography revealed a 57-mm LAA aneurysm. Surgical ablation was performed through a right mini-thoracotomy, and the LAA aneurysm was obliterated with a 50-mm AtriClip (Atricure Inc., Westchester, OH, USA). However, follow-up computed tomography showed residual communication, so the patient is still taking warfarin. We report that a minimally invasive strategy for treating LAA aneurysm can be considered, but incomplete closure may occur; thus, caution is needed.

Key words: 1. Left atrial appendage aneurysm
2. Minimally invasive surgery
3. AtriClip

Case report

A 49-year-old man presented with aggravated palpitation and dizziness that had lasted for 3 weeks. He had been diagnosed with atrial fibrillation (A-fib) at another hospital 5 years ago. Three years previously, transesophageal echocardiography (TEE) revealed a giant left atrial appendage (LAA) with a thrombus, and the patient underwent radiofrequency catheter ablation. Although A-fib continued after the procedure, he had been taking warfarin since then. Because his symptoms had worsened, the patient was referred to Asan Medical Center to be evaluated for surgical treatment.

At the time of presentation, the patient had stable vital signs, with a blood pressure of 113/68 mm Hg and an irregular heart rate of 90 beats per minute. The patient was taking 50 mg of pilsicainide 3 times a day, and 5 mg of nebivolol and 5 mg of warfarin once a day. Cardiac magnetic resonance imaging (MRI) showed a 57-mm LAA aneurysm (Fig. 1), and transthoracic echocardiography (TTE) revealed normal dimensions of the left atrium (LA) and normal left ventricular function without any defect of the pericardium or valvular pathology. A thrombus was not clearly visible on TEE. Based on the test results, the patient was deemed to have a congenital LAA aneurysm, and a plan was made for the patient to undergo surgical ablation and LAA occlusion for the treatment of recurrent A-fib and the prevention of embolic stroke.

Surgical ablation was performed through a right mini-thoracotomy via the fourth intercostal space. Cardiopulmonary bypass (CPB) was established by cannulating the superior vena cava (SVC) percutaneously and the right femoral vein and artery

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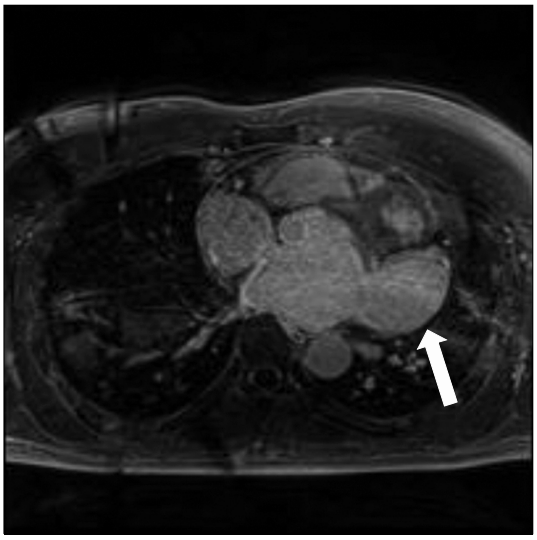

Fig. 1. Preoperative magnetic resonance imaging showing the aneurysmal left atrial appendage (arrow).

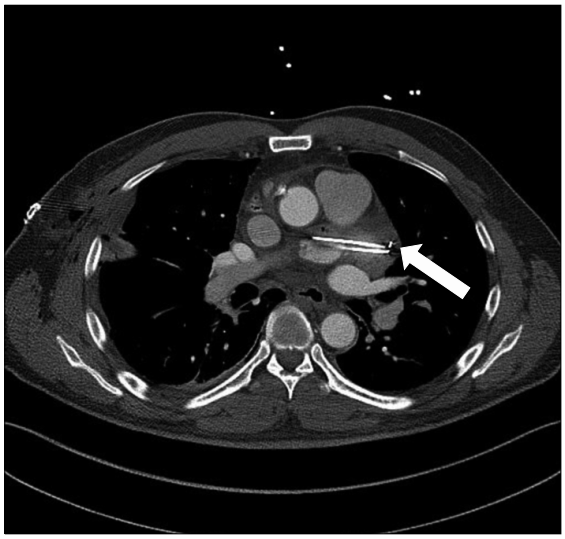

Fig. 2. Postoperative computed tomography scan showing a contrast opacification. The arrow designates the AtriClip (Atricure Inc., Westchester, OH, USA).

through an inguinal incision. After ablating the SVC and cavo-tricuspid isthmus with the heart beating, crystalloid cardioplegia was administered through an aortic root cannula and the aorta was cross-clamped. After opening the LA through the interatrial groove, the LA was ablated; the ablation lesion included a box lesion isolating the pulmonary vein (PV), a linear lesion connecting the PV-box lesion to the mitral valve annulus, and another linear lesion connecting the PV-box lesion to the LAA orifice. The LAA was obliterated with a 50-mm AtriClip (Atricure Inc., Westchester, OH, USA) (Fig. 2). The orifice of the LAA was further obliterated with suture ligation inside the LA. The durations of CPB and aortic cross-clamping were 120 and 55 minutes, respectively. The patient was extubated at 3 hours after surgery and transferred to the general ward on postoperative day 1. The patient regained a normal sinus rhythm and was discharged on postoperative day 5.

On a follow-up computed tomography (CT) scan, the patient was found to have contrast opacification remaining in the LAA, suggestive of a residual channel between the LA and the thrombosed LAA. The patient is still taking warfarin, and the thrombus in the LAA showed a progressive decrease in size on a follow-up CT scan. The patient has not had any neurologic complications since surgery.

Discussion

LAA aneurysm is a rare pathologic condition, with fewer than 100 cases reported worldwide [1]. In 1962, Parmley and colleagues reported the first case of a LAA aneurysm encountered during a surgical procedure [1]. LAA aneurysm is classified as congenital or acquired, and congenital LAA aneurysm can be further divided into intra- and extra-pericardial types. The extra-pericardial type is associated with a secondary protrusion of the LA due to a congenital defect of the pericardium, and the intra-pericardial type is thought to be caused by a developmental weakness in the wall of the LA and/or the appendage, although the pericardium is intact [2,3]. Acquired LAA aneurysm can develop due to an inflammatory reaction or degenerative changes, such as mitral stenosis, mitral regurgitation, syphilitic myocarditis, and tuberculosis [3].

Patients with LAA aneurysm may be asymptomatic or present with atrial tachyarrhythmias, mostly in the second or third decade of life due to the ectopic focus of atrial rhythm generation, or systemic thromboembolism caused by stagnant blood flow in the aneurysm [2]. TEE is preferred to TTE for identifying intra-atrial or LAA thrombi, and cardiac CT or cardiac MRI may be helpful for confirming the diagnosis and studying the relationship of the LAA aneurysm

with the surrounding structures [1].

Surgical obliteration is the mainstay of treatment for preventing potentially fatal cardiovascular adverse events, such as stroke, in patients with LAA aneurysm [3]. The optimal strategies for successful LAA aneurysm exclusion are under debate because there is no gold-standard surgical method; options include neck ligation, purse-string techniques, and stapling, all with or without excision [4]. However, these conventional methods may require a median full sternotomy and pose the risk of injuring the left circumflex coronary artery and adjacent structures during the procedure. In this regard, the closure of an LAA aneurysm by clipping may have the advantage of avoiding such risks through a minimally invasive approach. However, few case reports have described the treatment of LAA aneurysm by a minimally invasive approach [5]. In Korea, several cases of LAA aneurysm treated with surgical resection via a median sternotomy have been reported, but no report has described an attempt to treat LAA aneurysm using a minimally invasive approach or clipping.

The AtriClip is a device that was recently introduced for use in occluded LAAs, but incomplete closure by this device has been frequently reported. Ad et al. reported that a residual stump occurred in 3 (13%) of 24 patients who underwent LAA closure with AtriClip [6]. Kanderian et al. [7] reported that incomplete LAA closure occurred in 27% of patients who underwent excision, 77% who underwent suture exclusion, and 100% who underwent stapler exclusion in their cohort. Hence, because incomplete LAA closure is associated with an increased risk of thrombus formation, long-term oral anticoagulants are recommended to prevent thromboembolic complications after incomplete closure [8]. Regular screening is recommended to identify residual channels, and complete endocardial closure of an incompletely ligated LAA may be a reasonable option for patients who cannot tolerate long-term anticoagulation therapy.

In our present case, the patient also underwent internal obliteration in order to secure a complete closure of the aneurysm after his LA chamber was opened for a maze procedure to treat A-fib. The patient's clinical symptoms abated after surgery. Despite our efforts, however, a residual communication was confirmed on follow-up CT; thus, we continued anticoagulation medication, and we are considering whether to proceed with second-stage surgery after discussing treatment options with the patient. We are also considering annual CT and TTE follow-ups to determine when to discontinue warfarin.

In conclusion, we report that a minimally invasive strategy, such as clipping, can be considered for treating LAA aneurysm in order to reduce the risks and complications associated with the median full sternotomy approach. However, as seen in our case, the clipping method may result in incomplete closure; thus, caution is needed until the efficacy of the clipping method is improved and further validated.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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