Minimally invasive resection of a giant left atrial appendage aneurysm

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Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication May 4, 2022; revisions received Sept 28, 2022; accepted for publication Oct 4, 2022; available ahead of print Oct 13, 2022.

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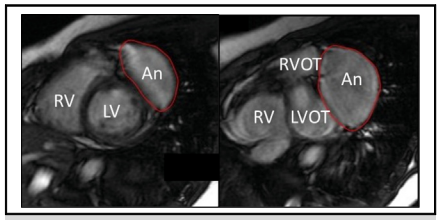
JTCVS Techniques 2022;16:219-22

2666-2507

https://doi.org/10.1016/j.xjtc.2022.10.004



T1-weighted cardiac magnetic resonance image of large left atrial appendage aneurysm.

CENTRAL MESSAGE

Congenital left atrial aneurysms are rare and are associated with arrhythmias and intraatrial thrombus. Minimally invasive resection is a safe and effective management, particularly in young patients.

Congenital left atrial aneurysms are extremely rare and have been associated with the development of supraventricular arrhythmia, as well as increased risk of intraatrial thrombus formation, thromboembolic complications, and rupture.[1-3] Due to the risk of catastrophic thromboembolism or aneurysmal rupture, surgical resection is frequently recommended for management of this condition, regardless of symptoms.[1,3]

We present a unique case report of a pediatric patient with giant left atrial appendage aneurysm who was successfully managed with a minimally invasive resection technique. The Institutional Review Board of Vanderbilt University deemed this study "nonresearch" (number: 211716, decision date: September 8, 2021).

CASE PRESENTATION

An otherwise-healthy 17-year-old female patient presented after having a syncopal event. Her physical examination was unremarkable, and electrocardiogram revealed a normal sinus rhythm. Her initial work-up included a transthoracic echocardiogram (Figure 1, *A*, *C-F*), which revealed a large left atrial aneurysm with normal biventricular function and no valvular abnormalities. To further characterize this, cardiac magnetic resonance imaging was performed, which confirmed the left atrial appendage aneurysm measuring 7.1 × 7.6 × 5.7 cm (Figure 2). A multidisciplinary team discussion regarding the management of this case was initiated and surgical resection was recommended. Given the patient's young age, a minimally invasive approach was preferred.

The patient was brought to the operating room and transesophageal electrocardiogram images were obtained to confirm the identified anatomy (Figure 1, *B*). A 4-cm left anterolateral thoracotomy incision was made, at the fourth intercostal space from the midclavicular line to the anterior axillary line. The pericardium was opened posterior to the phrenic nerve, and the left atrial appendage aneurysm was visualized (Figure 3, *A*). The right femoral artery and vein were then exposed. Heparin was administered, and the right femoral artery and vein were cannulated over a wire using transesophageal echocardiogram guidance. After initiation of cardiopulmonary bypass, a vascular stapler was inserted through a more lateral keyhole counter-incision. Using both ports, similar to a thoracic wedge resection, the aneurysm was stapled across at its base with care to avoid the left circumflex coronary artery. The staple line was reinforced with interrupted 4-0 polypropylene suture with pledgets. The resected specimen is shown in Figure 3, *B*. Transesophageal echocardiography demonstrated no residual aneurysmal outpouching and preserved biventricular function. The patient had a routine postoperative course, and her incision was well healed with excellent cosmetic result at 2-month follow-up.

COMMENTS

Congenital left atrial aneurysms can be either intrapericardial or extrapericardial in nature. The extrapericardial type is felt to be due to a congenital defect of the pericardium, through which the otherwise-normal left atrium herniates.[2,4] The intrapericardial type, however, is thought to

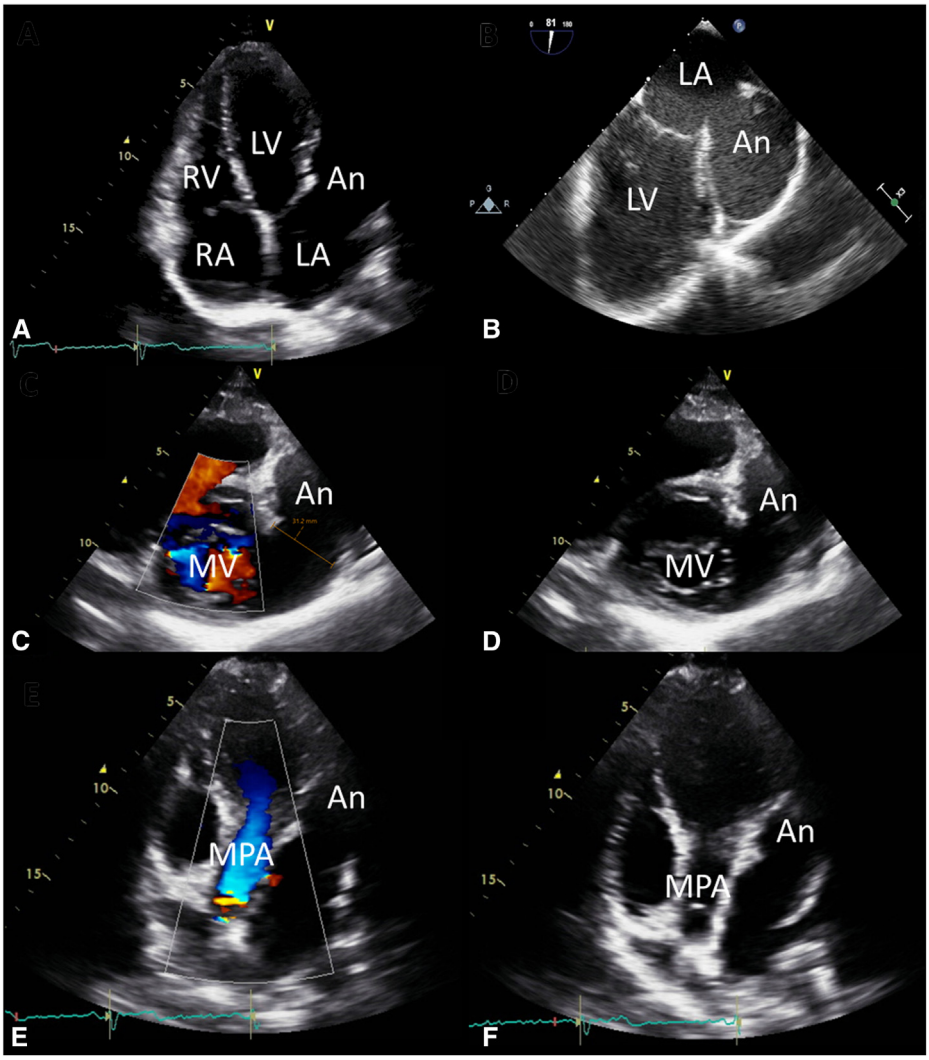


FIGURE 1. Echocardiographic characterization of left atrial appendage aneurysm. A, Transthoracic echocardiogram with large left atrial aneurysm. B, Transesophageal echocardiogram demonstrating large left atrial aneurysm. Transthoracic ultrasound with color Doppler, C, and without color, D, across the mitral valve, with the aneurysm ostia to the left of the mitral valve, consistent with left atrial appendage location. Transthoracic ultrasound with Doppler color, E, and without color, F, in the main pulmonary artery and aneurysm to the left of the main pulmonary artery, consistent with left atrial appendage location. *LV*, Left ventricle; *RV*, right ventricle; *An*, aneurysm; *RA*, right atrium; *LA*, left atrium; *MV*, mitral valve; *MPA*, main pulmonary artery.

be due to a developmental weakness in pectinate muscles of the left atrium.[2,3,5]

Patients with congenital left atrial aneurysms typically present in their third decade of life; however, the age at presentation in the literature ranges from less than 1 day to 88 years,[1,3] with more severe cases typically presenting at younger ages.[3] Symptoms of left atrial aneurysms can include palpitations, tachycardia, shortness of breath, chest pain, and cardiac decompensation in severe cases.[2,3] Unfortunately, in some patients the first symptom is due to a catastrophic thromboembolic complication or aneurysmal rupture.[2]

Various approaches have been described for the surgical management of the congenital left atrial aneurysm. The most widely used approach is median sternotomy with cardiopulmonary bypass, aortic crossclamping, and surgical resection of the aneurysm with left atrial reconstruction. This strategy may be particularly useful when the aneurysm is extremely large, there are other cardiac defects, or when thrombus is present,[1,3,6] as full sternotomy and circulatory support allow for better visualization and improved control. Less-invasive surgical approaches, such as left minithoracotomy, provide the advantage of cosmesis and may be appropriate for patients for whom thrombi have been ruled

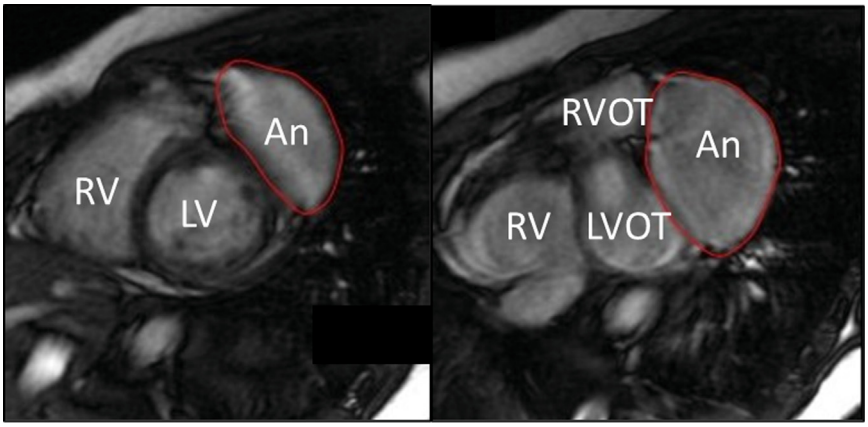


FIGURE 2. T1-weighted cardiac magnetic resonance image of large left atrial appendage aneurysm. *An*, Aneurysm; *RVOT*, right ventricular outflow tract; *RV*, right ventricle; *LV*, left ventricle; *LVOT*, left ventricular outflow tract.

out on preoperative imaging.[1,3,6] This approach can be accomplished without cardiopulmonary bypass, if the aneurysm is small or located far from the atrial wall; however, the use of cardiopulmonary bypass is best left to the judgment of the surgeon. Our preferred approach is to use full cardiopulmonary bypass. Circulatory support with cardiopulmonary bypass runs the major risks of systemic inflammatory response syndrome, kidney injury, and coagulopathy but carries the advantages of hemodynamic support, improved visualization of the neck of the aneurysm via decompression, and better control in case of acute hemorrhage. For aneurysms with short and/or wide necks that preclude the placement of a vascular stapler, cardiopulmonary bypass can be helpful to facilitate surgical ligation of the neck. In addition, it is our practice to reenforce the stapled or surgical suture line with either a double suture layer or interrupted felt pledgets. Caution should be instituted when considering the use of an external left atrial appendage ligation clip alone.[4] These devices may not be occlusive. Therefore, more definitive management of the aneurysm sac is recommended.

In this case, surgical resection of the aneurysm was recommended, given its excessive size, to reduce the risk of supraventricular arrhythmia and thromboembolism. Endovascular closure was considered; however, this was not feasible due to the large size of the aneurysmal neck. Resection also obviates the need for placing a young person on warfarin, which is of particular concern in young female patients of childbearing age. Our approach, via a small left anterolateral thoracotomy with a counter incision for the stapler, allowed excellent visualization and control, and the added benefit of an exceptional cosmetic outcome in a young person. We decided to use cardiopulmonary bypass in this case due to the large aneurysmal neck and to maximize exposure by decompressing the aneurysm. Even though this aneurysm was large, carefully selected patients with appropriate anatomy may benefit from this approach. This case report highlights the need for additional literature on the safety and efficacy of less-invasive surgical approaches to the congenital left atrial aneurysm.

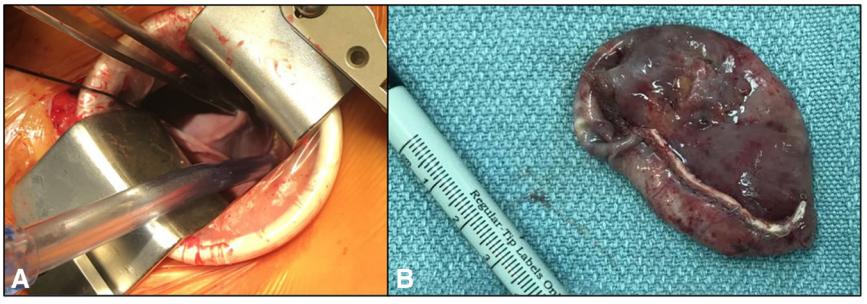


FIGURE 3. A, The minimally invasive approach allowed good exposure and visualization of the aneurysm (*forceps*) through small left anterolateral thoracotomy. B, Excised large left atrial aneurysm surgical specimen, decompressed.

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