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Case Reports

Mitral Valve Surgery in Patients With an Implanted Amplatzer Septal Occluder: A Review of 2 Cases

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Abstract

Surgical approaches for mitral valve exploration vary, with the preferred approach being via the interatrial groove. Data on whether the interatrial groove approach can be used for mitral valve surgery in patients with a previously implanted Amplatzer septal occluder (ASO) (St Jude Medical, an Abbott company) are extremely limited. The authors performed mitral valve surgery using the transatrial septal approach on 2 patients following explantation of an ASO, which significantly impedes the interatrial groove approach. Concomitant surgical procedures with mitral valve replacement, removal of the ASO, and closure of an atrial septal defect with a patch significantly prolonged the cross-clamp and cardiopulmonary bypass durations, which is the reason for intraoperative low cardiac output syndrome. An intra-aortic balloon pump and venoarterial extracorporeal membrane oxygenation were used in these 2 patients because of low cardiac output syndrome. When planning mitral valve surgery in patients with a previously implanted ASO, the device precludes the interatrial groove approach and can produce an unpredictable clinical scenario.

Keywords: Septal occluder device; Amplatzer occluder device; mitral valve

Introduction

The Amplatzer septal occluder (ASO) (St Jude Medical, an Abbott company) is designed for placement in the interatrial septum to close an atrial septal defect (ASD). Made of nitinol mesh, the device consists of double self-expandable discs, with a larger left atrial side; it is available in lengths from 4 mm to 40 mm.[1,2]

The most important step in mitral valve surgery is to obtain adequate exposure of the valve. The interatrial groove (Waterstone or Sondergaard), transatrial oblique, and transatrial longitudinal septal approaches are the 3 main ways to access the left atrium. Although the preferred approach is the interatrial groove,[3] the presence of a septal occluder device in the interatrial septum complicates surgical exploration of the interatrial groove by limiting the mobility of the anterior edge of the right atrium.

No reports have been published about whether the interatrial groove or transatrial septal approach can be used to expose the mitral valve in patients with a previously implanted ASO. In this article, the authors share their experience of mitral valve surgery and its clinical results in patients with an ASO.

Case Reports

The first patient, a 73-year-old woman, presented at the authors' clinic with palpitations and shortness of breath. She had had a percutaneous intervention for secundum ASD (36-mm ASO) 4 years previously. Arrhythmia and a 4/6 systolic murmur in the mitral area were detected on physical examination. Atrial fibrillation was detected on electrocardiography. Ejection fraction (EF) was 45%; severe mitral regurgitation, moderate tricuspid regurgitation, and an ASO in the interatrial septum were detected on echocardiography. Mitral valve replacement (MVR), tricuspid valve repair, and atrial fibrillation ablation were planned for the patient.

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The second patient, a 65-year-old man, presented at the author's clinic with chest pain and shortness of breath. Eight years previously, he had had a percutaneous intervention for secundum ASD (28-mm ASO). Physical examination revealed sinus rhythm and a 5/6 systolic murmur in the mitral area. Ejection fraction was 40%; severe mitral regurgitation, severe aortic regurgitation, and an ASO in the interatrial septum were detected on echocardiography. Three-vessel coronary artery disease was diagnosed on coronary angiography. Three-vessel coronary artery bypass graft surgery, MVR, and aortic valve replacement were planned for the patient.

Technique

Under general anesthesia and with orotracheal intubation, cardiopulmonary bypass was initiated after complete sternotomy and aortabicaval venous cannulation. Myocardial protection during cardioplegic arrest was achieved through the antegrade administration of cold-blood cardioplegic solution on induction, which was continued every 20 minutes by the retrograde route from the coronary sinus, in accordance with the hospital's protocol. A final warm-blood "hot shot" infusion through the retrograde route preceded release of the aortic cross-clamp.

In both patients, an interatrial groove approach was planned preoperatively. When the heart was positioned for the interatrial groove approach, however, the edges of the ASO were protruding toward the interatrial groove in both atria, more on the right atrial side (Fig. 1). This condition did not allowed sharp and blunt dissection from the anterior edge of the right atrium toward the interatrial groove. Thus, the team decided on a transatrial septal approach.

In the first case, the left atrium was reached by removing the ASO through right atriotomy. Mitral valve replacement (No. 27 mechanical mitral valve; St Jude Medical), tricuspid annuloplasty (No. 33 flexible ring; St Jude Medical), and monopolar radiofrequency ablation for atrial fibrillation (Cardioblate System; Medtronic Inc) were performed. In the second case, MVR (No. 27 biological mitral valve; St Jude Medical), aortic valve replacement (No. 23 biological aortic valve; St Jude Medical), and 3-vessel coronary artery bypass graft were performed. The ASDs were repaired using a pericardial patch in both patients.

The patients could not be separated from cardiopulmonary bypass because of prolonged cross-clamp (113 and 194 minutes, respectively) and cardiopulmonary bypass time (230 and 312 minutes, respectively). Intraaortic balloon pump and venoarterial extracorporeal membrane oxygenation were used to maintain hemodynamic stability. Both patients were successfully weaned from venoarterial extracorporeal membrane oxygenation and discharged from the hospital on the 66th and 28th postoperative days, respectively.

Abbreviations and Acronyms

ASD	atrial septal defect
ASO	Amplatzer septal occluder
EF	ejection fraction
IVC	inferior vena cava
LA	left atrium
MVR	mitral valve replacement
RA	right atrium
SVC	superior vena cava

Discussion

In both surgical cases in this report, the ASO was removed and a transatrial septal approach was used because the device impeded an interatrial groove approach. Concomitant surgical procedures with MVR, removal of the ASO, and closure of the ASD with a patch significantly prolonged the cross-clamp and cardiopulmonary bypass durations, which is the reason for intraoperative

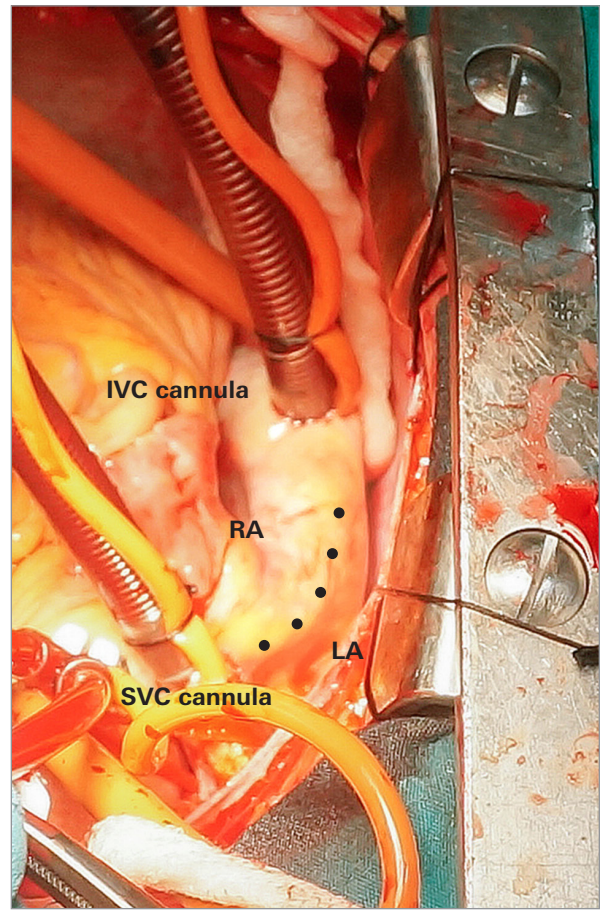

Fig. 1 Intraoperative photograph shows an Amplatzer septal occluder protruding toward the interatrial groove (dotted section).

IVC, inferior vena cava; LA, left atrium; RA, right atrium; SVC, superior vena cava.

low cardiac output syndrome. Furthermore, in the first case, patient age greater than 65 years and low EF (left ventricular EF <50%) were preoperative risk factors for low cardiac output syndrome. In the second case, low EF was a preoperative risk factor for low cardiac output syndrome.[4]

Amplatzer septal occluders have proven their reliability and efficiency in secundum ASD closure.[1] These devices come in 27 sizes[2]: 36-mm and 28-mm ASOs were implanted in the current patients, respectively. In the authors' experience, ASOs in these sizes placed in the interatrial septum project to both the right and left atrium (more to the right side) toward the interatrial groove (Fig. 1). Similar clinical situations may not be encountered in patients with smaller ASOs. To the authors' knowledge, no reports investigating the effect of ASO size on surgical approach have been published to date.

The interatrial groove is formed by a fold in the tissue between the right upper pulmonary vein and the venous sinus of the right atrium. For the interatrial groove approach, first, sharp and blunt dissection is used on the anterior edge of the right atrium, then an incision is made starting in front of the right superior pulmonary vein and extending parallel to the interatrial groove to reach the left atrium. If the left atrium diameter is small or there are intense adhesions resulting from a previous operation, the interatrial groove approach should not be used.[3] In the 2 patients in this report, the rigid structures of the ASOs and their location in the interatrial septum prevented the team performing the surgical maneuver described (Fig. 2). Studies have been published regarding removal of ASOs because of early and late complications,[5,6] but in these cases, the ASOs were removed because mitral valve surgery could not be performed from either an interatrial groove or transatrial septal approach, resulting in what may be a new indication for ASO removal.

Mitral valve surgery can be performed using minimally invasive or robot-assisted surgery as well as traditional techniques, with the interatrial groove approach being the only method for mitral valve repair in robot-assisted surgery.[7] Therefore, during preoperative planning for mitral valve surgery in patients with an ASO, surgeons should bear in mind that right atriotomy, ASO removal, and a transatrial septal approach may be needed. Imaging techniques (eg, cardiac computed tomography, cardiac magnetic resonance imaging) may be used to arrive at a decision regarding surgical approach. In addition, removing the ASO and closing the existed ASD with a patch extend the cross-clamping time, which may increase both mortality and morbidity.[8] Removing the ASO alone has not been shown to result in complications.

With respect to transatrial septal vs interatrial groove, the approaches are comparable, with operative time in favor of the interatrial groove approach. Dysrhythmias can be seen with the transatrial septal approach, but

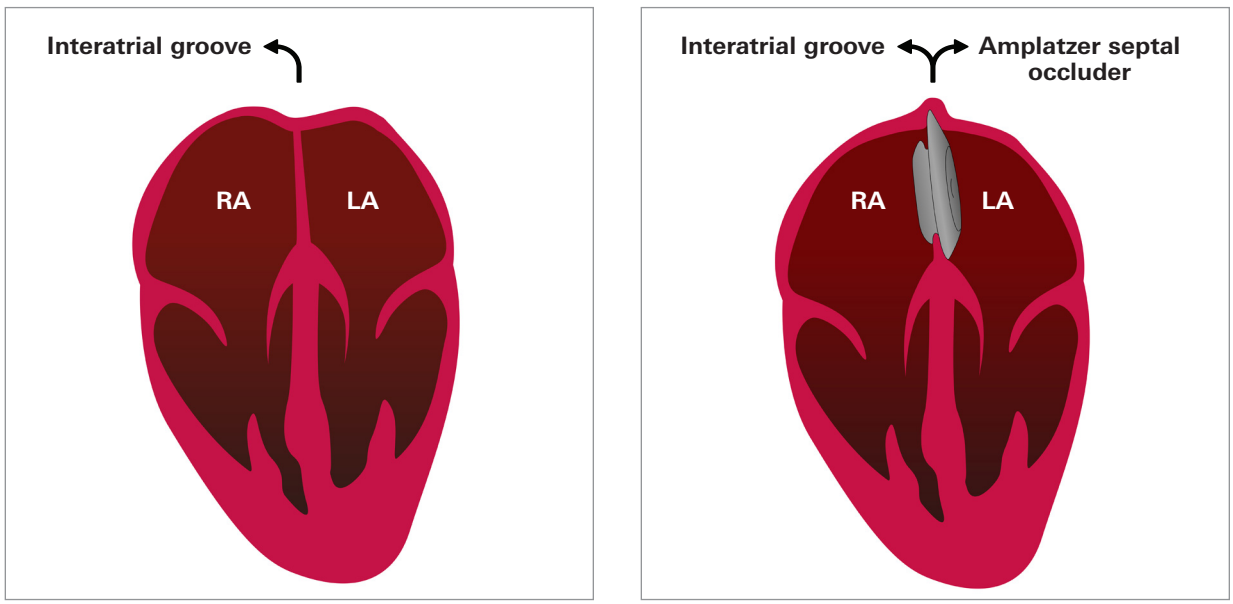

Fig. 2 Illustration shows **A**) the interatrial groove without an ASO and **B**) the ASO protruding toward the interatrial groove in the interatrial septum.

ASO, Amplatzer septal occluder; LA, left atrium; RA, right atrium.

most are transient. Overall, the transatrial septal approach presents a better view.[9] Ultimately, surgeons should decide on an approach on a case-by-case basis.

Based on the authors' experience with patients implanted with ASOs, the interatrial groove approach cannot be used for mitral valve surgery, and ASOs may need to be removed. This situation should be considered during preoperative preparation to better avoid a clinical scenario that will lead to morbidity and even mortality.

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