Echocardiographic visualization of laceration of atrial septum during balloon sizing of atrial septal defect

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Abstract Transcatheter closure of atrial septal defect (ASD) has become an accepted alternative to surgery. A number of complications associated with ASD device closure have been recognized but most are rare or minor in severity. We report a rare complication of atrial septal laceration during transcatheter closure of secundum ASD. We discuss the diagnostic confusion, which resulted in the decision for surgical correction.
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Case report

A 35-year-old-female was referred to our hospital with the diagnosis of secundum atrial septal defect (ASD) for device closure. She had intermittent palpitation for 3 months. Cardiac examination revealed fixed split second heart sound and an ejection murmur at the left upper sternal edge. The rest of the examination was within normal limit. Electrocardiogram showed normal sinus rhythm with incomplete right bundle branch block. Transthoracic and transesophageal echocardiography confirmed the diagnosis of a secundum ASD of 20-mm maximum diameter and adequate rim suitable for device closure. There was mild right-sided heart enlargement and elevated right ventricular systolic pressure (RVSP = 35 mmHg) with no additional associated cardiovascular abnormality (Fig. 1a). She was scheduled to undergo Amplatzer device occlusion of the defect under general anesthesia. Right-sided catheterization and angiography were performed according to a standard protocol. The assessment of the stretched diameter of the ASD was made with a Meditec sizing balloon. The stretched diameter was measured at 24–25 mm. During this part of the procedure the balloon passed from the left atrium to the right atrium with slight but not marked resistance. Following manipulation of the Meditec sizing balloon, two echo-dense linear structures were observed on transesophageal echocardiography extending from both edges of the ASD (Fig. 1b). The structures were highly mobile, extending toward the right atrial cavity and measuring approximately 20 mm in length (Fig. 2). Because of this observation, which was assumed to be a thrombus, the procedure was terminated and the patient was started on intravenous heparin infusion. A transthoracic echocardiography was repeated 12 h later, and showed the highly mobile linear structures to be longer and extending to the left atrium. Because of a perceived risk of systemic embolization, surgical exploration was deemed indicated.

At surgery, there was no detectable intracardiac thrombus. The linear structures represented edges of the lacerated atrial septum. The laceration
involved the superior and posterior aspects of the atrial septum. The secundum part of the atrial septum was torn and created a crescent like flap. The atrial septum was repaired and the ASD closed with autologous pericardium. The postoperative period was uneventful and postoperative transesophageal echocardiography showed no abnormal masses and no residual shunting.

Discussion

For many years, surgical closure was the only definite treatment for secundum ASD. The first non-surgical approach at closing an ASD was by King and colleagues in 1976 but was not widely adopted into clinical practice. The last decade, however, has witnessed the development of several devices for closure of secundum ASD. This approach has become accepted alternative to surgery, and the preferred method in selected patients. It has been shown to be safe and effective in the vast majority of patients. With increasing use of this technique, a number of complications have been recognized (Table 1). Because of continuous echocardiographic monitoring approximately 6–10% of patients are documented to have some sort of complication. These complications are either related to access site, the device used, or cardiac catheterization complications. Though these complications are uncommon some are serious and warrant urgent surgical intervention. To

![Figure 1](image1.png)

**Figure 1**  Transesophageal echocardiographic imaging of the atrial septal defect: (a) immediately prior to the procedure (black arrow) and (b) demonstrates the lacerated interatrial septum (white arrow) early during balloon sizing of transcatheter ASD device occlusion (ASD, atrial septal defect; LA, left atrium; RA, right atrium).

![Figure 2](image2.png)

**Figure 2**  Transesophageal echocardiographic imaging demonstrates the lacerated interatrial septum (arrows) approximately 10 min after balloon sizing of transcatheter ASD device occlusion (LA = left atrium, RA = right atrium, Lac IAS = lacerated interatrial septum).
Echocardiographic visualization of laceration of atrial septum

Table 1  Commonly reported complications of device closure of atrial septal defect

<table>
<thead>
<tr>
<th>Complications</th>
<th>Losay et al. (n = 44)</th>
<th>Chessa et al. (n = 417)</th>
<th>Chan et al. (n = 100)</th>
<th>Hijaji et al. (n = 75)</th>
<th>Sievert et al. (n = 200)</th>
<th>Du ZD et al. (n = 442)</th>
<th>Berger et al. (n = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient arrhythmia, %</td>
<td>9.0</td>
<td>2.6</td>
<td>1.3</td>
<td>1.3</td>
<td>&lt;1.0</td>
<td>3.4</td>
<td>4.9</td>
</tr>
<tr>
<td>Transient heart block, %</td>
<td></td>
<td>&lt;1.0</td>
<td>1.0</td>
<td>1.0</td>
<td></td>
<td>&lt;1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Atrial septal thrombosis, %</td>
<td></td>
<td>&lt;1.0</td>
<td>&lt;1.0</td>
<td>6.7</td>
<td>10.0</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Device malposition/embolization, %</td>
<td>4.5</td>
<td>3.5</td>
<td>1.0</td>
<td>2.6</td>
<td>10.0</td>
<td>&lt;1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Residual shunt ≥48 h, %</td>
<td>15.9</td>
<td></td>
<td>15.1</td>
<td>6.7</td>
<td>17.0</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Pericardial effusion, %</td>
<td>2.3</td>
<td>&lt;1.0</td>
<td>0.0</td>
<td>3.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Our knowledge atrial septal laceration has not been previously reported as a cause of morbidity. Sizing balloon manipulation or passing the guidewire through a small atrial septum fenestration was likely to have caused this injury. Other possible causes are over-stretching of the sizing balloon with too much contrast or manipulating the sizing balloon in ASD associated with aneurysmal atrial septum. The echocardiographic features were unfamiliar and non-specific and we could not exclude large intracardiac thrombosis. In retrospect we were unable to identify features, which with confidence, would have enabled us to differentiate between a septal flap and thrombus. With this uncertainty we believe the appropriate management was termination of the procedure and referral to surgery for identification of the problem and closure of the ASD. In the future three-dimensional echocardiography or intracardiac echo may better assist in differentiating laceration from thrombus formation on atrial septum.

References


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