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CASE REPORT

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Closure of an ascending aorta perforation during a transseptal puncture procedure: transcatheter closure with a muscular ventricular septal defect occluder

Yanbin Song[1†], Dawei Lin[2†], Xiaochun Zhang[2*] and Daxin Zhou[2*]

Abstract

Background Ascending aortic perforation is a rare complication of the transseptal puncture procedure that often requires emergency management.

Case presentation We report the case of a 53-year-old woman with severe mitral stenosis (MS) who underwent percutaneous balloon mitral valvuloplasty (PBMV). After the transseptal puncture procedure, a right atrium-iatrogenic ascending aortic perforation was observed. An 8-mm muscular ventricular septal defect (VSD) occluder was then successfully used for emergency closure.

Conclusion Percutaneous closure of ascending aortic perforations via a muscular VSD occluder is a feasible treatment approach.

Keywords Muscular VSD occluder, Aorta perforation, Transseptal puncture

Background

Transseptal puncture is a technique that is routinely performed during left atrial intervention. Aortic root perforation is one of the worst complications for which there are no safe and effective rescue measures, and patients must undergo surgery. Here, we report a case of transcatheter closure of an ascending aorta perforation via a muscular ventricular septal defect (VSD) occluder.

Case presentation

A 53-year-old female patient with atrial fibrillation (AF) was hospitalized due to a 2-year history of chest tightness and shortness of breath. She was diagnosed with heart failure upon admission. Echocardiography revealed significant mitral stenosis (MS; measuring 0.6 cm^2) with mild pulmonary hypertension (PH; pulmonary artery systolic pressure: 42 mmHg) and dilations in both atria (left atrium: 89 mm; right atrium: 70 mm). Percutaneous balloon mitral valvuloplasty (PBMV) was suggested, as the patient had no contraindications.

An atrial septal puncture system (Synaptic Medical, China) with an 18 G puncture needle was used for transseptal puncture. However, a guidewire was observed in

†Yanbin Song and Dawei Lin contributed equally to the study and share senior authorship.

*Correspondence:
Xiaochun Zhang
zhang.xiaochun1@zs-hospital.sh.cn
Daxin Zhou
Daxin_zhou@163.com
[1]Department of Cardiology, Wujin Hospital Affiliated With Jiangsu University, The Wujin Clinical College of Xuzhou Medical University, Changzhou City, Jiangsu Province, China
[2]Department of Cardiology, Zhongshan Hospital Affiliated With Fudan University, Shanghai, China

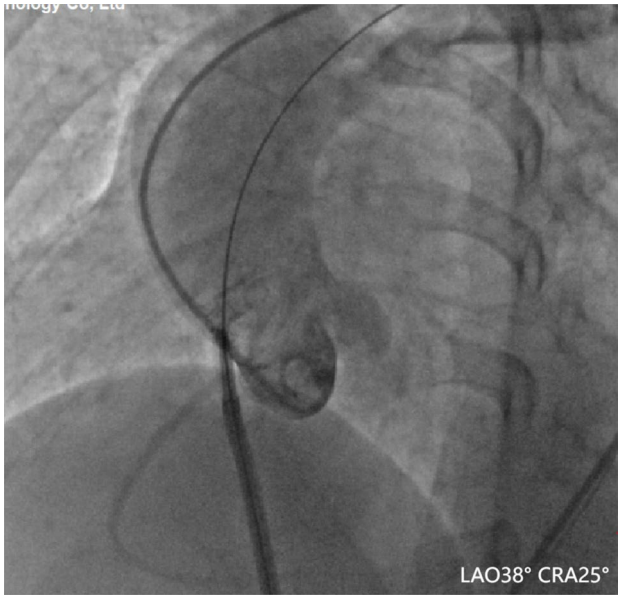

Fig. 1 X-ray image showing the Swartz sheath being advanced into the ascending aorta

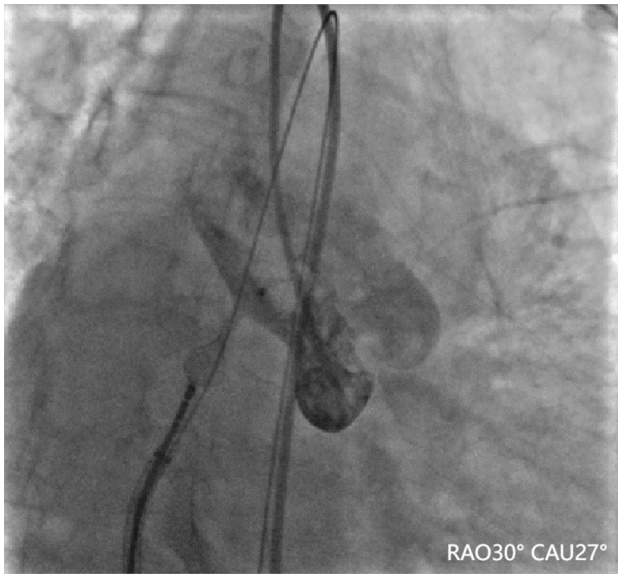

Fig. 2 The muscular VSD occluder was successfully deployed at the targeted position of the right atrium-ascending aorta perforation

the aorta after the puncture. Transthoracic echocardiography (TTE) and multiposition radiography indicated that the 8.5 F Swartz sheath catheter (Synaptic Medical, China) had crossed the ruptured aorta due to mistaken identification (Fig. 1). Considering the risk of cardiac tamponade, the procedure was immediately suspended. Fortunately, the patient's vital signs and consciousness were normal. No pericardial effusion was observed via echocardiography. Therefore, transcatheter closure was selected as the primary treatment option.

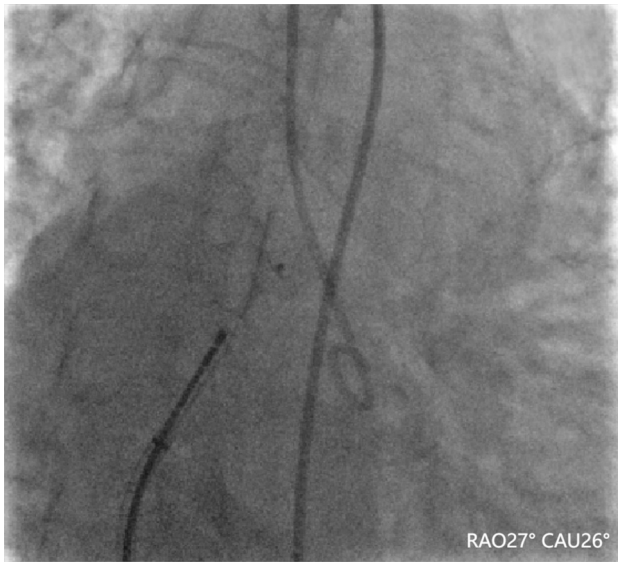

Fig. 3 A 260-cm J-tipped guide wire was then carefully withdrawn after confirmation of successful closure via X-ray

Considering the inherent advantages, as well as the perforation size and clinical experience, we selected an 8-mm muscular VSD occluder. An in vitro test was subsequently performed to confirm the feasibility of advancing an 8-mm muscular VSD occluder (Lifetech, China) with a 7 F sheath in the Swartz sheath with a J-tipped guidewire reserved for other emergency procedures. The muscular VSD occluder was successfully deployed to the perforation, between the right atrium and the ascending aorta (Fig. 2). Finally, the 260-cm J-tipped guidewire was easily withdrawn after successful closure, which was confirmed by radiography (Fig. 3). An aortogram obtained via a 6 F pigtail tube demonstrated that the right atrium-aortic perforation had been fully closed (Fig. 4). The second puncture, guided by TTE and multiposition radiography, was subsequently carried out by a more experienced physician and was successful. PBMV was successfully performed using a 3.0×40 mm balloon. The patient recovered well from the procedure and was discharged from the hospital three days later. The patient was followed for one month and reported no discomfort. No pericardial effusion was observed (Fig. 5).

Discussion

Transseptal puncture is a technique that is routinely performed in mitral valvuloplasty, catheter ablation for AF, and left atrial appendage closure. Complications associated with transseptal puncture occur in 1% of procedures. In one report of 3756 patients who underwent transseptal puncture procedures, only three aortic root perforations were observed [1]. Nevertheless, our case demonstrates that transseptal puncture guided by transthoracic ultrasound and radiography remains difficult,

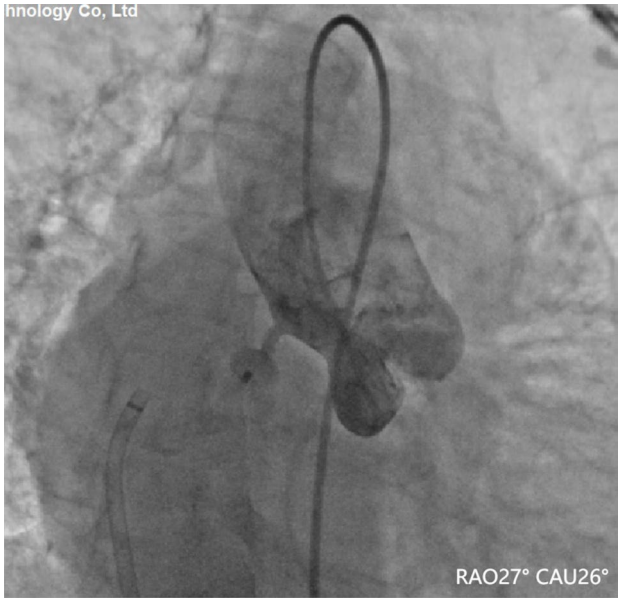

Fig. 4 Aortogram of the pigtail catheter showing that the right atrium-aorta perforation was closed

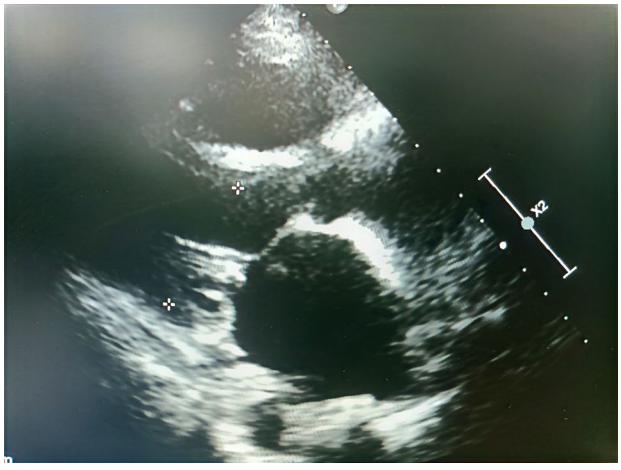

Fig. 5 TTE demonstrated no pericardial effusion during the follow-up

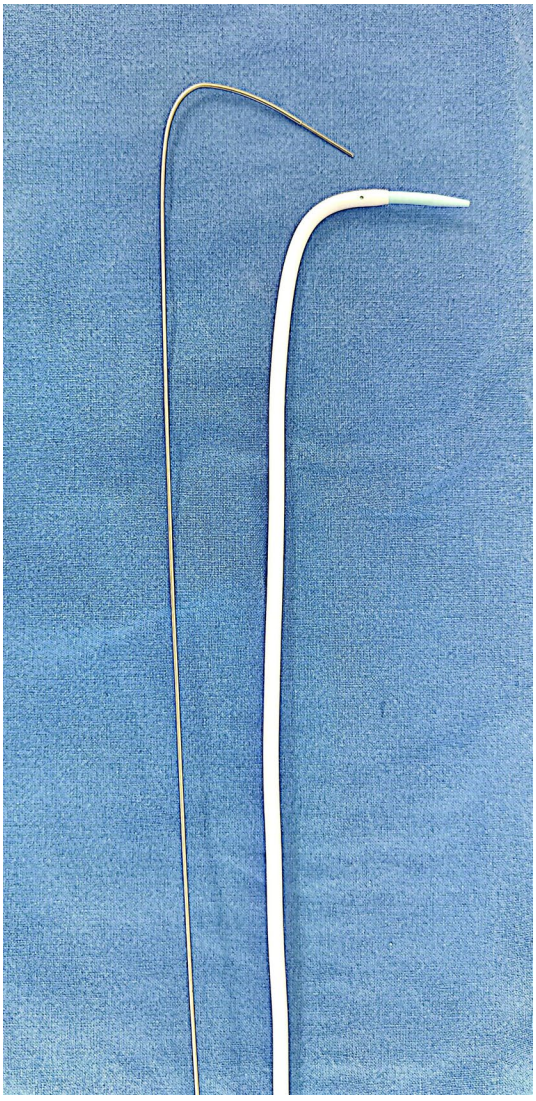

Fig. 6 The needle was reshaped to provide greater curvature in this case

owing to the unusual anatomy of the region. Intracardiac echocardiography-guided puncture can be performed to avoid serious complications during transseptal puncture procedures, particularly in patients with a large atrium or unusual anatomy [2]. If a patient has a large atrium, it is also necessary to reshape the needle to provide greater curvature (Fig. 6). The coronary sinus catheter and the pigtail catheter in the aortic root can also be used to guide transseptal puncture [3].

Cardiac tamponade may not occur if the sheath is not advanced, thus creating a much larger hole. Unfortunately, we did not perform pressure tracing and instead advanced the Swartz sheath into the ascending aorta, which was not prudent at that stage. Previous studies have shown that cardiac tamponade usually occurs immediately and requires surgical treatment [4]. However, percutaneous management may represent a feasible option in the case of hemodynamic stability. A previous report revealed that a similar perforation was closed via an Amplatzer™ duct occluder [5]. Considering the inherent advantages of the muscular VSD occluder for defects > 6 mm and < 3 mm in size [6], as well as the perforation size and physician clinical experience, the VSD occluder may better fit the ascending aorta perforation than the Amplatzer™ duct occluder does. Therefore, we selected an 8-mm muscular VSD occluder. An in vitro test revealed that an 8-mm muscular VSD occluder could be used for right atrium-iatrogenic ascending aortic perforation through an 8.5 F (2.8 mm) Swartz sheath. During the observation period, we found that this percutaneous strategy was viable and effective. Reversal of heparinization with protamine sulfate is unnecessary if there is no

evidence of active bleeding [5]. In our case, this measure was not considered.

Percutaneous closure of ascending aortic perforations via a muscular VSD occluder is a viable treatment approach. Our case highlights the fact that timely evaluation and effective intervention are crucial for avoiding adverse outcomes.

Abbreviations

MS	Mitral stenosis
PBMV	Percutaneous balloon mitral valvuloplasty
AF	Atrial fibrillation
PH	Pulmonary hypertension
VSD	Ventricular septal defect

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Not applicable.

Author contributions
Yanbin Song and Dawei Lin contributed to data collection and drafted the manuscript. Xiaochun Zhang and Daxin Zhou revised the manuscript. All the authors have read and approved this final manuscript.

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Data availability
The data and materials can be obtained from the authors upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was performed according to the guidelines of the Declaration of Helsinki. The study was approved by the Ethics Committee of Wujin Hospital Affiliated with Jiangsu University (2023-SR-055). The patient provided written informed consent.

Consent for publication
The patient provided written informed consent for the publication of her personal and clinical details along with any identifying images in this study.

Clinical trial number
Not applicable.

Competing interests
The authors declare no competing interests.

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