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CASE REPORT

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Right ventricular free wall perforation during pericardiocentesis, and an inappropriate device selection for percutaneous treatment

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Abstract

Right ventricular (RV) perforation is a rare but life-threatening complication of pericardiocentesis and is usually treated surgically. We presented a case of RV free wall perforation, which occurred during pericardiocentesis and tried to be closed percutaneously with the Amplatzer vascular plug-III (AVP-III) device. The occluder device sealed the perforation, but it was in an insecure position; therefore, the patient underwent surgical repair. As an AVP-III device, with a middle disk thicker than the RV myocardium, it may cause the RV myocardium to stretch outwards, so it should not be used for the treatment of RV perforation by the transcatheter way.

KEYWORDS

Amplatzer vascular plug III, pericardiocentesis, ventricular perforation

1 | INTRODUCTION

Right ventricular (RV) perforation is a rare but life-threatening complication of pericardiocentesis and is usually treated surgically.[1] There are also iatrogenic cases of cardiac rupture repaired by percutaneous closure devices. Here, we present a case showing an unusual complication of transcatheter treatment of the RV rupture due to the inappropriate device selection.

2 | CASE REPORT

A 45-years-old male patient was admitted to the emergency department with dyspnea, cough, and palpitation complaints. He has been followed with a lung cancer diagnosis for 2 years, and a pericardial window opened 6 months ago due to cardiac tamponade. At presentation, he was hypotensive and had sinus tachycardia. Pericardial shadow was found to be increased on the chest radiograph, and transthoracic echocardiography (TTE) was performed. TTE showed a massive pericardial effusion causing the diastolic collapse in the RV and right atrium. Emergency pericardiocentesis was planned, and a 6-French (6-Fr) sheath was advanced into the pericardial space via a subxiphoid puncture under TTE and fluoroscopy guidance. Three hundred and fifty milliliters of fluid with serous property were aspirated, and the patient was taken to the coronary intensive care unit for slow drainage of the pericardial fluid. The pericardial drainage changed about its property and turned to a hemorrhagic character after 18 h. TTE revealed fibrin-containing pericardial effusion surrounding the heart. Aspirating the pericardial fluid was tried but failed since the 6-Fr drainage catheter was clogged. Computed tomography (CT) was performed, and the 6-Fr sheath was found to penetrate the RV myocardium (Figure 1A).

RV free wall may have been punctured due to inadvertent pushing of the 6-Fr sheath during pericardial fluid drainage. A 36-gauge needle was placed immediately from the subxiphoid region for rescue pericardiocentesis, and the hemorrhagic pericardial fluid was evacuated. After that, we have decided to close the RV free wall perforation percutaneously due to the high risk of open surgery. At that time, only the Amplatzer vascular plug-III (AVP-III) device was available in our center due to the pandemic condition. A 0.032-in. wire was advanced through the 6-Fr sheath

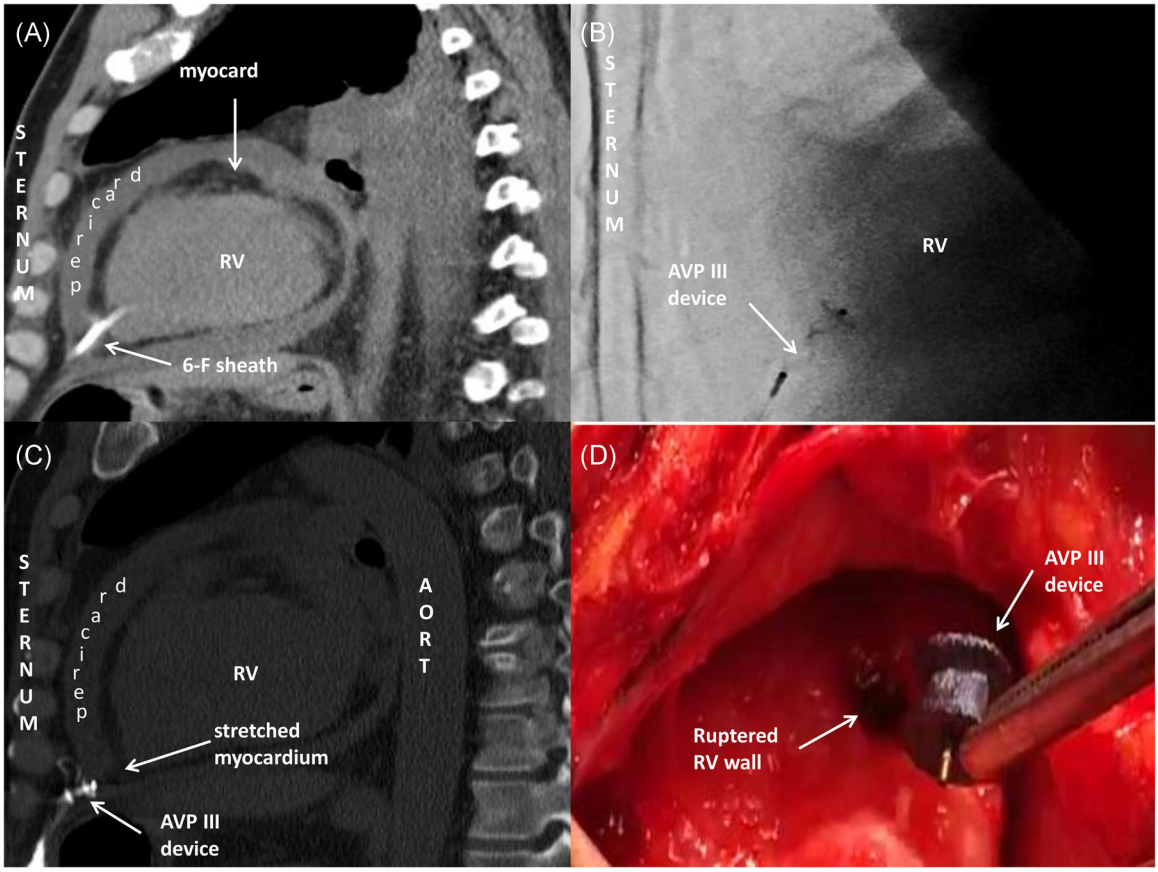

FIGURE 1 (A) Computerized tomography in the sagittal plane, showing the penetration of the 6-Fr sheath to the right ventricular (RV) myocardium. (B) 180° lateral fluoroscopic window, demonstrating the position of the Amplatzer vascular plug-III (AVP-III) device on the RV free wall. (C) Computed tomography in the sagittal plane indicating how the AVP-III device stretched the RV myocardium outwards. (D) Intraoperative imaging revealing ruptured RV free wall and dislocated AVP-III device

to the pulmonary artery, and a 6-Fr multi-purpose (MP) catheter was deployed over the 0.032-in. wire into the RV. After that, the 6-Fr sheath was removed, and the 6 mm AVP-III device was deployed into the RV through the MP catheter. The distal disk of the device opened in the RV; then, the entire system was withdrawn until resistance was felt. Finally, the proximal disc was released, considering that it was in the appropriate position under the guidance of fluoroscopy and TTE (Figure 1B and Video S1). We could not check the device's location angiographically due to the lack of opaque delivery through the 6 Fr MP catheter. After the procedure, the patient was clinically stable, and no more fluid accumulation was detected with TTE. On the second day, CT was performed to check the device location. CT revealed that the device sealed the ruptured RV free wall, but in an insecure position. The AVP-III device was pulling the RV free wall downward, towards the parietal pericardium (Figure 1C). The patient was referred for emergent surgical repair as the device may lead to laceration of the RV free wall during the heart's cyclical movement. During the surgery, the device was removed, and the ruptured RV free wall was repaired with biological glue and primary suture (Figure 1D).

3 | DISCUSSION

Pericardiocentesis is a widely used procedure for diagnosing or treating massive pericardial effusion and a life-saving procedure, especially in cardiac tamponade situations.[2] Although pericardiocentesis is usually performed under TTE or fluoroscopy guidance, it still carries the risk of complications. The overall major complication rate of pericardiocentesis is 3%, and iatrogenic ventricular rupture occurs in 1% of the procedures.[3] Surgical exploration and primary repair is generally known as the first choice for these major complications; however, surgery can not be an appropriate option in some high-risk cases. There are several cases in the literature in which iatrogenic cardiac perforations were closed by percutaneous closure devices. Stolt et al.[4] reported a whole series of five patients occurred iatrogenic cardiac perforations. All of these cases were successfully repaired with the Amplatzer Septal Occluder device. Similarly, RV rupture developed during pericardiocentesis was closed with an Amplatzer duct occluder II device.[5] Alternatively, acute RV free wall perforation during pericardiocentesis was successfully plugged with the Angio-Seal vascular closure device.[6] In the present case, we used

the AVP-III device for the first time in the literature to close the iatrogenic RV free wall rupture. However, the patient underwent surgical repair due to the unsafe location of the device. This complication may be explained as follows: The device may have caused the RV myocardium to stretch outwards as the AVP-III device's middle disk was thicker than the RV free wall. The device may not have been adequately supported by the elongated, relatively thinner RV free wall myocardium. Therefore, the device may have shifted downwards due to the RV myocardium's excessive traction during the cyclic movement of the heart.

4 | CONCLUSION

We recommend that the AVP-III device, with a middle disk thicker than the RV myocardium, should not be used for the treatment of RV perforation by the transcatheter way.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

ETHICS STATEMENT

Written and oral informed consent was taken from the patient.

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REFERENCES

1. Imazio M, Adler Y. Management of pericardial effusion. *Eur Heart J*. 2013;34:1186-1197.
2. Hsu LF, Scavée C, Jaïs P, Hocini M, Haïssaguerre M. Transcardiac pericardiocentesis: an emergency life-saving technique for cardiac tamponade. *J Cardiovasc Electrophysiol*. 2003;14:1001-1003.
3. Tsang TS, Freeman WK, Barnes ME, Reeder GS, Packer DL, Seward JB. Rescue echocardiographically guided pericardiocentesis for cardiac perforation complicating catheter-based procedures. The Mayo Clinic experience. *J Am Coll Cardiol*. 1998;32:1345-1350.
4. Valérie S, Cook S, Räber L, et al. Amplatzer Septal Occluder to treat iatrogenic cardiac perforations. *Catheter Cardiovasc Interv*. 2012;79(2):263-70.
5. Saxena A, Karmakar S, Narang R. Successful percutaneous device closure of right ventricular perforation during pericardiocentesis. *JACC Cardiovasc Interv*. 2016;9(22):e221-e222.
6. Petrov I, Dimitrov C. Closing of a right ventricle perforation with a vascular closure device. *Catheter Cardiovasc Interv*. 2009;74(2):247-250.

SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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