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Iatrogenic aorto-right ventricular fistula after transcatheter pulmonary valvuloplasty

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### Iatrogenic aorto-right ventricular fistula after transcatheter pulmonary valvuloplasty

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**Abstract**

We present an adult case of iatrogenic aorto-right ventricular fistula that developed after percutaneous transcatheter pulmonary valvuloplasty for pulmonary valve stenosis using Mustang® (Boston Scientific, Marlborough, MA, USA) double balloons following definitive repair of double outlet right ventricle. At outpatient follow-up, an abnormal shunt between the aortic root and the right ventricular outflow tract was detected by echocardiography and enhanced computed tomography. The ratio of pulmonic to systemic blood flow was measured at 1.64 by cardiac catheterization. We successfully performed patch closure of the aorto-right ventricular fistula, concomitant with pulmonary valve replacement and tricuspid valvuloplasty.

**Keywords:** Aorto-right ventricular fistula, iatrogenic, pulmonary valve stenosis, percutaneous transcatheter pulmonary valvuloplasty

## Introduction

An aorto-right ventricular (RV) fistula is a rare but clinically significant cardiovascular disease that can lead to hemodynamic compromise and heart failure. This abnormal communication between the aorta and the RV can arise from various etiologies, including penetrating or blunt trauma [1], congenital malformations [2], infective endocarditis with aortic root abscess formation [3], and iatrogenic factors [4–6]. Among these, iatrogenic aorto-RV fistulas have gained increasing clinical attention due to the expanding surgical [4] and transcatheter [5, 6] aortic valve interventions, where mechanical injury to the interventricular septum or aortic root can result in abnormal communication. Recently, transcatheter aortic valve implantation (TAVI) has emerged as a significant cause of aorto-RV fistulas, typically due to oversizing of the prosthetic valve, excessive deployment force, or pre-existing septal calcification [5, 6]. While aorto-RV fistulas following aortic valve interventions are well documented, their occurrence after pulmonary valve interventions is exceptionally rare. We herein present a rare case of iatrogenic aorto-RV fistula following percutaneous transcatheter pulmonary valvuloplasty (PTPV) in an adult with postoperative congenital heart disease, highlighting the potential for this unexpected complication of PTPV.

Case Report

We report the case of a 33-year-old woman (weight, 46.7 kg) with double outlet right ventricle (tetralogy of Fallot type), bilateral superior vena cava, and trisomy 21. She underwent intraventricular tunnel repair using both the pulmonary and tricuspid valve annuli at 1 year of age. At 9, 10, and 21 years of age, she underwent percutaneous transcatheter balloon pulmonary angioplasty (PTPA) for supra-valvular pulmonary stenosis (SVPS) and PTPV for valvular pulmonary stenosis (VPS) using Tyshak II® (NuMED, Hopkinton, NY, USA) double balloons. At 33 years of age, she underwent PTPA for SVPS and PTPV for VPS (pulmonary valve annulus, 16 mm) using Mustang® (Boston Scientific, Marlborough, MA, USA) double balloons (12 mm in diameter, inflated at 14 atm × 1 min × 3 times). One month after the procedure, outpatient follow-up revealed a significant increase in brain natriuretic peptide (BNP), rising from 26.5 to 189.8 pg/ml. Moreover, echocardiography and enhanced computed tomography detected an abnormal shunt between the aortic root and the RV outflow tract (Fig. 1). Follow-up cardiac catheterization (2 months after the procedure) confirmed the presence of an aorto-RV fistula, with the ratio of pulmonic to systemic blood flow of 1.64. In addition, central venous pressure elevated from 7 to 13 mmHg, and RV end-diastolic volume (RV end-diastolic volume index) increased from 88.8 (69.9) to 120.7 ml (95.0 ml/m²). The systolic

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6 pressure of the RV and the pullout pressure gradient between the RV and the main  
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9 pulmonary artery changed from 50 and 27 mmHg (pre-PTPV) to 50 and 8 mmHg (2  
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12 months after PTPV), respectively. Mild tricuspid regurgitation (TR) had progressed to  
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15 moderate.

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18 The patient was placed on cardiopulmonary bypass using peripheral femoral-to-  
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21 femoral cannulation. After achieving cardiac arrest without difficulty, tricuspid  
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24 valvuloplasty was initially performed through a right atriotomy, consisting of antero-  
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27 septal commissural annuloplasty to address the TR. Subsequent exploration through a  
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30 right ventriculotomy revealed the aorto-RV fistula, located adjacent to the superior  
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33 margin of the previously placed expanded polytetrafluoroethylene (ePTFE) patch used  
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36 for rerouting the interventricular communication. The fistulous communication was  
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39 successfully closed using a 0.4-mm ePTFE patch with interrupted sutures. Following  
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42 fistula repair, pulmonary valve replacement was performed using a 25-mm Mosaic  
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45 bioprosthesis valve (Medtronic Inc., Minneapolis MN), and the RV outflow tract was  
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48 also reconstructed using bovine pericardium to ensure adequate hemodynamics. The  
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51 patient was successfully weaned from cardiopulmonary bypass with stable  
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54 hemodynamics. The postoperative course was uneventful. After a 4-day stay in the  
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57 intensive care unit, the patient was discharged home on 17th postoperative day without  
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major complications.

The patient has been regularly followed at the outpatient clinic. The most recent echocardiography, performed 12 months after the procedure, showed no residual aorto-RV fistula and favorable RV function with good pulmonary valve competence and mild TR. The latest plasma level of BNP was 27.9 pg/mL.

**Discussion**

Iatrogenic aorto-RV fistula has been previously described in the literature as a relatively uncommon complication of cardiovascular interventions. Most cases of iatrogenic aorto-RV fistula have occurred following surgical [4] or transcatheter [5, 6] aortic valve implantation, where the proximity to the aortic root and interventricular septum predisposes to this complication. In contrast, most iatrogenic aortopulmonary fistulas have been associated with PTPV [7] and transcatheter pulmonary valve implantation (TPVI) [8], reflecting the anatomical relationship between the pulmonary artery and the aorta. However, iatrogenic aorto-RV fistula following PTPV has not been previously reported, making this case unique in the literature.

The temporal relationship between fistula formation and clinical manifestation is highly variable, ranging from immediate recognition during the procedure to delayed

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6 presentation months or even years later. The clinical presentation of an aorto-RV fistula  
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9 depends on the degree of left-to-right shunt and the underlying cardiac function. Small  
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12 shunts may remain asymptomatic and be detected incidentally during routine follow-up  
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15 imaging, while larger communications can lead to progressive RV volume overload,  
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18 elevated pulmonary arterial pressure, and eventually right heart failure. In the present case,  
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21 the aorto-RV fistula was detected during routine follow-up due to an elevated plasma  
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24 BNP level and was deemed to required intervention based on objective hemodynamic  
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27 parameters: a pulmonary-to-systemic blood flow ratio of 1.64, elevated central venous  
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30 pressure, increased RV end-diastolic volume, and progressive TR.  
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33 The technical aspects of this case warrant particular attention regarding the balloon  
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36 selection for PTPV. In the present case, low-pressure balloon (Tyshak II) was initially  
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39 utilized but yielded insufficient therapeutic effect for the stenotic RV outflow tract.  
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42 Consequently, a high-pressure balloon (Mustang) was employed to achieve adequate  
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45 dilatation, which resulted in the development of an iatrogenic aorto-RV fistula.  
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48 Intraoperative findings revealed that the fistula was located adjacent to the previous  
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51 ePTFE patch, which had sclerosed with progressive fibrosis over more than 30 years since  
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54 the initial corrective repair.  
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57 Although the exact mechanism of iatrogenic aorto-RV fistula formation in the  
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present case remains unclear, several factors are likely to contribute to this complication. One proposed mechanism in TAVI-related aorto-RV fistulas involves mechanical trauma from the displacement of heavily calcified tissue during valve deployment [6]. We hypothesize that a similar mechanism occurred in the present case: high-pressure balloon inflation may have caused rupture of the tissue adjacent to the chronically sclerosed ePTFE patch (without evidence of calcification on computed tomography), creating an abnormal communication between the aorta and the RV. This suggests that the combination of high-pressure balloon dilation and the presence of calcified or fibrotic patch near the intervention site may predisposed to aorto-RV fistula formation. If such complications can occur after PTPV using high-pressure balloons, similar risks may exist with TPVI, particularly when sclerosed or calcified patches are located near the pulmonary valve annulus.

The management approach for aorto-RV fistulas has evolved in recent years. Transcatheter closure techniques using occluder devices have been attempted with promising short- and intermediate-term results, offering a less invasive alternative to surgical repair [4, 5]. In the present case, a completely percutaneous approach might have theoretically included transcatheter closure of the fistula using an occluder device combined with TPVI. However, balloon dilation during TPVI could have forcibly

enlarged the fistula and worsened the defect. Therefore, we opted for surgical repair of the aorto-RV fistula, concomitant with pulmonary valve replacement and tricuspid valvuloplasty.

This case highlights the importance of careful consideration of balloon selection and inflation pressure during PTPV, particular in patients with previous cardiac surgery. Furthermore, it emphasized that the need for vigilant follow-up after transcatheter procedures to detect potential delayed complications such as fistula formation.

#### **Declaration of conflicting interests**

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References

1. Theron JP, Du Theron H, Long M, Marx JD. Late presentation of aorto-right ventricular fistula and associated aortic regurgitation following penetrating chest trauma. *Cardiovasc J Afr.* 2009;20:357-9.

2. Rad EM, Hijazi ZM, Pouraliakbar H, Mirzaaghayan MR, Zamani H. Congenital aorto-cardiac connections (CACC) revisited: Introduction of a novel anatomic-therapeutic classification. *Pediatr Cardiol.* 2021;42:1459-77.

3. Carvalho G, Bestetti RB, Godoy M, Culy P, Leme Neto AC. Aorta-right ventricle fistula. An unexpected complication of bacterial endocarditis. *Arq Bras Cardiol.* 2005;85:346-7.

4. Lebreiro AM, Silva JC. Transcatheter closure of an iatrogenic aorto-right ventricular fistula. *Catheter Cardiovasc Interv.* 2012;79:448-52.

5. Alabbady AM, Sattur S, Bauch TD, Harjai KJ. Aorto-right ventricular fistula and paravalvular leak after transcatheter aortic valve implantation. *JACC Case Rep.* 2019;1:859-64.

6. Shakoor MT, Islam AM, Ayub S. Acquired aorto-right ventricular fistula following transcatheter aortic valve replacement. *Case Rep Cardiol.* 2015;2015:608539.

7. Vida VL, Biffanti R, Stellin G, Milanesi O. Iatrogenic aortopulmonary fistula

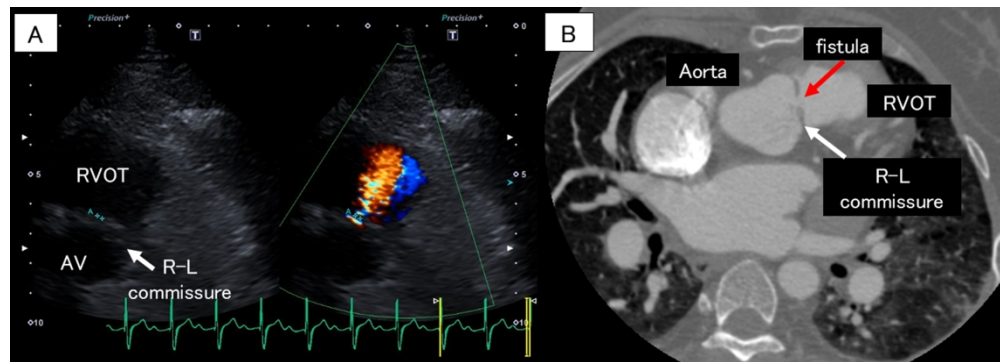
occurring after pulmonary artery balloon angioplasty: A word of caution. *Pediatr Cardiol.* 2013;34:1267-8.

8. Kenny D, Holoshitz N, Turner D, Hijazi ZM. Aortopulmonary fistula after transcatheter pulmonary valve replacement. *Circ Cardiovasc Interv.* 2013;6:e67-8.

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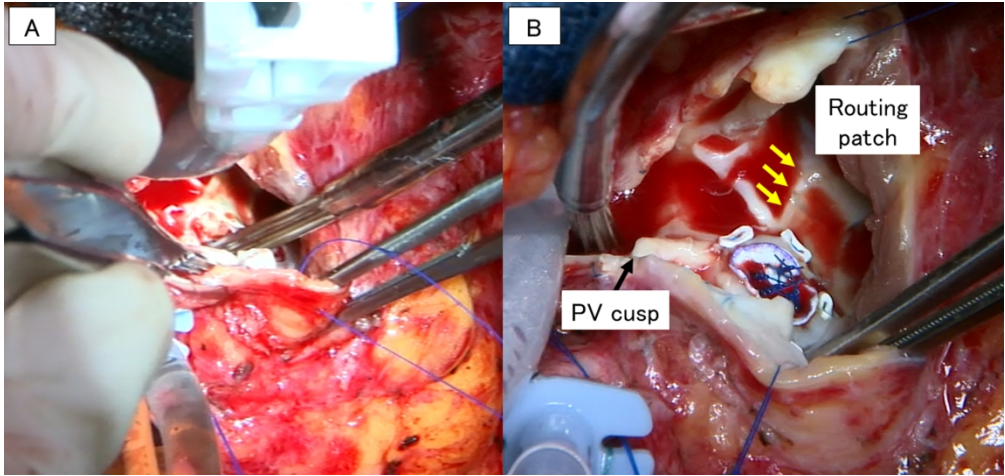
**Figure Legends**

1. Preoperative echocardiography (short-axis view) (A) and enhanced computed tomography (B) demonstrated that the aorto-right ventricular fistula was located adjacent to the right-left commissure. AV: aortic valve, L: left, R: right, RVOT: right ventricular outflow tract.
2. Intraoperative photograph. The aorto-right ventricular fistula, into which the metal tip of the suction tube was inserted, was identified just below the right dorsal cusp of the pulmonary valve via right ventriculotomy (A). The 0.4 mm expanded polytetrafluoroethylene patch used to close the fistula was adjacent to the previous sclerosed patch (B). PV: pulmonary valve.



Preoperative echocardiography (short-axis view) (A) and enhanced computed tomography (B) demonstrated that the aorto-right ventricular fistula was located adjacent to the right-left commissure. AV: aortic valve, L: left, R: right, RVOT: right ventricular outflow tract.

337x120mm (300 x 300 DPI)



Intraoperative photograph. The aorto-right ventricular fistula, into which the metal tip of the suction tube was inserted, was identified just below the right dorsal cusp of the pulmonary valve via right ventriculotomy (A). The 0.4 mm expanded polytetrafluoroethylene patch used to close the fistula was adjacent to the previous sclerosed patch (B). PV: pulmonary valve.

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