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CASE REPORT
Congenital heart disease

Percutaneous closure of an uncommon aortic pseudoaneurysm after arterial switch repair: a case report

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Background The development of an aortic pseudoaneurysm is a rather rare but potentially fatal complication after cardiac surgery for aortic valve and aorta disease. If a pseudoaneurysm is left untreated, it carries a substantial risk of rupture, thrombosis with subsequently systemic embolization, and compression of the surrounding structures.

Case summary We describe a case of a transcatheter repair of a more complex and uncommon pseudoaneurysm following aortic valve replacement in a patient with a history of arterial switch repair for transposition of the great arteries. The pseudoaneurysm originated from the aortic wall and connected to the left ventricular outflow tract (LVOT). The connection to LVOT was closed with a duct occluder, the neck to the aortic wall with an atrial septal defect occluder. After 1 month, the complete pseudoaneurysm was successfully thrombosed.

Discussion Percutaneous closure of a complex pseudoaneurysm after arterial switch repair is feasible and safe. However, lifelong follow-up is needed to determine the late results after transcatheter interventions.

Keywords Arterial switch • Pseudoaneurysm • Occluder • Interventional • Case report

Learning points

- Pseudoaneurysm after surgical intervention in congenital heart disease is not that uncommon.
- Transcatheter techniques might solve complications in a safe and efficient way.

Introduction

The development of an aortic pseudoaneurysm is a rather rare but potentially fatal complication after cardiac surgery for aortic valve and aorta disease. If a pseudoaneurysm is left untreated, it carries a substantial risk of rupture, thrombosis with subsequently systemic embolization, and compression of the surrounding structures.[1]

Surgical repair is one choice of treatment, however, the mortality rate ranges from 7% to 41%.[1,2] The high risk is mainly related to the consequences of redo-surgery. Hence, for these patients, percutaneous closure of the pseudoaneurysm appears an attractive alternative.

We describe a case of a transcatheter repair of a more complex and uncommon pseudoaneurysm following aortic valve replacement in a patient with a history of arterial switch repair for transposition of the great arteries.

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Timeline

0–1 year	Born with concordant atrioventricular connection and discordant ventriculo-arterial connection and ventricular septal defect
	Arterial switch operation and ventricular septal defect closure
1–2 years	Complete atrioventricular block
	Epicardial pacemaker implantation
2–17 years	Progressive aortic valve regurgitation
	Homograft implantation in the left ventricular outflow tract
18 years	Development of growing pseudoaneurysm
	Percutaneous closure of pseudoaneurysm
	Complete closure of pseudoaneurysm

Case presentation

We present an 18-year-old man with a history of transposition of the great arteries for which an arterial switch operation and a transpulmonary closure of an associated ventricular septal defect were performed shortly after birth. One year later, a pacemaker and epicardial leads were implanted because of a third-degree atrioventricular block. Despite not present in the first years after surgery, he developed progressive regurgitation of the neoaortic valve and consequently left ventricular dilatation. Aortic valve replacement with a decellularized homograft at the age of 17 years was performed. Follow-up transthoracic echocardiography at 5 months after the procedure detected an additional structure at the aortic root, raising the suspicion of a post-operative pseudoaneurysm. Computed tomography (CT) angiography confirmed the presence of a large pseudoaneurysm, measuring 4.5 × 1.8 × 2.5 cm, arising from the right side of the aortic root (*Figure 1*). The neck of the entry at the aortic site was measured 4 × 4 mm on CT.

This asymptomatic pseudoaneurysm was considered to be a post-operative sequelae and after revision of the post-operative echocardiogram at discharge retained as a pure incidental finding. Endocarditis was excluded by laboratory analyses, negative blood cultures, and exclusion of vegetations on transoesophageal echocardiography. It was hypothesized that the orifice of the pseudoaneurysm occurred first in the ascending aorta and that in a second time the pseudoaneurysm re-entered in the left ventricular outflow tract (LVOT).

Given its size, it was decided that repair was warranted. Because surgical reintervention was not preferred, transcatheter closure under general anaesthesia and fluoroscopic guidance was attempted. During the procedure, the patient was anticoagulated with intravenous heparin aimed at an activated clotting time above 250 ms.

Angiography in the ascending aorta revealed the ostium of a sizable pseudoaneurysm with an additional fistula of 4.6 × 3.4 mm in diameter between the pseudoaneurysm and the LVOT (*Figure 2*). In a next step, the aortic orifice of the pseudoaneurysm was reached through a right guiding coronary catheter and subsequently, this fistula to the LVOT was approached via the pseudoaneurysm with a Progreat micro-catheter (Progreat® Microcatheter, Terumo). Then, the fistula between the pseudoaneurysm and the LVOT was closed

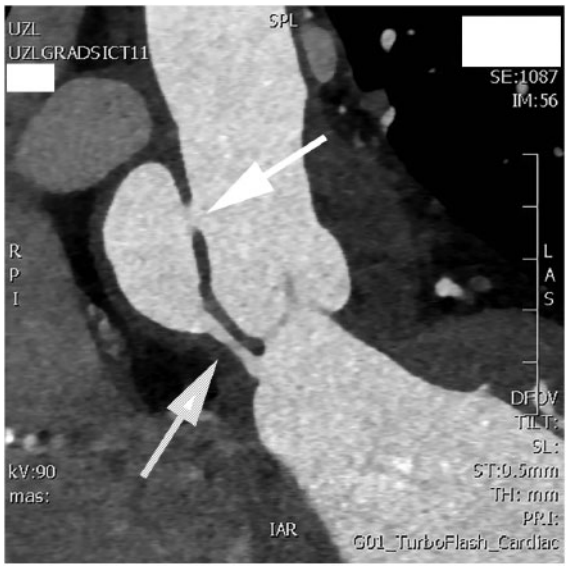

Figure 1 Contrast computed tomography demonstrating large pseudoaneurysm of the aortic root with entry above the right coronary artery (white arrow) and fistula originating from the base of this pseudoaneurysm, connecting with the left ventricular outflow tract (speckled arrow).

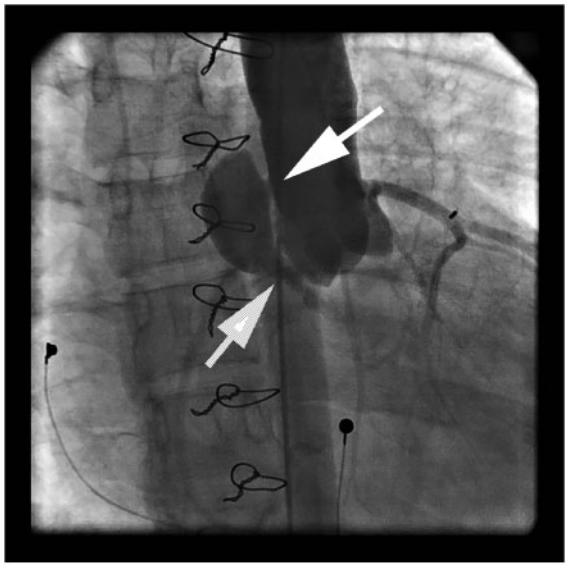

Figure 2 Aortography confirming presence of a large pseudoaneurysm of the aortic root with entry above the right coronary artery (white arrow) and fistula originating from the base of this pseudoaneurysm, connecting with the left ventricular outflow tract (speckled arrow).

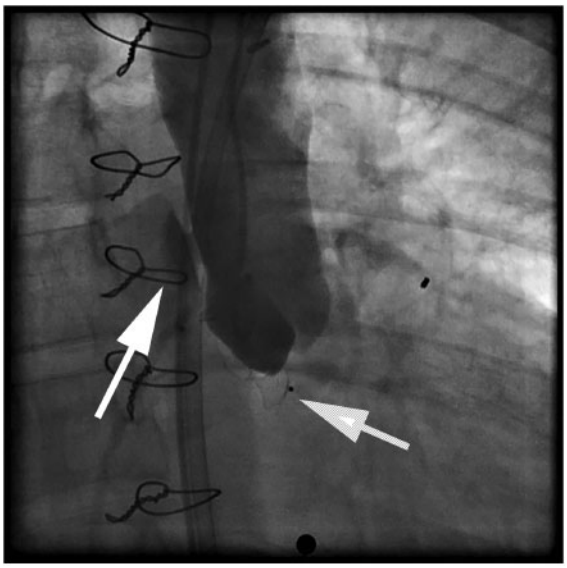

Figure 3 Aortography confirming stable position the two occluders devices: the duct occluder in the fistula connecting the pseudoaneurysm with the left ventricular outflow tract (speckled arrow). The atrial septal defect device is positioned in the neck of the pseudoaneurysm at the aortic root (white arrow). No interference with the right coronary artery is documented.

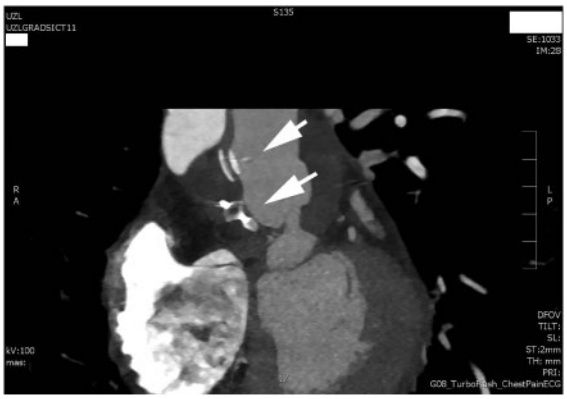

Figure 4 Contrast computed tomography demonstrating a complete occlusion of the pseudoaneurysm and a stable position of the two occluder devices (white arrows) 1 month after the procedure.

by a duct occluder (Amplatzer Duct Occluder II 9-PDA2-05-06, Abbott) with a disc size of 11 mm and waist of 5 mm. Subsequently, the aortic orifice of the pseudoaneurysm was closed using a 6 mm (waist) atrial septal defect (ASD) device (Figulla Flex II ASD device 29ASD06, Occlutech). We intended to close both entrances to be sure that no reintervention would be needed, as in our experience in previous cases it was noted that when only one orifice is closed, the residual pseudoaneurysm is continued to be fed by the second orifice. Control angiography demonstrated two well-positioned devices without contrast extravasation. Furthermore, the coronary arteries were free from compression, considering the close proximity of the ASD occluder to the right coronary artery (*Figure 3*).

The post-procedural course was uneventful, the patient was discharged the day after. No oral anticoagulation nor antiplatelet therapy was initiated as this might interfere with thrombus formation within the occluded pseudoaneurysm; also, the high-flow state over the LVOT and the ascending aorta contains no indication for systematic antiplatelet therapy. A CT scan after 1 month showed no residual contrast flow in the pseudoaneurysm (*Figure 4*).

At follow after 6 months, patient revealed no symptoms and could undertake all normal daily activities. Transthoracic echocardiography showed a good function of the aortic homograft and a complete occlusion of the pseudoaneurysm. The left ventricular cavity remained only slightly dilated however with preserved ejection fraction and without any clinical nor echocardiographic signs of heart failure. Treatment with a low-dose beta-blocker and angiotensin-converting enzyme-inhibitor was continued.

Discussion

Successful percutaneous closure of aortic pseudoaneurysms using a device designed for congenital heart defects has been previously reported to be a suitable, attractive, and safe option.[3–5] To the best of our knowledge, we reported the first successful case of a percutaneous closure of a more complex aortic pseudoaneurysm using two different types of occluder devices, appropriately to the underlying anatomy. Hence by applying this transcatheter technique a third complex and high-risk surgical intervention could be avoided. Important determinants of technical feasibility are the size of the neck of the pseudoaneurysm well as potential interference of implanted devices with the surrounding anatomy. If because of the size of the pseudoaneurysm vital structures are compressed, surgery remains the treatment of choice.[6,7] More multicentre data on long-term outcome of transcatheter closure procedures are needed to compare with standard surgery and to confirm safety and efficiency of the extended use of these techniques in high-risk patients, unsuitable for surgery. In case of unavoidable surgical reintervention, no interference with the implanted devices is expected. Also, removal of one of the devices would be no technical problem.

Conclusions

Percutaneous closure of a complex pseudoaneurysm after arterial switch repair is feasible and safe. However, lifelong follow-up is needed to determine the late results after transcatheter interventions.

Lead author biography

Els Troost is adjunct-clinic head at the Congenital and Structural Cardiac Unit of the University Hospitals Leuven, Belgium since 2003. She is involved in the clinical team for diagnosis and follow up of adults and young adults with congenital heart lesions and has a specific interest in high risk pregnancies and started a multidisciplinary pregnancy heart team.

She is an author and co-author of numerous articles within the field of congenital cardiology and is active member of the BSC and ESC.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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