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Brief Report

Transcatheter closure in two rare cases of left-to-right shunt with Cardio-O-Fix occluders

Jacek Bialkowski,[1] Celal Akdeniz,[2] Ahmet Celebi[2]

[1]*Department of Congenital Heart Diseases and Pediatric Cardiology, Medical University of Silesia, Silesian Center for Heart Diseases, Zabrze, Poland;* [2]*Department of Pediatric Cardiology, Dr Siyami Ersek Thoracic and Cardiovascular Surgery Center and Research Hospital, Istanbul, Turkey*

Abstract We present two procedures of transcatheter closure: that of an aorto-pulmonary window in a 12-month-old infant with a body weight of 7 kilograms, and that of ruptured sinus of Valsalva aneurysm into the right atrium in an adult patient. In the first case, we applied the muscular ventricular septal defect Cardio-O-Fix, while in the other we applied the patent ductus arteriosus Cardio-O-Fix occluder. The procedures were successful in both patients, and we achieved complete closure of the unwanted shunts.

Keywords: Transcatheter closure; congenital defects; aorta

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TRANSCATHETER CLOSURE OF MANY DEFECTS WITH left-to-right shunt has become the method of choice. The introduction of new types of nitinol mesh devices – Amplatzer occluders, was a real milestone in this field. Recently, similar devices, the Cardio-O-Fix occluders, have been introduced into clinical practice, but the experience relating to their use is as yet limited.[1,2] They are made from nitinol mesh and are conformance mark-approved (conformance mark 0197). These devices are dedicated to the closure of specific common cardiac defects, such as atrial septal defects, patent arterial ducts, or muscular ventricular septal defects.

Circulatory anomalies with left-to-right shunt, such as the cases described below, are very rare. In both, the shunt was closed with Cardio-O-Fix occluders. The first patient was an infant with an aorto-pulmonary window and the other, an adult male with a ruptured sinus of Valsalva aneurysm into the right atrium.

Correspondence to: J. Bialkowski, Department of Congenital Heart Diseases and Pediatric Cardiology, Medical University of Silesia, Silesian Center for Heart Diseases, Zabrze, Poland. Tel/Fax: +48 32 2713401; E-mail: jabi_med@poczta.onet.pl

Case 1

A 12-month-old male child, weighing 7 kilograms, presented with failure to thrive and cardiac failure with a continuous murmur. An echocardiographic examination revealed enlarged left side of the heart and an intermediate type of aorto-pulmonary window according to Ho et al.[3] A small secundum atrial septal defect and persistent left superiorcaval vein were also present. After right heart catheterisation, we performed aortic root angiography in the right anterior oblique projection to delineate the aorto-pulmonary window. The mean pulmonary artery pressure was 34 millimetres of mercury, with the pulmonary-to-aortic flow ratio of 1.7. The aorto-pulmonary window diameter was 4.3 millimetres. The defect was crossed from the pulmonary artery side with the right Judkins catheter. Then, a stiff guide-wire was placed into the descending aorta. A 7 French long sheath with a 45-degree angulation was passed through the aorto-pulmonary window and its tip was positioned in the ascending aorta. A 6-millimetre Cardio-O-Fix muscular VSD occluder (Starway Medical Technology Incorp., Beijing, China) was loaded. The left disc was opened in

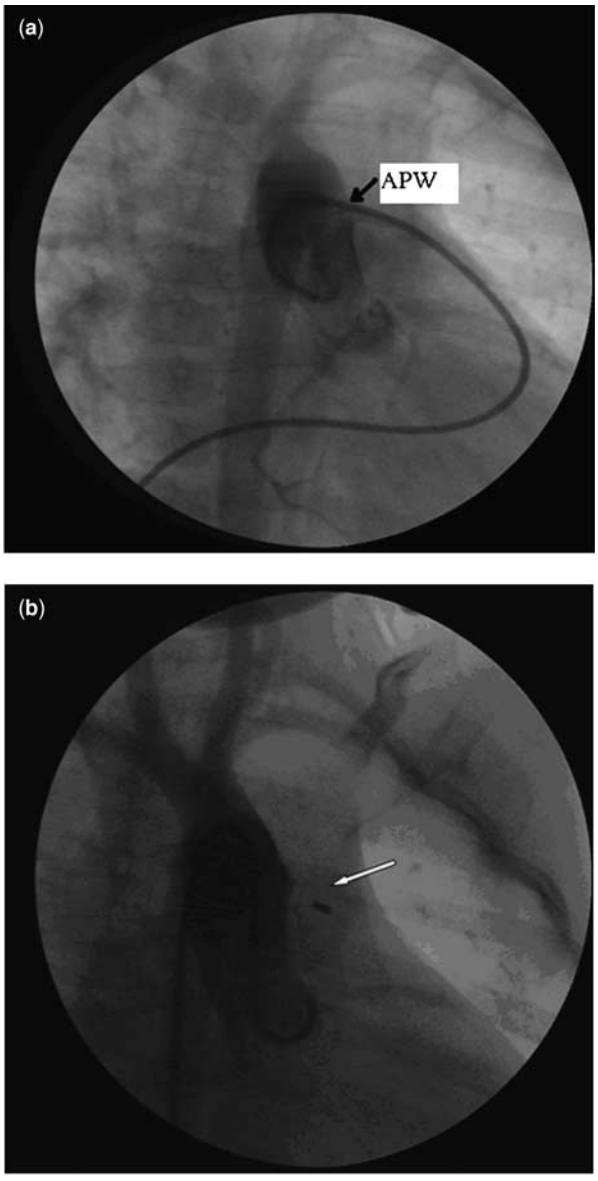

Figure 1.
*Aortogram (RAO 30). Aorto-pulmonary window. (**a**) Before and (**b**) after the usage of muscular ventricular septal defect Cardio-O-Fix occluder (white arrow).*

the ascending aorta, close to the aorto-pulmonary window, and then the right disc in the pulmonary artery. No aortic or pulmonary artery gradients were detected in the haemodynamic measurements before device deployment. Control aortography performed after releasing the device, showed its correct position and complete closure of the aorto-pulmonary window without compression of the coronary arteries (Fig 1). The mean pulmonary artery pressure dropped to 14 millimetres of mercury. Procedural time was 101 minutes and fluoroscopy time was 29 minutes. A Doppler echocardiographic examination performed immediately after the procedure and 24 hours later, confirmed the complete closure of the defect. The patient's hospital course was uneventful, enabling him to be discharged the next day after the procedure. At the 3-month follow-up, the patient gained 900 grams and continues to be asymptomatic.

Case 2

A 38-year-old man with body weight of 64 kilograms presented with fatiguability and continuous murmur in the precordial region. He was subsequently admitted for transcatheter closure of a ruptured noncoronary sinus Valsalva aneurysm into the right atrium. Diagnostic catheterisation confirmed the echocardiographic diagnosis, with a mean pulmonary artery pressure of 30 millimetres of mercury and a pulmonary to systemic (QP/QS) blood flow ratio of 1.9. Angiography in the right anterior oblique projection visualised the ruptured sinus Valsalva aneurysm into the right atrium. The entrance of the aneurysm was 6 millimetres and the diameter – 12 millimetres, with multiple shunts to the right atrium. A multipurpose catheter, with a 0.035×260 centimetres guide-wire, was introduced from the aorta through the defect into the right atrium, where a lasso captured it (Andrasnare 10 millimetre, Andramed, Germany), and it was withdrawn through the venous sheath; an arterio-venous loop was created. Then, a 7 French Amplatzer delivery system with a 180-degree angulation was introduced from the right femoral vein into the ascending aorta, and an 8/6 millimetre Amplatzer Duct Occluder (AGA Medical Corp., Plymouth, USA) was implanted. The device retention disc was opened in the aneurysm, and the rest of the device in the right atrium. After a few minutes, the device embolised into the right pulmonary artery, and was withdrawn with the use of a 10 French Mullins sheath (Cook Inc., Bloomington, USA) and a 7 French Bioptom Forceps (Cordis, Johnson & Jonhnson Comp, Miami Lakes, USA). Then, the procedure was repeated, and a larger device – a 12/10 millimetre PDA Cardio-O-Fix Occluder was implanted through the 8 French Cardio-O-Fix delivery system with a 180-degree angulation (Starway Medical Technology Inc., Beijing, China). Control angiography after releasing the device confirmed its good and stable position, with no residual shunt (Fig 2). Transoesophageal echocardiography immediately after the procedure and by transthoracic echocardiography after 24 hours also confirmed its position. Procedural time was 180 minutes and fluoroscopy time was 35.2 minutes. The patient remained without any residual shunt after 4 months of follow-up.

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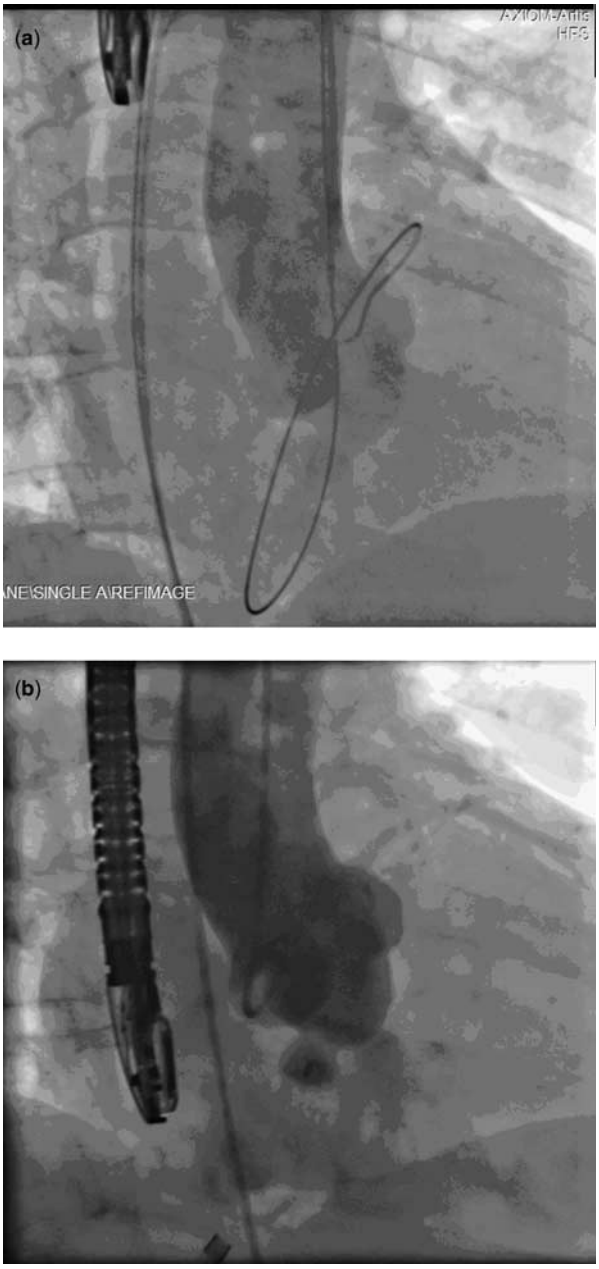

Figure 2.
*Aortogram (RAO 30). Ruptured noncoronary Valsalva sinus aneurysm into right atrium. (**a**) Before and (**b**) after closure with a 12/10 millimetre Cardio-O-Fix PDA occluder.*

Discussion

The experience with transcatheter closure of aorto-pulmonary window is limited. For its percuatneous closure, few types of devices have been used.[4] The Amplatzer atrial septal defect or duct occluder could be a good alternative in adults with large defects but not in infants, as it can protrude either to the aorta or the pulmonary artery. On the other hand, in the presence of pulmonary artery hypertension, it is better to use the muscular ventricular septal defect occluder with retention discs on both sides of the defect to prevent embolisation. The new Amplatzer duct occluder type II could be another alternative. We crossed the defect from a venous access, similar to Rohit et al[4]. The retrograde approach is easier, but requires an arterio-venous loop, as indeed was the case in our second patient with ruptured aneurysm of Valsalva into right atrium.[5] In both circumstances of window or ruptured aneurysm of Valsalva, the Cardio-O-Fix occluders had the same value as the original Amplatzer devices. Cardio-O-Fix occluders have almost the same construction, shape, sizes, and other characteristics as Amplatzer devices. Delivery systems are also similar, except perhaps the delivery cable is stiffer, and it is necessary to use one French larger sheath in comparison with the original Amplatzer system. Generally, this device costs half price of an Amplatzer occluder.

To our best knowledge, our infant with aorto-pulmonary window is the second documented case of applying a muscular ventricular septal occluder to close such a defect.[6] In our recent publication, we show the utility of Amplatzer devices including duct and atrial septal occluders, for the closure of ruptured sinus of Valsalva aneurysm.[7] On the other hand, the above-presented case with ruptured sinus of Valslava anueurysm indicates the necessity to apply oversized devices. The diameter of our patient's ruptured aneurysm was 6 millimetres, and the initial 8/6 millimetre Amplatzer Duct Occluder was ineffective (embolisation). Then, the application of the 10/12 millimetre PDA Cardio-O-Fix Occluder was successful. Longer follow-up after such procedures with the application of the discussed devices is necessary to evaluate their long-term efficacy.

Conclusion

Transcatheter closure in selected patients with an aorto-pulmonary window and a ruptured sinus of Valsalva aneurysm with Cardio-O-Fix occluders seems to be feasible and safe.

Addendum

Two months ago, we closed successfully a ruptured aneurysm of sinus of Valsalva to right atrium in a 50-year-old male using a 12/14 millimetre PDA Cardio-O-Fix Occluder.

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