CASE REPORT

Successful percutaneous closure of a residual atrial septal defect due to device failure

Silvia Aguiar Rosa a,*, Filipa Ferreira b, Lídia de Sousa a, António Fiarresga a, José Diogo Martins c, Ana Galrinho a, Ana Agapito a, Paula Fazendas b, Fátima F. Pinto c, Rui Cruz Ferreira a

a Cardiology Department, Santa Marta Hospital, Lisbon, Portugal
b Cardiology Department, Garcia de Orta Hospital, Almada, Portugal
c Paediatric Cardiology Department, Santa Marta Hospital, Lisbon, Portugal

Received 3 April 2016; accepted 5 September 2016
Available online 5 June 2017

Abstract A 39-year-old woman underwent uneventful percutaneous occlusion of an ostium secundum atrial septal defect (ASD) with a 22 mm Ultrasept ASD Occluder®. Transesophageal echocardiography (TEE) performed two years after implantation revealed a de novo residual left-to-right shunt through the correctly implanted device. Three-dimensional transesophageal echocardiography (3D TEE) further clarified this finding by showing a perforation of the device membrane coating. The patient underwent transcatheter closure of the residual shunt with a 20 mm Ultrasept PFO® device. The procedure was guided by fluoroscopy and real-time 3D TEE. At the end of the procedure 3D TEE documented correct device deployment with complete defect coverage and absence of residual shunt.

© 2017 Sociedade Portuguesa de Cardiologia. Published by Elsevier España, S.L.U. All rights reserved.

KEYWORDS
Atrial septal defect; Residual shunt; Percutaneous intervention

PALAVRAS-CHAVE
Comunicação interauricular; Shunt residual; Intervenção percutânea

* Corresponding author.
E-mail address: silviaguiarosa@gmail.com (S. Aguiar Rosa).
Case report

A 39-year-old woman presented for percutaneous closure of an ostium secundum atrial septal defect (ASD) with a balloon-sized diameter of 21 mm, which was performed successfully using a 22 mm Ultrasound ASD Occluder™ (Cardia, Eagan, MN, USA) with no complications, under fluoroscopic and transesophageal echocardiography (TEE) guidance. The day after the procedure, transthoracic echocardiography (TTE) showed a correctly placed device with no residual shunt. Two years after the procedure, TTE followed by TEE revealed a residual left-to-right shunt through the correctly implanted device. Three-dimensional (3D) TEE enabled more detailed characterization, showing a perforation of the membrane coating 0.09 cm² in area on the inferior portion of the device (Figure 1A and D). Although there were no obvious signs of right ventricular overload, the patient complained of fatigue on minimal exertion and occasional chest discomfort.

She accordingly underwent a second cardiac catheterization for hemodynamic measurement and possible transcatheter closure of the residual shunt. The procedure was performed under general anesthesia, guided by fluoroscopy and real-time 3D TEE (Figure 1B, C, E and F). The Qp:Qs obtained by catheterization was 1.7 and therefore we decided to proceed with implantation of a second device. We chose a 20 mm Ultrasound PFO occluder with the expectation that a similar device would conform better to the previously implanted occluder.

The device defect was crossed with a combination of a 6 F right Judkins diagnostic catheter (Boston Scientific, Natick, MA) and a standard 0.35″ ZIPwire™ Hydrophilic Guide Wire (Boston Scientific, Natick, MA) placed in the left superior pulmonary vein. We opted not to perform balloon sizing;

Figure 1 (A and D) Three- (3D TEE) and two-dimensional transesophageal echocardiography images showing residual shunt through the device (22 mm Ultrasound ASD Occluder™); (B and C) delivery sheath through the Ultrasound device in fluoroscopic view and in 3D TEE; (E and F) closure of residual shunt in the 22 mm Ultrasound device with a 20 mm Ultrasound PFO device, with the final result documented in fluoroscopic view and in 3D TEE.
otherwise the interventional procedure was performed with
the standard ASD closure technique, taking extra care with
the 9 F delivery sheath to avoid displacement of the device
already in place.
During the procedure, 3D TEE was of crucial importance
in guiding the position of guidewires and sheaths, delivery
and spatial relations between devices.
The procedure took 60 min with a total radiation time of
14 min and total radiation dose of 865 mGy (8101 cGy.cm²).
At the end of the procedure 3D TEE documented cor-
rect device placement with complete defect coverage and
absence of residual shunt.

Discussion

The Ultrascept ASD device is covered by a polyvinyl alcohol
(PVA) membrane. PVA is a bioabsorbable elastomeric poly-
mer with good biocompatibility that is commonly used in
medical devices due to its low protein adsorption, absence
of toxicity and bioadhesive characteristics. Although the
use of this material in ASD closure devices is generally
successful, a few cases of PVA membrane perforation and
recanalization have been described recently. According
to company data only 10 cases have been reported, all of
them with ASD occluders and none with PFO closure devices.
The mechanism by which the PVA coating degrades is not
completely understood, but is likely related to incomplete
endothelialization due to delayed or inadequate endothe-

lial response. This phenomenon has been reported in a few
patients with other ASD devices, such as the AmplatzerTM
family, supporting the hypothesis of an absent or inadequate
endothelization response in specific patients, of unknown
cause. In our patient, there was no evidence of an early
residual shunt, but we cannot speculate on the specific
causes that may have given rise to this mid-term residual
ASD.

We adopted a percutaneous approach guided by real-time
3D TEE, which offered precise spatial location of the per-
foration and orientation of sheaths and devices. A 20 mm
Ultrascept PFO occluder was chosen because (a) it appeared
to be the most easily adjustable for the small but asymmet-
ric hole, (b) no residual holes have been reported in these
devices, (c) we thought that it would be better to juxta-
pose two devices with the same type of frame, and (d) it has a
low profile, resulting in a small increase in thickness and
no compression of surrounding structures, particularly the
aortic wall.

This case highlights the importance of close follow-up in
all patients with ASD treated with implanted devices. There
should be a low threshold for TEE in the event of any sus-
picious findings on TTE or changes in the patient’s clinical
status. Our case demonstrates a new and successful way
of correcting ASD device perforations with a percutaneous
approach that avoids the need for surgical intervention.

Ethical disclosures

Protection of human and animal subjects. The authors
declare that no experiments were performed on humans or
animals for this study.

Confidentiality of data. The authors declare that they have
followed the protocols of their work center on the publica-
tion of patient data.

Right to privacy and informed consent. The authors have
obtained the written informed consent of the patients or
subjects mentioned in the article. The corresponding author
is in possession of this document.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

polyvinyl alcohol membrane-covered atrial septal defect closure
2. Bartel T, Bonaros N, Müller S. Device failure weeks to months
after transcatheter closure of secundum type atrial septal
and late dislocation after implantation of an Amplatzer septal
histopathologic findings in nine patients with surgically explanted
ASD/PFO devices: do we know enough about the healing process