Late cardiac perforation after transcatheter closure of an atrial septal defect using the Amplatzer septal occluder

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The transcatheter closure of atrial septal defects (ASD’s) is a non-surgical technique widely used for children and adults. The Amplatzer Septal Occluder (ASO - AGA Medical Corp., Minnesota) is the device most commonly used worldwide with excellent results. Nevertheless, early and late erosions/perforations have been reported. Early ones have been generally related to operator experience or technical difficulties during the procedure while later ones -specifically cardiac perforations, have been related to friction-forces produced by the device itself1,2.

We report a case of a patient with late cardiac perforation 4 years after ASD closure using an ASO device.

CASE REPORT.

A 5 year-old asymptomatic female was the 30th ASO device closure of central isolated ASD’s in our series performed in the year 2001. The defect was a typical ostium secundum type measuring 13 mm by trans-esophageal echocardiography (TEE). The total septal length was 46 mm in the caval vein axis and 40 mm in the atroventricular-posterior wall axis; all the defect rims were considered sufficient for device implantation—including the retroaortic one. The stretched balloon (Meditech, Boston Scientific) diameter size was 19 mm. In a uncomplicated procedure, a 20 mm ASO was implanted following the recommended AGA protocol achieving a complete closure of the defect3.

The following day a transthoracic echocardiography and chest X-ray demonstrated a normally positioned ASO without residual shunt or other remarkable findings. The patient was discharged on oral aspirin 6 mg/Kg/day for 6 months as part of our routine protocol in the Paediatric Cardiology and Paediatric Cardiovascular Surgery Department, Ramón y Cajal Hospital – Madrid, Spain. She was asymptomatic with normal yearly echocardiograms and chest X-rays until 4 years later when she come back hospital with clinical discomfort. The echocardiogram performed showed a significant pericardial effusion with mild collapse of the right heart chambers, cardiac perforation device related was take in mind. A pericardiocentesis drained 150 ml of blood and the decision was made to attempt surgical removal of the ASO. A median sternotomy was performed and the surgeon clearly saw the protruding rim of the device and two small perforations facing each other: one in the superior aspect of left atrium in front of the aorta, and the other in the own aortic wall at the level of the non-coronary aortic sinus (Fig 1A-B). The ASO was removed, the ASD successfully closed with autologous pericardial patch, and the perforations repaired. Three years after the surgical procedure the patient is doing well with normal echocardiograms.

DISCUSSION

As far as we know this is the first case report of perforation occurring more than 3 years after an
uncomplicated ASD closure with ASO device. After Divekar’s review in 2004, other authors have reported isolated cases, occurring early or late after implantation. To date we have found 39 cases reported in the literature with cardiac erosion/perforation with or without associated fistula between the atrial wall and the aorta, presenting as an early or late event\textsuperscript{4,5,6,7,8,9,10,11}. The incidence of this complication is difficult to estimate due to the absence of accurate data on number of implanted devices but it appears to be an infrequent problem. Among these 39 cases, the clinical presentation occurred after hospital discharge in more than 60\% of cases. Three deaths have been reported but only one was irrefutably considered to be device related\textsuperscript{1,2}. Erosion/perforation has been described after closure of patent foramen ovale as well\textsuperscript{12,13,14,15}.

Upon retrospective analysis of the TEE images of our case obtained during ASO placement, we found that although the stretched balloon sizing diameter was 19 mm, actually distance between the edges of the ASD with occluded flow was 15 mm. Following the recommendations at the time (year 2001), we used the balloon sizing diameter plus one extra millimeter based on the rim sizes and total septal length measurements. However, given the current recommendations to use the stop flow balloon size not to exceed 150\% of the non-stretched defect size, and our retrospective measurements of the TEE images, we may have oversized the device potentially leading to cardiac erosion\textsuperscript{1,14}. Nevertheless, as of 2001 (the date of our case), no clear data on device erosion had been published and the relation between stretched balloon diameter and device size selection was less strict. Currently we use the “stop flow technique” of sizing the ASD measuring only the balloon distance occluding the atrial shunt based on the recommendations of Amin and Carlson\textsuperscript{1,14}.

The exact mechanism of erosion/perforation in this and other reported cases is not clearly understood. According to Amin et al, uncontrolled friction forces of the device itself associated with changes in the geometry of the interatrial septum, surrounding walls and device may all play a role\textsuperscript{1}. According to recent information about the influence of device size on perforation cases, this appears most prevalent in “smaller” than in “larger” devices\textsuperscript{1,2}.

Although we removed the device surgically, this is not the universal recommendation in the literature\textsuperscript{2}. In some of the reported cases, the device was left in place after repairing the erosion, without recurrences during a short follow up period. Cardiac perforation can present as pericardial effusion, new cardiac murmur, chest pain or symptoms of near-syncope or collapse. As demonstrated by our case, the timing of erosion/perforation is quite unpredictable, thus leading to the need for life long clinical and echo examinations.

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**BIBLIOGRAPHY**


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