Percutaneous retrieval of an interatrial septal occluder device embolized into the aortic arch

Aortik arkusa embolize olan interatriyal septal kapatma cihazının perkütan yolla çıkarılması

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Percutaneous closure of secundum atrial septal defects (ASD) may be complicated by immediate embolization. We report on a 35-year-old woman who underwent percutaneous device closure for a secundum ASD. The diameter of the defect was measured as 4 mm by two-dimensional transesophageal echocardiography and a 7-mm Figulla ASD occluder device was implanted without prior balloon sizing of the defect. Immediate embolization was noted into the aortic arch. Attempts to pull the devices into the sheath with a loop snare failed even after replacing the delivery sheath with a bigger one. Finally, a bioptome was used to grab and place the screw mechanisms in the sheath and percutaneous retrieval of the embolized ASD occluder was achieved. Balloon sizing was performed after removal, yielding a stretched diameter of 12 mm and a 15-mm device was deployed with success.

Key words: Device removal/instrumentation; echocardiography; heart catheterization/complications; heart septal defects, atrial.

Sekundum tipi atriyal septal defektlerin (ASD) perkütan yolla kapatılması sırasında cihaz embolizasyonu meydana gelebilir. Bu yazıda, sekundum tipi ASD için perkütan kapama uygulanan 35 yaşında kadın hasta sunuldu. Defektin çapı ikiboyutlu transözofageal ekokardiyografi ile 4 mm olarak ölçüldükten sonra, balonla ölçüm yapmadan, 7 mm'lik Figulla ASD tıkayıcı cihazı hastaya yerleştirildi. Ancak, cihaz takılır takılmaz arkus aortaya embolizasyon meydana geldiği gözlendi. Cihaz parçalarını çember tuzak ile taşıyıcı içine alma girişimleri, taşıyıcı kılıfının daha büyüğü ile değiştirilmesine karşın başarılı olmadı. Sonuçta, vida mekanizmaları biyoptom kullanılarak yakalanıp taşıyıcı kılıf içine alındı ve embolize olan ASD tıkayıcı cihaz perkütan yolla çıkarıldı. Bu işlemden sonra yapılan balonla ölçümde defektin gerili çapı 12 mm ölçüldü ve 15 mm'lik bir cihaz başarıyla yerleştirildi.

Anahtar sözcükler: Cihaz geri alımı/enstrümantasyon; ekokardiyografi; kalp kateterizasyonu/komplikasyon; kalp septal defekti, atriyal.

Transcatheter closure has been accepted as a successful alternative to surgery in the treatment of secundum type atrial septal defects (ASD).[1] However, with the increasing use of this new technique, several complications have been identified.[2]

We report a rare complication of immediate device embolization of an ASD occluder into the aortic arch, possibly due to transcatheter closure of the ASD without balloon sizing of the defect. We also present a snare technique in which a bioptome was used effectively in grabbing the screw mechanisms and retrieving the device.

CASE REPORT

A 35-year-old woman with a history of recurrent transient ischemic attack was referred for evaluation of the etiology of thromboembolism. Transthoracic echocardiography and transesophageal echocardiography (TEE) revealed a 4-mm secundum ASD with adequate margins for deployment of a percutaneous closure device (Fig. 1a, b). The patient was taken to the cardiac catheterization laboratory. After general anesthesia, the diameters of the defect were measured on two-dimensional TEE images in various planes and a 7-mm Figulla ASD occluder device (Occlutech

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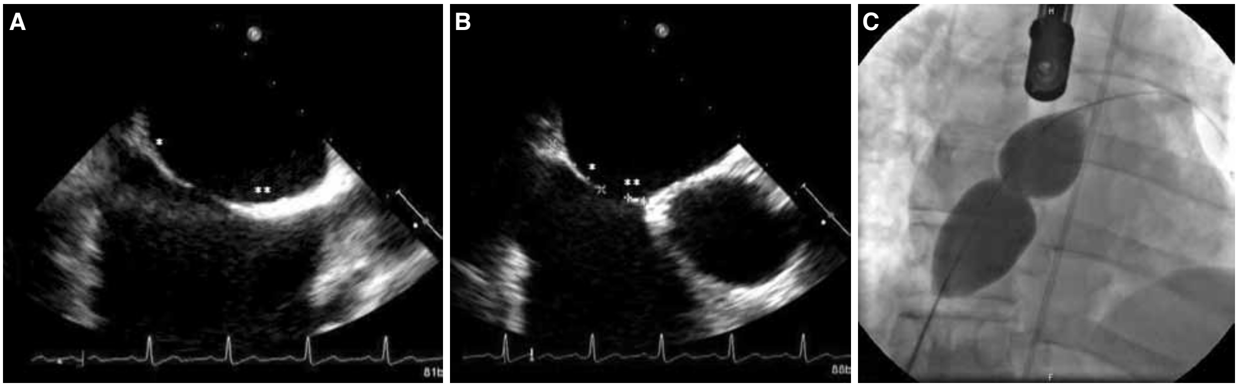

Figure 1. Transesophageal echocardiograms showing a small atrial septal defect with adequate margins for deployment of a percutaneous closure device: **(A)** *superoposterior rim=2 cm, **inferoposterior rim=1.8 cm; **(B)** *posterior rim=1.68 cm, **superoanterior rim=0.4 cm. **(C)** Balloon measurement of the defect. The indentation at the centre of the balloon defines the stretched diameter as 12 mm.

GmbH, Jena, Germany) was implanted without balloon sizing of the defect. Unfortunately, immediate embolization occurred into the aortic arch. In the first instance, the device was captured with a loop snare that was introduced retrogradely through the femoral artery. Then, the screw mechanism of the right atrial disk was snared after several attempts. The loop snare was used effectively to pull the devices into the femoral artery (Fig. 2a), but when we pulled the device back and tried to place it into the sheath, we felt a great deal of resistance because of the misalignment of the screw of the right atrial disk (Fig. 2b). The delivery sheath was replaced with a bigger one (12 Fr) to facilitate taking the screw into the sheath, but combined use of this sheath with a loop snare was unsuccessful. Afterwards, we used a bioptome effectively in grabbing the screw mechanisms and retrieving the device (Fig. 2c). Balloon sizing was performed in the second attempt yielding a stretched diameter of 12 mm (Fig. 1c) and a 15-mm device was deployed with success.

DISCUSSION

Transcatheter closure techniques have become an increasingly used alternative to surgical closure of secundum type ASDs. However, acute failure of these devices may occur due to several reasons, the most important being poor patient and/or device selection.[3] The use of undersized ASD occluder devices has been reported as the most common cause of embolization, followed by inadequate or floppy rim.[4] In our case, the stretched diameter of the ASD measured by balloon sizing was considerably larger than the echocardiographic size. There may be several reasons for this discrepancy. Because ASDs rarely have a perfect circular shape, it may be difficult to precisely measure the correct largest diameter of the defect.[5] There may be also a certain amount of flexibility and redundan-

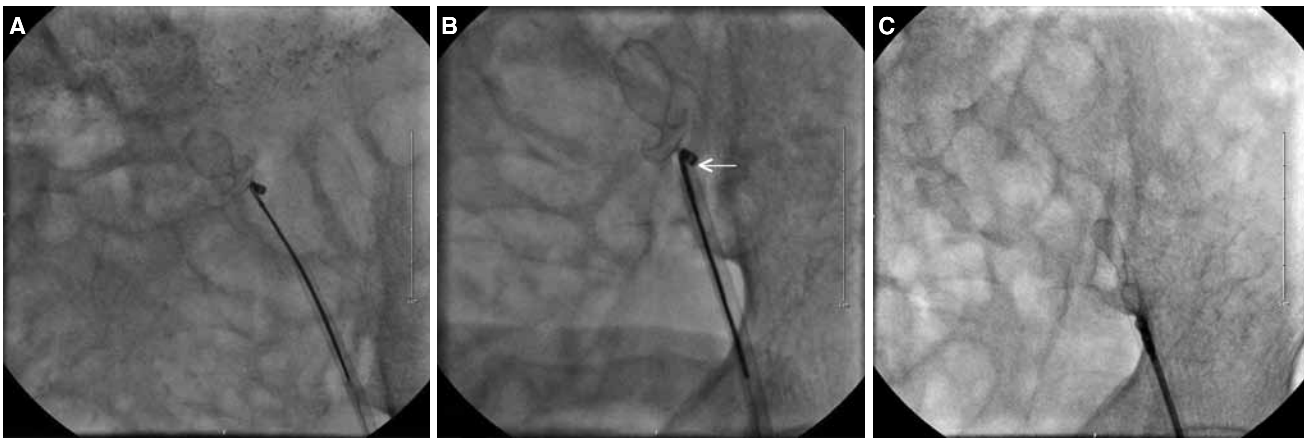

Figure 2. (A) The loop snare was used effectively to pull the devices into the femoral artery, **(B)** but it failed to pull the screw of the right atrial disk into the sheath because of misalignment between the screw and the sheath (arrow). **(C)** A bioptome was used effectively in grabbing the screw mechanisms and retrieving the devices from the femoral artery.

cy of the tissue surrounding the defect, resulting in a larger defect when stretched with the balloon. We think that balloon sizing of an ASD would be the most helpful technique in determining the size of the occluder device.

Studies comparing the results of measuring defect size by TEE prior to catheterization and balloon sizing during catheterization reported conflicting results. Amin and Daufors[6] concluded that balloon sizing was not necessary for closure of secundum ASDs, whereas Helgason et al.[7] found that the stretched diameter obtained during catheterization was significantly greater than the diameter obtained by TEE.

Percutaneous retrieval of the embolized device is possible in about 70% of cases, and several techniques have been described, including the use of large sheaths, snares, or bioptomes.[4] Additionally, notching of the tip of the retrieval sheath was reported to be helpful in pulling the right atrial screw into the sheath.[4] In several cases or cases series, bioptomes were used to capture the device to avoid the movements and further embolization of the device, but when used alone, they were not effective in grabbing the screw mechanisms and retrieving the devices.[4,8] In our case, percutaneous retrieval of an embolized Figulla ASD occluder from the femoral artery was successful with the use of a bioptome. This was achieved after an unsuccessful attempt with a loop snare. It should also be noted that, as the diameters of the aorta, iliac and femoral arteries decrease distally up to around 7 mm, accommodation of a less flexible double disc >20 mm in diameter may not be feasible. Especially, for percutaneous retrieval of a large ASD occluder device, we should take intimal injuries and dissection of these vessels into account. However, in the present case, the left atrial disc was 18 mm in diameter and there was no resistance during retrieval of the device from the femoral artery.

This case emphasizes that, in addition to a careful echocardiographic assessment, the stretched diameter of the defect should also be obtained during the procedure to determine the size of the occluder. A bioptome may be helpful in pulling the screw of the right atrial disk into the sheath as an alternative to a loop snare.

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