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Complete Percutaneous Retrieval of Migrated VSD Occluder Device from the Pulmonary Artery: Management of a Catastrophic Complication

Pulmoner Artere Embolize Olan VSD Kapama Cihazının Perkütan Yolla Çıkarılması: Feci Bir Komplikasyonun Yönetimi

ABSTRACT

Transcatheter closure of muscular ventricular septal defects (VSD) remains a safe and effective method with low complication rates. However, device migration can pose a significant challenge to interventional cardiologists due to potential mortal consequences. A 21-year-old female presented to our clinic with exertional dyspnea and was diagnosed with a muscular VSD. The defect was percutaneously closed using an Amplatzer occluder device. On the first post-procedural day, the patient experienced repeated episodes of coughing and mild hemoptysis. Imaging revealed migration of the VSD occluder device to the right pulmonary artery (PA). Percutaneous retrieval of the device was then decided upon. The right PA was accessed using a hydrophilic guidewire and a pigtail catheter. This catheter was exchanged for an 8-Fr sheathless guide catheter, and a 6-Fr Judkins right catheter was advanced into the right PA through the sheathless guide catheter using the mother-and-child technique. Multiple attempts using a snare were made to retrieve the migrated device. Eventually, the proximal marker point, the hub of the device, was grasped and pulled back from the PA, then externalized through the sheath without the need for surgical cutdown. Our report represents a case of complete percutaneous retrieval of an embolized VSD occluder device from the PA.

Keywords: Complications, congenital heart disease, interventional cardiology, ventricular septal defect

ÖZET

Musküler VSD'nin transkateter kapatılması, düşük komplikasyon oranları ile güvenli ve etkili bir yöntem olmaya devam etmektedir. Bununla birlikte, cihaz embolizasyonu, ölümcül sonuçları nedeniyle girişimsel kardiyoloji için büyük bir zorluk teşkil edebilir. Efor dispnesi şikayeti ile kliniğimize başvuran 21 yaşında kadın hasta musküler VSD tanısı aldı. Defekt Amplatzer occluder cihazı kullanılarak perkütan olarak kapatıldı. Hasta işlem sonrası ilk günde tekrarlayan öksürük nöbetleri ve hafif hemoptizi yaşadı. Görüntülemede VSD kapama cihazının sağ pulmoner artere atmış olduğu görüldü ve cihazın perkütan olarak çıkarılmasına karar verildi. Sağ pulmoner artere hidrofilik kılavuz tel ve pigtail kateter ile ulaşıldı. Daha sonra kateter 8-Fr kılıfsız kılavuz kateter ile değiştirildi ve 6-Fr Judkins sağ kateter analı kızlı tekniği kullanılarak kılıfsız kılavuz kateterden sağ pulmoner artere ilerletildi. Embolize olan cihazı geri almak için snare kullanılarak birden fazla girişimde bulunuldu. Sonunda cihazın proksimal radyo-opak noktasından, göbeğinden tutularak pulmoner arterden geri çekildi ve cerrahi kesiye gerek kalmadan femoral arterdeki kılıf içinden eksternalize edildi. Olgumuz, pulmoner artere embolize olan VSD kapama cihazının perkütan yolla geri çıkarılmasını anlatmaktadır.

Anahtar Kelimeler: Komplikasyon, konjenital kalp hastalığı, girişimsel kardiyoloji, ventriküler septal defekt

CASE REPORT
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Transcatheter closure of muscular ventricular septal defects (VSD) remains a safe and effective method with low complication rates. However, device migration can pose a significant challenge to interventional cardiologists due to the potential for mortal consequences. In this case, we demonstrate successful transcatheter retrieval of an embolized muscular VSD occluder.

Case Report

A 21-year-old female presented to our clinic with exertional dyspnea. She had no prior diseases, drug use, or any cardiovascular diseases in her family history. Physical

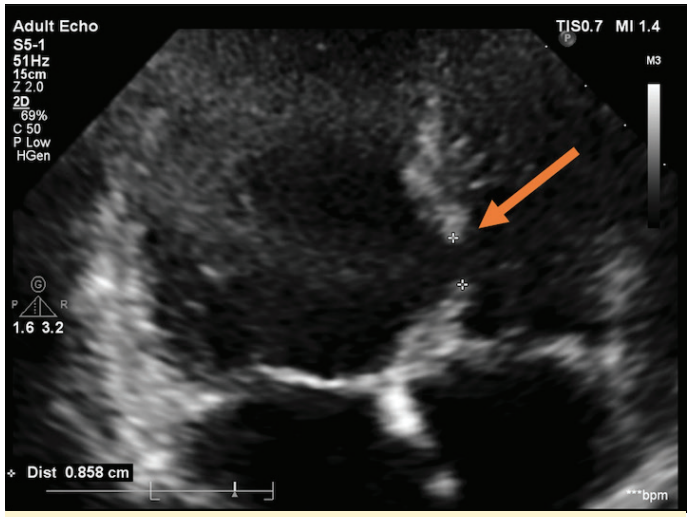

Figure 1. TTE demonstrating a muscular VSD measuring 8.5 mm.

septum or in the right heart chambers. Chest imaging revealed the migrated VSD occluder device in the right pulmonary artery (PA) (Figure 2). Heart team decided on percutaneous retrieval of the device with surgical backup. The patient was taken to the catheterization lab, and a 10-Fr sheath was inserted into the femoral vein under local anesthesia. Right pulmonary artery was accessed with a hydrophilic guidewire and a pigtail catheter (Figure 3a). The catheter was then exchanged for an 8-Fr sheathless guide catheter, and a 6-Fr Judkins right catheter was advanced into the right pulmonary artery through the sheathless guide catheter using the mother-and-child technique (Figure 3b). Multiple attempts with the snare were made to retrieve the migrated device (Video 4). Eventually, proximal marker point, the hub of the device, was grasped and pulled back from the PA, then externalized through the sheath without the need for surgical cutdown (Figure 3c, Figure 3d, and Video 5). Patient was then offered both a second transcatheter closure of the defect and a surgical alternative, but the final decision was surgical closure of the defect, considering the patient's wish.

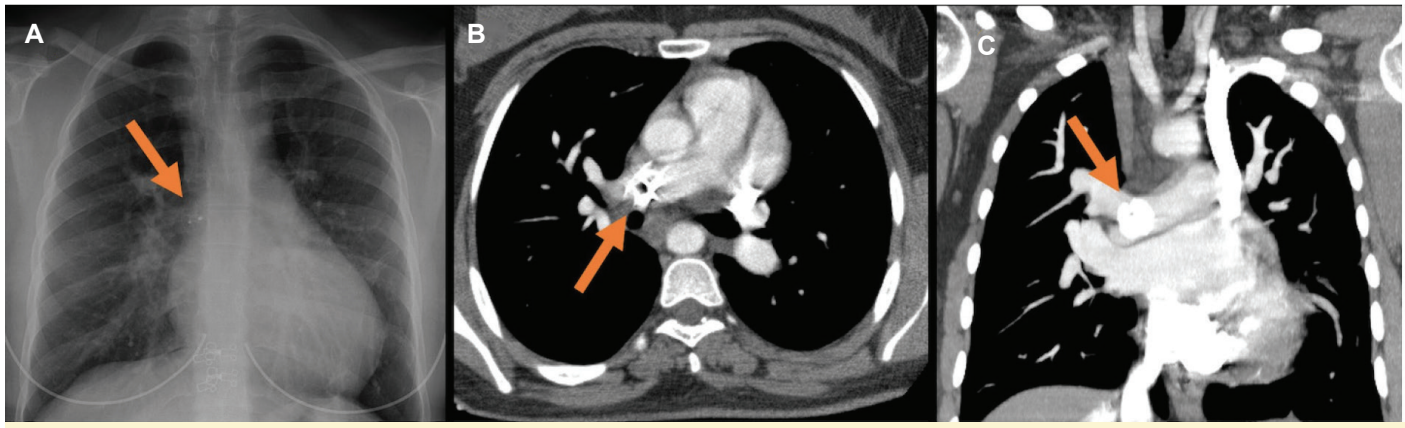

Figure 2. Chest X-Ray (A) showing the embolized device and Thoracic Computed Tomography (B and C) revealing the exact localization of the device in the right PA.

examination revealed a 4/6 pansystolic murmur heard over the left sternal border; oxygen saturation was 98% on room air. Transthoracic echocardiogram (TTE) showed a muscular VSD of 8.5 mm with a left-to-right shunt (Figure 1, Video 1). Cardiac catheterization revealed a significant left-to-right shunt with a Qp/Qs of 3.2, a mean pulmonary artery pressure of 41 mmHg, and a pulmonary vascular resistance (PVR) of 2.25 Wood units. Considering patient's status and the defect's anatomy, institutional heart team decided on percutaneous closure of the VSD. An Amplatzer muscular VSD occluder with a 10-mm waist diameter was deployed under transesophageal echocardiogram (TEE) guidance without complications (Video 2 and Video 3). On the first post-procedural day, the patient experienced repeated episodes of coughing and mild hemoptysis. Bedside TTE could not visualize the occluder device either on the interventricular

ABBREVIATIONS

FDA	Food and Drug Administration
PA	Pulmonary artery
TEE	Transesophageal echocardiogram
TTE	Transthoracic echocardiogram
VSD	Ventricular septal defects

Discussion

Isolated VSD is the most commonly recognized cardiac anomaly, accounting for almost 30% of all forms of congenital heart diseases. Membranous and perimembranous are the two most common types; true muscular VSDs are much rarer, accounting for roughly 10% of VSDs.[1]

A retrospective cohort study in Europe reported that surgical closure of VSD is still more popular than transcatheter devices, with devices accounting for only 9.7% of all VSD closures.[2] Surgical closure can be performed with low operative mortality (1.2%) and good long-term results.[3] However, transcatheter closure has become an alternative, particularly in residual VSDs, in VSDs that are poorly accessible for surgical closure, and in muscular VSDs that are located centrally in the interventricular septum.[4] Nonetheless, these lesions should have good delineation of location and adequate rims to hold the device; otherwise, embolization of the device could occur. The Amplatzer muscular VSD device is the only device approved by the Food and Drug Administration (FDA) for closure.

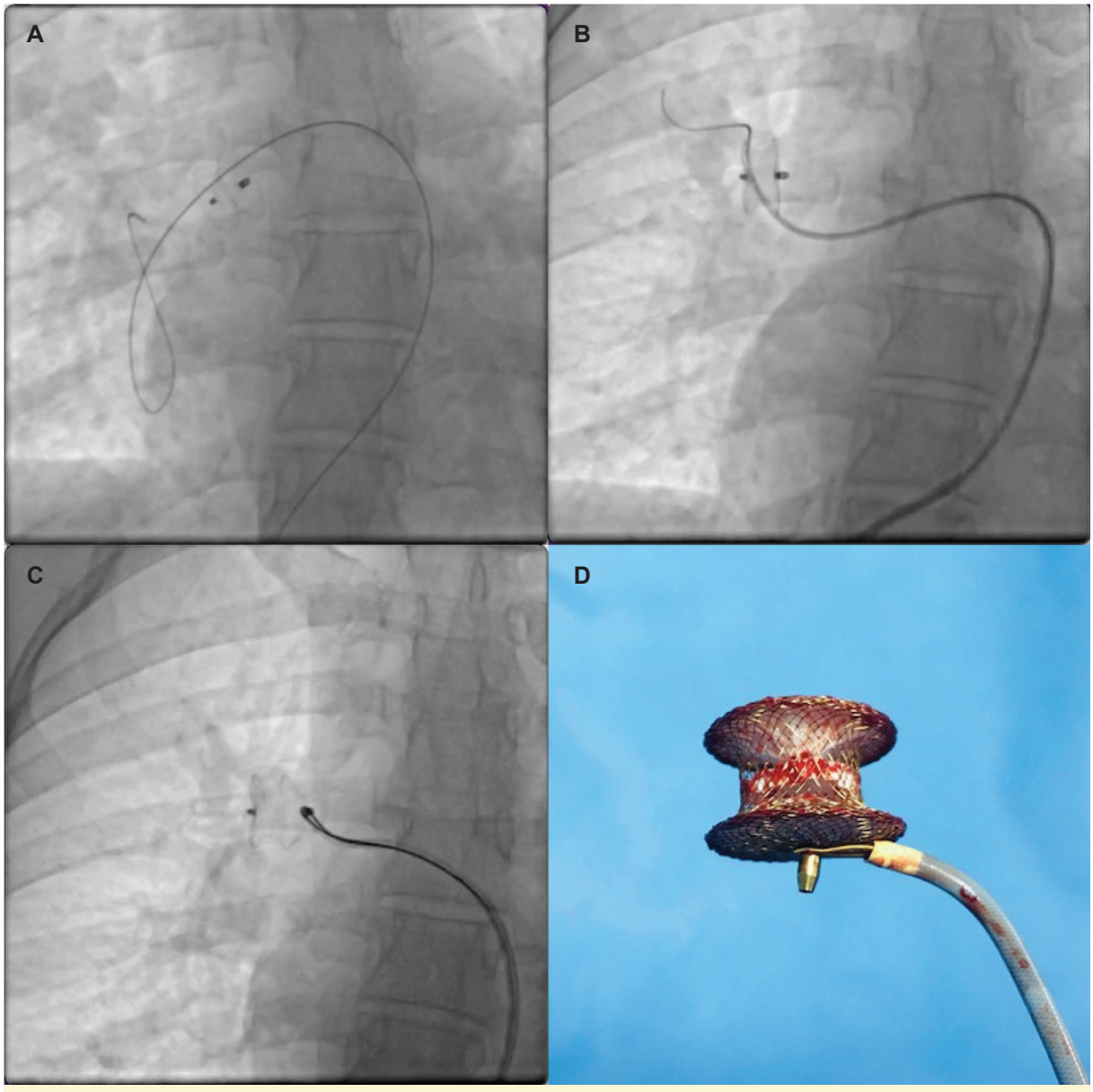

Figure 3. (A) Right pulmonary artery was accessed with a hydrophilic guidewire and a pigtail catheter. (B) After exchanging for an 8- Fr sheathless guide catheter, a 6-Fr Judkins right catheter was advanced into the right pulmonary artery through the sheathless guide catheter using the mother-and-child technique. (C) Grasping the device at its proximal marker point with a snare, pulling it back, and externalizing the device through the femoral sheath (D).

Despite advancements in structural heart interventions, device embolization remains a rare but life-threatening complication. This complication has been reported in 3-7.6% of patients undergoing transcatheter VSD closure.[5,6] It can lead to catastrophic consequences such as hemodynamic deterioration and sudden cardiac arrest. Considering lower morbidity, non-surgical management of device migration is crucial. Sadiq et al.[7] have reported a case of perimembranous VSD device embolization to the PA and percutaneous retrieval in an infant. Further, Tai et al.[8] have reported a series of seven cases of perimembranous device embolization to the PA, six of which were managed percutaneously with a similar technique as demonstrated in our case. The most common reason for embolization is the selection of an undersized device, followed by an inadequate subaortic rim. Confirming correct device deployment requires the essential use of TTE and angiography. We sized the VSD at end-diastole by TTE, and the device waist diameter selection should be approximately 2 mm larger than the defect size. We selected a device with 10 mm waist diameter, 1.5 mm larger than the defect. Considering a larger device with a 12 mm waist diameter would have been too large for this particular patient. However, a larger device could have been more appropriate, as an undersized device is the most common reason for embolization.

In general, transcatheter retrieval of devices requires capturing and immobilizing the device to a safe location, away from valves

and without obstructing aortic or pulmonary flow, followed by retraction of the device into a large retrieval sheath, larger than the original delivery sheath. Accordingly, we started our procedure with a 10-Fr femoral sheath. It is also important to note that, during retrieval using a snare, we aimed to grasp the device from its marker point-screw, perpendicularly to its structural axis. In that way, we re-folded and retracted the device and were able to externalize it through the femoral sheath without the need for surgical cutdown.

Conclusion

Our report represents a rare and early complication of transcatheter VSD closure, namely device embolization to the PA, and its successful percutaneous retrieval. Transcatheter retrieval of the embolized device could be preferred over surgery when feasible.

Informed Consent: Written informed consent was obtained from the patient.

Peer-review: Externally peer-reviewed.

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Video 1. TTE showing a muscular VSD with a left-to-right shunt.

Video 2. Deployment of an Amplatzer muscular VSD occluder with a 10-mm waist diameter under TEE guidance.

Video 3. Device position after deployment.

Video 4. Attempt to retrieve the migrated device.

Video 5. Grasping the device at its proximal marker point with a snare, pulling it back, and externalizing it through the femoral sheath.

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