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## Case report

# Conservative management of asymptomatic lately embolized amplatzer atrial septal occluder device to the supraceliac abdominal aorta: case report and the literature review ☆,☆☆

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## ABSTRACT

Atrial septal defects of a single Secundum with favorable anatomy and margins are commonly treated with septal occluder devices. Device embolization is a well-known rare and serious complication of transcatheter structural heart interventions. Percutaneous transcatheter closure under fluoroscopic guidance using the occluder device has been considered as a safe and effective alternative to open surgery with a higher technical success rate. However, and in selected cases it can be managed conservatively. In the current study we reported our local experience in the conservative non-surgical management of a patient presented with asymptomatic lately migrating and embolized amplatzer atrial septal defect occluder device into the supraceliac abdominal aorta. This conservative management was adopted after failure of the multiple trials of the endovascular retrieval of the embolized device. However, the procedure was terminated to keep away from any local vascular complications. The patient was followed up for more three years with serial computed tomography angiography on a scheduled outpatient basis. In the current study, we reported and sharing our local experiences for the non-operative, conservative management of a dislocated and embolized atrial septal defect occluder device to the supraceliac abdominal aorta.

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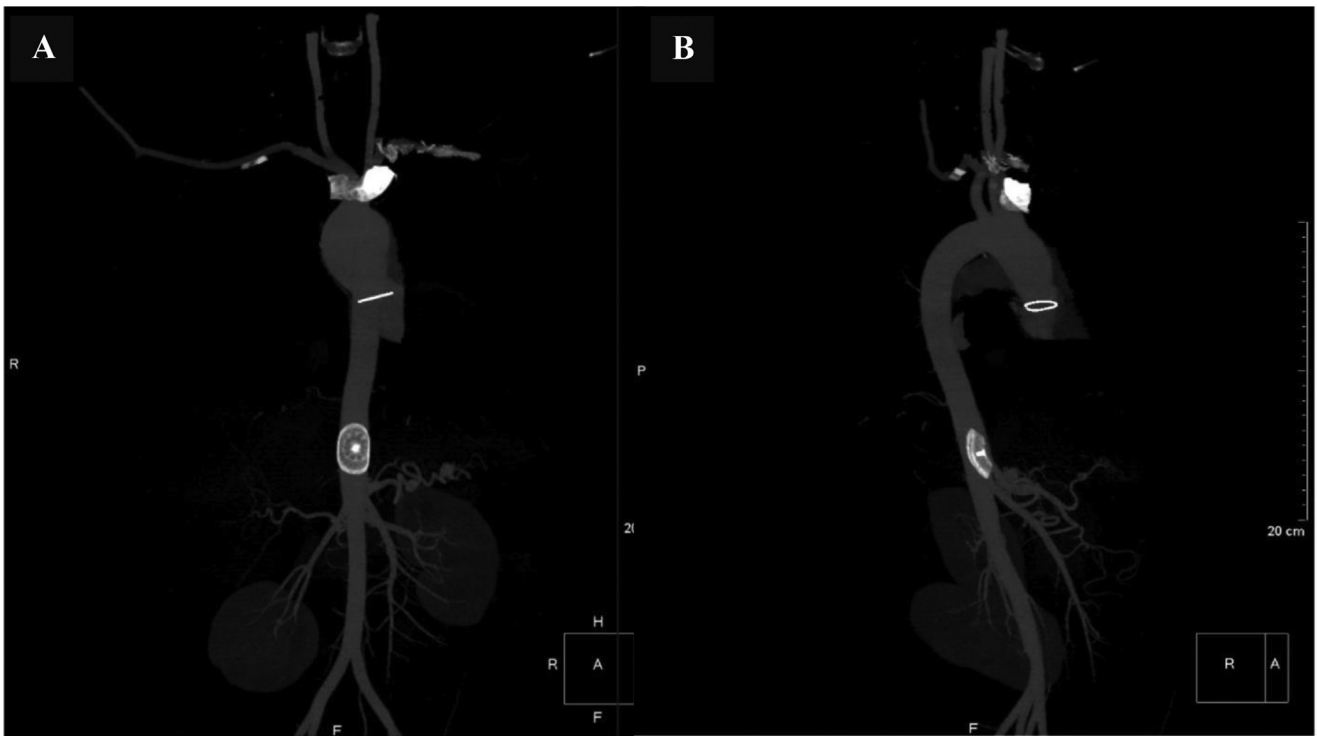
Atrial septal defect is one of the common forms of congenital heart disease. It significantly accounts for about 10% of all congenital cardiac anomalies and typically presents with left-to-right shunt [1]. Device management methods for such defects are increasingly emerging such as the percutaneous transcatheter technique. Moreover, the use of an intraoperative occluder device for closure of atrial septal defect (ASD) under the guidance of transesophageal echocardiography can also be adopted [2]. Furthermore, fundamental device investigations have demonstrated that individual devices may provide safe and effective alternatives to surgical closure of the ASD. Transcatheter percutaneous closure of ASD with atrial occluders avoids sternotomy and cardiopulmonary bypass, in addition to the faster postoperative recovery [3]. However, cardiac arrhythmias, hemopericardium, as well as device migration and embolization are significant life-threatening complications. Embolization of the ASD occluders is the major adverse outcome. The incidence of device embolization is difficult to estimate with perfection because of the underreporting bias. The vast majority of device embolization occurs during the interventional procedures but, late embolization has been detected up to 12-months following the procedure [1,3]. Emergency surgical or percutaneous retrieval of the embolized device with the closure of the defect is the most common line of management and must be adopted whenever possible [3]. In the current study we reported a rare case of asymptomatic late presentation of ASD occluder device that embolized into the abdominal aorta at the level of supraceliac trunk. This patient was treated conservatively by watchful waiting on an outpatient basis, with strictly scheduled follow up using computed tomography angiography (CTA), after failure of endovascular retrieval of the embolized device.

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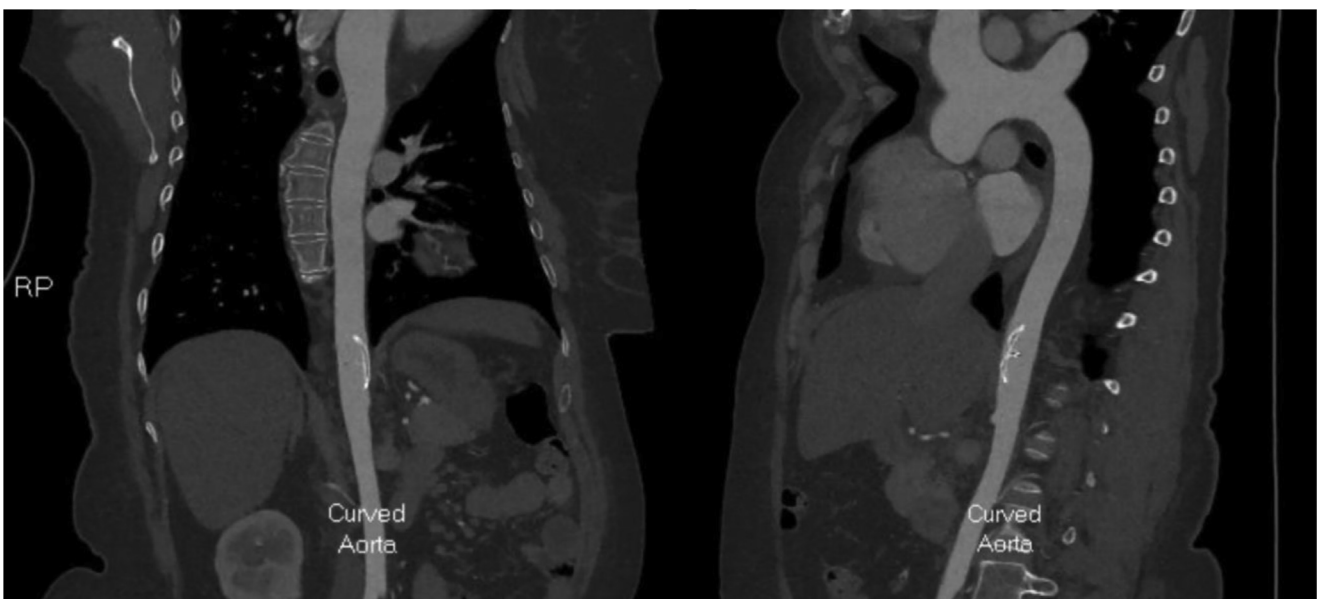
## Case report

After approval of our Institutes' Review Board committee no. 51/04/05/2021, we reported a 41-year-old female patient who presented with a large ASD (Ostium Secundum type) of 28 mm. The patient underwent a transcatheter percutaneous closure by using a large Amplatzer Atrial Septal Occluder device (AASOD) of 32 mm. Postoperatively, she was given Aspirin 150 mg and Clopidogrel 75 mg daily. Two months after AASOD implantation, the patient developed recurrent cardiac symptoms. In spite of that, she never returned to her cardiologist until one year later. Transthoracic echocardiography was performed and revealed a patent ASD with an absent AASOD in and around the defect. Further evaluation with CTA revealed that the AASOD was embolized into the anterior wall of the abdominal aorta at the level of the supraceliac trunk (Fig. 1). There was no local thrombosis within the device, no intra-aortic thrombosis, and no vegetations developed anywhere. Yet, there were no abdominal symptoms or lower extremity vascular complications (i.e. manifestations of acute

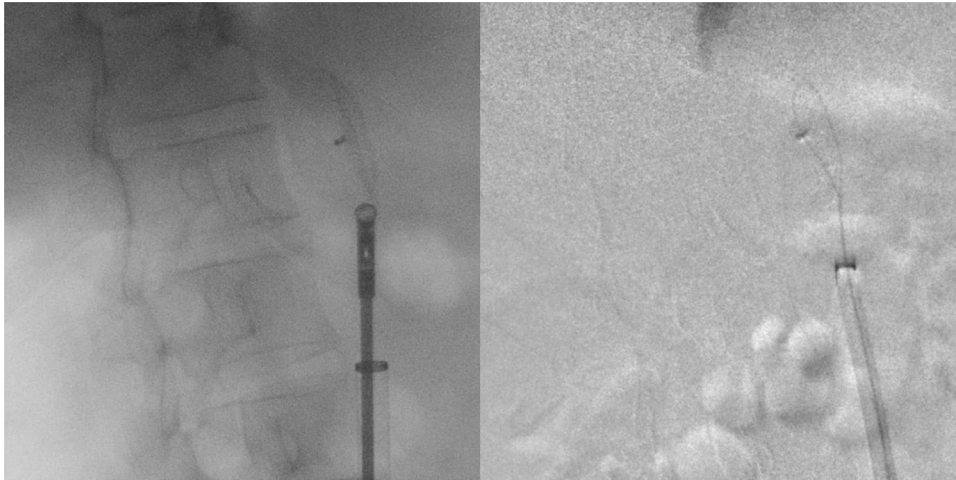
lower limb ischemia, trash foot, color changes). As the condition is asymptomatic, the patient denied percutaneous removal of the embolized device and asked for follow up. Anticoagulation is being maintained and monitored long time [4,5]. Furthermore, and in addition to warfarin therapy, antiplatelet agent was continued in the form of Aspirin chewable tablet (81 mg/d) [6]. The patient was lost to follow up for another year because she got pregnant. Her Pregnancy was uneventful despite patent ASD except for moderate shortness of breath and legs edema which both controlled with medications. Now patient being 2 years after her AASOD placement, CTA revealed the embolized AASOD adherent to the anterior wall of the abdominal aorta just above the origin of the celiac trunk, with no evidence of alteration of the blood flow in either visceral aortic branch (Fig. 2). In addition to the patency of the abdominal aorta and aortoiliac bifurcation. After delivery, the patient agrees to remove the embolized AASOD and is then referred to us for possible percutaneous endovascular retrieval. During the procedure, a 16-French long sheath (Medtronic with adjustable head) was inserted. Multiple attempts to retrieve the device were adopted using the Triloops snare and endovascular grasper (Fig. 3) was failed and the interventional procedure was unsuccessful. Although the AASOD could be grasped, it cannot be detached off the aortic wall because of adhesion and endothelialization within the past two years. However, we decided to terminate the procedure, to avoid serious vascular complications. We discussed the case in a multidisciplinary team including vascular surgeons, interventional radiologists, cardiologists, and cardiac surgeons. They decided to remove the device by open surgery. The patient was admitted for surgical closure of the ASD and surgical removal of the AASOD. Because the patient is asymptomatic and the device is stabilized in its position for over two years, the patient refused its surgical removal, and preferred to surgically close the ASD only. Furthermore, she continued to take both warfarin and antiplatelet therapy, even the device has been endothelialized because it was close to celiac artery orifice and were concern about causing occlusion and was followed up every six months for the next 12 months. Follow up CTA 3 years after embolization was repeated on each visit and revealed that the AASOD was fixed and steady to the aortic wall with good arterial flow through the patent aorta and visceral arteries (Fig. 4). Comparing the previous CTA, the position and the status of the device has been not changed without any local aortic thrombosis with patent abdominal aorta and the iliac bifurcation (Fig. 5). Therefore, we planned to have managed the patient conservatively on an outpatient basis and followed up her with watchful waiting and CTA biannually in the first two years and then annually in the subsequent years. Furthermore, the patient was instructed to attend the hospital immediately if she developed either abdominal symptoms or lower extremity thromboembolic manifestations such as coldness, limb pain, color changes, numbness. The patient has been followed for another two years without any changes of the device position on CTA and still asymptomatic (Fig. 6).



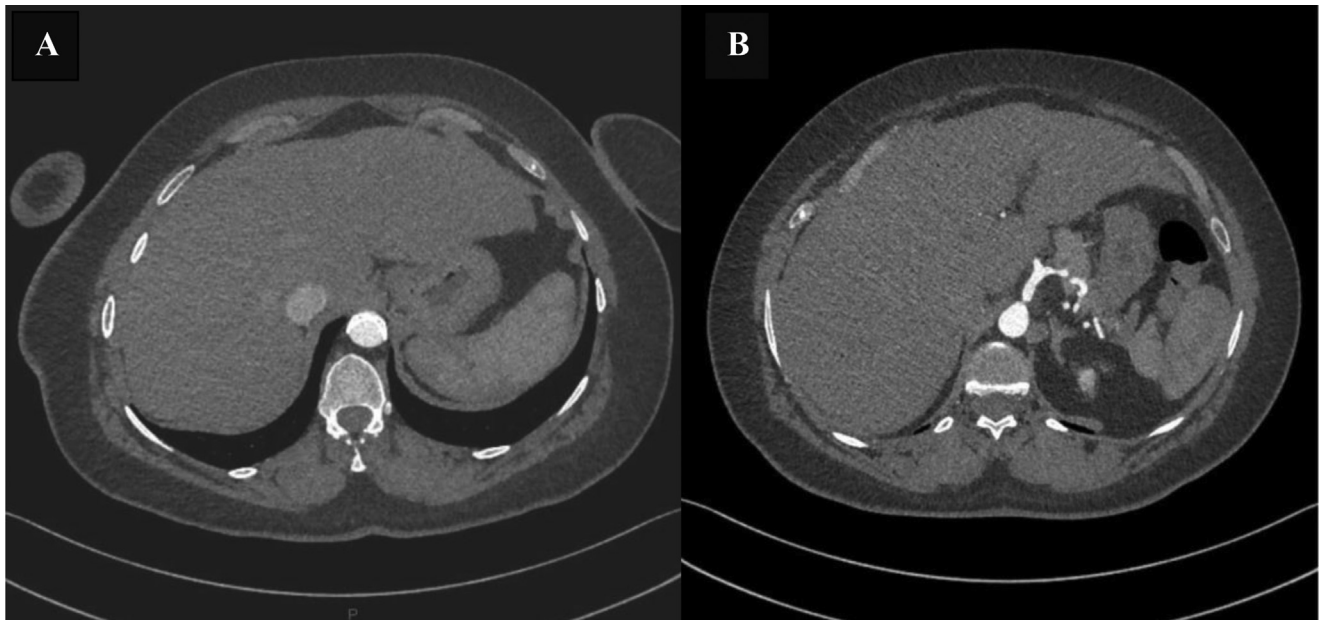
**Fig. 1** – CTA shows the migrated AASOD, which becomes settled in the anterior abdominal aorta just above the origin of celiac trunk, anterior view (A). No associated aneurismal dilatation, dissection or extravasation, with patent abdominal aorta, visceral and iliac arteries lateral view (B).



**Fig. 2** – CTA lateral view 2.5 y after the migration of the embolized AASOD of 37 mm in size. However, it appears adherent and fixed to the anterior wall of the abdominal aorta just above the origin of the celiac trunk, opposite to the T12 vertebral level, without compromising the aortic flow or its branches.



**Fig. 3 –** Fluoroscopic imaging of the embolized AASOD with repeated attempts to remove it using the endovascular grasper and the Triloops snare.

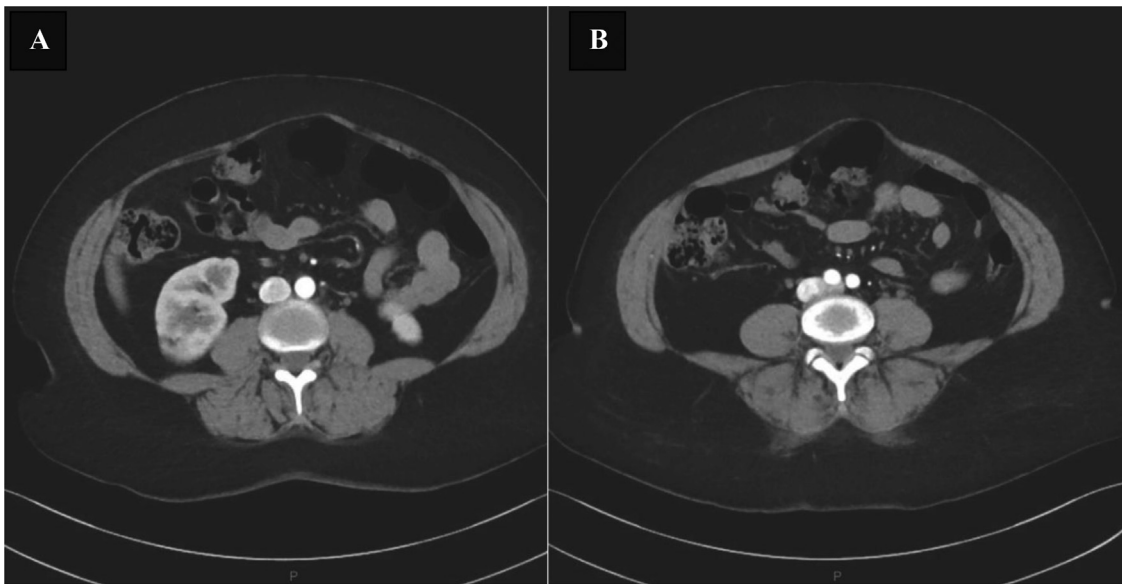


**Fig. 4 –** Repeated follow up CTA after 3 y of the embolized AASOD, and revealed that the AASOD was fixed and steady to the anterior aortic wall (A) with good arterial flow through the patent aorta as well as the visceral arteries (B).

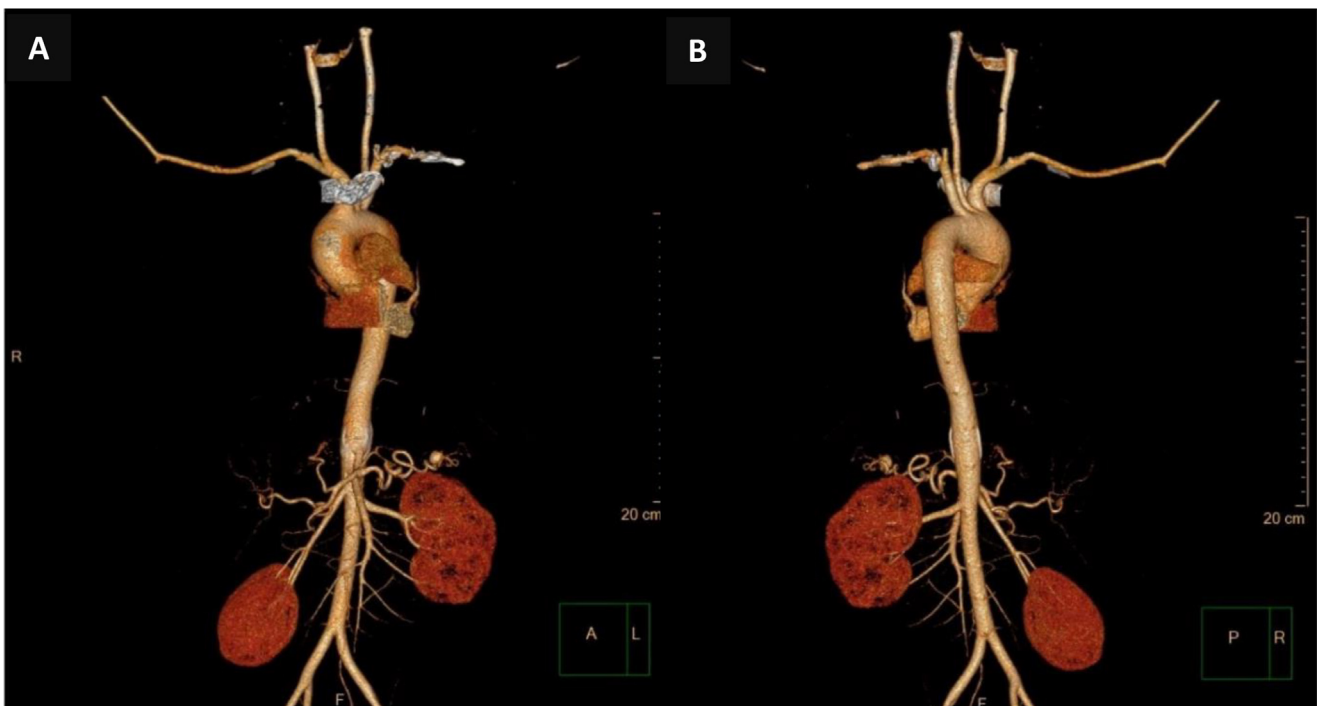
## Discussion

Since the development of the transcatheter percutaneous interventional era for the management of congenital cardiac defects, transcatheter closure of atrial septal defects has been adopted as an acceptable alternative to open heart surgery since the first clinical case was reported in 1976 [7]. Commonly associated complications with ASD occluder devices include erosion, cardiac perforation, residual shunts, dislocation, embolization, infective endocarditis, device-related thrombosis, and sudden death [8]. The incidence of atrial septal occluder dislocation and embolization is one of the late, major, and rare

complications of percutaneous transcatheter closure of congenital heart defects, which reached up to 1%, even in highly experienced centers [9]. Moreover, device embolization into any part of the cardiovascular system was reported to be one of the most common complications followed by significant residual shunt. In the majority of the cases, the AASO device embolized into the main pulmonary artery in 89% [10], left ventricle, left atrium, ascending aorta, aortic arch, descending thoracic aorta, or abdominal aorta [11]. Device embolization usually occurs in the early postoperative period and is commonly developed within the first 24-48 hours in 67% of patients following its implantation. The early embolized device usually settled in the right cardiac chambers [12]. Whereas



**Fig. 5** – Follow up CTA with contrast showed patency of the abdominal aorta (A); as well as the iliac bifurcation (B), without local aortic thrombosis or distal embolization.



**Fig. 6** – Redemonstration of embolized AASOD with CTA after 5 Y of its embolization to the supraceliac abdominal aorta. Through a 3-D anteroposterior view, the device was found adherent to the anterior and lateral walls of the abdominal aorta on both sides above the origin of the celiac artery and away from the visceral branches (A) without any local aortic thrombosis. While the 3-D posteroanterior view showed completely patent abdominal aorta down to the common iliac arteries without any distal complications.

late device embolization might take up to more than a year to be detected and may/may not be recognized [13]. Unfortunately, as in our case, the device embolized later in the supraceliac abdominal aorta within 2 months after implantation. Many factors influencing the development of device embolization. These factors are related to the type of the used device, the size of the defect, a thin atrial tissue verge, high mobility of the occluder device after its implantation, the insertion of a device smaller than the defect, and the complete absence or shortened aortic rim [14]. Moreover, trial of endovascular retrieval of the device at a vascular laboratory using the snare technique eventually failed in more than 50% [15]. This goes in accordance with our case, as we failed to retrieve the device. As surgical retrieval of embolized AASO device is urgent and adopted in 77% of the cases, the high risk of mortality during the procedure and its complications were reported in few cases [15]. Moreover, the success rate of ASD device endovascular retrieval ranges from 5% to 75% of the cases. Also, it was stated in some reports of the surgical literature that the retrieval procedure of an embolized AASO device can be highly challenging and, in some cases, irretrievable [15]. On the other hand, conservative management of embolized AASO device into the abdominal wall was reported only in one case [15], coinciding with that reported in our case. In the current study, we discuss the 5<sup>th</sup> reported case worldwide of a late AASO device embolization into the abdominal aorta who presented after more than one year of the primary procedure. The treatment of choices for embolized AASO device is either surgical removal, endovascular retrieval, hybrid, robotic, or rarely conservative. With regards to our case, we planned to treat the patient by watchful waiting after failure of an attempt of endovascular retrieval, at six months in the first year and then annually in the subsequent years. This follow up schedule may be beneficial in detecting and treating early local and distant lower extremity vascular complications. We planned this decision because the device is fixed and adherent to the aortic wall, not obstructing the aortic flow, not thrombosed, and not causing local intra-aortic thrombosis and because patient refused surgical intervention. In addition to the absence of either abdominal or peripheral vascular manifestations of the lower limbs, with no thromboembolic complications. Furthermore, the long-term outcome of observational management is unknown and needs to be thoroughly evaluated by increasing the number of sample populations. Moreover, this type of conservative observational (i.e. watchful waiting) management representing a promising tool in reducing the operative morbidity and mortality, especially in cardiac patients with a high-risk for open surgical procedures.

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## Conclusion

Embolized atrial septal defect occluder device into the abdominal aorta may be considered as a serious complication especially, when affecting the major artery like the abdominal aorta. This type of embolization was reported only in sporadic cases. When occurs, the device must be removed by either surgical or endovascular technique, depending on the severity of the case, the patients' general condition, and the surgeon's ex-

perience. However, if the embolized device is asymptomatic and cause no harm (whether local or distant), observational conservative management can be performed, especially if the patient is at high-risk for open surgery or if there is failure of endovascular retrieval after multiple trials. Moreover, strict observational management must be adopted to detect early local or distant complications.

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## Author contributions

Samer Koussayer: made the conception and design of the study, acquisition of data, revising it critically for important intellectual content; Ahmed Mousa: analysis and interpretation of data, drafting the article, revising it critically for important intellectual content; Mai A. Elkalla: analysis and interpretation of data, drafting the article, revising it critically for important intellectual content; Raghad Alaujan: analysis and interpretation of data, drafting the article, revising it critically for important intellectual content; Bassam Khalil: analysis and interpretation of data, drafting the article, revising it critically for important intellectual content; All authors: made the final approval of the version to be submitted.

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## Research involving Human

All procedures performed in study involving human participants were in accordance with the ethical standards of the institutional/national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

"This article does not contain any studies with animals performed by any of the authors".

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## Consent for publication

Not applicable.

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## Availability of data and material

The datasets used and/or analyzed that support the findings of this study are available from the corresponding author upon reasonable request.

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