Surgical Approach To An Unsuccessful Device Closure of Atrial Septal Defect
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Citation

Abstract
Atrial septal defect (ASD) is the second most frequent congenital heart defect seen among grownups after bicuspid aortic valve. This defect must be closed due to morbid and mortal complications seen particularly in 4th or 5th decades; such as heart failure, systemic or pulmonary emboli. There have been many reports of excellent early follow up results after device closure of ASD. This method is an effective and fairly safe alternative to surgery with minimal periprocedural complications.

In this study, we aimed to present a case with ASD under the light of the literature who had undergone primary surgical repair due to thrombus formation on the tip of occluding device during an unsuccessful attempt of device closure.

INTRODUCTION
Secundum atrial septal defect (ASD) is a common congenital heart disease and accounts for approximately 6% to 10% of all congenital cardiac defects(1,2). Since 1976, when King and associates attempted the first transcatheter closure of a secundum ASD in humans, device closure has evolved significantly(3). Surgical closure of ASD has a low perioperative mortality and morbidity, it is still associated with a cosmetic disadvantage and a longer hospital stay compared with device closure(4). The alleged advantages of percutaneous closure over surgical closure as shown by some studies in older children and adults include avoidance of cardiopulmonary bypass, decreased complication rates, shorter hospital stays and greater cost-effectiveness(5,6).

The Amplatzer Septal Occluder (ASO) is the first and only device to receive full approval for clinical use in patients with secundum atrial septal defect (ASD) from the United States Food and Drug Administration(7). Interventional ASD closure is now widely practised and has replaced surgical ASD closure in many centres(8). Improvements in design have made the devices retrievable, and reduction in the size of the introduction systems allows interventional treatment even in young patients(9).

CASE PRESENTATION
Our case was a 37-years-old woman. She was admitted to our Cardiology Outpatient Clinic with complaints of dyspnea, tachycardia and increasing fatigue. The transthoracic echocardiography (TTE) which was performed in admittance to our institution, showed a dropout image in interatrial septum compatible with ASD and dilatation of right-sided structures of the heart (diameter of right atrium: 52 millimeters, diameter of right ventricle: 44 millimeters). Transesophageal echocardiography (TEE) revealed a secundum ASD of 2.3 centimeters in diameter at the region corresponding to foramen ovale. She was then hospitalized by Department of Cardiology for percutaneous closure of ASD. Before the attempt for closure, the defect's diameter was measured as 2.5 centimeters by the sizing balloon (Figure 1).
Afterwards, the procedure was continued with a 26-mm ASO. But, the device was then removed since it did not catch the rim and it was considered that the defect could be larger than 25 millimeters. Therefore, a 32-mm ASO device was inserted into left atrium under the guidance of TEE. Due to the tendency to coagulation, routine dose of 5000 IU of unfractioned heparin was completed to 12500 IU. Nevertheless, during TEE examination a suspicious image compatible with thrombus material was seen. Therefore, the device was then removed carefully and a thrombus material was observed on the tip of the device (Figure 2).

She was then transferred to our clinic for surgical repair after this unsuccessful attempt. She was operated under endotracheal general anesthesia and in supine position. Following a median sternotomy, pericardium was opened longitudinally. After heparinization, extra-corporeal circulation is established between the venae cavae and the ascending aorta. A cross clamp was placed on aorta and by antegrade intermittent isothermic blood cardioplegia from aortic root, cardiac arrest was established. Hypothermia was moderate (30ºC). A vent was placed via the right superior pulmonary vein. Standart right atriotomy was made. ASD was evaluated regarding its localization, size, other related cardiac structures and possible associated abnormalities (Figure 3).

**Figure 1**
Figure 1: Sizing procedure using the sizing balloon

**Figure 2**
Figure 2: View of thrombus formed on the tip of ASO device

**Figure 3**
Figure 3: Perioperative view of ASD.
It was determined that primary closure of the defect would not have caused any tension on the septum and the defect was closed primarily by 4/0 polypropylene suture material. Right atriotomy was closed in a standard fashion. Postoperative rhythm was sinusal. She didn’t required inotropic support during weaning from cardiopulmonary bypass and early postoperative period. The volume of blood transfused was one unit. The quantity of mediastinal drainage was 300 cc. She was extubated after an intubation duration of 7 hours and stayed in the intensive care for 2 days. The hospital stay was 7 days. Postoperatively an echocardiographic investigation was revealed no residual shunt for the repaired ASD. She was followed at our outpatient clinic without additional problem.

**DISCUSSION**

ASD transcatheter occlusion techniques have become alternative to surgical procedures. A number of different devices are available for transcatheter ASD closure(1). In study of Lisignoli et al., for 98 consecutive patients (mean age 52.5 +/- 13 years, 61 women), indications of percutaneous closure of a patent foramen ovale (PFO) included recurrent transient ischaemic attack (47%), cryptogenic stroke (34%), peripheral embolism (11%), disabling migraine with aura (4%), professional scuba diving (1 pt) and severe platypnea-orthodeoxia syndrome (1 patient). In same study; major complications included heparin-induced thrombocytopoenia in 1 patient and device dislodgement in 1 patient; minor complications were mostly related to the catheter introduction site (2 patients) and mild immediate shunt (2 patients)(9).

The type and incidence of complications depend partially upon different devices(6). In study of Gao et al., transcatheter closure of ASD with Amplatzer septal occluder (ASO) was performed in 119 patients. The immediate, one month and one year complete occlusion rates were 93.8% (105/112), 97.3% (109/112) and 98.2% (110/112), respectively. Residual shunt remained in 2 cases(6).

Risk of complications do not seem to occur more frequently than after closure of smaller defects if one adheres to certain sizing and implantation measures. The incidence of transient atrial tachyarrhythmias seems to be low(10). If the diameter of ASD is over 36 mm, the device choice should depend on the maximum diameter of ASD determined with echocardiography. It is very important to avoid air embolism and atrial perforation during the procedure(12). The self centering Amplatzer septal occluder offers a different approach by stenting the interatrial communication(r). This unique technique makes it possible to close even large defects (up to 38 mm), while the inability to close such large defects remains a limitation of the patch type devices(s,t). The device can obstruct the orifice of the right pulmonary veins in rare cases with a more superior and posterior defect location(1). TTE and TEE have proved to be very important tools for the exact anatomical delineation of the defect within the atrial septum. As it is difficult to examine defects in older patients using TTE, inspection of the exact nature of the septal rim near to other cardiac structures like the atrioventricular valves, the right pulmonary veins, or the inferior caval vein must be carried out with TEE before catheterisation. TEE is also very important to ensure the correct positioning of the device before and after its release(r).

Device embolization risk was reported to be about 1.1%(2). Diab et al. believe that more experience in using the ASO device in young infants will make this technical complication less frequent(r).

In conclusion; although atrial septal defects are mostly asymptomatic, they should be occluded with appropriate techniques due to such potentially morbid and mortal late complications as arrhythmias, heart failure and paradoxic embolism if remained open.

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