Case Report

Anesthetic management of Amplatzer atrial septal defect closure device embolization to right ventricular outflow tract

ABSTRACT

Percutaneous device closure of atrial septal defect (ASD) is an alternative treatment to surgery with advantages of avoidance of surgery, short procedure time, early discharge from hospital, and lower rates of complications. However, percutaneous device closure is associated with infrequent life-threatening complications such as device embolization. We report a case device embolization of the ASD occlude device into right ventricular outflow tract resulting progressive hypoxia. The role of anesthesiologist as a team leader in managing such emergency is discussed.

Key words: Amplatzer device embolization; anesthetic management; atrial septal defect; cardiac catheterization laboratory; transesophageal echocardiography

Introduction

Atrial septal defect (ASD) is a persistent communication between two atria. The gold standard treatments for ASD are surgical closure. Percutaneous device closure has proven to be effective and safe as an alternative therapy to surgical repair.[1] Percutaneous device closure has several advantages over surgery including less surgical morbidity, avoidance of a scar, and reduced hospitalization duration.[2] However, the procedure or device related complications are potentially fatal.[3] We report a rare case of acute embolization of ASD device to right ventricular outflow tract (RVOT) leading to hypoxia. The management of the case is discussed with a review of literatures.

Case Report

A 34-year-old female was referred to cardiology outpatient department with complains of shortness of breath and palpitation. Chest X-ray showed increased broncho-vascular markings. Electrocardiogram showed P pulmonale, right ventricular hypertrophy, and heart rate (HR) 100/min with normal sinus rhythm. The two-dimensional transthoracic echocardiography (TTE) revealed a large ostium secundum ASD (26 mm × 21 mm) having left to right shunt with mild tricuspid regurgitation (TR), moderate pulmonary artery (PA) hypertension, and left ventricular ejection fraction of 60%. The patient was recruited for trans-catheter ASD device closure. Transesophageal echocardiography (TEE) was performed in catheterization laboratory (CL) and revealed a large secundum ASD measuring 26 mm size, with sufficient rims surrounding ASD. On catheterization, right ventricular pressure recorded as 55/20 mm Hg with mean 34 mm Hg. Amplatzer ASD occluder (St. Jude Medical, St. Paul, Minnesota, USA) of 36 mm diameter was implanted

Access this article online	
Website: www.saudija.org	Quick Response Code
DOI: 10.4103/1658-354X.174911	

How to cite this article: Das S, Kumar P, Bhardwaj V, Palleti R. Anesthetic management of Amplatzer atrial septal defect closure device embolization to right ventricular outflow tract. Saudi J Anaesth 2016;10:335-8.

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under monitored anesthesia care with propofol and fentanyl. After 5 min, peripheral oxygen saturation (SpO_2) dropped to 90% with blood pressure (BP) 130/82 mm Hg and HR 110/min. Repeat TTE detected migration of ASD device to RVOT.

Catheter guided retrieval was tried but failed. The SpO_2 dropped further to 80% with BP 82/46 mm Hg and HR 124/min. Tracheal intubation was done and the patient shifted to operating room (OR). Intraoperative TEE revealed, device below pulmonary valve in the RVOT [Figure 1], a large ASD and severe TR [Figure 2]. After heparinization with activated clotting time >480 s, cardiopulmonary bypass (CPB) was established. After opening the right atrial chamber, surgeon noticed an abrasion in the anterior part of inter-atrial septum; the device was stucked in posterior chordae tendineae of tricuspid valve [Figure 3]. The device was retrieved followed by Dacron patch closure of ASD and tricuspid valve repair. The patient was weaned from CPB with infusion of nitroglycerine 1 μg/kg/m and TEE confirmed successful closure of ASD [Figure 4].

Hemodynamic parameters remained stable with SpO_2 100%. Intraoperative period was uneventful. The patient was shifted to intensive care unit and extubated after 6 h. In postoperative period, Doppler ultrasonography was performed which showed normal flow in bilateral femoral arteries and veins. The patient was discharged from hospital on the seventh postoperative day.

Discussion

The first percutaneous device closure of ASD was performed in 1974. Echocardiographic evaluation of rim quality and

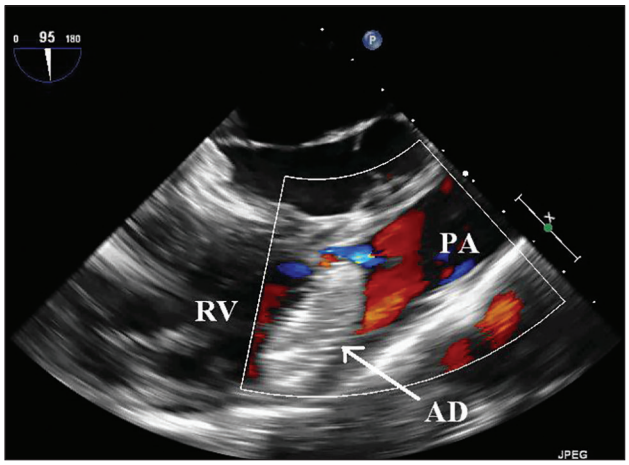

Figure 1: Transesophageal echocardiography two-dimensional color Doppler mid esophageal modified right ventricle inflow outflow view showing atrial septal defect device (indicated by white arrow) at right ventricular outflow tract and obstructing pulmonary artery flow. AD: Amplatzer device; RV: Right ventricle

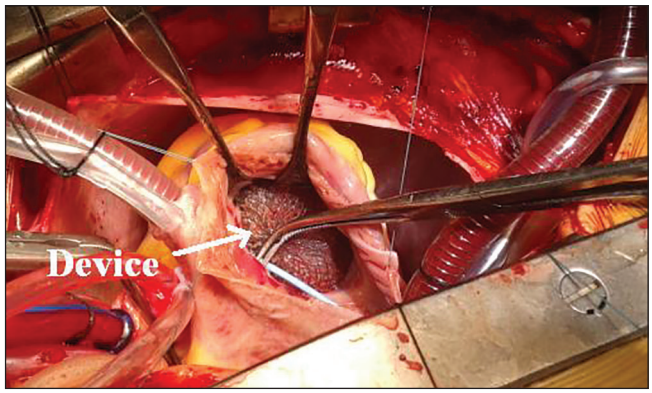

Figure 3: Surgical image showing Amplatzer device (indicated by white arrow) obstructing right ventricular outflow tract

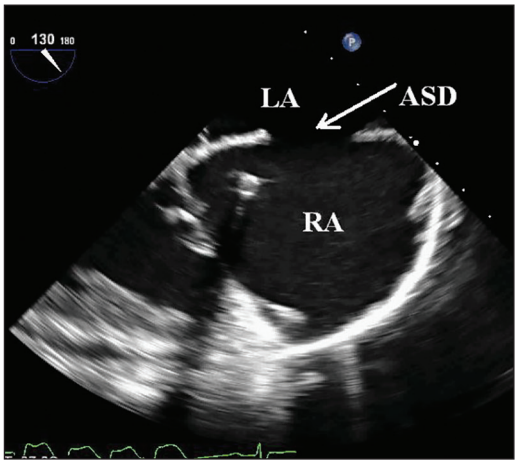

Figure 2: Transesophageal echocardiography two-dimensional mid esophageal modified bicaval view showing atrial septal defect with adequate rim. RA: Right atrium; LA: Left atrium

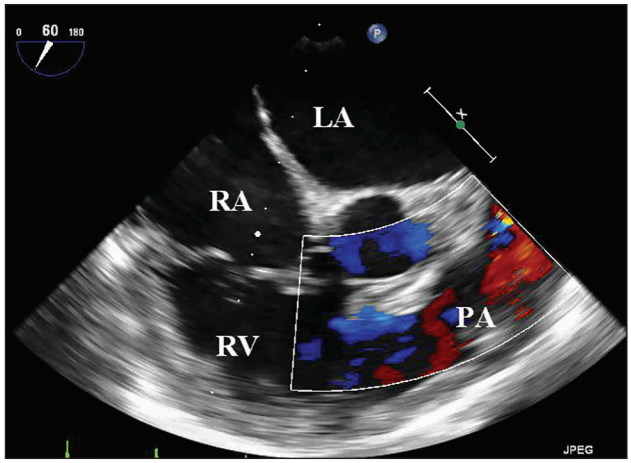

Figure 4: Transesophageal echocardiography two-dimensional color Doppler mid esophageal right ventricle inflow outflow view showing retrieval of atrial septal defect device. There is no right ventricular outflow tract obstruction and no residual septal defect. RV: Right ventricle; RA: Right atrium; LA: Left atrium

measurement of the gradients help inappropriate selection of the patient for the procedure. During the intervention, TEE guidance confirms the echocardiographic findings and assists in deployment procedures. Immediate procedural success rate of Amplatzer septal occluder is 95-98%. The amplatzer device stents the defect, and occlusion is achieved partly by the thin Dacron patch inserts but mainly by *in situ* thrombosis and subsequent endothelialization.[4] Adverse events such as arrhythmia, cerebral embolism, cardiac tamponade, and device embolization requiring immediate surgical removal can occur. Among these device embolization is potentially life-threatening.[5] The reported incidence is 0.01-0.55% and can be higher in less experienced operators.[6]

Clinical presentations depend on localization and orientation of the embolic device. When ASD devices embolized, usually there is no significant hemodynamic compromise even when a large device passed through or lodged in a ventricle but when it migrates to RVOT/PA or left side of the heart patient may become symptomatic and life-threatening.[7]

The same situation happened in our case by embolization of device in RVOT and obstructing PA blood flow resulting in severe hypoxia and hypotension. The immediate management was surgical removal of the errant device and closure of the ASD. Percutaneous retrieval can be attempted by using the devices including large sheaths, gooseneck snares, or endomyocardial biopsy forcep.[8] An uncomplicated surgical retrieval of a device and closure of an ASD can be made significantly more complicated by an ill-advised attempt of retrieval of an embolized device particularly if the device embolized to the PA or either ventricle.[9] In our case, the device was stuck in posterior chordae tendineae of tricuspid valve hence percutaneous retrieval was unsuccessful.

The common reasons for the device embolization immediately after the procedure are undersized ASD device, small left atrium to accommodate the device, inadequate or floppy rim, and operator-related technical issues.[10] Device embolism may also occur during the late periods of postimplantation. The patients at high risk of device embolism must be followed more carefully by echocardiography.

Anesthesia for ASD device closure in the CL might be challenging due to its remote location. Anesthesia modalities for device closure are general anesthesia with tracheal intubation, total intravenous anesthesia, and monitored anesthesia care. General anesthesia is preferred for facilitating the insertion of TEE probe. During the procedure, hemodynamic alteration in form of arrhythmia, alteration in BP, and HR can occur. The complication such as device embolization produces immediate hemodynamic and respiratory threat as in this case report. Anesthesiologist has to be vigilant and prepared to manage such emergency scenario. Transfer of patient from CL to OR is again the role of anesthesiologist in coordinating the team with simultaneous stabilization of patient's vitals. In the OR, anesthesiologist may perform TEE to guide surgeon for location of device and its complete retrieval. The successful closure of ASD could be confirmed by postoperative TEE.

Conclusion

Application of strict criteria for selecting ASD device closure by comprehensive evaluation and careful monitoring for the possible embolization of device are mandatory. Anesthesiologists not only play greater role in administering anesthesia in remote location but also pivotal in stabilizing vital parameters in the moment of hypoxia and hemodynamic instability due to device embolization. Anesthesiologist may act as a team leader in coordinating such type of emergency.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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