Case Report

Surgical removal of an embolized amplatzer device from left ventricle

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Coronary artery fistula is an uncommon but hemodynamically significant anomaly of the coronary arteries, occurring as an incidental finding in 0.1% to 0.2% of coronary angiograms. Although half of the patients with a coronary artery fistula remain asymptomatic, the other half develops CHF, infective endocarditis, myocardial ischemia, or rupture of an aneurysm. This report is illustrative of the right coronary artery fistula to the right pulmonary artery in a 57-year-old male. The definitive diagnosis was made during transesophageal echocardiography and confirmed at operation.

Key words: Atiral septal defect(ASD), amplatzer septal occluder (ASO),device embolization

Introduction

Atrial septal defect (ASD) is the prevalent congential heart disease (3.78 per 10000 live birth).[1] Surgical treatment is safe and effective but the complications relate to thoracotomy, bleeding, arrhythmia, post pericardectomy syndrome, and residual defects[1]. There have been some creative efforts by interventional cardiologists in closing ASD using various devices. ASD closure device was first described by Ring et al. in 1976. The devices used for closure are composed of cardioseal, amplatzer septal occluder (ASO), and the angelwings[2]. The amplatzer septal occluder (ASO) is a device approved by FDA for transcatheter closure of secundum atrial septal defects and fenestrations post Fontan operation[3,4].

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The ASO is a self-expandable, double disc device made from a Nitinol wire mesh. Nitinol is a metal alloy used in many medical appliances. The two discs are linked together by a short connecting waist corresponding to the size of ASD. In order to increase its closing ability, the discs and the waist are filled with polyester fabric[3].

Case report

A 12 year-old boy with symptoms of palpitation and fatigue underwent transthoracic echocardiography, which showed a 20 mm diameter secundum ASD, and EF=77%. The patient was therefore seemed to be a good candidate for ASD closure using ASO. After positioning and releasing, the device was embolized to LA and subsequently to LV. Efforts for percutanous extraction of the device were failed, and the patient was transferred to OR in cardiogenic shock.

A midsternotomy insicion was made, mediastinal cavity opened and CPB established using 2 venous cannulae and caval tapes. We made an incision in RA, and approached LA and then LV through ASD. The occluding device was then removed, ASD closed primarily and CPB was discontinued easily and without any difficulties. Postoperative echocardiography showed no residual ASD and after an uneventful and normal post operation period, the patient was discharged from hospital.

Discussion

Surgical ASD closure has been performed since 1948 with good results and low mortality and morbidity. The operation needs a sternotomy or less commonly thoracotomy incision, CPB and 3-7 days of hospital admission.[5] During past few years, different devices for percutanous closure of ASD have been used for more than 2700 cases worldwide. Amplatzer has been used since 1995 and compared to other competitive devices, and it has passed tests of superiority and applicability. The superiorities of Amplatzer are its simple use and possibility of changing its position. This is due to compositon of nitinol (memory wire) and excellent design, which could retract into the catheter and removed if it was not properly placed in the heart. It is available in 40 mm size[3]. Most ASD secundums can be closed by Amplatzer. Common criteria for a patient being suitable for closure by Amplatzer included a defect with less than or equal to 34 mm, a 4 mm rim of septal tissue surrounding the defect and sufficient distances from surrounding valves and structures[3]. The hazards of ASO are thick profile of device and high amount of nitinol in device and the potential for nikle toxicity[6]. Complications of percutanous ASD closure are air embolism,vascular trauma resulting from large sheathes, device embolization, clot embolization through AV valve, occlusion of pulmonary or systemic venous return, perforation of atrial septum, aortic perforation, infective endocarditis, atrial arrhythmia, device malposition necessitating its removal, delayed breakdown of device and residual atrial[7-10].

According to reports of FDA, the most common complications following Amplatzer insertion are erosion and perforation of heart. There are some reports of this complication occurring many years after insertion[4]. Embolization does not commonly occur but if developed, the reasons were insufficient rim around the defect, early release of device, and mismatch between the size of ASD and Amplatzer which was due to the use of small Amplatzer for a large ASD. Transesophageal echocardiography (TEE) performed during Amplatzer placement seems to be a potential contributor to preventing technical errors and occurrence of complications[11-13]. We recommend using TEE for such interventions since this was not included in our study. The reason for embolization in our patients seemed to be due to both insufficient rim, and mismatch between the size of defect and device. Most cases of embolization were localized to RA and RV in decreasing order of frequency. The reason for this propensity was due to lower pressure in RA and RV compared to those in the left chambers. Contrary to previous reports, embolization in our patient was restricted to left side and LV due to technical error[9, 11-13]. In a study conducted by Berger et al. in one of 61 cases of ASD closure using

Amplatzer, embolization of the Amplatzer device was observed in the left ventricle. The device could be retrieved from the heart, but vascular surgery was required to extract it from the femoral artery[9]. In our patient nonsurgical retrieval was not possible. In another study performed on 236 patients by Fischer et al. with transcatheter closure of ASD, at cardiac catheterisation, devices were not implanted in 18 patients because of overstretched diameter of the ASD, the unstable device, compromised mitral valve, or obstructed upper right pulmonary vein[14]. Upon angiographic and haemodynamic assessment, 8 patients with additional systemic or pulmonary vein anomalies, or an Qp: Qs less than 1.5, were excluded from the study[8]. Bialkowski et al. compared closure and complication rates in 91 children with secundum atrial septal defects. Of these, 44 with mean age, 8.1±4.7 years were treated surgically and 47 with mean age, 10.1±4.9 years were treated by percutaneous Amplatzer septal occluder with complications classified as mild, moderate, or severe. The closure rate was similar in both groups with 42/44 children (95.5%) in the surgical versus 46/47 patients in the device groups (97.5%). As for complications, mild forms were observed in 17/44 patients in the surgical group vs 2/47 in the device group, moderate in 11/44 in the surgical vs 1/47 in the device group; and severe in 2/44 in the surgical group vs none in the device group. Blood products were administered to 18 cases in the surgical and to 1 patient in the device group ($P < 0.001$). Transcatheter closure of secundum atrial septal defects with the Amplatzer device has the advantage of fewer complications, shorter hospitalization, and reduced need for blood products. Nonetheless, the surgeon's ability to close any atrial septal defects regardless of its size or location remains an important advantage of surgery. Surgical Complications include pericardial effusion headache, heartblock, rhythm disturbance, pneumonia, atelectasis,bleeding and stroke[2]. In a report by David et al. 186 patients had atrial defects closed by means of Amplatzer device with no major complications. There were 8 (4.3%) minor complications including 4 device embolizations with 2 removed percutaneously and 2 surgically. Also, 4 instances of arrhythmia comprising 3 transient, and 1 persistent complete heart block. The closure rate for 121 patients with 6 months follow-up was 99%[15].

According to the last reports from US, ASD was closed without any important complications in 186 cases. The patients had a low rate of complications consisting of device embolization which in 2 cases it was extracted percutanously and in 2 patients surgically, arrhythmia in 3 patients including 1 case of permanent complete heart block. Moreover, in 121 cases, the occlusion rate was 99% after 6 months. In most reports, surgical complications after ASD closure were 10-20%. In comparative studies performed by berger et al., no difference was found between prevalence of complications in surgical or ASO closure of ASD. Embolization and percuatanous extraxtion of ASO, after releasing the device from its position, was reported,though the prevalence and causes of embolization and effective methods for extraction were not described systematically in a company-designated analysis.

The prevalence of embolization of ASO in a wide range of sizes of ASD and device was observed in 21 cases of 3824 device closures (0.55%). Most embolizations were due to underdeveloped rim or undersized devices. Of 21 cases of embolizations, 15 cases were extrated percutanously using a goose neck snare without any morbidity or mortality and in 6 cases, it was removed surgically. Other possible causes of embolizations were early release of ASO or lack of meticulous assessment[11]. Kositseth et al. studying 103 patients from April 1998 to Novemeber 2002, reported one case of embolization of ASO (ASD or ASO) in LA, Bialkowski et al. reported one case of embolization of ASO in 181 cases of ASO placement[2]. In a large series, embolization of ASO was reported in 1.1% of cases that required surgical removal in 0.2% of cases. Because the prevalence of embolization of ASO in experienced hand was approximately 1 in 200 cases, operators must be familiar with techniques and instruments and be ready for percuatnous extraction of ASO if necessary. In regard to complication of dehiscense after surgical closure managed by amplatzer, both techniques seemed to have complementry role in the treatment of patients. Amplatzer ASD closure in a single procedure had a lower chance of success than surgery. Overall, there were more complications in the surgical group but in most cases they were minor and did not require any changes in management, Hospital stay and time taken to return to normal activities were significantly shorter in the Amplatzer group patients, but median medical costs was similar for both groups, although the cost of surgical closure seemed to be lower in developing countries[17]. Postoperative changes in sizes of the left and right ventricle indices were more favorable in patients after closure of ASD with ASO (ASDorASO) compared with surgical procedure[6,10,11,14,16,17,18-20]. We concluded that device embolization is an uncommon complication of Amplatzer ASD closure, that can be managed surgically or by percutaneous extraction methods.

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