Case report - Congenital

Perforation of the right atrium and the ascending aorta following percutaneous transcatheter atrial septal defect closure

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Abstract

Transcatheter closure of secundum atrial septal defect has become an alternative to surgery. We present a patient with hemodynamic collapse secondary to cardiac perforation occurring 36 h after the placement of an Amplatzer Septal Occluder and discuss complications of this kind of device.

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1. Introduction

Conventional open surgical ASD repair is a time-tested and well-developed technique with a mortality rate close to zero and with favourable long-term results. Percutaneous transcatheter ASD closure provides superior cosmetic, is less invasive and allows for shorter hospital stays. It is also assumed to have a similar morbidity and mortality and comparable long-term results, when compared to conventional open repair.

Even so, transcatheter ASD closure is not completely risk free. The most frequently cited complications are: residual shunts, malpositions and dislocations of occluders, occluder embolization into the left atrium, right atrium, right ventricle and pulmonary artery, arrhythmias, tromboembolization into the central nervous system and injury of groin vessels at the place of a puncture, device impingement on caval veins, on the right upper pulmonary vein, and on the mitral and tricuspid valves and thrombus of the device [1,2]. All of these may require conversion to an immediate surgical repair. There are also reports regarding the perforation of heart cavities or the development of fistulas between the atria and the aorta as a result of the percutaneous ASD closure [3–6].

2. Case report

A 33-year-old (female) patient was examined for shortness of breath, NYHA II class. Transthoracic (TTE) and transesophageal echocardiography (TEE) showed ASD type II, sized 22×18 mm, with a significant left-to-right shunt with pulmonary to systolic flow Qp/Qs ratio 3:1. In anatomic terms, the anterosuperior atrial septal defect rim was absent and the posteroinferior rim had been developed. After obtaining informed consent, the patient underwent transcatheter closure of the atrial septal defect by means of the Amplatzer Septal Occluder (Amplatzer Septal Occluder, AGA Medical, Golden Valley, MN, USA) (ASO).

The procedure, which was performed under intravenous sedation (without general anesthesia) and under the TEE control, was performed without complications. Technically, the implantation was successful without any residual shunt.

After the procedure, the patient did well. During the first day, approximately 36 h after the procedure, she started to complain of the chest pain. TTE showed a small hemodynamically nonsignificant pericardial effusion. One hour after this examination the patient became hypotensive requiring volume expansion and the administration of catecholamines. Urgent repeat echocardiography showed progression of the pericardial effusion, with signs of tamponade and collapse of the right side heart. Pericardial drainage was performed under echocardiographic control from the subxiphoidial region. Once the patient has hemodynamically stabilized, an urgent surgical exploration was performed.

The patient was transferred to the operating room, median sternotomy was performed and bleeding source was identified: The smaller right-side ASO disc had cut through the dome of the right atrium between the superior vena cava and the aortic root where it created a 4-mm perforation. Another perforation was at the aortic root in the region of the non-coronary sinus, where the occluder was pressed against the aorta via the dome of the right atrium. The aortic wall perforation was longitudinally, approximately 8 mm long, with a transmural defect 4 mm. After removal of the coagulum, there was a minor bleeding jet (Fig. 1).
Cardiopulmonary bypass was established and the heart was arrested. After opening the right atrium we found the ASO, which was positioned well. The ASO was removed and the large septal defect was closed using a pericardial patch. The aortic and atrial perforation were closed with 5-0 polypropylene interrupted suture supported with pericardial pledgets. Extracorporeal circulation was discontinued without complications. The post-operative course was uneventful.

3. Discussion

Atrial perforation after ASO implantation is a rare complication. Four such complications have been described in the literature [3–6], though their actual number is probably higher, as is clear from personal communication between authors of Ourania Preventza & Co. and the firm AGA Medical [3]. These are perforations of the dome of the right or left atrium by the right or left-side ASO disc which may perforate even the aortic root in a non-coronary sinus. This complication may occur early or even several months after the implantation.

From published cases, complications occurred 3 weeks, 3 months and 6 months after the implantation, respectively. In two cases, the dome of the left atrium was injured, in one case the dome of the right atrium was affected. The ascending aorta was injured in two cases, one of them developed an aorto-atrial fistula which was manifested by haemolysis. In all these cases the anterosuperior atrial septal rim was absent.

In the case of our patient, tamponade developed early, 36 h after the ASO implantation. According to pre-implantation echocardiographic examination the anterosuperior rim was absent, also. Echocardiography performed immediately after the ASO implantation showed a close contact of both ASO discs with the ascending aorta (Fig. 2). The occluder was not positioned in such a manner that both the right-side and the left-side disc would touch the aorta in a saddle-like manner and touch it tangentially. The right-side disc was pressed closely against the aorta, which resulted in the cutting of the right disc through the right atrium to the aortic root.

The absence of atrial septal defect rims is a risk factor which may have an adverse effect on the outcome of ASO implantation. If the postero-inferior rim is absent, the implantation is problematic since the occluder may interfere with atrioventricular valves, inferior vena cava or pulmonary veins and there is an increased risk of occluder malposition. In the case of large defects where the anterosuperior rim is not developed, ASO implantation is possible, but technically more difficult due to the necessity to change the orientation of the left-side disc prior to the introduction and detachment of the right-side disc [7,8]. In the case of absence of the anterosuperior rim the use of larger ASO is recommended, where both discs have to rest on the aorta in a saddle-like manner. It is possible that the use of larger ASO might prevent complications in the case of our patient, however, we were limited by the small size of the left atrium. In hindsight, the only possible option was completion of the catheter-based procedure without the defect closure.

During the last two years there have been 30 ASO implantations in the adult patients with ASD in our hospital. An unfavorable anatomy with absent anterosuperior rim was present in 60%, one of the patients developed above-mentioned complication (the risk is 6%).

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References


