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Surgical Treatment of Device Related Complications in Congenital Heart Diseases Treated with Percutaneous Modalities

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ABSTRACT

Secundum atrial sepal defect and patent ductus arteriosus are the most frequently encountered congenital heart diseases. They are treated with percutaneous modalities with high success rates and low morbidity and mortality rates. Peri-procedural complications may occur in the early period or in late follow-up. The most striking feature when complications occur is the high mortality rates observed when surgical treatment is required. Here we report one case with patent ductus arteriosus surgically treated due to broken coil and two cases of atrial septal defect directed to surgery one in the early (with the suspicion of device embolization during the procedure) and one in the late post-procedure period (residual shunt) of device closure. First two patients were directed to emergent surgery, whereas the last one underwent elective surgery. Coil was removed in the case with ductus. There was no embolus due to the device in the second case and defect was closed with a patch. The device was removed and patch closure of the defect was performed in the third case. We believe that, these percutaneous modalities should be employed in centers where cardiac surgical back-up is available.
Key Words: Ductus arteriosus; permanent; heart septal defects; atrial; septal occluder device; complications; treatment

Perkütan Tedavi Edilen Konjenital Kalp Hastalıklarında Cihaz İlişkili Komplikasyonların Cerrahi Tedavisi

ÖZET

Sekundum atrial septal defekt ve patent duktus arteriozus en sık karşılaşılan konjenital kalp hastalıklarıdır. Bu patolojiler, perktütan girişimlerle yüksek başarı, düşük morbidite ve mortalite oranları ile tedavi edilmektedir. Periprosedürel komplikasyonlar erken dönemde ya da geç takip sırasında oluşabilmektedir. Bu komplikasyonlar oluştuğunda cerrahi tedavi gerekli ise yüksek mortalite oranları ile karşılaşılmaktadır. Biz burada kırılmış 'coil' sebebiyle cerrahi uygulanan bir patent duktus arteriozus vakası ve biri erken (işlem sırasında cihaz embolisi şüphesi), diğeri geç dönemde (rezidü kaçak) komplike olmuş cihaz ile kapatılmış iki atriyal septal defekt vakasını bildiriyoruz. İlk iki hasta acil şartlarda, diğeri ise elektif olarak opere edilmiştir. Duktus vakasında 'coil' çıkarılmıştır. İkinci vakada cihaz embolisi saptanmamış, defekt yama ile kapatılmıştır. Üçüncü vakada ise cihaz çıkartılmış, yama ile defekt kapatılmştır. Biz perkütan girişimlerin, kalp cerrahisi desteğinin sağlanabildiği merkezlerde yapılması gerekliliğine inanıyoruz.
Anahtar Kelimeler: Duktus arteriozus; patent; kalp septum kusurları; atriyal; septal vokluder cihaz; komplikasyonlar; tedavi

INTRODUCTION

Secundum atrial septal defect (ASD) is the most common congenital heart disease (CHD) accounting for almost 10% of CHD[1]. It is the second most common CHD encountered in adult population[2]. Patent ductus arteriosus (PDA) is another frequent CHD making up 5%-10% of CHD[3]. Percutaneous transcatheter closure has become standard in these particular cardiac pathologies and is becoming more widely employed[1-4]. Since the first efforts for non-surgical closure in PDA in 1966, over 30.000 devices were implanted for treatment of secundum ASD[5]. However, procedure related complications occur and adversely affect outcomes[6,7].

We report three cases with congenital heart defects treated with percutaneous modalities that required surgery due to device related complications.

CASE REPORTS

Case 1

A 13-month boy weighing 7 kg suffering from congestive heart failure symptoms was admitted with diagnosis of PDA. Echocardiographic data confirmed the

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diagnosis (PDA with dimensions of 4.9x2.8x4.5 mm) without any associated anomalies. Following calculations of shunts and exact measurements of dimensions (PVR:0.84 Woods, Qp/Qs:2.16), percutaneous closure of the defect with coil was decided. A 5F sheath was inserted through the right femoral vein and a 5F NIH catheter was delivered from the pulmonary arteries to the aorta through the PDA and via inferior caval vein, across the patent foramen ovale (PFO) into the left atrium and pulmonary veins. Another 5F sheath was inserted through the left femoral artery. A 6x11 mm sized Nic-Occlud® PDA occlusion system (PFM Medical, Köln, Germany) was used to close the PDA. Despite proper sizing, residual shunt was observed. Due to incomplete occlusion, attempts to restore to the delivery system were made, but the coil was fractured from the hinge point. Due to potential aortic embolization, the patient was referred to urgent surgery.

Under general anesthesia, left posterior thoracotomy was performed. A side clamp was introduced to the point of ductal end of aorta. A 1 cm vertical incision was performed on clamped area through which the coil was pulled away during a brief declamping period (Figure 1). Total exclusion of the coil was assured followed by re-clamping and the duct was closed with double ligation and transfixion. The whole postoperative course was uneventful and the patient was discharged on 4th postoperative day.

Case 2

A 40-year old male patient was referred to our hospital for percutaneous closure of secundum ASD. After cardiologic evaluation, a circular secundum ASD with a diameter of 1.5 cm was confirmed (Qp/Qs:2.01) and percutaneous closure was planned. During deployment of the occluder device, an unknown floating mass was detected on the septum, and the decision for percutaneous closure was changed to surgery.

Under general anesthesia, median sternotomy was performed. Cardiopulmonary bypass (CPB) under mild hypothermia was established through aortobicaval cannulation. After aortic cross clamping, right atriotomy was performed. There was no mass or foreign body over the septum and in the atria. The septum was perforated on the posterior aspect and a free floating septal tissue was observed. This part was excised and the defect was closed with a Dacron patch. The postoperative course was uneventful and the patient was discharged on postoperative fifth day.

Figure 1. The broken coil was removed by surgery, the coil was uninterrupted and complete

Case 3

A 23-year old female patient was referred to our hospital for surgical removal of Amplatzer occluder device and closure of the defect. She was diagnosed of Patent foramen ovale (PFO) 3 years ago after a transient ischemic attack and Amplatzer occluder device closure was performed in another center. The follow-up was uneventful and there was no residual shunt. But, 3 months prior to the admission, during routine follow-up examination in the center where the device was implanted, device prolapse due to migration on the anterosuperior aspect was detected and decision for surgical removal was made. The patient was referred to our center.

Under general anesthesia, median sternotomy was performed. Cardiopulmonary bypass under mild hypothermia was established through aortobicaval cannulation. After aortic cross clamping, right atriotomy was performed. Device deployment on the anterosuperior aspect was observed with residual shunt from the left atrium. The device was removed (Figure 2) and the defect was closed with a Dacron patch. The postoperative course was uneventful and the patient was discharged on postoperative fifth day.

DISCUSSION

Transcatheter treatment modalities have become routine in ASD and PDA closure worldwide[1,6]. The main advantages are avoidance of general anesthesia, surgical trauma and unwanted effects of CPB; shorter length of hospital stay, earlier return to work or school and better cosmetic results[6,7].

There is general agreement that a PDA should be closed as early as feasible. The percutaneous closure technique has been proven to be safe even in infants lower than 8 kg weight[3]. Size of delivery sheaths, long fluoroscopy times especially for low weight infants, aortic obstruction due to device protrusion and even emboli have been reported as complications related with the procedure. Major complication rates were reported to be as high as 6.9%, more frequently in low weight infants. Careful selection of the device according to the size and shape of the PDA may help to reduce the rate of embolization[3,8]. Most of

Figure 2. The atrial occluder device was removed, it was unharmed and complete

these embolized devices can be retrieved using some special designed trans-catheter equipments, but in some occasions surgical approach is necessary and urgent. The outcomes of patients experiencing complications are worse than elective surgical cases[3]. We successfully treated a case with broken coil surgically without any complication.

Percutaneous closure of ASD has become routine in appropriate cases in many centers. Despite the lower morbidity and mortality rates, procedural complications like device malposition or embolization, incomplete ASD closure, mitral or aortic valve injury, cerebrovascular complications, atrial wall erosion and access site related complications occur[6,9]. Not all complications occur in the early post-procedure period, but can occur during late follow-up. Unfortunately, it is known that mortality is higher than elective surgical repair when a procedure related complication requiring surgical treatment occur[6]. We successfully treated a case operated soon after the procedure and the other on the third year. We used dacron patch instead of pericardium for closure due to surgeon's preference.

In conclusion, the percutaneous treatment modalities are not risk free. In the early or late follow-up, complications may arise. Particularly in the immediate post-procedure period, urgent surgery may be required. The cardiology and cardiovascular surgery teams should work in collaboration in order to prevent and treat such complications. All three cases were first intervened in centers with cardiovascular surgery back-up which positively affected the immediate action and successful treatment. Time may be the limiting factor in some cases, immediate action should be made. Therefore, we believe that these modalities should be employed only in centers where cardiac surgical backup is available to avoid lethal complications. Follow-up should be made with precaution, since major complications may also occur very late. With advances in percutaneous techniques, safer devices and lower complication rates will be available.

CONFLICT of INTEREST

The authors reported no conflict of interest related to this article.

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