Transcatheter Patch Occlusion of Secundum Atrial Septal Defect in Adults: An Early Serious Complication Requiring Urgent Surgical Intervention

Erişkinlerde Transkateter Patch ile Sekundum Atriyal Septal Defektin Oklüzyonu: Acil Cerrahi Müdahale Gerektiren Ciddi Bir Erken Komplikasyon

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ABSTRACT A 27 year old woman with large secundum atrial septal defect (25-30 mm), right ventricular dilatation and high pulmonary arterial pressure (40 mmHg) referred to our hospital. Catheter closure minimizes hospital stay and recovery, avoids surgical wounds and their potential complications, and conveys the same hemodynamic benefits as does surgery. After taking patient's informed concent, the defect was occluded with transcatheter patch (Custom Medical Devices, Athens, Greece, CE0434). After procedure transthoracic echocardiography and transesophageal echocardiography demonstrated that the patch sticked to a narrow area of the posterior margin with the rest of the patch floating in the atrial chamber with glue particules and fibrin deposits on it. Due to the risk of complete patch detachment and embolization, urgent open surgical exploration with primary closure was performed. This is the first case in literature with a serious complication with transcatheter patch occlusion.

Key Words: Atrial septum; heart septal defects, atrial; heart catheterization; complications

ÖZET 27 yaşında kadın hasta geniş sekundum atriyal septal defekt (25-30 mm), sağ kalp dilatasyonu ve yüksek pulmoner arteriyel basınçla (40 mmHg) hastanemize başvurdu. Transkateter kapatma hastanede kalış ve iyileşme sürecini azaltır, cerrahi yaraları ve potansiyel komplikasyonlardan korunma sağlar ve cerrahi ile aynı hemodinamik avantajlara sahiptir. Hastadan yazılı onam alındıktan sonra transkateter yama (Custom Medical Devices, Atian, Yunanistan, CE0434) ile defekt kapatıldı. İşlemden sonra transözofajiyel ekokardiyografi ve transtorasik ekokardiyografi ile yamanın arka kenarda dar bir alana yapıştığı, geri kalan kısmının atrial boşlukta üzerinde yapışkan partiküller ve fibrin parçacıklarıyla sallandığı gösterilmiştir. Yamanın tam olarak ayrılması ve embolizasyonu riski nedeniyle acil açık cerrahi yapılarak primer onarım gerçekleştirilmiştir. Bu, literatürde transkateter yama oklüzyonu ile gelişen ilk ciddi komplikasyondur.

Anahtar Kelimeler: Atriyal septum; kalp septum kusurları, atriyal; kalp kateterizasyonu; komplikasyonlar

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Atrial septal defect (ASD) is a congenital heart disease characterized by the wall between the right and left atria does not close completely.[1,2] The transcatheter closure of secundum atrial septal defect (ASDs) has been a preferred method in suitable cases due to good medium-term results, shorter hospitalization period and cosmetic advantage. Transcatheter occlusion devices have been used for many cardiovascular defects, including patent ductus arteriosus, surgical systemic-to-pulmonary artery shunts, atrial septal defect and ventricular septal defect.[3,4] There are some

articles describing device-related complications but not with transcatheter patch (TP) correction.[5] We are reporting the first case in literature of a TP which was found sticked to a narrow area of the posterior margin with the rest of the patch floating in the atrial chamber with glue particules and fibrin deposits on it requiring an emergency surgical intervention.

CASE REPORT

A 27 years-old woman was referred to our hospital because of a large ASD (>10 mm). On physical examination, she had a fixed split second heart sound on a systolic murmur heard best at the left upper sternal border. Further studies with transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) demonstrated a large ASD (25-30 mm). TTE and TEE revealed right sided volume overload, signs of the right heart dilatation and mild mitral stenosis. The pulmonary arterial pressure was 40 mmHg.

The catheter closure minimizes hospital stay and recovery, avoids surgical wounds and their potential complications, and conveys the same hemodynamic benefits as does surgery. According to Sideris et al's successfull results[5] and a full description of the device which has been reported previously[1] we took cardiologists advice and decided that the patient was suitable for TP (Custom Medical Devices, Athens, Greece, CE0434) closure. A strecth diameter of less than 36 mm with the edges of the septum facing toward the mitral valve, coronary sinus, and left superior pulmonary vein were required for inclusion, with a minimum edge length of 6 mm, except in the case of the aortic edge. As the shape of the defect was elliptical, the device chosen was with a size equal to or up to 4 mm larger than the maximum longitudinal diameter. Adequate atrial septal rims was detected by echocardiography and written informed consent was taken from the patient for TP correction.

The patient was scheduled to undergo TP closure. The procedure was carried out with previously described technique. As the defect was 27 mm in size transcatheter large patch (30 mm) (Custom Medical Devices, Athens, Greece, CE0434) was implanted. After 24 hours, TTE and TEE were performed to assess the result of closure. The patch sticked only 1/4th of the rim and was away from the rim floating in the atrial chamber (Figure 1). There was a significant left to right shunt was found. TP closure was assessed as unsuccessful.

Due to the risk of complete patch detachment and embolization, urgent surgical exploration was advised. Open surgical closure with direct sutures (primary closure) was performed as tension on suture track was not expected and during the operation we saw that the defect was elliptical in shape with appropriate dimentions. During operation we saw the patch which was 2.5-3 cm length, 0.5-1 cm width, mobile at superior position and stick to only ¼ th of the rim. The adherence strength was poor as the patch can easily be isolated from the rim. There was a 3-4 mm mobile, pedinculated sticky tissue (Baxter Coosil, fibrin glue) and fibrin deposits on it. The glue particules were cleaned and the patch was removed (Figure 2).

DISCUSSION

The patients with a significant ASD with signs of right heart dilation should be offered elective closure soon after the diagnosis is established, irrespective of age.[6] Surgical closure of ASDs has been practiced for more than 45 years, and has been considered the standard treatment for patients with ASDs.[7]

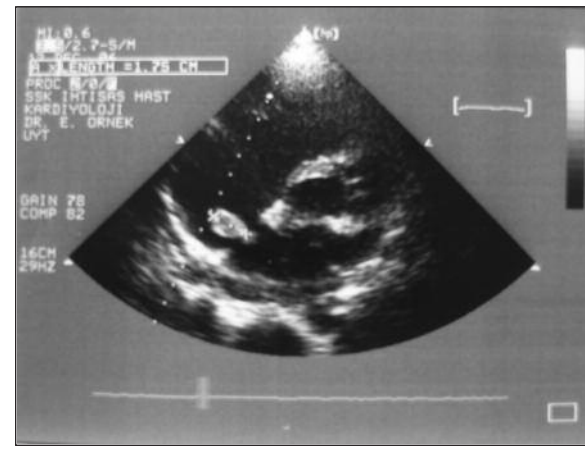

FIGURE 1: Transthoracic echocardiography view of ASDs and the patch in atrial chamber which is away from the septum.

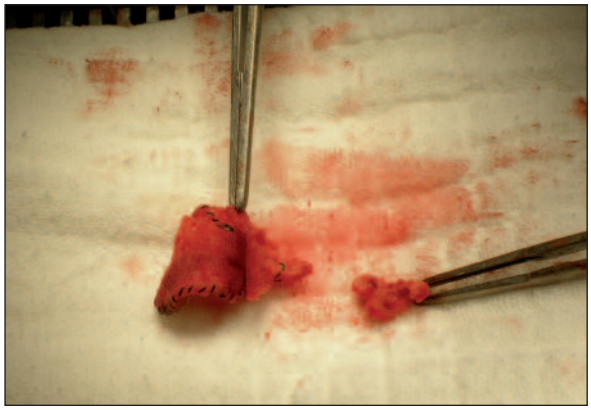

FIGURE 2: Removed patch with glue and fibrin particles.
(See for colored form http://cardivascular.turkiyeklinikleri.com/)

Surgical closure is required for patients with ostium primum and sinus venosus ASDs, as well as for patients with secundum ASDs whose anatomy is unsuitable for device closure. In some settings, surgical closure of secundum defects is still preferred or required.[8] A secundum ASD may be closed with direct sutures ("primary closure") or with a patch using pericardium or synthetic material. Ostium primum defects require patch closure and repair of the "cleft" AV valve.[9,10]

In most centers in the developed world, device closure has become the treatment of choice for secundum ASDs. The procedure is supported by transesophageal or intracardiac echocardiography.[11] Catheter closure minimizes hospital stay and recovery, avoids surgical wounds and their potential complications, and conveys the same hemodynamic benefits as does surgery. Indications for catheter closure are the same as for surgical closure, but patient selection criteria are more narrowly defined. Patients with a stretched secundum ASD >36 mm, those with inadequate atrial septal rims to permit stable device deployment, or those with proximity of the defect to the AV valves, the coronary sinus, or the vena cavae are usually referred for surgical repair.[12]

Device closure is a safe and effective procedure in experienced hands, with major complications such as cardiac perforation or device embolization occurring in fewer than 1% of patients.[13] Successful closure is achieved in up to 95% of patients, although small residual shunts are often seen on echocardiography at the end of the procedure; these are not hemodynamically important, and most will close spontaneously within 1 year. It is possible that device closure of ASDs may reduce the risk of atrial flutter and fibrillation if ASDs are closed at a younger age, if smaller defects are treated, and because of the absence of surgical scars, which themselves may act as a reentrant circuit for arrhythmia. Only early data are available on this point, however, and patients who undergo ASD closure late, whether surgical or catheter, have been subjected to the same chronic hemodynamic burden and thus have a similar arrhythmic potential.[14] In the Mayo Clinic series, the prevalence of late atrial flutter or fibrillation rose progressively with mean age at surgery above 11 years[15] whereas in another series of ASD patients aged 60 years, arrhythmia prevalence was 52%.[16] In the surgical series from Toronto, the preoperative and postoperative risks of atrial flutter or fibrillation were closely related to patient age above or below 40 years. Older patients remain at risk of systemic thromboembolism despite complete closure of the ASD.[17]

Transcatheter closure is associated with all the general risks inherent in any interventional cardiac catheterisation procedure such as the risk of contrast reactions, and the introduction of infection. Complications of femoral vein access include haematomas that may rarely require blood transfusions and, even more rarely, surgical repair when retroperitoneal haematomas have developed.[18] Chessa et al.[19] have reported on a large series of 417 patients who had catheter closure of secundum ASDs. There were 36/417 (8.65%) complications, of which 11 were major and 25 minor. The most common complication was device embolisation/malposition occurring in 3.5% of cases. Of the 15 patients in whom devices embolised or were malpositioned, 10 required surgical retrieval while in the remainder the devices were retrieved by catheter techniques. The next most common complication was arrhythmia, which occurred in 11/417 (2.6%) of cases. In six of these 11, atrial fibrillation required electrical cardioversion.

Four hundred patients with atrial septal defect treated surgically were reviewed in a study. Thirty five (8.7%) developed arrhytmias post-surgery which persisted for over a year. Sinus bradycardia was found in 10 patients, nodal rhythm in 21, and atrial fibrilation and flutter in 4 patients.[20] In another study twenty-nine cardiac events (CE) were identified with Amplatzer septal occluder (ASO). Five were excluded because findings were inconclusive for device-related CP. All patients presented with chest pain, shortness of breath, hemodynamic collapse, or sudden death. Ten patients were <18 years of age, and 76% were women. The CEs occurred early in 20.8% and late in 66.6% (unknown in three patients). The CEs presented 1.5 h to 3 years after intervention. All cardiac perforation (CP) occurred in the anterosuperior atrial walls and/or adjacent aorta. All patients with CP and hemopericardium had cardiac tamponade; pericardiocentesis was performed in 10 patients. Surgical exploration was performed in 19 of 24 patients. The ASO was explanted in 15 patients and remains implanted in 7 patients. Good outcome was reported in 14 patients; 3 patients had neurological deficits, and 3 patients died (unknown in 4 patients). Among the remaining 24 CEs, 14 had defined CP and hemopericardium, 3 had defined CP and fistula formation, and 5 had hemopericardium only. The ASO size ranged from 12 to 38 mm. A Dutch group have reported longitudinal follow up of 21-33 years (mean 27 years) after surgical closure of secundum ASDs in 135 patients.[21,22] There was no cardiovascular mortality, stroke, heart failure, or pulmonary hypertension. However, symptomatic supraventricular tachyarrhythmias occurred in 6% of patients after 15 years and 5% needed pacemaker implantation.[22] Thus arrhythmias appear to be the main long term complication after surgical closure of ASDs but we did not see this complication after surgical closure.

In Sideris et al's report 20 patients undergoing TP closure median age was 37 and median defect diameter was 26 mm. Eighteen patients had immediate effective ASD occlusion; 2 patients had significant residual shunts. One of the patients with residual shunt received a second patch 6 months later with full occlusion.[5] In a multicentre study from 29 paediatric cardiology centres, a comparison was made between transcatheter closure using the Amplatzer septal occluder in 442 patients and surgical closure in 154 patients. For the device group, device embolisation requiring surgical removal was the most common major complication, occurring in four patients. Cardiac arrhythmias requiring major treatment occurred in two patients. In the surgical group major complications included pulmonary oedema and large pericardial effusions requiring pericardiocentesis in two patients and prolonged intensive care unit stay in one patient; large pericardial effusion with tamponade requiring pericardiocentesis or catheter drainage in three patients; repeat surgery because of a large amount of drainage from the chest tube in two patients; and surgical wound complications requiring sternal wire removal and other treatments in two patients. Cardiac arrhythmia was the most common minor complication in both groups.[23]

In our case, the adherence strength of the patch was poor and the patch easily isolated from the rim. We speculated that the problem may be related with biologic glue or technical problems due to incomplete contact between patch and ASD's rim. Accordingly, this could cause embolization of the glue particules and fibrin deposits. At the same time total patch embolization might have occured. On the other hand, it is reported that it can be embedded in the heart and eventually become endotheliazed without the use of surgical sutures or supporting wires.[5]

Although transcatheter closure of secundum ASD with transcatheter patch is an effective method resulting in significant improvement in clinical semptoms; precise attension should be given for the possibility of embolization as a worrisome complication.

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