Aortic Root Rupture During Transcatheter Aortic Valve Replacement Operation: Case Report

Perkütan Aort Kapak İmplantasyonu Sırasında Aort Kökü Rüptürü

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ABSTRACT Transcatheter aortic valve replacement (TAVR) is applied to patients with severe aortic stenosis with high surgical risk. As expected these patients have several comorbid conditions which are increasing mortality and morbidity of surgical aortic valve replacement (AVR). However, the process has its own mortal complications. 86-year-old female patient with severe aortic stenosis had undergone to TAVR operation. Balloon inflated 29 mm transcatheter bioprosthesis aortic valve was inserted. After the implantation aotic rupture was developed. Aortic root rupture is the one of the most catastrophic complication in TAVR.

Key Words: Aortic rupture; sinus of valsalva; aortic valve stenosis; heart valve prosthesis implantation

ÖZET Transkateter aort kapak replasmanı (TAVR) cerrahi riski yüksek, ciddi aort darlığı olan hastalarda tercih edilen bir işlemdir. Yüksek riskli hastalar için mortalite ve morbiditeyi arttıran birtakım komorbit koşulların varlığı cerrahi hasta grubunda beklenen bir durumdur. Ancak TAVR işleminin kendine özgü mortal seyredebilecek komplikasyonları vardır. 86 yaşında ciddi aort darlığı nedeni ile işleme alınan hastaya traskateter balon ile şişirilebilen 29 mm aort kapak takılmıştır. Kapak implantasyonunu müteakiben hastada aort kökü rüptürü gelişmiştir. Aort kökü rüptürü TAVR işleminin en katastrofik seyredebilecek komplikasyonlarındandır.

Anahtar Kelimeler: Aort rüptürü; valsalva sinüsü; aort kapak stenozu; kalp kapağı protezi implantasyonu

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Transcatheter aortic valve replacement (TAVR) is applied to patients with severe aortic stenosis with high surgical risk. As expected these patients have several comorbid conditions which are increasing mortality and morbidity of surgical aortic valve replacement (AVR). The first TAVR operation performed in 2002, and currently it is widely accepted alternative to surgical AVR in patients with high surgical risk. Although mortality and morbidity are lower in surgical action AVR, compared to TAVR procedure, TAVR has considerably high life threatening complication risk. The most pronounced life threatening complications of TAVR are aortic annular rupture and cerebro-vascular embolism. Aortic root rupture is confined to ballon expandable valve implantation, however, cerebro-vascular event is a complication of both ballon expandable and self expandable valve implantation.

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CASE REPORT

Eighty-six years old woman presented with NYHA class 3-4 shortness of breath. Echocardiographic examination revealed moderate mitral stenosis and severe aortic stenosis which has a mean gradient of 70 mm Hg. Measured via echocardiography, aortic valve area was 0.6 cm^2. In medical history she had hypertension, diabetes mellitus, osteoporosis and coronary vascular disease. Heart team decided that the patient had high risk for surgical aortic valve replacement. Her coronary angiogram showed 95% narrowing in proximal LAD artery lumen and the lesion was stented with 3.5-12 mm Bare-metal stent. Chest tomography showed partial atelectasis and light tubular bronchiectasis in her left lung. Bilateral carotid and vertebral artery color Doppler ultrasonography has shown calcified atheromatous plaques in the left carotis communis artery and in the internal carotid artery. Aortic annulus diameter was measured 26 mm in transesophageal echocardiography (TEE) images. Multislice computed tomography (CT) images revealed that aortic annulus diameter was 25x28 mm. TEE measurement of aortic annulus diameter was 26 mm. Aortic annulus area measured and calculated from CT images and found 568 mm^2 also the annulus measurement accepted 27 mm (Figure 1). Considering these measurements heart team decided to implant 29 mm Edward's Sapien transcatheter heart valve through femoral artery. One month later after the percutananeous coronary intervention (PCI) the patient was taken to TAVR procedure. A temporary pacemaker lead was placed into the right ventricle through the left femoral vein. After conventional peripheral angiography left femoral artery exploration was performed by cut-down method. The patient heparinized and activated clotting time level kept above 300 second. Balloon aortic valvuloplasty was performed by 25X50 mm balloon following arterial pressure drop under rapid pacing.[1] Following the valvuloplasty, Edwards Sapien XT 29 mm valve was implanted succesfully, and the delivery system was retrieved (Figure 2). No interference with mitral valve function, no conduction system impingement, no overhanging native aortic leaflets was observed (Figure 2). After few minutes of delivery, blood pressure dropped abruptly. TEE has shown large pericardial effusion and cardiac tamponad. An aortic root angiogram revealed aortic root rupture (Figure 2). Emergent pericardiosyntesis and sternotomy was performed. Surgical exploration revealed disorganised myocardial fibers and rupture at the left ventricle outflow tract (LVOT) under the left coronary sinus. LVOT was fixed from inside using pledged sutures. Aortic annulus was not damaged. A bioprosthesis aortic

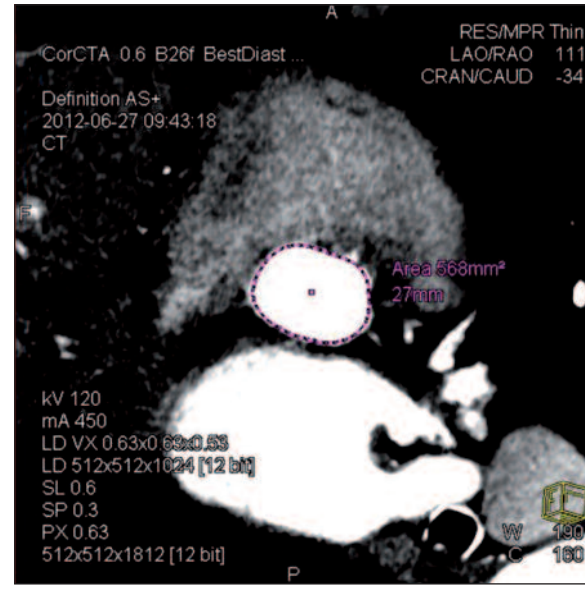

FIGURE 1: CT measurement of the aortic annulus area.

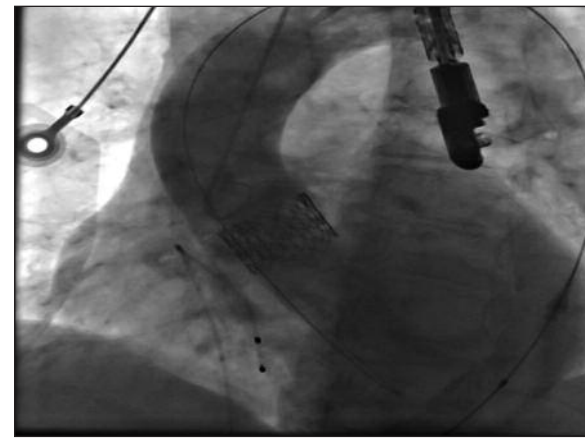

FIGURE 2: Delivery system successfully retrieved after placement of Edwards Sapien XT 29 mm valve.

valve was replaced and operation completed. Partly weaning from pump it was clear that there was leakage from tens of points on a large area. Additional efforts to stop leakage was futile, and the patient could not be saved.

DISCUSSION

TAVR is a good choice for aortic stenosis patients with high surgical risk. However, its complications might be life threatening.[2] The most prevalent life threatening complication of TAVR is aortic root rupture, its incidence ranges between 0.5% to 1%, and 50% of patients with aortic root rupture dies.[3] Aortic root rupture occurs most commonly at the inferior portion of the aortic annulus, an area described as a "vulnerable zone" due to the absence of external supporting structures and its proximity to the pericardial cavity. This membrane is a thin collagenous structure and thus the thinnest structure between the left ventricular out flow tract and the base of the aortic root.[4] In our case the rupture occured between the posterior of the left coronary sinus and non-coronary sinus (Figure 3). Oversize valve implantation in a smaller annulus , heavy annular calcification which is extending well into the left ventricular outflow tract

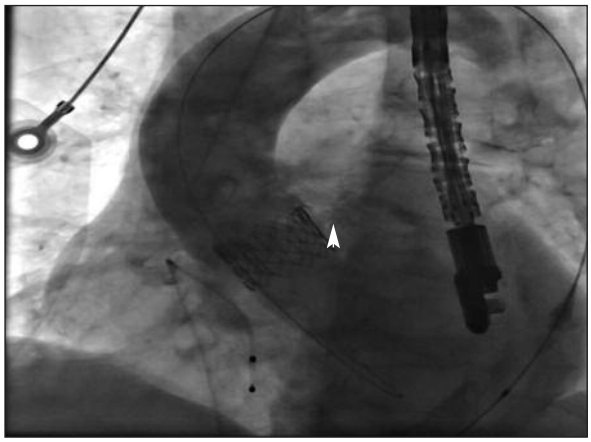

FIGURE 3: Arrow sign is showing the opaque leak below the left main coronary artery.

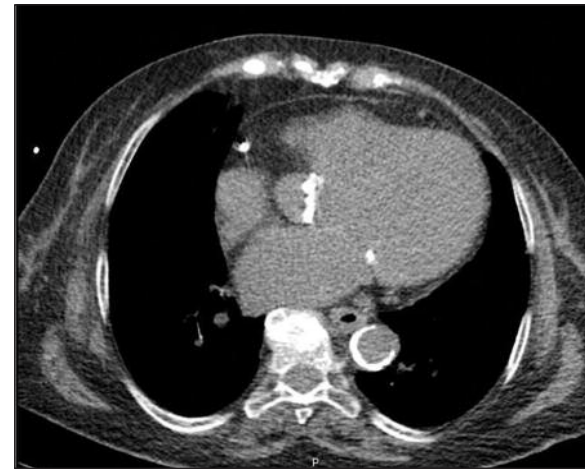

FIGURE 4: Heavy calcification is seen above the annulus.

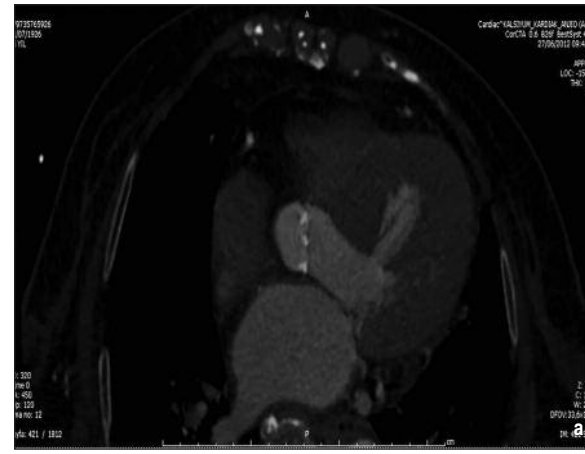

FIGURE 5a, b: No severe calcification is seen at the level of LVOT.

is an important predictor of aortic root rupture.[5] They have studied aortic root rupture in 31 patient who had aortic root rupture. Aortic root rupture was identified in 20 patients and periaortic hematoma in 11 case. Most patients with aortic rupture were deceased. Patients with root rupture had a higher degree of subannular/LVOT calcification and a higher frequency of ≥20% annular area oversizing and balloon postdilatation.[5] In our case multislice CT images has shown that left ventricular outflow tract was free of remarkable calcification (Figures 4, 5a, 5b). The percentage of oversizing (positive value) or undersizing (negative value) was calculated by using the formula (transcatheter heart valve area/annular area-1)x100.[6] Fully inflated 29 mm valve have 661 mm^2 area. With full inflated 29 mm valve we made 16.37% oversizing in 568 mm^2 area, however a 26 mm valve would be undersized. It is widely accepted that 10% oversizing is enough for avoiding paravalvular leakage, and more than 20% oversizing is an independent predictor of aortic annulus rupture.[5] Retrospectively considering the case, we inferred that a 29 mm valve could be inflated to 28 mm or a 26 mm valve could be post dilated if a significant regurgitation is developed. Valve in valve and simultaneous pericardiocentesis or surgical intervention may be considered to tide over this grave clinical condition.[6] Either way aortic rupture is a catastrophic complication.

Annulus diameter, aortic valve calcifications and LVOT calcifications should be evaluated and measured carefully to avoid complications especially in ballon expandable transcatheter valve implantation.

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