

Valve-in-valve implantation due to malposition of transcatheter aortic valve applied by coronary guide wire protection in presence of lower-lying coronary ostium

Düşük yerleşimli koroner ostium varlığında koroner kılavuz tel koruması ile uygulanan transkateter aort kapağının yanlış pozisyonuna bağlı kapak içine kapak yerleştirilmesi

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ABSTRACT

Although transcatheter aortic valve implantation is an important procedure in the treatment of severe aortic stenosis with a high-operative risk today, technological difficulties and limitations still exist. Life-threatening complications, such as coronary artery occlusion, are considered potential risks. The presence of low coronary ostium distance is one of the major limitations of the transcatheter aortic valve implantation. An impaired coronary blood flow during transcatheter aortic valve implantation results from the presence of a low coronary ostium height. In case of short distance between the coronary ostium and valve, a detailed preoperative evaluation should be performed and additional precautions should be taken during the transcatheter aortic valve implantation to avoid coronary obstruction. Coronary occlusion at a lower rate can be achieved, if a shorter prosthesis is placed too low as possible into the aortic annulus. In this article, we report an 82-year-old female case of low coronary ostium height at high-risk for surgery due to severe aortic stenosis, in whom valve-in-valve implantation was performed using coronary guidewire protection due to the malposition of the first valve.

Keywords: Aortic valve stenosis; coronary occlusion; prosthetic heart valve implantation.

Transcatheter aortic valve implantation (TAVI) has emerged as a life-saving treatment of choice for patients with severe aortic stenosis (AS), who are considered to be surgically high-risk candidates.^[1-3] Despite the increasing use of TAVI currently, the potential risks for life-threatening complications still

ÖZ

Günümüzde transkateter aort kapak implantasyonu cerrahi riski yüksek ciddi aort darlığı tedavisinde önemli bir işlem olmasına rağmen, teknolojik zorluklar ve sınırlamalar halen mevcuttur. Koroner arter ağzı tıkanması gibi yaşamı tehdit eden komplikasyonlar potansiyel risk olarak kabul edilmektedir. Düşük koroner mesafesinin varlığı, transkateter aort kapak implantasyonunun önemli sınırlamalarından biridir. Transkateter aort kapak implantasyonu sırasında koroner kan akımının bozulması, düşük koroner ostium yüksekliğinin varlığından kaynaklanır. Koroner ostium ile kapak mesafesinin kısa olduğu durumlarda, koroner tıkanmadan kaçınmak için ameliyat öncesi detaylı değerlendirme yapılmalı ve transkateter aort kapak implantasyonu sırasında ilave güvenlik tedbirleri alınmalıdır. Daha kısa bir protez kapağın aortik anulusa mümkün olduğunca çok düşük yerleştirilmesiyle daha az düzeyde koroner tıkanma oluşabilir. Bu yazıda, düşük koroner ağzı yüksekliği olan ve cerrahi için yüksek riskli ileri aort darlığı bulunan, ilk kapağın yanlış pozisyonu nedeniyle kılavuz tel ile koroner korunma sağlanarak kapak içine kapak yerleştirme işlemi yapılan 82 yaşında bir kadın olgu sunuldu.

Anahtar sözcükler: Aort kapak darlığı; koroner tıkanma; protez kalp kapağı implantasyonu.

remain.^[1] Coronary flow impairment, as a major issue in TAVI, may result from the obstruction of the coronary ostium.^[2] Although there are several TAVI studies reporting its incidence (usually <1%),^[2,3] data on this life-threatening complication have been limited to case reports and very small-scale case series. In this



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article, we present a successful implantation of the second transcatheter heart valve (THV) in a surgically high-risk AS patient with low coronary diameter as an invaluable bailout strategy for malpositioned valve following the first implantation procedure.

CASE REPORT

An 82-year-old female patient with a history of cerebrovascular event, chronic obstructive pulmonary disease, and renal impairment with a creatinine level of 2.1 mg/dL was admitted to our hospital for worsening dyspnea caused by severe calcific AS. She was in the New York Heart Association (NYHA) classification Class III dyspnea. On clinical examination, severe aortic stenosis (mean gradient: 45 mmHg; valve area: 0.7 cm²) with a reduced left ventricular ejection fraction (45%) was noted. Considering the advanced age and high-risk profile (logistic EuroSCORE: 23.2%; STS-PROM: 5.4%), the patient was referred to TAVI by the heart team. The distances from the left main coronary artery (LMCA) ostium to the aortic root and sinus of Valsalva (SOV) diameter were measured as 6.1 mm and 18.6 mm, respectively using multi-detector computed tomography (Figure 1a). The

procedure was performed via transfemoral approach with implantation of a 23 mm Edwards Sapien XT valve (Edwards Life Sciences, Irvine, CA, USA). We advanced a bare-metal stent via the guidewire into the left ascending artery (LAD) before THV deployment to protect coronary arteries from coronary obstruction. The position of the prosthesis was assessed by aortography and the THV was implanted during rapid ventricular pacing on the appropriate position (Figure 1b). However, malposition of the THV into sinus Valsalva was seen by aortography after the first deployment. The LMCA ostium was assessed using different angles on aortography; however, no occlusion of the LMCA was detected (Figure 1c). A severe paravalvular leakage occurred and we planned to implant a second THV due to the presence of severe periprosthetic aortic regurgitation and possibility of migration for THV. A bare-metal stent was withdrawn into the catheter successfully. The second THV, which is the same size with the first one, was implanted successfully to a deeper level into the left ventricular outflow tract passing through the first prosthesis. Repeated aortography showed normal coronary flow (Figure 1d, e). The early

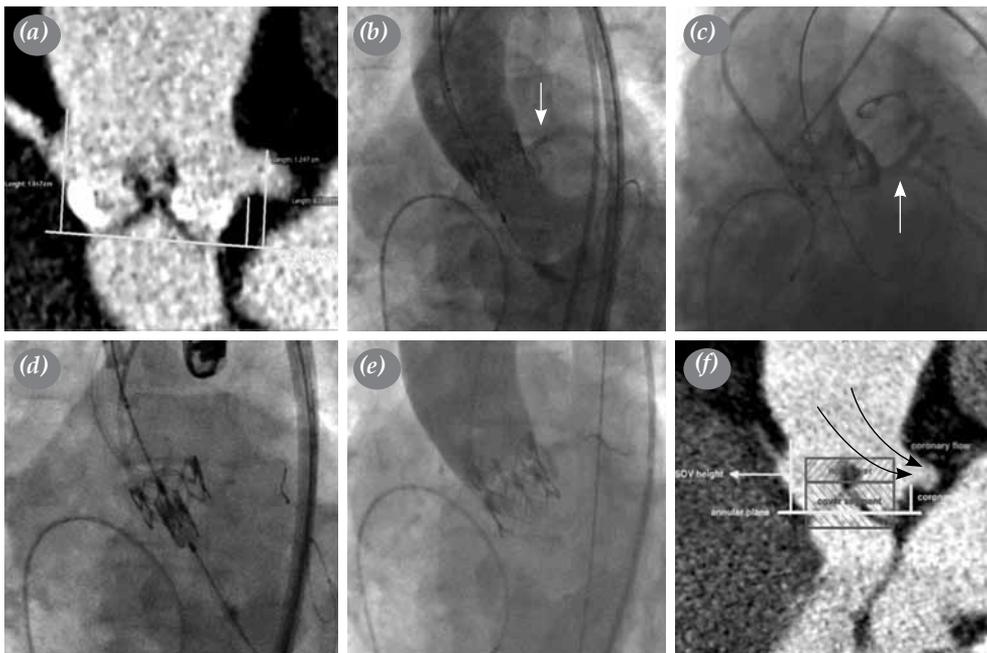


Figure 1. (a) Computed tomography angiographic measurements in the long-axis view for the left coronary artery height and sinus of Valsalva diameter. (b) A malpositioned transcatheter heart valve into the sinus of Valsalva was seen on aortography following the first deployment. (c) Aortography showed no obstruction of the left main coronary artery (white arrow). (d) A second valve as low as possible in the aortic annulus. (e) Good final angiographic results. (f) The possible reason of continuing coronary flow might be the coronary ostia lateral to the stent frame or there might be flow laterally from the open sinuses (black arrow).

postoperative course was uneventful. Postoperative echocardiographic examination demonstrated that the opening angle of the prosthesis was normal with a 14 mmHg mean gradient and a moderate paravalvular leakage. Two days after the procedure, the patient required implantation of a permanent pacemaker due to the left bundle branch block with sinus bradycardia. On day 8, the patient was clinically stable.

DISCUSSION

The presence of a low coronary orifice is an important limitation of TAVI.^[2] During TAVI, coronary flow restriction due to the obstruction of the coronary ostium may occur either by direct blocking from the implanted stent or from the native aortic leaflets immobilized against the coronary orifices.^[2] Coronary ostium height is an important factor associated with coronary obstruction following TAVI.^[2] The incidence of this complication may vary depending on the type of the transcatheter valves (balloon-expandable and self-expandable).^[2] The coronary obstruction rate is doubled among patients who received a balloon-expandable valve.^[2] Varying frame characteristics and valve implantation mechanisms of these two transcatheter valve systems can partially explain these differences. Moreover, the vast majority (>80%) of patients with coronary obstruction following TAVI are women and the occurrence of coronary obstruction is also more frequent among patients with a previous surgical aortic bio-prosthesis.^[2] Recent reports have shown that less coronary occlusion occurs, if a shorter stent is placed on the lower level as possible in the aortic annulus.^[4] We implanted the Sapien XT valve instead of CoreValve (Medtronic Inc., Minneapolis, MN, USA), as 23 no Sapien XT, which has a 14.3 mm height, is more suitable and shorter than the other valves for our case. We considered that THV should have been placed in a lower level as possible into the left ventricular outflow tract to avoid the proximity between THV and the coronary ostium. However, malposition of the THV into the sinus of Valsalva was seen on aortography, after the first deployment without an occluded LMCA. The possible reason of the continuing coronary flow after the initial THV might be coronary ostium lateral to the stent frame or there might be flow laterally from the open sinuses (Figure 1f). The Sapien XT valve was used in our case. Different prosthetic materials and their implantation mechanisms may also affect the possibility of the coronary flow impairment. For instance, a new generation Edwards Sapien 3 THV can better prevent the occurrence of this severe complication than the earlier generation of the balloon-expandable valve.^[5] Furthermore, CoreValve THV, which consists

of a concave shape with self-expandable implantation technique, can also prevent this complication. In patients at a high-risk for coronary obstruction, we suggest to implement additional precautions during the TAVI procedure, such as simultaneous angiography during the balloon valvuloplasty to visualize the coronary obstruction or coronary protection with placing a guidewire to the coronary artery in the presence of suggestive clinical and anatomical parameters of risk. Importantly, percutaneous coronary intervention was also reported to be feasible, which was attempted in 75% of the patients previously, with a success rate of 81.8%.^[2] Finally, the use of a transcatheter valve, which can be re-positioned or retrieved in case of coronary obstruction following the valve implantation, should probably be preferred in certain high-risk cases. In the present case, despite the intra-procedural pitfalls, the final result was satisfactory with relatively low transvalvular gradients without a coronary obstruction. It should be kept in mind that malposition of the prosthesis can complicate the TAVI procedure; however, it can be managed safely and effectively with bailout transcatheter techniques.

In conclusion, coronary obstruction following the transcatheter aortic valve implantation is a rare, but potentially fatal complication. Low-lying coronary ostium and small sinus of Valsalva may be anatomical risk factors, which highlight the importance of a thorough pre-procedural evaluation to avoid this complication.

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