Journal of Cardiology Cases 19 (2019) 133–135

Contents lists available at ScienceDirect

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase

Case Report

Transcatheter aortic valve replacement in a patient with anomalous origin of the left coronary artery

Sung Woo Cho (MD PhD)[a,1], Byung Gyu Kim (MD)[a,1], Taek Kyu Park (MD)[b], Seung-Hyuk Choi (MD PhD)[b], Hyeon-Cheol Gwon (MD PhD)[b], Sung-Ji Park (MD PhD)[b,**], Jong Chun Nah (MD)[a,*]

[a] Division of Cardiology, Department of Internal Medicine, Inje University College of Medicine, Seoul Paik Hospital, Seoul, South Korea
[b] Division of Cardiology, Department of Internal Medicine, Heart Vascular Stroke Institute, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea

ARTICLE INFO

Article history:
Received 22 June 2018
Received in revised form 25 October 2018
Accepted 5 December 2018

Keywords:
Anomalous origin of the left coronary artery
Transcatheter aortic valve replacement
Aortic stenosis

ABSTRACT

Transcatheter aortic valve replacement (TAVR) is widely performed in patients with severe aortic stenosis (AS), having a high surgical risk. However, reports of TAVR performed in patients with anomalous coronary arteries are rare. In existing literature, several complications including coronary obstruction are reported. In this study, we report a 77-year-old female patient with severe AS and anomalous origin of the left coronary artery from the right coronary sinus, who successfully underwent TAVR.

<**Learning objective:** During transcatheter aortic valve replacement in patients with anomalous coronary arteries, special attention might be given to the topographical location of the coronary artery from the aortic root and the implanted valve for preventing a coronary obstruction.>

Introduction

Transcatheter aortic valve replacement (TAVR) is a well-established therapeutic option in aged patients with severe aortic stenosis (AS) having a high surgical risk. Recently, the indication of TAVR has been gradually extended to intermediate-risk patients [1]. However, TAVR in patients with anomalous coronary arteries are rarely reported. In previous literature, several complications, such as coronary obstruction, have been reported [2–6]. In the present case, we describe a case of successful TAVR in a patient with anomalous origin of the left coronary artery (LCA) from the right coronary sinus.

Case report

A 77-year-old woman presented at our hospital with Canadian Cardiovascular Society Grade III exertional chest pain and New York Heart Association Functional Class III exertional dyspnea. She had a medication for hypertension and dyslipidemia. Transthoracic echocardiography showed a thickened and calcified aortic valve with severe AS (valve area of 0.46 cm^2 by the continuity equation, mean gradient of 85.2 mmHg, peak transaortic velocity of 6.28 m/s, and left ventricular ejection fraction of 69.3%) (Fig. 1A). A coronary angiography revealed an anomalous origin of the LCA from the right coronary sinus (Fig. 1B and C). The distal part of LCA originated from the conus branch of the right coronary artery (RCA) and proximal part of LCA originated from the right coronary sinus. These were located via a retroaortic course as shown by coronary aorta computed tomography angiography (CCTA) (Fig. 1D–G).

Although she had a low surgical risk (logistic EuroSCORE: 3.94%, Society of Thoracic Surgeons mortality risk: 2.55%), she strongly wanted to undergo TAVR. A CCTA showed that the sinus of Valsalva size was 28.4 × 28.9 × 29.6 mm (Fig. 2A) and the sinotubular junction size was 26.9 × 28.3 mm (Fig. 2B). The aortic annular area was 4.64 cm^2 and the annulus area-driven and perimeter-driven diameters were 24.3 and 25.2 mm, respectively (Fig. 2C). The distance of the right coronary ostia from aortic annulus plane was

* Corresponding author at: Division of Cardiology, Department of Internal Medicine, Inje University College of Medicine, Seoul Paik Hospital, 9 Mareunnae-ro, Jung-gu, 04551, Seoul, South Korea.
** Corresponding author at: Division of Cardiology, Department of Internal Medicine, Heart Vascular Stroke Institute, Samsung Medical Center, Sungkyunkwan University School of Medicine, 81 Irwon-ro, Gangnam-gu, 06351, Seoul, South Korea.
E-mail addresses: tyche.park@gmail.com (S.-J. Park), drnah1970@hanmail.net (J.C. Nah).
[1] Sung Woo Cho and Byung Gyu Kim contributed equally to this work.

https://doi.org/10.1016/j.jccase.2018.12.011
1878-5409/

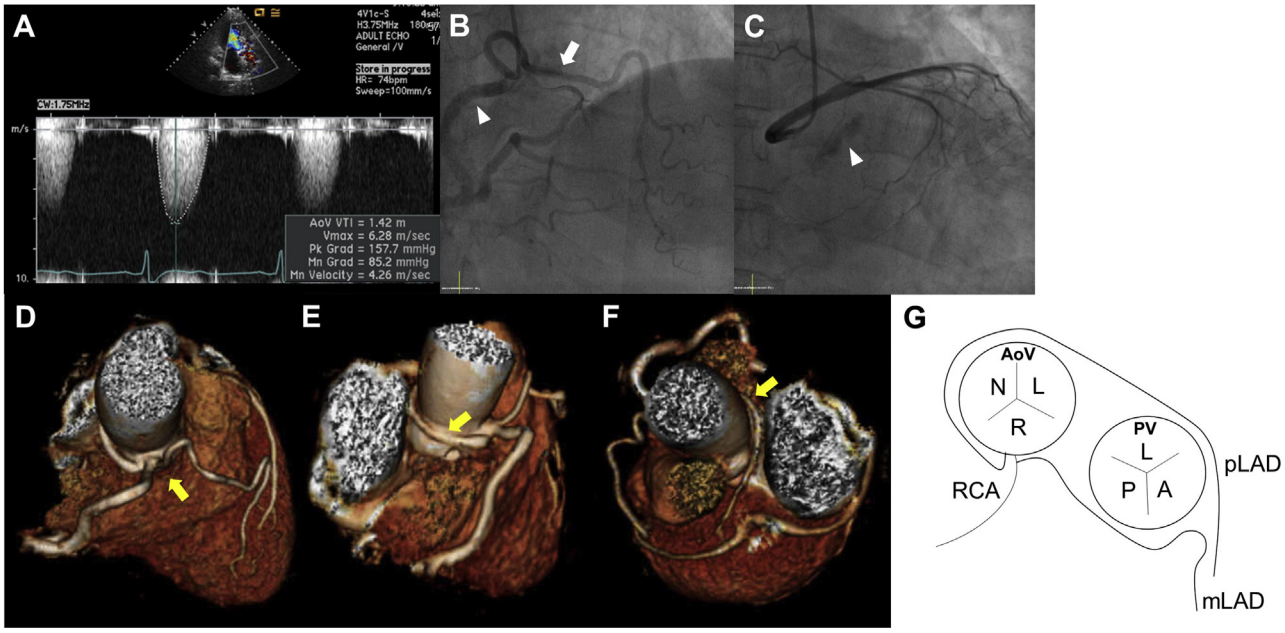

Fig. 1. (A) Transthoracic echocardiography showing a continuous wave Doppler image of severe aortic stenosis obtained from apical 5-chamber view before transcatheter aortic valve replacement. Coronary angiography showing a (B) right coronary artery (arrow head) and distal left coronary artery from conus branch (arrow). (C) Proximal left coronary artery from the right coronary sinus and severe calcified aortic valve (arrow head). Coronary aorta computed tomography angiography showing a (D) bifurcation and anomalous origin of the left coronary artery at the right coronary sinus (yellow arrow). (E and F) Proximal left coronary artery via retroaortic course adjacent to the sinotubular junction (yellow arrow) (G) Schematic diagram of relationship between coronary arteries and valves. A, anterior; AoV, aortic valve; L, left; mLAD, mid left anterior descending artery; N, non-coronary; P, posterior; pLAD, proximal left anterior descending artery; PV, pulmonic valve; R, right; RCA, right coronary artery.

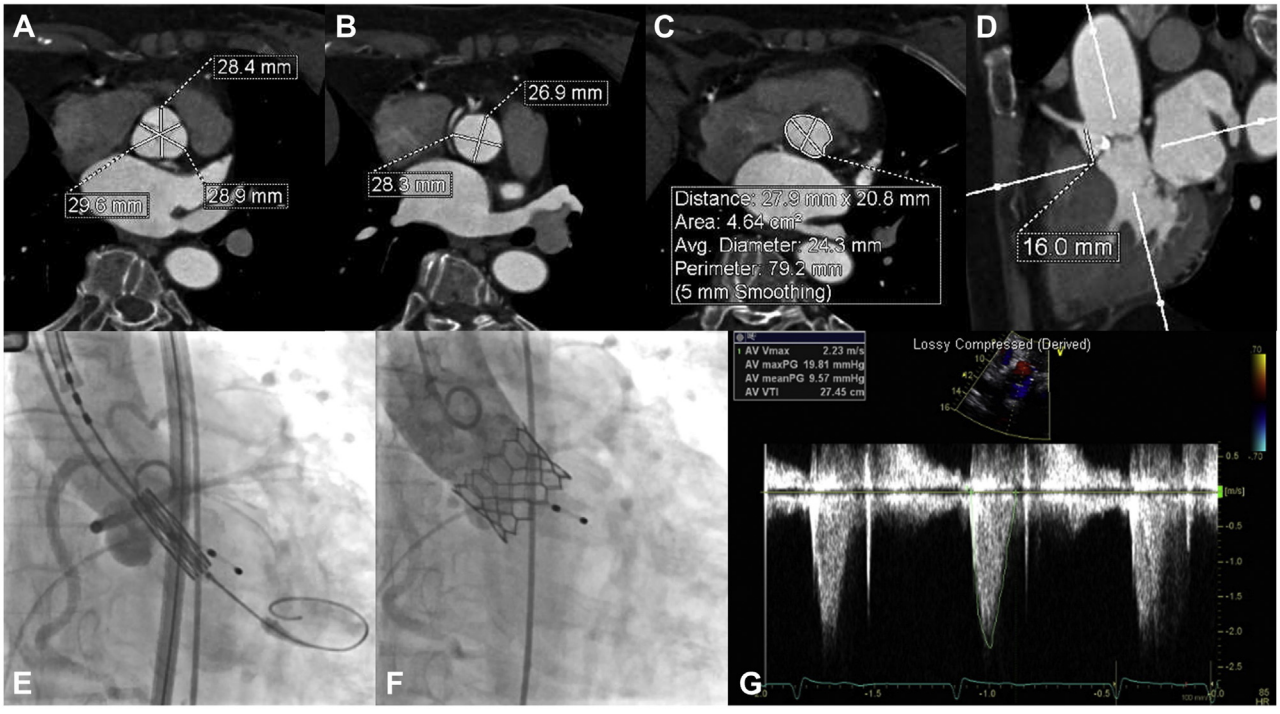

Fig. 2. Coronary aorta computed tomography angiography showing the size of (A) sinus of Valsalva and (B) sinotubular junction, (C) the aortic annular area and the annulus area-driven and perimeter-driven diameters, and (D) the distance of the right coronary ostia from aortic annulus plane. Aortography during the procedure, (E) before TAVR. (F) after TAVR. (G) Transthoracic echocardiography showing a continuous wave Doppler image of aortic valve obtained from apical 5-chamber view after TAVR.
TAVR, transcatheter aortic valve replacement.

16.0 mm (Fig. 2D). We decided to implant a 26 mm Edwards SAPIEN 3 valve (Edwards Lifesciences, Irvine, CA, USA) via femoral access with the use of general anesthesia and the aid of fluoroscopic and transesophageal echocardiographic guidance. We confirmed the final location of valve prosthesis by an aortography (Fig. 2E) and performed a balloon dilatation with nominal volume (23 mL) under rapid pacing (Supplementary Movie S1). The post-TAVR aortography revealed continued patency of the coronary artery and a well-positioned implanted aortic valve without any complications (Fig. 2F). The post-TAVR transthoracic echocardiography also showed the well-functioning implanted aortic valve with a mild paravalvular leakage (Supplementary Movie S2) and an improved AS (mean gradient of 9.57 mmHg and peak transaortic velocity of 2.23 m/s) without regional wall motion abnormality (Fig. 2G).

Discussion

The prevalence of anomalous coronary arteries and variations is known to be about 0.2–2.3% [6]. Anomalous LCA arising from the right coronary sinus is about five times less common than the anomalous origin of the RCA from the left coronary sinus [3]. Anomalous origin of the LCA from the right coronary sinus can be classified into four types by the course of coronary artery: inter-arterial, anterior, intra-septal, and posterior. Among them, the inter-arterial course is prone to compression, which is considered a risk factor for myocardial ischemia and sudden cardiac death especially during physical activity when both the pulmonary trunk and the aorta tend to dilate [6]. However, only one case of inter-arterial course of the anomalous LCA, undergoing successful TAVR without complications, has been reported [4].

A coronary obstruction during and after TAVR is one of the critical complications and was reported to occur in 0.5–1% of cases [7]. The underlying mechanism of coronary obstruction is supposed to be the compression of the coronary ostium due to calcified native valve leaflets [7]. The anatomical risk factors of coronary obstruction are reported to be a low coronary height (below 12 mm in height), a shallow sinus of Valsalva (below 30 mm in width), and a coronary artery disease itself [7]. In previous literature, two cases of coronary obstruction in the anomalous LCA arising from the right coronary sinus after TAVR have been reported [5,6]. The mechanism of obstruction in these cases is supposed to be different from that of a typical ostial obstruction. The obstruction occurred at the mid-portion of anomalous LCA, not at the ostium, by extrinsic compression with stretching force and the anomalous LCA was located adjacent to the aortic annulus [5,6]. However, we assessed a lower risk of coronary obstruction in this case and did not consider coronary protection. Because the course of the anomalous LCA in this case was retroaortic course, this had a lower risk of coronary compression than inter-arterial course. Furthermore, the anomalous LCA bifurcated early into two branches and was located apart from the aortic annulus and adjacent to the sinotubular junction in this case compared with previous cases. Finally, this case did not have other risk factors of coronary obstruction such as a low coronary height, a shallow sinus of Valsalva, less bulky calcified leaflets, and a coronary artery disease itself. Therefore, the risk of coronary obstruction during TAVR in patients with anomalous coronary arteries can be anticipated by an accurate analysis of the aortic root anatomy using CCTA.

Since there are few cases of anomalous coronary artery with TAVR procedure, no evidence and consensus exist on the choice of balloon-expandable or self-expandable valve. Because self-expandable valve can be recaptured until 2/3 of the bioprosthesis is implanted, it might have an advantage for preventing coronary obstruction. However, there is no direct evidence that self-expandable valve itself reduces the risk of coronary obstruction in the case of anomalous coronary artery. Sorbets et al. reported that each bioprosthetic valve does not appear particularly advantageous over the other in the case of anomalous coronary artery [8]. Further experience and evidence from more cases might be needed for clarifying this issue.

In summary, careful attention needs to be given to the topographical location of the coronary artery from the aortic root and the implanted valve for preventing coronary obstruction during TAVR.

Conflict of interest

None.

Acknowledgment

None.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.jccase.2018.12.011.

References

[1] Leon MB, Smith CR, Mack MJ, Makkar RR, Svensson LG, Kodali SK, et al. Transcatheter or surgical aortic-valve replacement in intermediate-risk patients. N Engl J Med 2016;374:1609–20.
[2] Mennuni MG, Pagnotta P, Presbitero P. Percutaneous aortic valve implantation in severe stenosis associated with anomalous origin of the circumflex coronary artery. Eur Heart J 2011;32:1687.
[3] Weich H, Ackermann C, Viljoen H, van Wyk J, Mabin T, Doubell AF. Transcatheter aortic valve replacement in a patient with an anomalous origin of the right coronary artery. Catheter Cardiovasc Interv 2011;78:1013–6.
[4] Giri J, Szeto WY, Bavaria J, Herrmann HC. Transcatheter aortic valve replacement with coronary artery protection performed in a patient with an anomalous left main coronary artery. J Am Coll Cardiol 2012;60:e9.
[5] Acosta-Velez JG, Garcia del Blanco B, Guindo J, Montiel Serrano J, Cuellar Calabria H, Marti Aguasca G, et al. Acute artery occlusion during transcatheter aortic valve replacement in a patient with an anomalous origin of the circumflex artery. JACC Cardiovasc Interv 2014;7:1324–5.
[6] Mizote I, Conradi L, Schafer U. A case of anomalous left coronary artery obstruction caused by lotus valve implantation. Catheter Cardiovasc Interv 2017;90:1227–31.
[7] Ribeiro HB, Webb JG, Makkar RR, Cohen MG, Kapadia SR, Kodali S, et al. Predictive factors, management, and clinical outcomes of coronary obstruction following transcatheter aortic valve implantation: insights from a large multicenter registry. J Am Coll Cardiol 2013;62:1552–62.
[8] Sorbets E, Choby M, Tchetche D. Transcatheter aortic valve implantation with either CoreValve or SAPIEN XT devices in patients with a single coronary artery. J Invasive Cardiol 2012;24:342–4.