

Combined chimney stenting and bioprosthetic valve fracturing during transcatheter aortic valve-in-valve implantation

Maciej Mazurek, Bartosz Rymuza, Piotr Scisło, Janusz Kochman, Marcin Grabowski, Zenon Huczek

1st Department of Cardiology, Medical University of Warsaw, Warszawa, Poland

Correspondence to:

Maciej Mazurek, MD,
1st Department of Cardiology,
Medical University of Warsaw,
Banacha 1A,
02-097 Warszawa, Poland,
phone: +48 22 599 19 58,
e-mail:
maciej.j.mazurek@gmail.com

Copyright by the Author(s), 2023

DOI: 10.33963/KPa.2023.0006

Received:

August 31, 2022

Accepted:

November 9, 2022

Early publication date:

December 23, 2022

Coronary artery occlusion (CAO) is a rare but life-threatening complication of transcatheter aortic valve implantation (TAVI). It is defined as evidence of new, partial, or complete obstruction of the coronary artery ostium [1]. Underlying mechanisms include obstruction caused by implanted bioprosthetic valves, native leaflets, calcifications, or artery dissection. The incidence of CAO is <1%, but there are several risk factors for its appearance including advanced age, female sex, and no previous coronary artery bypass graft. Other risk factors are low height of the coronary artery ostium, narrow sinus of Valsalva, use of balloon-expandable bioprosthesis, and valve-in-valve implantation, especially when treating stented prostheses with the leaflet sutured outside [2]. Chimney stenting is a technique for coronary artery ostium protection, by deployment of the stent extending from the coronary artery into the aorta, located exteriorly, parallelly, and cranially to the implanted valve.

An 84-year-old female with chronic heart failure with preserved ejection fraction (EF, 61%) and severe symptomatic aortic valve dysfunction was admitted to the hospital with New York Heart Association (NYHA) class III and Canadian Cardiovascular Society (CCS) class II symptoms. The patient underwent surgical aortic valve replacement with the use of a Sorin Mitroflow 19A prosthesis in 2013. Echocardiography showed severe bioprosthesis failure due to massive leaflets calcification with their minimal mobility, resulting in valve stenosis (V_{max} , 5.6 m/s; pressure gradient max/mean, 125/72 mm Hg; aortic valve area assessed using velocity time integral [AVA VTI], 0.78 cm²; aortic valve area index [AVAi], 0.48 cm²/m²)

and regurgitation (mainly transvalvular) with descending aorta holodiastolic flow reversal (24 cm/s). Computed tomography (CT) visualized a small aortic annulus diameter (15.4 mm), low height of the left main ostium (6.9 mm above the aortic valve annulus), and small projected valve-to-coronary distance (VTC <4 mm), which categorized the patient as at high risk of CAO occurrence.

By the decision of the Heart Team, the patient was referred for TAVI via right femoral access. An everolimus-eluting stent (4.0 × 28 mm) was parked in the the left anterior descending artery (LAD) and Evolut R 23 mm was introduced into the failed prosthesis. After achieving the optimal position, the valve was fully expanded. Immediately after valve expansion, DES was retracted from the LAD and implanted into the left main artery, and it partially protruded into the aorta ("chimney stenting"). Finally, Evolut R postdilatation with a non-compliant balloon (Atlas Gold 20 mm) and simultaneous stent postdilatation ("kissing balloon") was performed to fully expand the Evolut prosthesis in the surgical prosthesis (fracture or modify) and maintain the adequate stent lumen. Optimal valve implantation and coronary artery protection were achieved. Angiography showed the expected procedural result, with no signs of CAO and with TIMI3 flow. On postprocedural echocardiography, a good procedure effect with a 5% paravalvular leak was observed, and a mean pressure gradient across the prosthesis was 15 mm Hg. The patient was discharged in good clinical condition on day 5.

CAO is a major complication of valve-in-valve TAVI associated with an extremely unfavorable prognosis. Chimney stenting

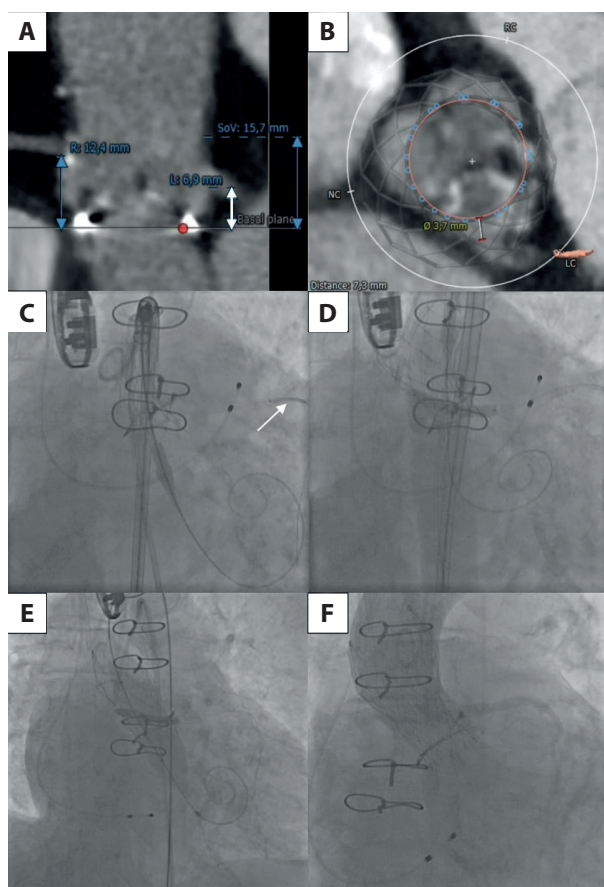


Figure 1. Low height of the LCA ostium on CT (A, white arrow) and small valve to coronary distance (B). Flaring of the Evolut R valve (C), a visible stent parked in the LAD (C, white arrow). Expansion of the stent extending from the LCA into the aorta (D). Postdilatation with a non-compliant 20-mm Gold balloon with simultaneous stent dilatation (E). The optimal procedure effect — the implanted Evolut R valve and patent LCA ostium with the use of DES (F) by the chimney stenting technique, preserved coronary blood flow

Abbreviations: CT, computed tomography; DES, drug-eluting stent; LAD, left anterior descending artery; LCA, left coronary artery

presents a safe and reproducible preventive method for avoiding CAO [3, 4]. Possible downsides of this technique include stent underexpansion requiring postdilatation or second stent implantation, which may result in a higher risk of thrombosis or restenosis. It may also be more difficult to intubate protruding stents when needed in the future. Annular rupture following bioprosthetic valve fracturing is very rare but probably should be avoided in the heavily calcified annulus, left ventricular outflow tract (LVOT), or in patients after aortic root enlargement and replacement. To avoid stent deformation during non-compliant balloon bioprosthesis postdilatation, as this case demonstrates, the “kissing-balloon” inflation could be successfully applied.

Article information

Conflict of interest: None declared.

Funding: None.

Open access: This article is available in open access under Creative Commons Attribution-Non-Commercial-No Derivatives 4.0 International (CC BY-NC-ND 4.0) license, which allows downloading and sharing articles with others as long as they credit the authors and the publisher, but without permission to change them in any way or use them commercially. For commercial use, please contact the journal office at kardiologiapolska@ptkardio.pl.

REFERENCES

1. Kappetein AP, Head SJ, Généreux P, et al. Updated standardized endpoint definitions for transcatheter aortic valve implantation: the Valve Academic Research Consortium-2 consensus document (VARC-2). *Eur J Cardiothorac Surg.* 2012; 42(5): S45–S60, doi: [10.1093/ejcts/ezs533](https://doi.org/10.1093/ejcts/ezs533), indexed in Pubmed: 23026738.
2. Ribeiro HB, Webb JG, Makkar RR, 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(17): 1552–1562, doi: [10.1016/j.jacc.2013.07.040](https://doi.org/10.1016/j.jacc.2013.07.040), indexed in Pubmed: 23954337.
3. Mercanti F, Rosseel L, Neylon A, et al. Chimney stenting for coronary occlusion during TAVR: insights from the chimney registry. *JACC Cardiovasc Interv.* 2020; 13(6): 751–761, doi: [10.1016/j.jcin.2020.01.227](https://doi.org/10.1016/j.jcin.2020.01.227), indexed in Pubmed: 32192695.
4. Tyczyński P, Chmielak Z, Dąbrowski M, et al. Modified chimney / snorkel stenting of the left main coronary artery after transcatheter aortic valve implantation. *Kardiol Pol.* 2020; 78(7–8): 792–793, doi: [10.33963/KP.15391](https://doi.org/10.33963/KP.15391), indexed in Pubmed: 32458674.