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Basílica procedure for prevention of coronary obstruction during transcatheter aortic valve implantation: case report from Latam

Procedimento BASILICA para prevenção de obstrução coronária durante implante de valva aórtica transcater: relato de caso da América Latina

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ABSTRACT – Transcatheter aortic valve implantation is considered a standard treatment for many symptomatic patients with severe aortic stenosis. Coronary artery occlusion after transcatheter aortic valve implantation is associated with a mortality rate of up to 50%. In this case report we described a patient with severe aortic bioprosthesis dysfunction, at high risk of coronary obstruction after transcatheter aortic valve implantation. This patient underwent Basílica procedure followed by valve-in-valve transcatheter aortic valve implantation. The patient demonstrated good improvement and was discharged from hospital after 2 days, without any symptoms. The patient remained asymptomatic at 6 months of follow-up.

Keywords: Transcatheter aortic valve replacement; Coronary occlusion; Aortic valve stenosis; Heart valve prosthesis; Bioprosthesis

RESUMO – O implante de valva aórtica transcater é considerado um tratamento padrão para muitos pacientes sintomáticos com estenose aórtica grave. A oclusão da artéria coronária após o implante de valva aórtica transcater está associada à taxa de mortalidade de até 50%. Neste relato de caso, descrevemos um paciente com disfunção grave da bioprótese aórtica, com alto risco de obstrução coronária após o implante de valva aórtica transcater. Esse paciente foi submetido ao procedimento BASILICA, seguido do implante de valva aórtica transcater *valve-in-valve*. O paciente teve boa melhora e recebeu alta hospitalar 2 dias depois, sem quaisquer sintomas. Ele permanecia assintomático aos 6 meses de acompanhamento.

Descritores: Substituição da valva aórtica transcater; Oclusão coronária; Estenose da valva aórtica; Próteses valvulares cardíacas; Bioprótese

INTRODUCTION

Transcatheter aortic valve implantation (TAVI) is considered a standard treatment for many symptomatic patients with severe aortic stenosis. The evolution of materials and implantation techniques has contributed to the consolidation of this procedure.¹⁻³

However, despite significant refinements, there is concern regarding potentially catastrophic issues. Coronary artery occlusion after TAVI is associated with a mortality rate of up to 50%.⁴ This complication occurs in up to 1% of the native valves and in up to 4% of valve-in-valve (ViV) procedures.⁴⁻⁶

In 2018, Khan et al.⁷ described a technique to prevent coronary artery occlusion during TAVI known as the Bioprosthetic or native Aortic Scallop Intentional Laceration to prevent iatrogenic Coronary Artery obstruction (BASILICA) technique.

In this case report we described a case of severe aortic bioprosthesis dysfunction, and high risk of coronary obstruction after TAVI. This patient underwent

BASILICA procedure, followed by ViV TAVI. This study was approved by the Research Ethics Committee (CAAE 52555621500005165) of the *Universidade de Cuiabá*.

CASE REPORT

A 73-year-old female patient complained of dyspnea on moderate exertion; upon physical examination, she presented a rough murmur (3+/4+) at the base that radiated to the sternal notch. Her past medical history included hypertension, coronary artery disease, two aortic valve replacements (biological prostheses), and a saphenous vein graft in the right coronary artery. Based on these findings, bioprosthesis dysfunction was the first diagnosis.

Transthoracic echocardiography revealed an aortic valve area of 0.3cm² and a mean gradient of 76mmHg across the aortic bioprosthesis. Computed tomography performed according to the TAVI protocol showed a high risk of coronary artery occlusion (Figure 1). Cinecoronariography did not reveal any significant stenosis in the unprotected coronary arteries.

Transcatheter aortic valve implantation was indicated after a Heart Team meeting. Due to the risk of coronary artery occlusion, the decision to perform laceration of the prosthesis leaflet (BASILICA procedure) was taken.

The procedure was performed with the patient under general anesthesia and invasive mechanical ventilation. The primary access was through the right femoral artery (two Perclose ProGlide™ devices were placed), and the secondary access was through the left femoral artery, right radial artery (with invasive arterial pressure monitoring), and the left radial artery (with a pigtail to perform aortography). A temporary pacemaker lead was inserted through the right internal jugular vein and positioned in the right ventricle. Following this, heparinization was performed.

A Lunderquist™ guidewire was positioned in the left ventricle (LV) to perform predilation of the aortic prosthesis with an Atlas Gold® 18x40mm balloon. Subsequently, a 20mm snare was inserted through the left femoral access and positioned inside the LV.

An Amplatz catheter was positioned in the aortic root, and a Progreat® microcatheter was directed to the left leaflet through it. A Cross-it 100 0.014" wire, connected to a Covidien® electrocautery machine at 70W energy (cutting mode), was then passed through the cuspid and positioned in the LV, where it was captured by the snare. Subsequently, simultaneous traction of the snare and the 0.014" guidewire was performed along with application of 70W energy, which resulted in complete laceration of the leaflet (Figure 2).

RC: right coronary sinus; LC: left coronary sinus; NC: noncoronary sinus; LVOT: left ventricular outflow tract; LCC: left coronary cusp; RCA: right coronary artery; NCC: noncoronary cusp.

Figure 1. Computed tomography findings.

Figure 2. BASILICA procedure steps.

A 0.014" guidewire was positioned distally in the left anterior descending artery and a drug-eluting stent was positioned, but not deployed. An Evolut™ R 23mm bioprosthesis was implanted according to the technique recommended for the ViV procedure. Angiographic and echocardiographic evaluations confirmed the success of the procedure.

The patient demonstrated good improvement and was discharged home after 2 days, without any symptoms. She remained asymptomatic at 6 months of follow-up.

DISCUSSION

After TAVI, the coronary arteries may become obstructed due to displacement of either the native valve leaflet or the bioprosthesis leaflet, which can either occupy the sinus of Valsalva or directly obstruct the coronary ostia. This impairment in the coronary flow can occur at the time of or up to several days after the implantation.⁴ Although rare, this complication can be devastating.

Supra-annular biological aortic valve prostheses reduce the distance from the valve leaflets to the coronary arteries, and their sutures reduce the width of the sinus of Valsalva.⁷ In this manner, the TAVI procedure can obstruct the coronary arteries.

The Valve-in-Valve International Data (ViVID) Registry (1,612 procedures) reported a 6.4% risk of coronary occlusion in stented surgical bioprosthesis models, with externally mounted leaflets, a 3.7% risk in stentless models, and a 0.7% risk in stented models with internally mounted leaflets.⁴ The following characteristics were associated with an increased risk of coronary occlusion after TAVI: female sex, ViV, coronary ostium height <10mm, sinus of Valsalva <30mm wide, and virtual transcatheter heart valve to coronary ostium distance <4mm.^{4,5}

Percutaneous coronary intervention and surgical revascularization may often be necessary in cases of coronary obstruction after TAVI; however, these procedures are challenging and the results achieved are not uniform. The strategies used to minimize the damage caused by this

complication are the placement of a 0.014" guidewire inside the coronary artery (with or without stenting), chimney stenting, and the BASILICA procedure.⁶⁻⁸

In the BASILICA procedure, the principle of catheter- and guidewire-directed radiofrequency loop is applied to lacerate the valve leaflet (native or biological prosthesis). This technique avoids the mechanical barrier created by the leaflets in the coronary ostia.⁶⁻⁸ The first human study recruited seven patients with aortic dysfunction, who were not eligible for surgery and were at high risk for coronary artery obstruction.⁷

In the BASILICA trial (n=30), leaflet laceration had a 95% success rate, and there was no coronary occlusion. The only complication related to the procedure was hemodynamic instability in one patient, which was promptly resolved after TAVI.⁹

There was a high risk of coronary obstruction in the present case. The Heart Team decided for the BASILICA procedure, and it was successfully performed according to standard technique. Thus, reproducibility of the procedure was demonstrated. Some aspects of this procedure have been revised, such as a possible worsening of anchorage of the expandable balloon valves after the BASILICA procedure, use of bipolar electrocautery (for severe calcification),⁷ a protection system against cerebral embolization, dedicated catheters, and 4D echocardiography for guidance, among others. To the best of our knowledge, this case report is the first to describe the BASILICA procedure in Latin America, demonstrating its feasibility.

TAVI is an established procedure for the treatment of aortic valve disease; however, some patients may be at risk of coronary artery obstruction, with catastrophic consequences. The BASILICA procedure is able to minimize this complication. The identification of high-risk patients and appropriate planning of TAVI with the BASILICA procedure are essential to implement the treatment, and consequently minimize coronary obstruction.

Transcatheter aortic valve implantation is not a future option, but rather very present, to treat severe aortic stenosis and aortic bioprosthesis dysfunction. The issue is

whether BASILICA may be considered the state-of-the-art technique to avoid coronary obstruction. Next generation bioprostheses will certainly be designed to avoid this catastrophic complication. This field of knowledge may evolve, and better transcatheter prosthesis will hopefully be available. The humanity requires it!

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None.

CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: SMJ, DD, ECCM and DCO; data collection: SMJ, DD and ACF; data interpretation: SMJ, DD, ECCM and DCO; text writing: SMJ, DD, ECCM and DCO; approval of the final version to be published: SMJ, DD, ECCM, MJMC, ACF and DCO.

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