

## CASE REPORT

# Snare-Assisted Aortic Valve Crossing for TAVI: A Case Report

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## Abstract

In some transcatheter aortic valve implantation (TAVI) procedures, difficulty in crossing the valve delivery system occurs. There are some described anatomical risk factors as extreme angulation, heavy calcification, and bicuspid morphology. A possible reason may be an unfavorable angle of approach because of the outward push by the incoming crimped bioprosthesis and insufficient support/trackability of the extra stiff wire. Several techniques, tips, and tricks have been developed to overcome this problem and avoid procedure failures, such as the “pull-and-push” technique, pre-dilation, buddy wire, balloon cushion, buddy balloon and snare techniques. Here, we report a case of TAVI complicated by the difficulty in crossing the calcified native aortic valve (AV) that was solved with the snare technique without complications.

## Introduction

TAVI is a widely spread procedure with class I recommendation for the treatment of severe symptomatic aortic stenosis (AS) among patients of various risk profiles and ages above 70 years old.<sup>1,2</sup> Current practices do not recommend routine pre-dilation to reduce procedural time, reduce contrast volume and avoid crossing the arch multiple times.<sup>3</sup> In some cases, difficulty in crossing the valve delivery system occurs. There are some described anatomical risk factors as extreme angulation, heavy calcification, and bicuspid morphology.<sup>4</sup> Also, for unknown reasons, it has been described as more common when using the Corevalve bioprosthesis.<sup>5</sup>

## Keywords

Aortic Valve; Transcatheter Aortic Valve Replacement; Aortic Valve Stenosis.

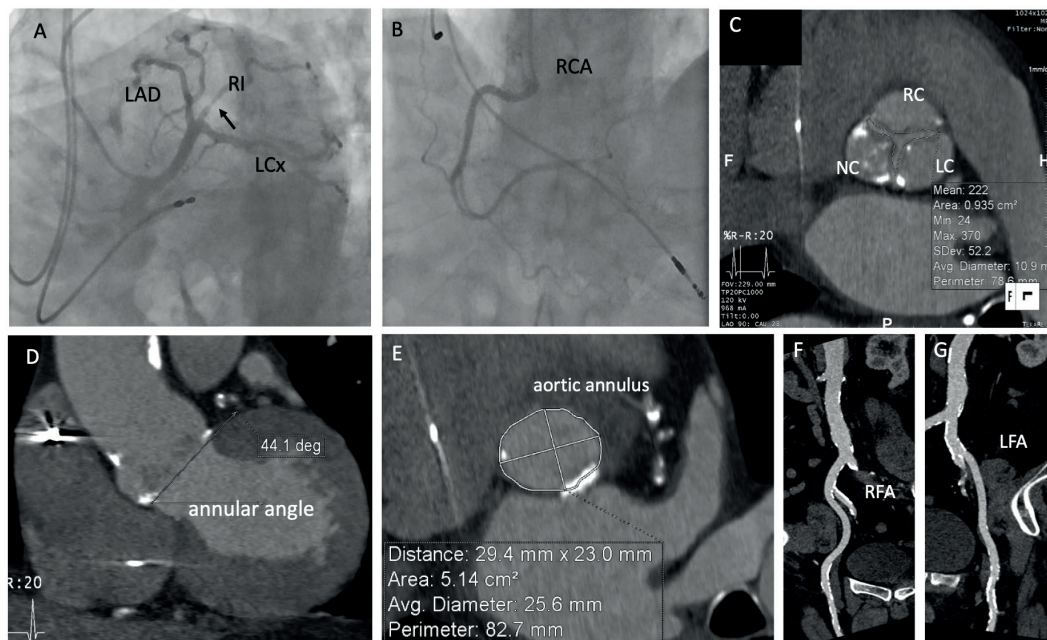
A possible reason may be an unfavorable angle of approach because of the outward push by the incoming crimped bioprosthesis and insufficient support/trackability of the extra stiff wire.<sup>5</sup> Several techniques and tips and tricks have been developed to overcome this problem and avoid procedure failures, such as the “pull-and-push” technique, pre-dilation, buddy wire, balloon cushion, buddy balloon and snare techniques.<sup>4-7</sup> Here, we report a case of TAVI complicated by difficulty in crossing the calcified native aortic valve (AV) that was solved with the snare technique without complications.

## Clinical case description

A 76-year-old male patient presented in the cardiology clinic with symptomatic severe AS with fatigue in NYHA functional class III, without dyspnea, angina or syncope. He has a prior medical history of arterial hypertension, chronic obstructive pulmonary disease, peripheral artery disease, paroxysmal atrial flutter and a dual-chamber permanent pacemaker implanted for AV-node disease. He was administered edoxaban, nebivolol, perindopril, furosemide, spironolactone, atorvastatin, gabapentin and formoterol. The transthoracic echocardiogram showed a severely calcified tricuspid AV, with mean gradient of 52 mmHg and aortic valvular area of 0.6 cm<sup>2</sup>, mild left ventricular hypertrophy, left ventricular ejection fraction 60%, mild-to-moderate mitral regurgitation, mild tricuspid regurgitation with an estimated pulmonary artery systolic pressure of 35 mmHg and no pericardial effusion. The ECG showed sinus rhythm with ventricular pacing. Coronary angiogram (Figures 1 A-B) showed a significant stenosis in Ramus Intermedius of 90%. Carotid Doppler ultrasound showed obstructive disease in the left internal carotid artery, with 70% stenosis. After a discussion with the heart team, the patient was selected for a TAVI procedure.

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**Figure 1 – Coronary angiogram (images A-B) and pre-procedural CTA (images C-G). The left coronary artery (image A) and right coronary artery (image B) show an obstructive lesion in the proximal ramus intermedius (arrow).**

LAD: left descending artery; LCx: left circumflex artery; RI: ramus intermedius; RCA: right coronary artery; RFA: right femoral artery; LFA: left femoral artery.

Pre-procedural cardiac computed tomography angiography (CTA) for TAVI planning (Figures 1 C-G) shows a tricuspid AV with severe calcification, AV calcium score of 3560 units and marked calcification in the commissures next to the non-coronary cusp, mean annular diameter of 25.6 mm and annular angle of 44°. Coronary ostia were high (16 mm for the left main coronary artery and 14 mm for the right coronary artery), with a very low risk for coronary obstruction. Ilio-femoral axis evaluation showed good luminal diameters (7.1x9.5 mm for the right femoral artery, 7.3x8.9 mm for the left femoral artery), moderate non-circumferential calcification, and no significant tortuosity.

Through the right femoral artery, a pre-dilation was made using a 20 mm size balloon (Figure 2A), followed by unsuccessful attempts to cross the valve delivery system of Corevalve Evolut Pro 29 mm (Medtronic) through the native AV. Later on, it was attempted to perform buddy wire and buddy balloon techniques (Figures 2B and C) in order to fill the external commissure (between the non-coronary and right coronary cusps), allowing centralization and better alignment of the valve delivery system, but they were also unsuccessful.

Through the left femoral artery, a snare was placed around the valve delivery system. To perform that, both the stiff wire already in the LV and the valve delivery system had to be pulled back. The crossing straight wire was snared, placed again into the LV and exchanged again by the preshaped stiff wire. By snaring the delivery system and pulling it to a better centralization, the operators were able to cross the native calcified AV. This technique is shown in Figures 2 D-F. The valve was later delivered without complications and post-dilated with a 24 mm size balloon (Figure 3), with a good final result and no paravalvular regurgitation. No complications occurred during the hospitalization. The post-procedural transthoracic echocardiogram showed a well-functioning prosthetic valve without a paravalvular leak, and the patient was discharged on the third day. At six months of follow-up, the patient was clinically improved at NYHA functional class I.

## Discussion

Failure in AV crossing is a rare complication of TAVI procedures but should be expected in some cases in high-volume centers.<sup>4,6</sup> Some anatomical risk factors associated

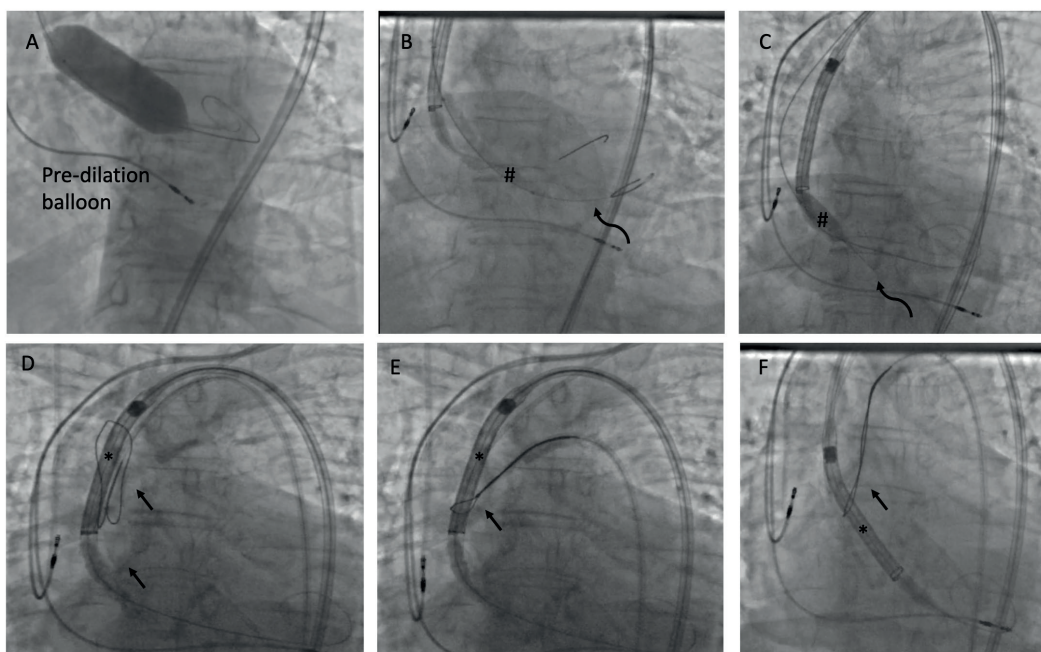


Figure 2 – Fluoroscopic images of pre-dilation (image A) and buddy wire (curved arrows) and buddy balloon (number sign) techniques with unsuccessful AV crossing (images B and C). Snare technique (images C-E) with the placement of snare (arrows) around the valve delivery system (asterisks) through the left femoral artery to perform a pulling movement and centralize the valve (image E), allowing the native valve crossing (image F).

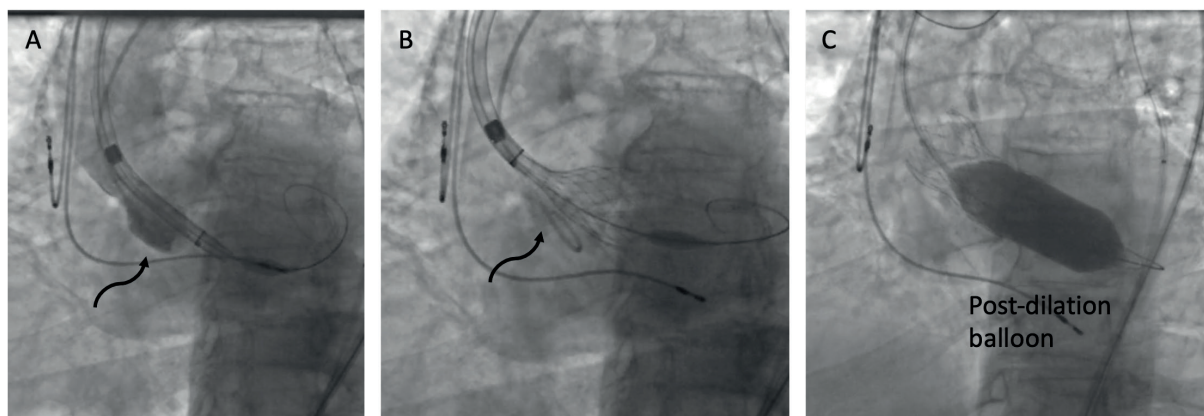


Figure 3 – Positioning and release of the valve Corevalve Evolut Pro 29 mm (curved arrows) in images A and B, post-dilated with a 24 mm balloon (image C).

with AV crossing have been described as extreme angulation, significant tortuosity, heavy calcification, extensive fusion between the right coronary cusp and non-coronary cusp and bicuspid morphology.<sup>4</sup> Thus, a correct and extensive pre-procedural evaluation with cardiac CTA could identify these unfavorable features,

allowing better planning and selection of material (i.e., selecting a balloon-expandable valve that has a better crossing and alignment profile). In these cases of unsuccessful crossing, accessory techniques, such as the “pull-and-push” technique, pre-dilation, buddy wire, and buddy balloon, may be needed to avoid procedure

failure. The snare technique poses another alternative bailout technique for this purpose.<sup>4,6-9</sup> There are very few cases reported so far, but in theory, these more aggressive accessory techniques are associated with an increased risk of stroke.<sup>4</sup>

### Learning objectives

1. Failure in AV crossing is a rare complication of TAVI procedures but should be expected in some cases in high-volume centers.
2. Some anatomical risk factors have been described, enhancing the important role of an extensive evaluation of the pre-procedural CTA images.
3. In these cases of unsuccessful crossing, the snare technique is an interesting bailout technique that avoids procedure failure.

### Author Contributions

Conception and design of the research: Fiarresga A, Cacela D; acquisition of data: Grazina A, Rodrigues I; analysis and interpretation of the data and writing of the manuscript: Grazina A, Teixeira BL; critical revision

of the manuscript for intellectual content: Rodrigues I, Fiarresga A, Cacela D.

### Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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### Study Association

This study is not associated with any thesis or dissertation work.

### Ethics Approval and Consent to Participate

The authors declare to have obtained informed consent from the patient for the publication of the clinical case report, in accordance to the local ethical committee (Comissão de Ética para a Saúde da Unidade Local de Saúde de São José) requiring no further ethical approval.

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