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Case Report
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Snare-Assisted Aortic Valve Crossing: 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 and tips and tricks have been developed to overcome this problem and avoid procedure failure, as the "pull-and-push" technique, pre-dilation, buddy wire, balloon cushion, buddy balloon and the snare techniques. Here, we report a case of TAVI complicated by difficulty in crossing the calcified native aortic valve that was solved with the snare technique without complications.

Keywords: Transcatheter aortic valve implantation; Aortic Valve crossing; Aortic stenosis; Aortic valve calcification; Snare technique

Introduction

Transcatheter Aortic Valve Implantation (TAVI) is a widely spread procedure with class I recommendation for the treatment of severe symptomatic aortic stenosis in patients with intermediate or high surgical risk or low surgical risk with age above 75 years old [1]. Current practice does not recommend routine pre-dilation to reduce procedural time, reduce contrast volume and avoid crossing the arch multiple times [2]. 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 [3]. Also, it has been described as more common when using the CoreValve bioprosthesis, for unknown reasons [4]. 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 [4]. Several techniques and tips and tricks have been developed to overcome this problem and avoid procedure failure, as the "pull-and-push" technique, pre-dilation, buddy wire, balloon cushion, buddy balloon and the snare techniques [3-6]. Here, we report a case of TAVI complicated by difficulty in crossing the calcified native aortic valve that was solved with the snare technique without complications.

Case Presentation

A 76-years-old male patient presented in the cardiology clinic symptomatic severe Aortic Stenosis (AS) with fatigue, in NYHA functional class III, without dyspnea, angina or syncope. He has 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 medicated with edoxaban, nebivolol, perindopril, furosemide, spironolactone, atorvastatin, gabapentin and formoterol. The transthoracic echocardiogram showed a severely calcified tricuspid Aortic Valve (AV), with mean gradient of 52 mmHg and aortic valvular area of 0.6 cm^2, 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. The coronary angiogram (Figure 1A-1C) showed a significant stenosis in Ramus Intermedius of 90% and carotid ultrasound an obstructive stenosis in the left internal carotid artery of 70%. After discussion in heart team, the patient was selected for a Transcatheter Aortic Valve Implantation (TAVI) procedure.

Pre-procedural cardiac Computed Tomography Angiography (CTA) for TAVI planning (Figure 1D-1G) shows a tricuspid aortic valve, with severe calcification, AV calcium score of 3,560 units and marked calcification in the commissures next to the non-coronary cusp, mean annular diameter of 25.6 mm and annular angle of 44º. Coronary ostia were high (16 mm for left main

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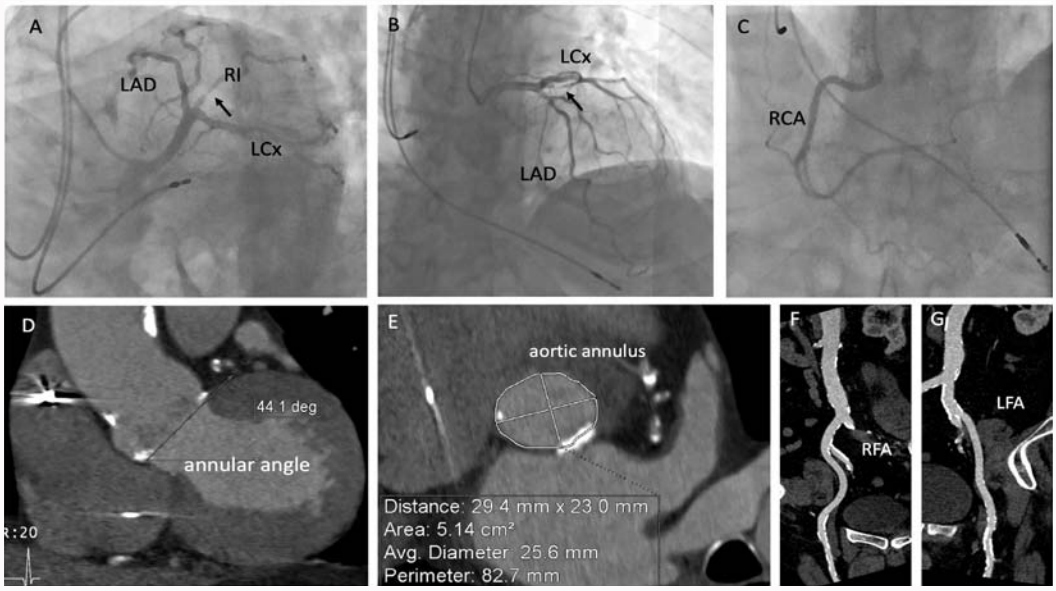

Figure 1: Coronary angiogram (images A-C) and pre-procedural CTA (images D-G). Left coronary artery (images A and B) and right coronary artery (image C) showing an obstructive lesion in the proximal ramus intermedius (arrow). (LAD – Left Descending Artery; LCx – Left Circumflex Artery; RI: Ramus Intermedius; RCA: Right Coronary Artery; RFA: valve Corevalve Evolut PRO 29 mm right femoral artery; LFA – Left Femoral Artery).

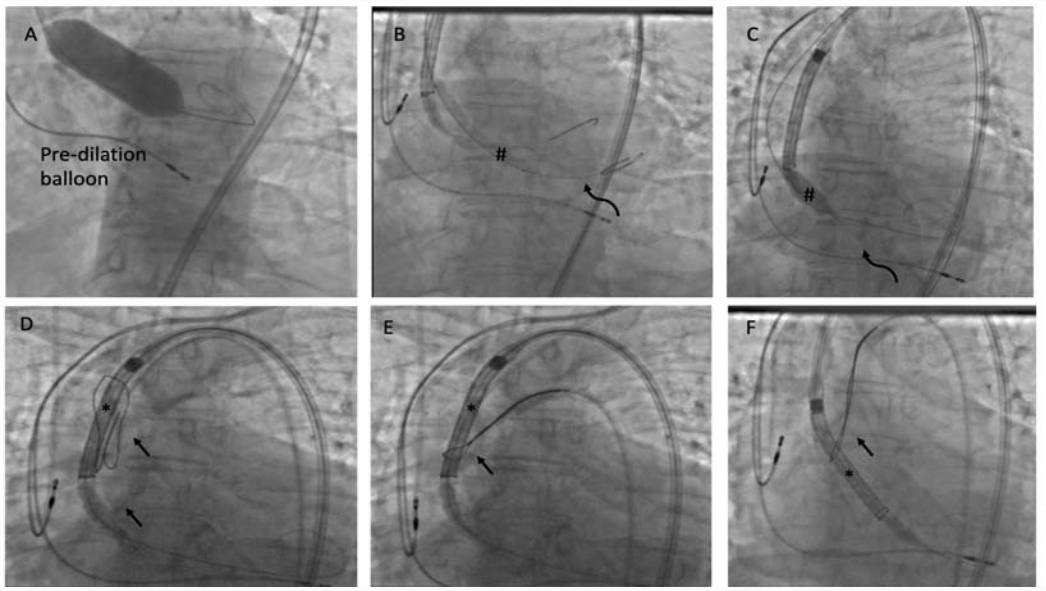

Figure 2: Fluoroscopic images of pre-dilation (image A) and buddy-wire (curved arrows) and buddy-balloon (number sign) techniques with unsuccessful aortic valve crossing (images B, C). Snare technique (images C-E) with placement of snare (arrows) around the valve delivery system (asterisks) through the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

coronary artery and 14 mm for right coronary artery), with very low risk for coronary obstruction. Ilio-femoral axis evaluation showed good luminal diameters (right femoral artery 7.1 mm × 9.5 mm, left femoral artery 7.3 mm × 8.9 mm), 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 unsuccess in attempting to cross the valve delivery system of CoreValve Evolut Pro 29 mm (Medtronic) through the native aortic valve. After, it was attempted to perform buddy-wire and buddy-balloon techniques (Figure 2B, 2C), 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, also unsuccessfully.

Through the left femoral artery, a snare was placed around the valve delivery system, pulling it to a better centralization of this system, that this way was able to cross the native calcified aortic valve. This technique is shown in Figure 2D-2F. The valve was after delivered without complications and post-dilated with a 24 mm size balloon (Figure 3), with good final result and no paravalvular regurgitation. No complications occurred during the hospitalization, the pos-procedural transthoracic echocardiogram showed a well-functioning prosthetic valve, without paravalvular leak and the

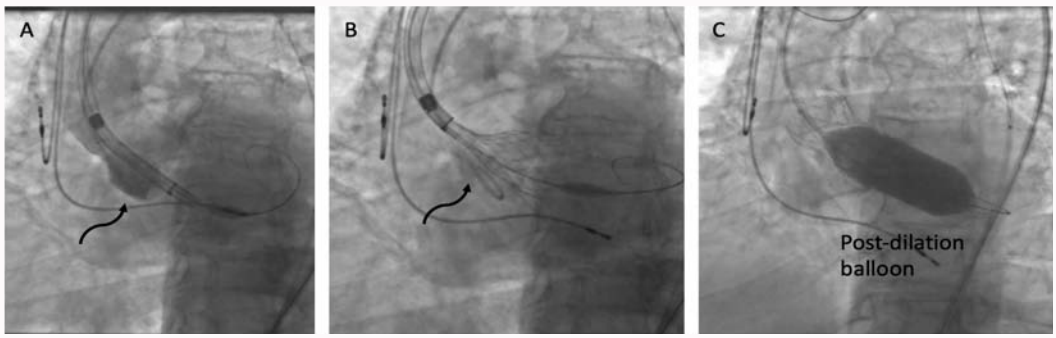

Figure 3: Positioning and release of the valve Corevalve Evolut PRO 29 mm (curved arrows) in images A and B, post-dilated with a 24 mm balloon (image C).

patient was discharged at the third day. At 6 months of follow-up, the patient was clinically improved, at NYHA functional class I.

Discussion

Failure in aortic valve crossing is a rare complication of TAVI procedures but should be expected in some cases in high volume centers [3,5]. Some anatomical risk factors associated with aortic valve 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 [3]. Thus, a correct and extensive pre-procedural evaluation with cardiac CTA could identify these unfavorable features allowing a 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, as the "pull-and-push" technique, pre-dilation, buddy-wire, buddy-balloon may be needed to avoid procedure failure. The snare technique poses another alternative bailout technique for this purpose [3,5-8]. There are very few cases reported so far, but in theory these more aggressive accessory techniques are associated with increased risk of stroke [3].

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