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# VALVULAR AND STRUCTURAL HEART DISEASES

## *Case Report*

# Intravascular Ultrasound-Guided Stenting of Left Main Stem Dissection After Medtronic Corevalve Implantation

**N.M. Van Mieghem* and P.P. de Jaegere**

**Transcatheter aortic valve implantation (TAVI) implies the introduction, positioning, and deployment of a stented bioprosthesis in the (calcified) native aortic valve. We report an at first glance uneventful TAVI with the Medtronic Corevalve System, which was followed by transient electrocardiographic changes suggesting acute left main stem disease. The diagnosis of acute left main stem dissection extending from the left coronary cusp was firmly established by intravascular ultrasound. The ostium of the left main stem was successfully treated with intravascular ultrasound-guided placement of a drug eluting stent.** © 2013 Wiley Periodicals, Inc.

**Key words: valvular heart disease; TAVI; aortic stenosis**

## INTRODUCTION

Transcatheter aortic valve implantation (TAVI) has become an accepted treatment option for elderly patients with symptomatic severe aortic valve stenosis (AS) with a prohibitive or high operative risk [1,2]. A TAVI procedure still is a fairly complex procedure mandating appropriate patient selection, meticulous pre-procedural planning (risk stratification, imaging), and knowledge of a wider spectrum of interventional tools and techniques. The growing global experience has illustrated potential TAVI-related complications [3]. In this case report, we describe the occurrence and treatment of an acute left main stem dissection following successful TAVI with the Medtronic Corevalve System™ (MCS) (Medtronic Corp., Minnesota, MN) and illustrate the feasibility and value of intravascular ultrasound (IVUS) for diagnosis and treatment in this particular setting.

## CASE REPORT

An 86-year-old female patient presented to the outpatient clinic because of worsening angina (CCS class 3) and dyspnea (NYHA class 3). Transthoracic echocardiography confirmed severe AS with a transaortic peak velocity 4.7 m/sec and measured aortic valve area 0.7 $cm^2$. Diagnostic coronary angiography demonstrated a right dominant coronary system with diffusely heavily calcified non-obstructive coronary artery disease. Over the last years, she had developed invalidating poly-arthritis for which total knee prosthesis was scheduled. She was discussed in the heart valve team. The Logistic EuroSCORE was 11.4% and the Society of Thoracic Surgeons (STS) score was 4.2%. She was walking aid dependent and therefore considered to be frail. With this global clinical picture in mind a consensus for TAVI was reached.

The aortic annulus size was measured 27 mm × 24 mm with pronounced aortic root calcification and properly sized common femoral arteries as determined by baseline Multi-Slice Computed Tomography scan. The patient was considered a good candidate for TAVI with the MCS.

Details of the MCS TAVI have previously been described [4]. The procedure evolved under general anesthesia. After Echo guided access to the common

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Conflict of interest: Nothing to report.

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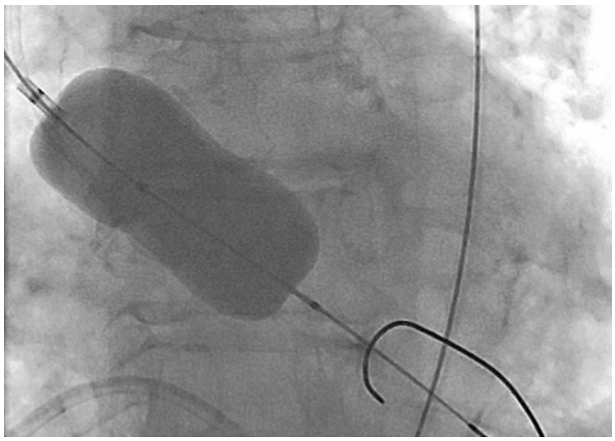

Fig. 1. Balloon aortic valvuloplasty.

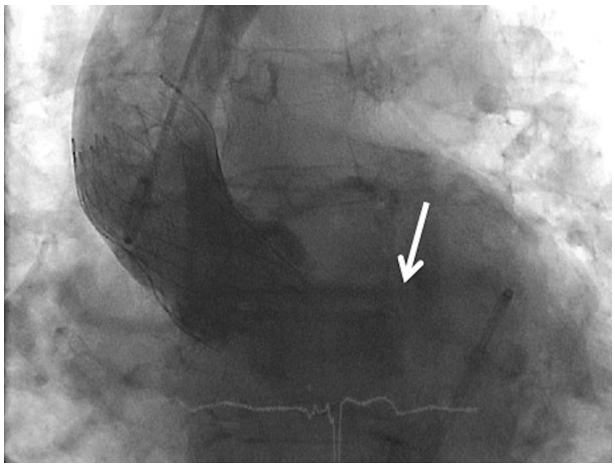

Fig. 2. Corevalve in situ with at least moderate aortic regurgitation (arrow).

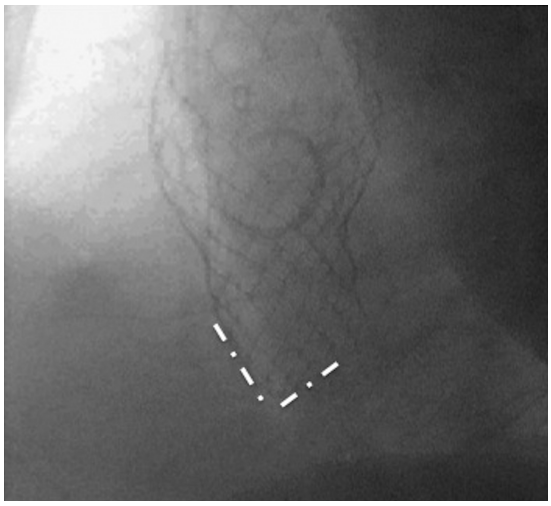

Fig. 3. Still frame taken from rotational angiogram; the dotted lines illustrate the frame underexpansion.

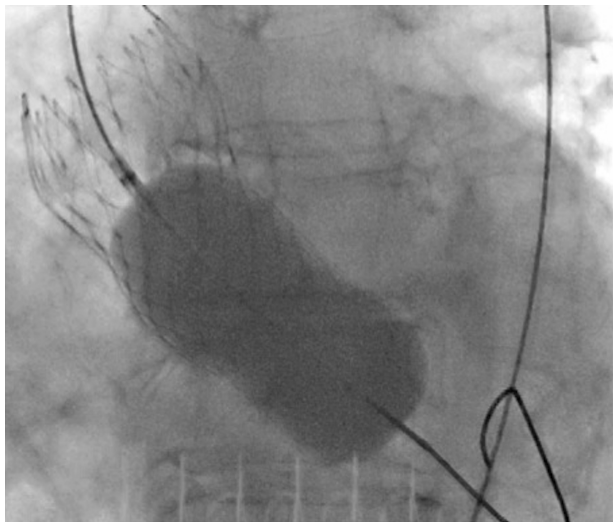

Fig. 4. Postdilatation of the medtronic corevalve.

femoral artery and the introduction of a transvenous temporary pacemaker into the right ventricular apex, the native aortic valve was retrogradely crossed with an extra support long guidewire. Under rapid burst pacing balloon, aortic valvuloplasty was performed using a Green Arrow PBAV-26$^{TM}$-balloon (SYM$^{TM}$, Lifetech Scientific Co., Ltd), which was gradually inflated up to 24 mm diameter (Fig. 1). A 29-mm MCS was then positioned and deployed. Control aortogram demonstrated at least moderate aortic regurgitation (AR) (Fig. 2). A rotational angiogram suggested localized prosthesis underexpansion (Fig. 3). We decided to postdilate the prosthesis with the Green Arrow PBAV-26$^{TM}$-balloon up to 26 mm diameter (Fig. 4). The final aortogram showed adequate MCS positioning with no residual AR and clear visibility of both coronaries (Fig. 5). After vascular closure of the groin, the patient was weaned uneventfully. In the following hours, she developed waxing and waning chest discomfort with accompanying dynamic ST-T changes on sequential electrocardiograms (Fig. 6, upper and lower panels). The transient diffuse ST-depressions with ST-elevation in aVR were reminiscent of a left main stem problem. The patient was brought back to the catheterization laboratory. An Amplatz Left 1 guiding catheter was selected to cautiously maneuver through the MCS frame struts. A subselective angiogram confirmed a left main stem dissection (Fig. 7). In order not to distort the framework, we opted to wire the left main stem with the guiding catheter fixated in a subselective position through the struts. A High Torque Whisper Extra-Support coronary guidewire was advanced into the left anterior descending artery and a Pilot-50 coronary guidewire into the left circumflex artery. IVUS confirmed a dissection entry port in the left sinus of Valsalva perpetuating into the left main stem (Fig. 8). Of note, the distal left main bifurcation was not affected which allowed for a

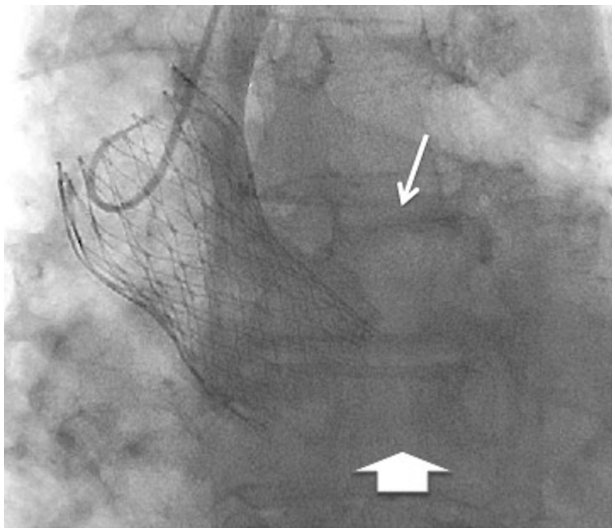

Fig. 5. Aortogram after postilating the medtronic corevalve. White arrow: left coronary artery. Arrow head: no contrast in the left ventricle.

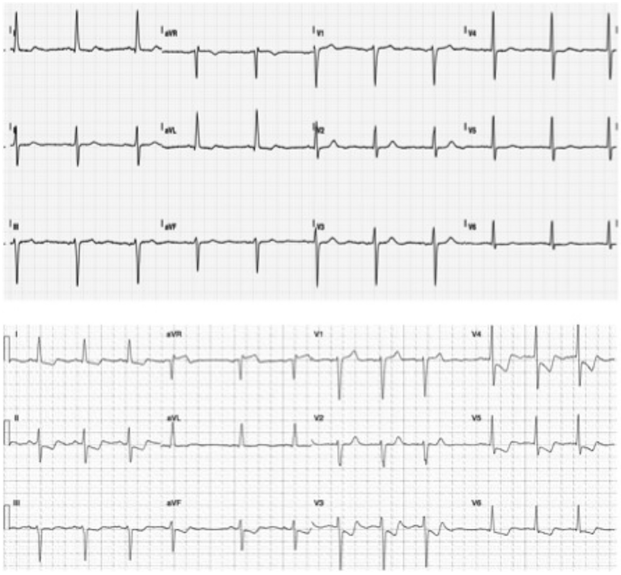

Fig. 6. Upper panel: baseline ECG. Lower panel: dynamic ST depressions V3-6, I, II, and aVF. ST elevation in aVR.

selected stent size to land before the bifurcation. After predilation with a 2.5 mm × 12 mm non-compliant Voyager Balloon, a Xience Prime 4.0 mm × 12mm drug eluting stent was implanted into the ostial left main stem, followed by postdilation with a 4.0 non-compliant Voyager Balloon (Fig. 9). IVUS confirmed the good final angiographic result with adequate stent apposition (Fig. 10).

## DISCUSSION

TAVI is a catheter bound minimally invasive alternative to surgical aortic valve replacement for selected

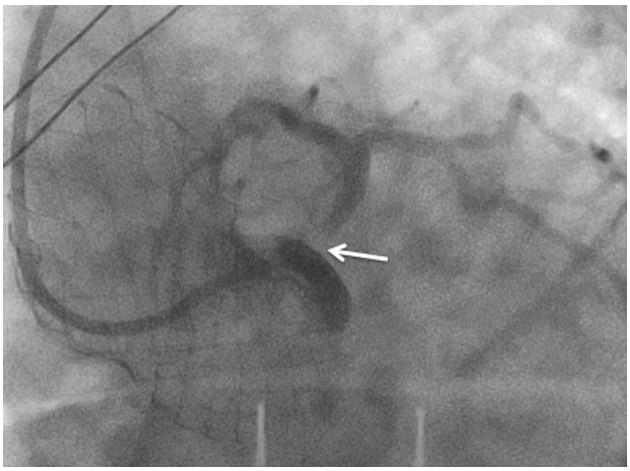

Fig. 7. Coronary angiogram in "spider view" of left main stem. Arrow: dissection of proximal left main stem.

patients with higher operative risk. Two conceptually different valve systems have Conformité Européenne (CE) mark approval: the Edwards SAPIEN$^{TM}$ (Edwards Life-sciences, Irvine, CA) is a balloon expandable device whereas the Medtronic Corevalve System$^{TM}$ is self-expandable. Apart from the fundamentally different implantation technique, both devices have specific device and procedure-related complications.

In the present case report, we describe the occurrence of left main stem dissection after MCS TAVI. Immediate TAVI-related coronary complications are a rare entity and the etiology can be diverse: coronary obstruction by native aortic valve leaflets or attached calcium deposits, true embolization of calcium debris into the coronary arterial bed, aortic dissection extending into one of the coronary ostia, mechanical obstruction of the coronary ostia by an excessively high implanted valve prosthesis, etc. [3]. Baseline multi-modality imaging can help in risk stratification of these particular complications: the length of the native aortic leaflets can be measured and compared with the distance from the virtual aortic annulus to the ostium of the right and left coronary artery (the so-called coronary height), qualitative and (semi-) quantitative analysis of the calcium burden can guide operators, the respective sizes of the aortic annulus, aortic sinuses, sino-tubular junction and ascending aorta can be measured etc. [5].

The pathophysiology in the case described above was illustrated by IVUS. One has to keep in mind that the Medtronic Corevalve framework anchors itself in the aortic root and will in principle not touch the margins of the wider aortic sinuses where the right and left coronary arteries originate. During a postdilatation maneuver with a non-compliant balloon, the framework is briefly expanded with excessive force against the aortic wall potentially touching the wall of the aortic sinuses.

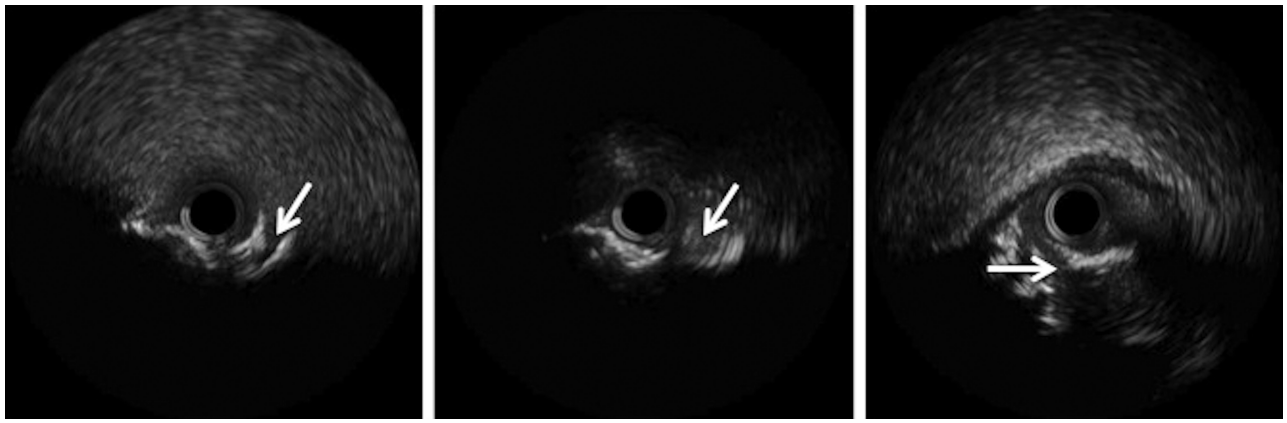

**Fig. 8. IVUS pull-back from the left main stem into the left coronary cusp of the aorta. Left panel: IVUS frame taken in the sinus of valsalva (only aortic wall partially visible). Arrow shows dissection entry port. Middle panel: Ostium of the left main stem with dissection (arrow). Right panel: Fibro-calcific dissection flap in the left main stem (arrow).**

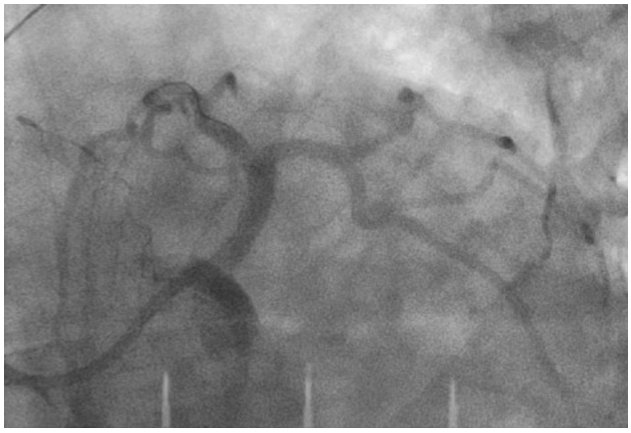

**Fig. 9. Coronary angiogram in "spider view" of the left main stem after stenting.**

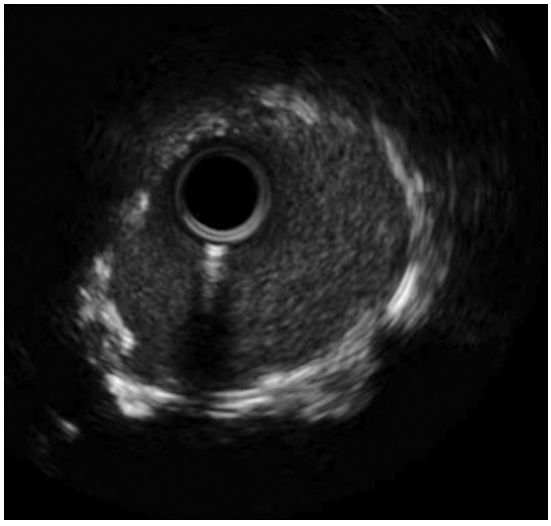

**Fig. 10. IVUS confirming good stent apposition in the left main stem.**

Theoretically this maneuver can crack calcified structures and create dissections of the ascending aorta and/or the ostium of a coronary artery as happened here. Postdilatation of an MCS prosthesis is required in approximately 15% of cases. In our series of 180 MCS TAVI cases, we encountered only 1 MCS postdilatation complicated by a coronary dissection, suggesting it is truly a rare event. The considerable clinical impact however warrants special attention.

In this case, the coronary arteries were accessible with guiding catheters through the MCS struts. We deliberately chose not to distort the framework and therefore parked the guiding catheter in front of an open MCS strut in line with the coronary ostia. Coronary stent implantation and final IVUS confirmation evolved unremarkably.

Percutaneous coronary intervention (PCI) after MCS TAVI has been described previously. The Siegburg group has demonstrated the feasibility of left main stenting through the MCS frame of a previously bypassed left main stem lesion [6]. Other groups reported successful PCI after both MCS TAVI [7] and Edwards SAPIEN TAVI [8,9].

IVUS is feasible after MCS TAVI and holds several assets. In this case report, it helped elucidate the pathophysiology of the left main stem dissection and also provided invaluable information to guide optimal stent size selection. The need for stenting across the distal left main bifurcation would have made the PCI much more complex with potential suboptimal results on the longer term (higher risk of major adverse events).

This case report underscores the importance of close follow-up of patients during the early days following

successful TAVI and the ability to respond to specific clinical and electrocardiographic signs, which may suggest potentially life-threatening events. To the best of our knowledge, we report for the first time the feasibility and value of IVUS in the evaluation of an iatrogenic left main stem dissection after MCS TAVI. IVUS guided emergent PCI appears safe and feasible within the first days after MCS TAVI.

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