Late Downward Dislocation of a Balloon Expandable Valve Into the Left Ventricular Outflow Tract Following Transfemoral Transcatheter Aortic Valve Implantation

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Figure 1. (A) Computed tomography: asymmetrical heavy calcification of the non-coronary cusp (NCC) and the commissure between the NCC and right coronary cusp (RCC) on short axis view. LCC, left coronary cusp. (B) Aortography: low valve position with mild aortic regurgitation just after SAPIEN XT valve implantation. (C, D) Aortography: severe aortic regurgitation with valve slanting and dislocating into the left ventricle at the sites of NCC and RCC (arrow).
Transcatheter aortic valve implantation (TAVI) has emerged as an alternative to conventional surgical valve replacement in selected patients with severe aortic stenosis (AS), who are either inoperable or at high risk during open heart surgery. The migration or embolization of an implanted transcatheter heart valve (THV) is a rare but life-threatening complication of TAVI, which usually occurs during the procedure. We report a case of late downward dislocation of a balloon expandable valve into the left ventricular outflow tract occurring 21 days after successful TAVI via the transfemoral approach.

A 67-year-old man with hypertension, dyslipidemia, and diabetes mellitus was diagnosed with symptomatic severe AS. The patient had a history of previous coronary artery bypass grafting performed 21 years previously, 3 previous percutaneous coronary interventions, left carotid endarterectomy and aorto-iliac bypass grafting. Transthoracic echocardiography (TTE) indicated severe degenerative AS with an area of 0.8 cm² and a mean pressure gradient of 60 mmHg. Left ventricular ejection fraction (LVEF) was 50%. Multi-slice computed tomography (MSCT) showed an aortic annulus diameter of 24 mm and asymmetrical heavy calcification of the non-coronary cusp (NCC; Figure 1A). MSCT also showed occlusion of the saphenous vein graft (SVG) to the diagonal artery but confirmed patency of the left internal mammary artery (LIMA)-left anterior descending artery (LAD) and right internal mammary artery (RIMA)-right coronary artery, which were both attached to the posterior sternum with the RIMA crossing the midline. The operative mortality risk based on the logistic EuroSCORE and STS scores were 32.5% and 13.6%, respectively. Considering the elevated surgical risk and in particular the risk of damaging the patent mammary grafts with redo surgery, the heart team decided for a transcatheter procedure. The procedure was performed via the right transfemoral approach under mild sedation. Immediately after balloon valvuloplasty with a 23-mm balloon, severe aortic regurgitation (AR) with cardiogenic shock occurred. A 26-mm SAPIEN XT valve (Edwards LifeSciences, Irvine, CA, USA) was deployed in an emergency procedure under rapid pacing (200 beats/min) with prompt hemodynamic stabilization. Aortography after the implantation showed the prosthesis in a slight low position with mild AR (Figure 1B). Trans-esophageal echocardiography (TEE)
showed only a mild-moderate paravalvular leak. Post-dilata-
tion was not performed because of the possible risk of annular
rupture related to the severe asymmetric calcification. Post-
procedural AR index was calculated as 21.9: [(59 – 22)/169]×
100.\(^3\) After an uneventful hospital stay, the patient was dis-
charged 5 days after the procedure with the pre-discharge TTE
showing adequate excursion of leaflets and mild-moderate para-
valvular leak. The patient was re-admitted to the emergency
room 21 days after TAVI, presenting with a 2-day history of
sudden onset of dyspnea and clinical signs of congestive heart
failure. TTE and TEE showed worsening of the paravalvular
leak, new-onset severe pulmonary hypertension and preserved
LVEF. The patient was intensively treated for congestive heart
failure for 6 days with no clear improvement. Follow-up aor-
tography, TTE and TEE were performed (27 days after TAVI),
showing downward dislocation of the valve into the left ven-
tricular outflow tract and severe AR, in particular through the
gap between the NCC and the valve (Figures 1C,2C). Due to
the risk of further valve migration into the LV, standard aortic
valve replacement was undertaken. Redo sternotomy was per-
formed to the left of the midline in order to avoid damaging
the RIMA. Identification and mobilization of the mammary
arteries was extremely difficult due to the presence of adhe-
sions. Surgical findings confirmed the echocardiographic and
aortographic findings. The valve was almost completely dis-
lodged into the LV with the native aortic valve completely
exposed (Figure 2D). There was no evidence of structural dam-
age to the prosthetic valve. A 23-mm mechanical valve (St
Jude Medical, St Paul, MN, USA) was successfully implanted
with standard surgical technique. Hemostasis was very chal-
 lenging during the procedure due to the patient being also on
dual antiplatelet therapy. In the first hours after surgery, how-
ever, the patient developed anterior ST-elevation and hypokini-
ness of the LV apex. Coronary angiography showed occlusion
of the mid-LIMA, which was uncrossable with a coronary
guidewire, which raised the suspicion of extrinsic compres-
sion by the surgical sutures. Repeat urgent surgery was per-
formed with placement of an SVG on the LAD. The patient
subsequently did well postoperatively and was discharged 8
days later to a cardiac rehabilitation unit.

Delayed migration is an extremely rare complication of TAVI
that has been reported in only a handful of case reports as oc-
curring at 2 days, 5 days, 3 weeks and 43 days after implanta-
tion of a SAPIEN XT valve.\(^4\)\(^-\)\(^5\) We considered 3 possible ex-
planations for the occurrence of this late valve dislocation: (1)
low valve positioning due to rapid deployment in an unstable
hemodynamic state after pre-dilatation; (2) insufficient valve
expansion without post-dilatation; and (3) asymmetrical heavy
calcification of the aortic valve. Valve sizing and positioning
are key steps to successful implantation of a THV. In this case,
the valve was suitably over-sized in relation to the annular
dimensions. Although valve implantation may be considered
slightly low in this case, there are numerous patients with a
THV implanted at the same depth that do not migrate. Although
we can only hypothesize about the mechanism, we believe that
it was the coincidence of the low implantation with the severe
asymmetric calcification. Non-uniformly distributed calcifica-
tion might prevent optimal anchoring or complete expansion
of the prosthesis. Paravalvular regurgitation was detected main-
lly around the NCC, which had intense calcification. Sinning
et al reported that patients with AR index <25 had a signifi-
cantly increased 1-year mortality risk compared to patients with
AR index ≥25.\(^3\) Considering the acceptable grade of AR as
assessed on TEE and aortography, post-dilatation was not per-
formed because of the possible risk of annular rupture. Fur-
thermore, it is worth remembering that the retrograde force
during diastole on a closed valve has been shown to be ap-
proximately 10-fold the antegrade force during systole, which
would have contributed to the dislocation toward the LV.\(^5\) On
the decision of management, valve-in-valve implantation via
the trans-apical route or snaring of the dislocated valve was
considered. Open surgery was chosen, however, to avoid com-
plete valve migration into the LV or antegrade migration di-
tally into the arch or descending aorta. Finally, this case also
illustrates the challenges and risks of performing redo surgery
in patients with patent mammary grafts. In conclusion, we
present an unusual case of late downward dislocation of an
Edwards THV, probably related to low implantation in a na-
tive valve with severe asymmetrical calcification, which pre-
sent ed as sudden onset of severe symptomatic AR.

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