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Transcatheter aortic valve implantation in degenerated aortic bioprosthesis complicated by a frozen leaflet phenomenon

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The outcomes of transcatheter aortic valve implantation (TAVI) have improved over years with rapid technological advances and growing experience of operators, however still several unexpected problems may occur during the procedure [1-3]. We present a case of patient with frozen leaflet phenomenon.

A 66-year-old male with history of atrial fibrillation, hypertension and chronic kidney disease presented with recurrent episodes of heart failure decompensations 8 years after surgical aortic valve replacement (Soprano Sorin bioprosthesis – 20) and concomitant CABG.

Echocardiography demonstrated degenerated bioprosthesis with mean and max gradient – 74 mmHg and 127 mmHg, respectively, mild regurgitation and ejection fraction of 50%. The patient underwent valvuloplasty of bioprosthesis 2 years before with temporary clinical improvement. After careful evaluation he was deemed to be at high surgical risk (EuroSCORE II 7,6%) and TAVI was recommended.

According to CT results (Figure 1A,S1) aortic annulus was 18,9 mm and with use of a Valve-in-valve application a 23 mm Evolute R (Medtronic, USA) prosthesis was selected. The procedure was performed under general anesthesia. Transfemoral access was obtained. After insertion of a guiding wire Confida into the left ventricle ventricular fibrillation occurred, treated with successful defibrillation. 23 mm Core Valve Evolute R was implanted with significant decrease in transvalvular gradient and trivial paravalvular leak (Figure 1B). A super stiff guidewire was removed. Few minutes later a sudden drop in blood pressure was observed with subsequent persistent and recurrent ventricular fibrillation. Resuscitation was initiated. Echocardiography excluded cardiac tamponade. Coronary angiography revealed no coronary obstruction (Figure 1C-D). However, a severe transvalvular insufficiency was observed in echocardiography and fluoroscopy. A frozen leaflet phenomenon was considered to be a causative factor – 6F pigtail catheter probing of implanted prosthesis was performed. An immediate haemodynamic stability was achieved. Echocardiography after TAVI revealed...
a mild paravalvular leak and mean and maximum transvalvular gradient 35 and 64 mmHg, respectively. The prosthesis-patient mismatch resulted from implantation of the prosthesis into small diameter of the first bioprosthesis and may be observed in up to 30% of patients undergoing valve-in-valve TAVI. After clinical stabilisation patient was discharged home 10 days after TAVI.

„Frozen leaflet” is a rare but potentially life threatening complication presenting with severe intraprosthesis leak and sudden hypotension. Several hypotheses were proposed to explain this phenomenon. Most probable is anchoring of the prosthetic leaflet on the stent during the crimping phase. Ferrari E. [4] suggested two ways of treatment depending on the patient hemodynamics – in stable patient to control position of a stiff guidewire, to verify the valve shape and re-balloon in case of distortion and to increase the blood pressure to mobilize the frozen leaflet from the stent, while in unstable – to implant a second prosthesis and to consider ECMO or femo-femoral cardiopulmonary bypass to stabilize the patient.

There are only single reports of a frozen leaflet phenomenon. All describe implantation of the second prosthesis as a final rescue treatment. Eggebrecht el al. [5] presented two cases of severe regurgitation during valve-in-valve procedure, one of them with central flow through the prosthesis, also treated with second prosthesis implantation (“valve-in-valve-in-valve”). Frozen leaflet phenomenon in our patient was probably caused by anchoring of the prosthesis leaflet by the degenerated bioprosthesis. However in the presence of two already implanted narrow prostheses (a 20 mm Soprano Sorin and a 23 mm CoreValve Evolut R) next prosthesis implantation was deemed harmful. The mobilisation of the frozen leaflet with a pigtail occurred to be a rescue manoeuvre. We suggest that such simple attempt should be recommended in similar cases before the decision of implantation of the second valve.
Finally, it is worth to mention a problem of prosthesis-patient mismatch after valve-in-valve TAVI in our patient. Currently, bioprosthetic valve fracture, a novel technique was developed to address this complication. Before or after implantation of the transcatheter prosthesis, a highpressure balloon inflation is performed to fracture the surgical sewing ring of the bioprosthesis. This procedure enables expansion of both prostheses, increasing the effective orifice area and improving the final result.

References


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Figure 1

A. Computed tomography result

B. Transcatheter aortic valve replacement
C-D. Coronary angiography

Supplementary Figure S 1 Computed tomography results