Concomitant Transcatheter Aortic and Mitral Valve-in-Valve Replacements Using Transfemoral Devices Via the Transapical Approach

First Case in United States

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An 85-year-old man was recently admitted to our institution with congestive heart failure (New York Heart Association functional class III/IV) and hemolytic anemia. The patient had a prior history of *Streptococcus viridans* bacterial endocarditis that resulted in severe aortic and mitral regurgitations. In 2002, he underwent surgical aortic (Carpentier-Edwards #25, Edwards Lifesciences, Irvine, California) and mitral (Hancock modified #29, Medtronic, Minneapolis, Minnesota) valve replacements. Transesophageal echocardiogram (TEE) performed during the recent hospitalization showed that the left ventricular ejection fraction was 55%. The Hancock modified bioprosthesis in the mitral position was well seated, but there was severe mitral regurgitation caused by a flail leaflet (Fig. 1A, Online Video 1). The effective regurgitant orifice was calculated to be 0.42 cm². Measurements of the internal dimensions of the mitral bioprosthesis using 3-dimensional reconstruction imaging.

From the Columbia University Medical Center/New York-Presbyterian Hospital and the Cardiovascular Research Foundation, New York, New York. Drs. Paradis, Kodali, Daneault, and Williams have received consulting fees from Edwards Lifesciences. Dr. Kodali is also a consultant for St. Jude Medical; he serves on the Scientific Advisory Board and has equity in Thubrikar Aortic Valve Inc. Dr. Hahn is a consultant for Abbott Vascular and the COAPT trial. Dr. Leon is a nonpaid member of the Scientific Advisory Board of Edwards Lifesciences and Medtronic Vascular; he is on the Executive Committee of the PARTNER trial. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Manuscript received July 3, 2012; accepted July 19, 2012.

Figure 1. TEE Showing the Mitral Bioprosthetic Valve

Transesophageal echocardiogram (TEE) demonstrating (A) color Doppler through the mitral bioprosthesis valve. Severe intraprosthetic mitral regurgitation caused by a flail leaflet generates an eccentric regurgitant jet (see Online Video 1). The effective regurgitant orifice was calculated to be 0.42 cm². (B) Measurements of the internal dimensions of the mitral bioprosthesis using 3-dimensional reconstruction imaging.
Figure 2. TEE Showing the Aortic Bioprosthetic Valve
Transesophageal echocardiogram (TEE) showing (A) planimetry of the orifice and (B) measurement of the internal diameter of the aortic bioprosthesis.

Figure 3. The 4 Prosthetic Heart Valves
Final fluoroscopic images showing the 4 prosthetic heart valves (Hancock modified, Carpentier-Edwards, and 2 Edwards SAPIEN transcatheter heart valves) in different angulations.
On the basis of his clinical presentation and the TEE findings, the patient was felt to require reoperative aortic and mitral valve replacements. He was evaluated by 2 cardiothoracic surgeons and judged to be inoperable on the basis of his advanced age, frailty, multiple comorbidities, and the complexity of the proposed surgery. Therefore, it was decided to proceed with transapical, transcatheter, double valve-in-valve implantation using 2 commercially available RetroFlex 3 transfemoral devices (Edwards Lifesciences, Irvine, California). In the hybrid operating room, without pre-dilation but under rapid ventricular pacing, a 26-mm Edwards SAPIEN transcatheter heart valve (THV) was first deployed within the Carpentier-Edwards valve in the aortic position (Online Video 2). With a 2-step inflation technique, an Edwards SAPIEN 26-mm THV was then deployed within the Hancock modified bioprosthesis in the mitral position (Online Video 3). TEE after deployment of both valves showed excellent function of the new aortic prosthetic valve with an AVA of 2.08 cm², peak and mean gradients of 12 and 6 mm Hg, respectively, and no significant aortic insufficiency. Moreover, there was only trace residual mitral regurgitation, and no significant stenosis (mitral valve area 1.65 cm²).

To our knowledge, this case represents the first concomitant transcatheter double valve-in-valve replacements performed in the United States (Fig. 3, Online Videos 4, 5, 6, and 7).

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APPENDIX

For supplementary videos and their legends, please see the online version of this paper.