Percutaneous Transcatheter Valve-in-Valve Implantation in Stenosed Tricuspid Valve Bioprosthesis

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Transcatheter valve-in-valve implantation is a promising treatment option for degenerated bioprosthetic heart valves in high-risk patients. Successful percutaneous techniques have been described for pulmonary and aortic valves. We present the first successful percutaneous tricuspid valve-in-valve implantation.

The patient was a fragile 74-year-old woman with chronic obstructive pulmonary disease (forced expiratory volume in 1 second, 53%), impaired renal function (modified diet in renal disease 35 mL/min/1.73 m²), and cardiac hepatic cirrhosis with ascites and cachexia (body mass index 19 kg/m²), admitted with chronic right-sided heart failure and severe stenosis of a degenerated tricuspid bioprosthesis. Previously, a partial atrioventricular canal defect had been treated in 3 consecutive surgical interventions. During the last procedure, 23 years ago, a mechanical mitral valve replacement (St. Jude 25 mm, SJM, Inc., St. Paul, MN) had been performed, combined with a bioprosthetic tricuspid valve replacement (pericardial Carpentier Edwards 25 mm, Edwards Lifesciences, Irvine, CA). Transthoracic echocardiography and live 3D imaging revealed normal left ventricular systolic function with acceptable function of the mitral valve prosthesis, dilated left atrium (278 mL), right ventricle and right atrium (103 mL), with diminished right ventricular function (TAPSE 11 mm), and a severely calcified and stenosed tricuspid valve with maximal and mean gradients of 18 and 11 mm Hg, respectively (Figure 1 and 4, Movie 1). Due to poor hemodynamic parameters, inotropes were being administered preoperatively, and a semiurgent percutaneous procedure was performed.

Cannulae for cardiopulmonary bypass were percutaneously placed via the right femoral vessels under local anesthesia, and a pacemaker wire was positioned in the left ventricle via the left femoral artery. Transesophageal echocardiographic visualization of the tricuspid bioprosthesis was hampered by scatter of the mechanical mitral valve. Alternatively, an intracardiac echocardiography probe (AcuNav™, Biosense Webster, Diamond Bar, CA) was inserted via the left femoral vein into the right atrium, rendering adequate peroperative imaging. Once stable hemodynamic condition was achieved, general anesthesia was started. A 22 Fr sheath was introduced via the right internal jugular vein. The steerable Edwards Retroflex balloon system permitted crossing of the tricuspid stenosed orifice over a curved guide wire (Cordis standard exchange J-tip, 0.035 inch) situated in the right ventricular apex. Valvuloplasty (balloon inflated to 22 mm) was performed under rapid ventricular pacing; concomitant contrast injection in the right atrium, during brief cardiopulmonary bypass interruption, confirmed complete occlusion of the orifice area. A 23 mm Edwards Sapien valve was crimped on the Retroflex delivery balloon system (Movie 2) and successfully implanted into the degenerated bioprosthesis (Figure 2 A-E, Movie 3). Intracardiac echocardiography and 3D transesophageal echocardiography confirmed adequate position and excellent function of the tricuspid bioprosthetic valve (Figure 3 and 4, Movies 4 and 5), with maximal gradient 5 (mean 2) mm Hg with trivial (< grade I) regurgitation. After 3 days via the right internal jugular vein. The steerable Edwards Retroflex balloon system permitted crossing of the tricuspid stenosed orifice over a curved guide wire (Cordis standard exchange J-tip, 0.035 inch) situated in the right ventricular apex. Valvuloplasty (balloon inflated to 22 mm) was performed under rapid ventricular pacing; concomitant contrast injection in the right atrium, during brief cardiopulmonary bypass interruption, confirmed complete occlusion of the orifice area. A 23 mm Edwards Sapien valve was crimped on the Retroflex delivery balloon system (Movie 2) and successfully implanted into the degenerated bioprosthesis (Figure 2 A-E, Movie 3). Intracardiac echocardiography and 3D transesophageal echocardiography confirmed adequate position and excellent function of the tricuspid bioprosthetic valve (Figure 3 and 4, Movies 4 and 5), with maximal gradient 5 (mean 2) mm Hg with trivial (< grade I) regurgitation. After 3 days...
of monitoring in the intensive care unit, the patient was discharged from the hospital at day 6.

We describe the first human percutaneous transcatheter tricuspid valve-in-valve implantation. Although valve positioning is fluoroscopy-guided, intracardiac echocardiography provides reliable monitoring when transesophageal echocardiographic is inadequate. Parallel position of the tricuspid valve to the caval veins can hamper the balloon to cross the heavily calcified tricuspid bioprosthesis. The Edwards Retroflex delivery system helps to achieve the coaxial position of the valve. Further development of steerable balloon catheters will facilitate this intervention. Percutaneous valve-in-valve implantation in degenerated bioprostheses in tricuspid valve position is a feasible treatment option in selected cases.


Disclosures

None.

References

Figure 3. Intracardiac echocardiography showing adequate position and function of the tricuspid transcatheter bioprosthesis.

Figure 4. Transthoracic echocardiography continuous wave Doppler showing the preoperative tricuspid valve stenosis and regurgitation (upper panel). After the percutaneous valve-in-valve implantation, the tricuspid gradient and regurgitation are decreased as shown in the lower panel.
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_Circulation_. 2011;123:e219-e221
doi: 10.1161/CIRCULATIONAHA.110.972836

_Circulation_ is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
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