Valve-in-Valve due to prosthetic tricuspid valve stenosis

Valve in valve por estenosis protésica tricuspídea

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ABSTRACT

Prosthetic tricuspid valve stenosis is an entity whose resolution is complex due to the patients' multiple comorbidities. Endovascular treatment using prosthetic valves designed for implantation in the aortic position recently has been described.
This is the case of a patient with prosthetic tricuspid valve stenosis resolved through valve-in-valve transcatheter aortic valve replacement (VIV-TAVR).

Keywords: *valve in valve implantation, tricuspid valve, tricuspid valve disease.*

RESUMEN

La estenosis que se desarrolla en una válvula protésica en posición tricuspídea es una entidad cuya resolución es compleja debido a las múltiples comorbilidades que estos pacientes presentan. El tratamiento endovascular de la misma utilizando prótesis diseñadas para ser implantadas en posición aórtica es una técnica de reciente descripción.
Presentamos el caso de una paciente portadora de estenosis protésica tricuspídea resuelta mediante reemplazo valvular transcatéter valve in valve.

Palabras claves: *implante valve in valve, válvula tricúspide, enfermedad tricuspídea.*

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CASE REPORT

This is the case of a 56-year-old woman with a past medical history of tricuspid valve replacement at the age of 33 due to infectious endocarditis treated with anticoagulation due to atrial flutter, and ligation of esophageal varices due to bleeding. The patient showed clinical signs of chronic right heart failure. EKG findings: severe right atrial dilatation (48 cm^2), and severe stenosis of the prosthetic tricuspid valve (mean gradient: 12 mmHg). The remaining parameters fell into the reference values.
Tricuspid valve implantation via endovascular approach was decided due to the high surgical risk involved.
The procedure was performed under conscious sedation. The right femoral vein was punctured, and a hemostasis introducer was placed using Seldinger technique. Afterwards, a hydrophilic guidewire (Laurate, Merit, Utah, United States) was advanced towards the left pulmonary artery that would be eventually exchanged using a Cobra 2 catheter (Impress, Merit, Utha, United States) for a high-support guidewire (Lunderquist, Cook Medical, Bjaeverskov, Denmak). Using the prosthetic valve annulus previously implanted as a reference, a 23 mm Edwards Sapiens 3 valve (Edwards Lifesciences, California, United States) was implanted in the tricuspid position released under a pacemaker of high-intensity power-frequency electric field setting. The injection of contrast material into the right atrium confirmed the passage of contrast towards the right ventricle, an unseen phenomenon at the beginning of the procedure. Regarding the readings of the pressure meter, a mean pressure of 31 mmHg before device implantation was confirmed in the right atrium followed by 27 mmHg readings after implantation. The pulmonary artery confirmed mean pressure levels of 16 mmHg before implantation, and 28 mmHg after implantation. The control EKG performed revealed no paravalvular leak, and a mean tricuspid gradient of 7 mmHg.
The patient's clinical course was favorable without complications during the hospital stay. She was released from the hospital 48 hours after implantation

DISCUSSION

Tricuspid stenosis (TS) is an unusual disease whose etiology is often rheumatic disease. Another important cause is degeneration affecting the biological prostheses surgically implanted in the tricuspid position in this case due to pannus formation and calcification at the base of the leaflets added to commissural fusion (1).
A biological prosthetic valve is said to have significant TS when the mean transvalvular gradient is ≥ 10 mmHg. Clinical signs are lower limb swelling, jugular ingurgitation, hepatomegaly, ascites, and exertional dyspnea. These signs are indicative of chronic right heart failure, and low cardiac output syndrome. Multiorgan failure can occur in advanced stages with the development of liver cirrhosis, renal failure, and protein-losing enteropathy. (2,3)
According to former studies, 75% to 85% of the patients treated with surgical tricuspid valve replacement with biological prosthetic valves are free from a second procedure for the next 8 to 10 years. This rate drops even further to 60% after 15 years (4). The surgical treatment of this condition is associated with a high mortality rate since these patients have multiple comorbidities, which adds to the complexity involved in a new sternotomy (5,6).
The management of valvular heart disease in the tricuspid position via endovascular approach using heart valves to treat aortic stenosis is an off-label procedure. Its short- and mid-term efficacy and safety profile has already been confirmed by several studies (2,4). As mentioned before, in the case of our patient, the endovascular approach was decided by the heart team while taking into account the patient's multiple comorbidities.
Regarding the implantation technique used, the impor-

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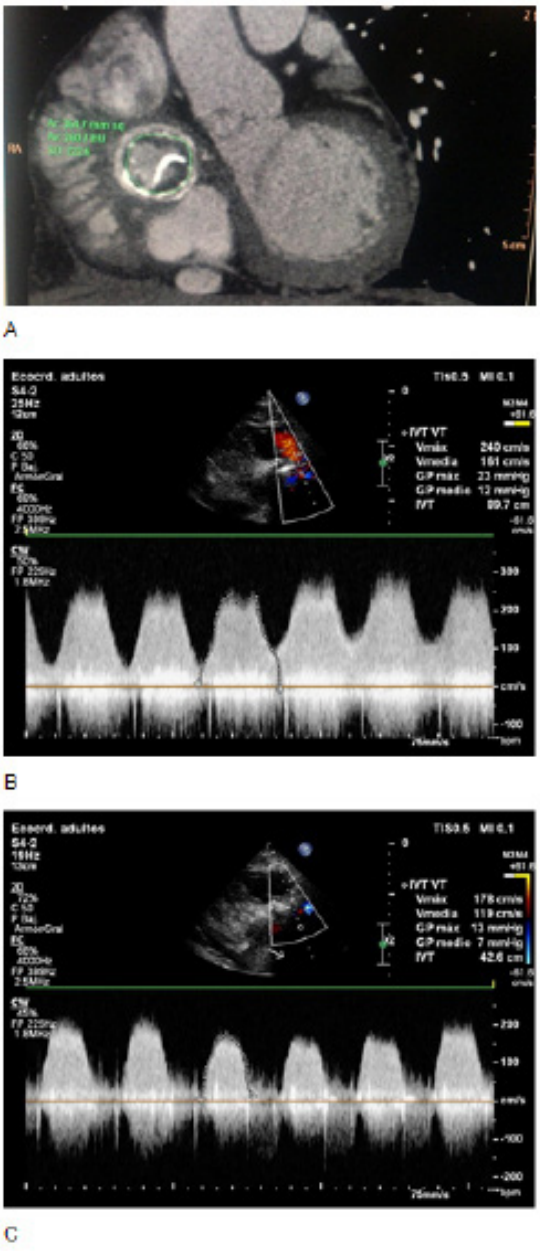

Figura 1. *A. Reconstrucción multiplanar en tomografía multicorte de válvula tricúspide protésica evidenciando signos de degeneración valvular con engrosamiento valvar y calcificación. B. Vista del tracto de salida del ventrículo derecho en la que se evidencia gradiente transvalvular medio tricuspídeo de 12 mmHg previo a la colocación de la prótesis valvular. C. Vista del tracto de salida del ventrículo derecho en la que se evidencia gradiente transvalvular medio tricuspídeo de 7 mmHg posterior al implante de la prótesis valvular en posición tricuspídea.*

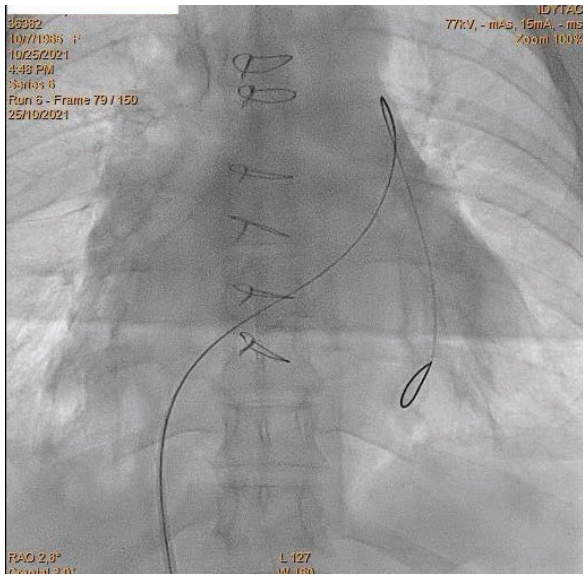

Figura 2. *Progresión de cuerda 0,035" de alto hasta rama segmentaria de arteria pulmonar izquierda.*

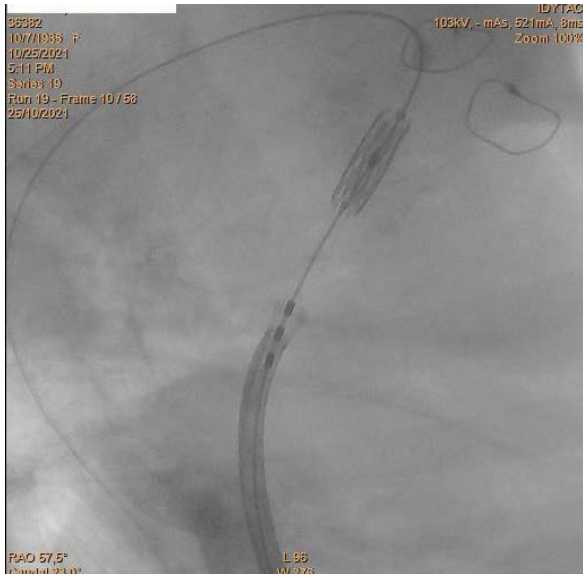

Figura 3. *Alineación de dispositivo en proyección derecha-caudal, tomando como referencia el marco de la válvula implantada por vía quirúrgica.*

tance of surgically fixing the balloon-expandable valve to the suture ring of the implanted valve to prevent displacement has been described. Also, looking for greater coaxiality between the 2 prosthetic valves regarding implantation. Angiographic images should be obtained perpendicularly to the prosthesis to optimize torsion. Also, the ventricular pacemaker of high-intensity power-frequency electric field helps minimize the movement of the surgical prosthetic valve annulus (7,8).

Regarding the size of the prosthetic valve, we should mention that they are named after their outer diameter. However, for the valve-in-valve technique the important thing is the valve internal diameter, which varies from one manufacturer to the next. Calcified or voluminous valves, pannus, and the prosthetic valve different sizes vary based on the valve internal diameter, which is why assessment through computed tomography scan is advised (7). Devices implanted inside valves of small diameters (≤ 27 mm) often show high gradients after implantation (2).

Regarding the hemodynamic phenomena seen after VIV-TAVR, reduced mean tricuspid gradient, increased right ventricular end-diastolic pressure, increased right ventricular systolic pressure, increased pulmonary artery mean pressure, increased pulmonary capillary wedge pressure, and lower mean right atrial pressure have been reported. The latter is the one with the fewest significant changes reported. Another parameter we should mention is the pulmonary artery pulsatility index whose formula describes the right ventricular systolic function (pulmonary artery systolic pressure – pulmonary artery diastolic pressure)/mean right atrial

Figura 4. *Post implante de válvula Edwards Sapiens 3™ en posición tricuspídea.*

pressure (3). In the case of our patient, the mean transvalvular gradient dropped 5 mmHg (13 mmHg and 8 mmHg before and after implantation, respectively), the pulmonary artery pulsatility index improved, and mean pulmonary artery pressure improved > 25 mmHg. This may be indicative of left ventricular misadaptation to the increased preload.

CONCLUSION

Tricuspid stenosis is a phenomenon due to the inevitable deterioration of biological prosthetic valves. Hemodynamically, it is characterized by increased right atrial pressure, increased systemic venous pressure, and decreased cardiac output due to the reduced preload of both the right and the left ventricles. In the case that was presented here and of a high-risk surgical patient, endovascular approach was decided. After valve implantation, the hemodynamic parameters improved as the direct measurements of pressures in the right heart chambers and pulmonary artery confirmed. The control EKC performed found no traces of paravalvular leak. The patient's clinical course improved significantly at the outpatient follow-up.

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