Transfemoral Aortic Valve Implantation in a Patient With Mitral Bioprosthesis: Technical Features and Forethoughts

Implante de válvula aórtica transfemoral en paciente con prótesis biológica mitral: aspectos técnicos y precauciones

To the Editor,

Experience with transcatheter aortic valve implantation (TAVI) in patients with mechanical mitral valve prostheses has recently been published.[1–4] We present the case of a transfemoral transcatheter aortic valve (TAV) (Edwards Lifesciences, Irvine, California) implantation in a patient with a mitral bioprosthesis (MBP). The presence of an MBP is not an indication approved by the manufacturer, although several cases of transapical implantation have been reported.[3,4]

The patient was an 86-year-old woman with a history of stroke, permanent atrial fibrillation, and MBP (Biocor 27, St. Jude Medical, St. Paul, Minnesota) implantation which had been performed 11 years earlier. She presented with symptoms of heart failure (New York Heart Association functional class III) presenting evidence of severe aortic stenosis with a valve area of 0.75 cm^2, a peak gradient of 64 mmHg, a mean gradient of 37 mmHg, pulmonary hypertension, and good left ventricular function. Given her logistic EuroSCORE of 43%, a medical-surgical meeting was called in which it was decided to attempt transfemoral TAVI since the iliofemoral anatomy was favorable. The operation was performed under general anesthesia and with 3-dimensional transesophageal echocardiography (3D TEE) monitoring, following standard procedure.[5] The baseline study showed an MBP strut protruding 9 mm into the left ventricular outflow tract (LVOT), but with sufficient space in the LVOT (in theory) to accommodate the TAV (Fig. 1). During the aortic valvuloplasty procedure, displacement of the balloon toward the aorta was observed without further deformation of the MBP (Fig. 2; video 1). The TAV (Edwards SAPIEN XT 23) implantation was initiated with 60% of the valve in the LVOT to prevent displacement toward the aorta, which finally occurred but with a scant magnitude (4 mm) (Fig. 2, video 2). A good result was achieved with the TAV in the high position without occluding the coronary ostia and/or impairing the MBP (video 3). The patient was discharged 6 days after the implantation procedure with stable normal left ventricular function, a peak gradient of 16 mmHg, and a mean gradient of 10 mmHg. At 5 months after the procedure, the patient was in functional class I-II and both prostheses were functioning correctly.

To the best of our knowledge, this is the first case of transfemoral TAVI in the presence of an MBP. However, we should recall that the presence of an MBP makes this off-label usage. The limitations of MBPs are as follows[3]: *a)* the profile (height) of MBPs is higher than that of mechanical valves, mainly due to the posts or struts to which the leaflets attach, and they usually protrude into the LVOT (Fig. 1); *b)* the structure and the leaflets of MBPs are more fragile than those of mechanic valves, and have the potential risk of damaging the MBP during the procedure; and *c)* MBPs are very radiotransparent, so that planning and monitoring the procedure using 3D TEE are essential to assess the relationship between the 2 prostheses, although implantation is still performed under fluoroscopic guidance.

Although the transapical approach is considered more stable due to the course of the catheter being shorter, a better

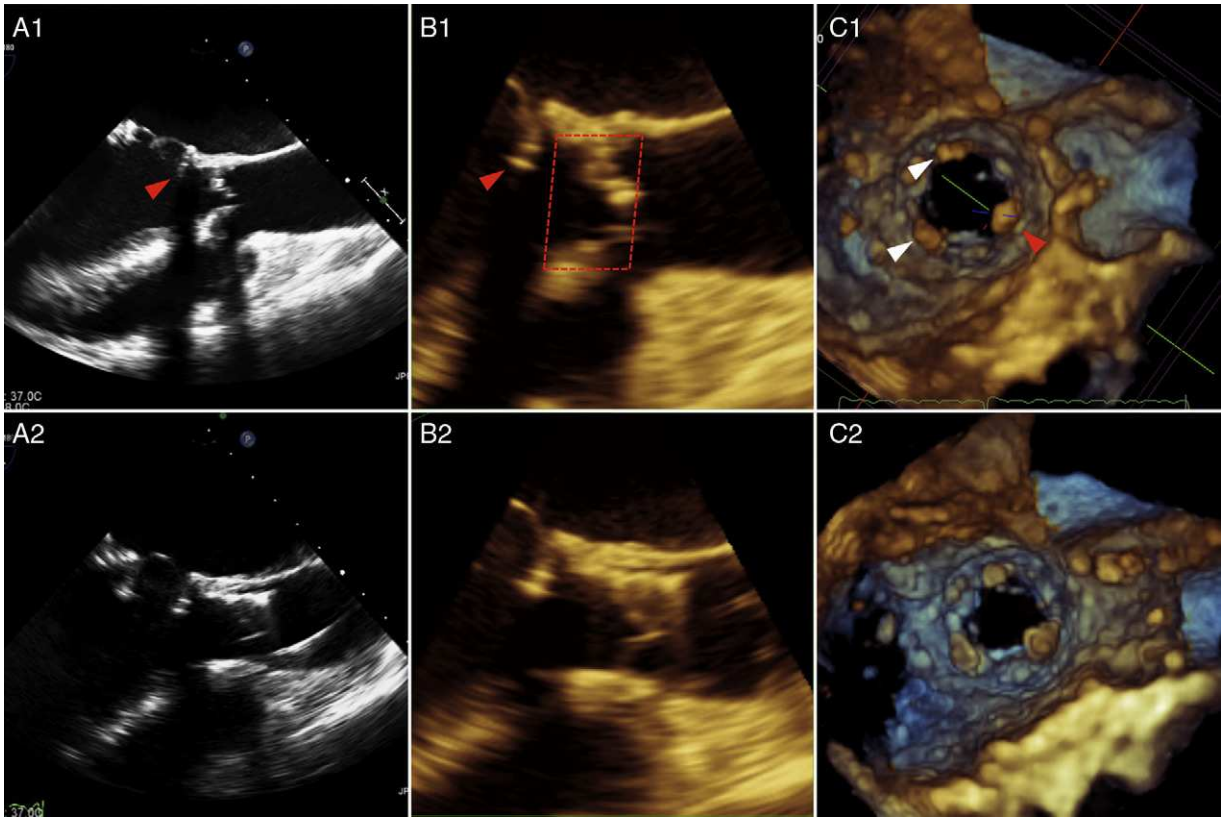

Figure 1. Transesophageal echocardiogram. A, 2-dimensional transesophageal echocardiogram. B, 3-dimensional multiplanar reconstruction. C, 3-dimensional transesophageal echocardiogram. The initial study (1) showed a strut of the biological mitral prosthesis protruding into the left ventricular outflow tract (arrow, A1, B1, C1), deployment site (dashed line, B1), and the arrangement of the struts (triangles) in relation to left ventricular outflow tract (C1). After implantation (A2, B2, C2) the transcatheter aortic valve can be seen in the high position and the intact mitral bioprosthesis.

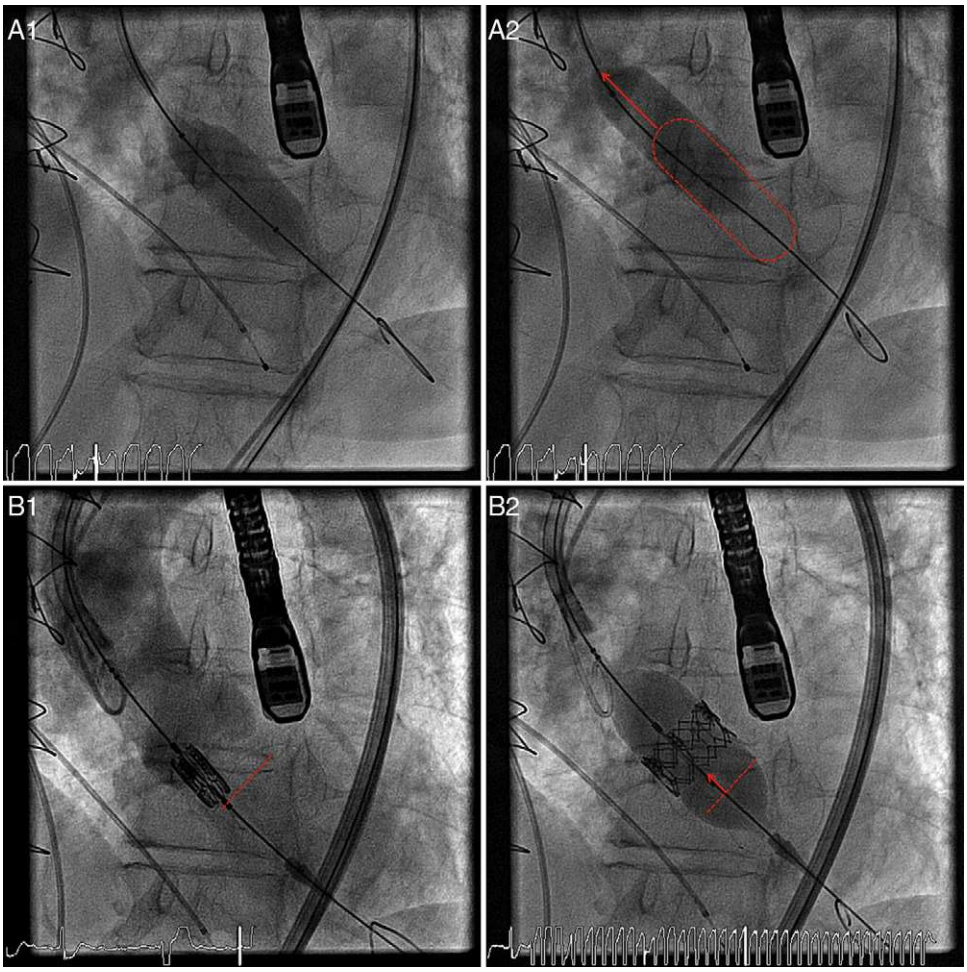

Figure 2. Fluoroscopy. Valvuloplasty (A1-A2) with displacement of the balloon (arrow) compared to the initial position (oval), and implantation (B1-B2), with less displacement (arrow) compared to the initial position (dashed line). The mitral bioprosthesis can be seen as a thin radiopaque ring.

implantation success rate has not been demonstrated. The new transfemoral delivery systems (Novaflex®) provide greater stability during the delivery of the TAV and, as shown in our case, make complex procedures possible using the femoral access route.

The following technical aspects have to be considered during these interventions[4]: *a)* prior meticulous study of the LVOT to avoid damage to the MBP and guarantee space for the TAV implantation, which can be performed using TEE or preferably using 3D TEE or computed tomography; *b)* assessment of the behavior of the valvuloplasty balloon because a shift indicates possible displacement of the TAV during implantation. The measures proposed to minimize displacement are to begin the implantation procedure with at least 60% of the TAV in the LVOT or perform a countertraction maneuver if displacement is expected; *c)* monitoring the impact of the valvuloplasty procedure on the MBP and avoiding damaging the MBP leaflets with the guidewire; and *d)* slow inflation of the prosthesis to correct displacements and obtain the hourglass shape that secures the TAV in position. The majority of published cases have described a displacement of the TAV toward the aorta and dislocations in which the prosthesis has to be permanently secured to some point in the aorta have also been reported.[4]

In conclusion, the transfemoral implantation of a TAV in the presence of an MBP is a viable alternative to the transapical access route and is facilitated by new delivery devices that increase stability during implantation.

CONFLICTS OF INTEREST

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SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found in the online version available at doi:10.1016/j.rec.2011.12.019.

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Inappropriate Left Ventricular Mass in a Young Population

Masa ventricular izquierda inapropiada en una población de adultos jóvenes

To the Editor,

The concept of inappropriate left ventricular mass (iLVM)[1] was introduced to distinguish between compensatory increases in LVM and clinically relevant, maladaptive changes.[2] iLVM is that which exceeds the expected value for a given individual based on sex, body size, and stroke work, and it is associated with an increased cardiovascular risk.[3,4]

We determined the prevalence of iLVM and assessed its relationship with left ventricular function (LVF) in 411 students (265 women; mean [SD] age, 20.62 [0.07] years) from the *Facultad de Ciencias Médicas* at the *Universidad Nacional de La Plata* in Argentina. A sample size of 174 individuals was calculated as sufficient to detect a prevalence of 6% with a 95% confidence level and a precision of 3%; group sizes of 25 to 50 were calculated as sufficient to detect minimal differences in parameters associated with LVF with an α risk of 0.05 and a β risk of 0.20. We analyzed family history of cardiovascular risk factors (RF), weight, height, waist and hip circumference, and blood pressure in all participants. Doppler flow and tissue Doppler echocardiography were used to characterize left ventricular structure and LVF. LVM was calculated according to Devereux et al.[5] and the LVM index (LVMI) was calculated by dividing the LVM by the individual's height in meters to the power 2.7; LVMI >47 g/m^{2,7} in women and >50 g/m^{2,7} in men is indicative of left ventricular hypertrophy. iLVM was calculated according to De Simone[2]; our cutoff was set at the 95th percentile (117%) according to the mass expected for the population with weight and blood pressure in the normal range. Systolic function was assessed by determination of the mean velocity of fiber shortening corrected for stress at peak systole (Vcf) and the peak systolic mitral annular velocity (S'); diastolic function was determined from the ratio of peak early mitral inflow velocity (E) and peak early mitral annular velocity (e') (E/e'). Continuous variables were expressed as means (SD) and categorical variables as percentages. Differences between continuous variables were analyzed by *t* test and the χ^2 test was used to compare categorical variables. Analysis of covariance was used to adjust the values of iLVM for body surface area, ratio of waist to hip circumference, and systolic blood pressure, and univariate analysis was used to assess the correlation between stroke work ratio and LVM. Data were analyzed using SPSS version 15.0. In all cases a cutoff of $P<.05$ was used to determine statistical significance.

The prevalence of iLVM in our students was 6% (95% confidence interval, 3.7%-8.2%). There were no significant differences in age, weight, height, sex, blood pressure, or family history of cardiovascular RF in those with appropriate (aLVM) and iLVM. Adjustment for covariables in students with iLVM (Fig. 1) did not alter the excess LVM of 36.7 (2.15) g observed in that group. The LVM at a given stroke work was greater in students with iLVM (Fig. 2; $P<.01$). The LVMI (29.09 [0.30] g/m^{2,7} in students with aLVM; 40.39 [1.91] g/m^{2,7} in students with iLVM; $P<.01$), prevalence of LVH (0.5% in students with aLVM; 8% in students with iLVM; $P<.01$), wall thickness (8.50 [0.05] mm in students with aLVM; 10.13 [0.23] mm in students with iLVM; $P<.01$), and relative wall thickness (0.37 [0.002] in students with aLVM; 0.44 [0.01] in students with iLVM; $P<.01$) were all greater in students with iLVM. There was also a reduction in S' (24.69 [0.41] cm/s in students with aLVM; 21.15 [1.65] cm/s in students with iLVM; $P<.03$) and Vcf (101.59% [0.9%] in students with aLVM; 91.94% [4.71%] in students with iLVM; $P<.01$), as well as an increase in E/e' (2.76 [0.05] in students with aLVM; 3.27 [0.30] in students with iLVM; $P<.01$) compared with students who had an aLVM.

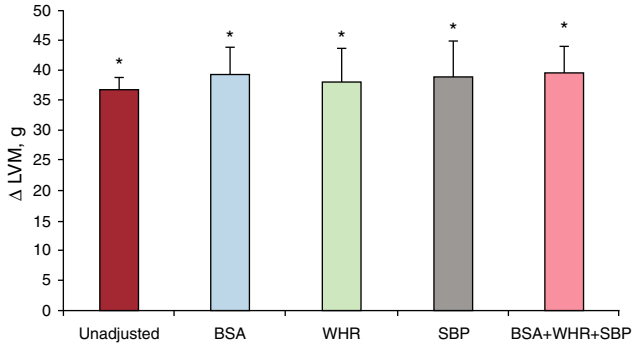

Figure 1. Differences in left ventricular mass in young adults with appropriate and inappropriate left ventricular mass with and without adjustment. BSA, body surface area; LVM, left ventricular mass; SBP, systolic blood pressure; WHR, waist-to-hip ratio. *$P<.05$.

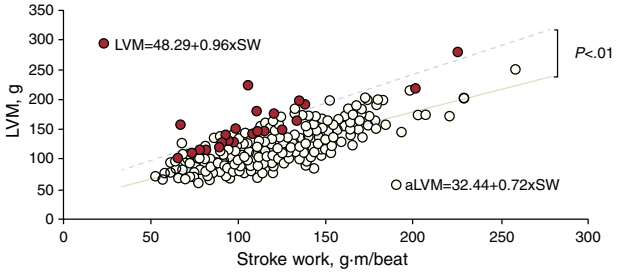

Figure 2. Relationship between stroke work (horizontal axis) and left ventricular mass. Filled circles correspond to young adults with inappropriate left ventricular mass. aLVM, appropriate left ventricular mass; LVM, left ventricular mass; SW, stroke work.