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RESEARCH CORRESPONDENCE

Early Hemodynamic and Structural Impact of Transcatheter Aortic Valve Replacement in Pure Aortic Regurgitation

Pure aortic regurgitation (AR) causing symptoms or determining significant volume overload-dependent heart remodeling is expected to benefit from aortic surgery (1). When surgery is considered at too high risk, experienced centers are currently considering offering transcatheter aortic valve replacement (TAVR) in selected patients with severe AR with suitable aortic valve anatomy (1). Yet, studies assessing the morphological and functional effect of TAVR performed for AR are lacking. Thus, we sought to evaluate the impact of TAVR in patients treated for pure AR.

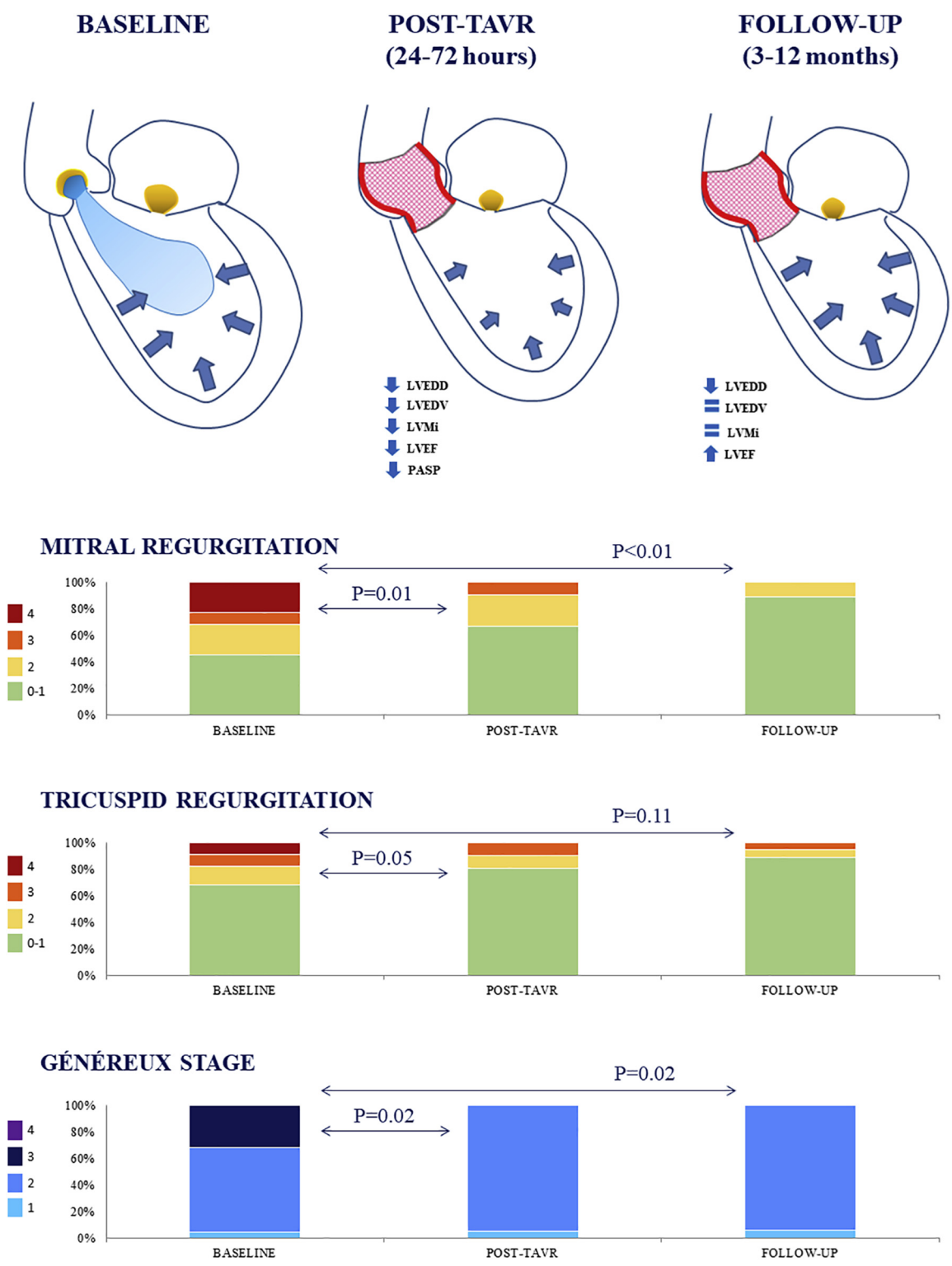
Consecutive patients with pure AR who underwent a TAVR procedure at our institution between January 2016 and October 2019 were retrospectively identified. Clinical data and procedure details were prospectively entered into a catheterization laboratory database with validated accuracy (2). The study was conducted within the framework of a systematic clinical, procedural, and follow-up data recording for transcatheter aortic valve prostheses implantation approved by the local Ethical Committee. Experienced physicians systematically performed a complete echocardiographic assessment according to European Association of Cardiovascular Imaging guidelines (3) before TAVR, after TAVR (24 to 72 h), and at follow-up (3 to 12 months). Hemodynamic and echocardiographic parameters were compared before and after TAVR. Paired samples *t* test and Mann-Whitney test were used to compare respectively continuous and categorical variables. Multivariable regression analysis was used to establish parameters predicting left ventricular end-diastolic diameter (LVEDD) variation as measure of LV remodeling. A p value <0.05 was considered statistically significant.

Twenty-two patients with severe AR, high surgical risk, and advanced heart damage were treated by TAVR using self-expandable prostheses (2 CoreValve [Medtronic, Minneapolis, Minnesota], 18 Evolut R [Medtronic], 1 Evolut PRO [Medtronic]). The procedure was successful in 21 (95.5%) patients, with 1 patient being referred for elective surgery after failure to anchor the larger prosthesis. Half of the patients with native AR had at least moderate calcification ($n = 6$, 50%), 2 (17%) of them had mild calcification, and 4 (33%) had no valve calcification at all.

As expected, an immediate hemodynamic impact of the TAVR procedure was documented by different parameters, including significant decrease in LV end-diastolic pressure (from 26.2 to 20.1 mm Hg at procedure end; $p = 0.012$) and sharp reduction in the estimated pulmonary artery systolic pressure (from 48.6 ± 17.3 mm Hg to 32.9 ± 7.8 mm Hg; $p < 0.001$ post-TAVR). Mean invasive transaortic gradients were 17.8 $\pm$ 12.3 mm Hg before TAVR and 13.4 $\pm$ 9.8 mm Hg immediately after. Residual post-TAVR AR was assessed by immediate post-procedural aortography and was mild in 5 (24%) patients and absent in all other patients.

When assessing the different echocardiographic parameters, a major impact on TAVR procedure on heart structure and function was documented

FIGURE 1 Global Impact of TAVR in Pure Aortic Regurgitation



LVEDD = left ventricular end-diastolic diameter; LVEDV = left ventricular end-diastolic volume; LVEF = left ventricular ejection fraction; LVMi = left ventricular mass indexed; PASP = pulmonary artery systolic pressure; TAVR = transcatheter aortic valve replacement.

(Figure 1). The first post-TAVR echocardiographic evaluation showed an immediate significant reduction in LV size (LVEDD: 60.0 ± 8.0 mm vs. 54.6 ± 8.1 mm; p = 0.002; LV end-diastolic volume index 87.1 ± 30.8 ml/m^2 vs. 71.4 ± 25.6 ml/m^2; p < 0.001) and in LV mass (163.2 ± 58.8 g/m^2 vs. 140.2 ± 45.6 g/m^2; p = 0.004). In parallel, a significant, slight, LV systolic performance reduction was observed (LV ejection fraction [LVEF] 49.1 ± 13.5% vs. 43.3 ± 13.1%; p = 0.008). No significant differences were found in diastolic function parameters. At follow-up, the improvements were stable, LVEDD showed further significant decrease (Figure 1), and LVEF increased returning to pre-procedural values (Figure 1). In all patients with baseline moderate-to-severe mitral and tricuspid regurgitation, a significant early reduction in the degree of valve regurgitation was observed and persisted at follow-up (Figure 1). Applying the Généreux classification, an overall significant impact on cardiac damage was documented in all patients with advanced stages before TAVR (Figure 1). The possible mechanisms for transient, early LVEF decrease include the loss of compensatory Frank-Starling mechanism (in the presence of sharp LV end-diastolic pressure reduction in a condition of volume overload) and the immediate reduction of concomitant mitral regurgitation. In this regard, no final explanation can be provided because effective stroke volume was not measured.

At multivariable analysis, LVEDD reduction at the follow-up assessment was predicted only by baseline LVEDD (p = 0.019).

After a mean follow-up time interval of 13 (range 3 to 36) months, all patients were alive and as high as 90% of patients were in New York Heart Association functional class I or II (at baseline >70% of patients were in New York Heart Association functional class III or IV).

In conclusion, we documented that successful TAVR in patients with pure AR and advanced heart damage is associated with a major heart modification characterized by: 1) early detectable, strong LV reverse remodeling; 2) transient, mild LVEF reduction (which is fully recovered at follow-up); and 3) favorable multilevel impact on heart structure and performance, which includes reduction of functional mitral and tricuspid regurgitation.

The present results support the use of TAVR in AR patients deemed at too high risk for conventional surgery.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Cardiovascular Interventions* author instructions page.

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RESEARCH CORRESPONDENCE

Prosthesis–Patient Mismatch Based on Energy Loss Index After Transcatheter Aortic Valve Replacement

Prosthesis-patient mismatch (PPM) constitutes a condition where the effective orifice area (EOA) of a normally functioning prosthesis is too small in