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**Review of Structural Late-Breaking Trials from the TVT Connect 2020 and PCR e-Course**

**2020 Virtual Meetings**

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## 1. Introduction

The COVID-19 pandemic replaced face-to-face meetings with virtual ones. Yet the research and innovation have not stopped and new data are available for presentation, irrespective of the meeting format.

In this article, we present a brief overview of the late-breaking clinical trials presented at the Transcatheter Valve Therapies (TVT) Connect 2020 conference, as well as selected structural clinical trials presented at the Paris Course of Revascularisation (PCR) e-Course 2020, that carry significant clinical implications.

## 2. TVT Connect

### *2.1. Real-World Experience with the SAPIEN 3 Ultra: A Propensity-Matched Analysis from the United States*

*Presenter: Dr. Tamim Nazif*

*Key Points: In the largest study to date, the fourth-generation balloon-expandable Edwards SAPIEN 3 Ultra valve achieved a significantly lower rate of paravalvular leak (PVL) when compared to its predecessor, the third-generation balloon-expandable Edwards SAPIEN 3 valve, according to registry data.[1]*

PVL following transcatheter aortic valve replacement (TAVR) has been associated with poorer clinical outcomes, including mortality.[2] The SAPIEN 3 valve saw the introduction of the polyethylene terephthalate (PET) skirt, which has significantly reduced rates of PVL as compared to earlier-generation TAVR valves.[3] The SAPIEN 3 Ultra valve retained the SAPIEN 3 balloon-expandable cobalt-chromium stent frame with an open-cell design to facilitate coronary access, bovine pericardial leaflets, and 14-French commander delivery

system, while enhancing the height of its outer PET skirt by 40%. There are limited data regarding the hemodynamics and clinical outcomes of patients undergoing TAVR using the SAPIEN 3 Ultra valve.

Tamim M. Nazif, MD, of Columbia University Medical Center, and co-investigators presented data from the Society of Thoracic Surgeons (STS)/American College of Cardiology (ACC) Transcatheter Valve Therapy (TVT) Registry. In this study, the authors identified 40,740 patients in the United States who underwent TAVR using either the SAPIEN 3 valve or the SAPIEN 3 Ultra valve from January 2019 through February 2020. Included in the study were 2648 patients who underwent elective transfemoral TAVR (1324 using the SAPIEN 3 valve and 1324 using the SAPIEN 3 Ultra valve) of a native aortic annulus. Using a logistic regression model, a propensity-score-matched analysis was performed with 1:1 matching of 27 covariates (baseline demographics, past medical history, laboratory data, echocardiographic data, and procedural data). The authors then examined clinical and echocardiographic outcomes at discharge and at 30 days between the matched patients.

With regard to procedural outcomes, patients who received the SAPIEN 3 Ultra valve had significantly shorter procedural times ( $75.3 \pm 36.6$  minutes vs.  $81.7 \pm 40.6$  minutes;  $p < 0.01$ ) and fluoroscopy times ( $12.3 \pm 10.3$  minutes vs.  $14.7 \pm 8.5$  minutes;  $p < 0.01$ ). One theory for this marked decrease could be the reduction of post-dilation using the SAPIEN 3 Ultra valve with its taller PET skirt.

When examining clinical outcomes, patients had a similar median intensive care unit length of stay (2.4 vs. 7.0 hours;  $p = 0.41$ ) but those in the SAPIEN 3 Ultra group did have a longer median length of hospital stay (2.0 vs. 1.0 days;  $p = 0.02$ ). On discharge, patients who received the SAPIEN 3 Ultra valve had significantly lower rates of mild PVL (8.9% vs. 13.9%;  $p < 0.01$ ),

similar rates of moderate or severe PVL (0.2% vs. 0.4%;  $p=0.45$ ) and similar mean gradients ( $11.9 \pm 5.0$  mmHg vs.  $11.9 \pm 5.0$  mmHg;  $p=0.77$ ). At 30 days, mortality (0.9% vs. 1.3%;  $p=0.34$ ), stroke (1.2% vs. 1.9%;  $p=0.38$ ), and need for pacemaker (6.0% vs. 5.7%;  $p=0.66$ ) were similar between the two groups.

Nazif acknowledged that the study was limited by its retrospective analysis of non-randomized data. Despite propensity-score matching, there could be unidentified confounders (including pre-TAVR computed tomography imaging) that could have impacted the results. Additionally, the STS/ACC TVT Registry echocardiographic data regarding PVL could not be independently adjudicated. Furthermore, the study follow-up was limited to 30 days. The statistical analysis was performed by Edwards Lifesciences.

## *2.2. Valve-in-Surgical Valve with SAPIEN 3 for TAVR: Propensity-Matched Analyses of Real-World Data*

*Presenter: Dr. Amr E. Abbas*

*Key Points: Real-world data of patients who underwent valve-in-valve (ViV) TAVR demonstrated excellent 30-day and 1-year outcomes compared to native TAVR and support the safety and efficacy of ViV TAVR across all risk groups.*

Registry data from the PARTNER II and STS/ACC TVT Registry have led to US Food and Drug Administration (FDA) approval of ViV TAVR in patients with prior surgical aortic valve replacement (SAVR) at high and extreme surgical risk using the second-generation Edwards SAPIEN XT valve and subsequently using the third-generation Edwards SAPIEN 3 valve. [4] There are limited data on ViV TAVR using the SAPIEN 3 valve in low-risk patients.

Amr E. Abbas, MD, of Beaumont Hospital Royal Oak, Michigan, and co-investigators analyzed a real-world data from the STS/ACC TVT Registry with ViV TAVR in patients with prior SAVR using the SAPIEN 3 and SAPIEN 3 Ultra valves.[5] Additionally, the authors compared these patients to propensity-score-matched patients across different risk groups who underwent native TAVR.

The authors identified 140,301 patients with prior SAVR who underwent native TAVR and 4759 patients in the United States who underwent ViV TAVR using either the SAPIEN 3 valve or the SAPIEN 3 Ultra valve from June 2015 through January 2020. Patients were excluded if they underwent non-transfemoral TAVR. Patients were then stratified by STS risk score. Of the 4273 included patients who underwent ViV TAVR, 1407 had an STS risk score <4% (28 of whom received a SAPIEN 3 Ultra valve), 1684 patients had an STS risk score between 4% and 8% (16 of whom received a SAPIEN 3 Ultra valve), and the remaining 1185 patients had an STS risk score >8% (16 of whom received a SAPIEN 3 Ultra valve). The primary outcome of interest was all-cause mortality at 1 year. The authors performed a multivariate analysis to identify predictors of all-cause mortality at 1 year.

In examining the baseline clinical characteristics of the patients with each risk group, patients in the highest-risk group (STS score >8%) were older and had more comorbidities and worse symptoms prior to ViV TAVR. Device success was similar among the three cohorts of risk (91.7% vs. 91.2% vs. 91.1%), as were the rates of successful device implantation (99.0% vs. 98.8% vs. 99.2%) and coronary compression/obstruction (0.8% vs. 1.0% vs. 1.2%). There were no annular ruptures across any of the cohorts. As expected, intensive care unit (19.1 hours vs. 21.6 hours vs. 24.0 hours) and hospital length of stay (1 day vs. 2 days vs. 3 days) correlated with risk. When the investigators examined echocardiographic changes at 30 days, they found

that mean aortic gradients (19.9 mmHg vs. 20.2 mmHg vs. 20.3 mmHg) and ejection fraction (54.0% vs. 54.1% vs. 51.6%) were similar between the cohorts. At 1 year, there were no significant changes in mean aortic gradient (20.3 mmHg vs. 20.2 mmHg vs. 20.7 mmHg) or ejection fraction (57.7% vs. 57.4% vs. 55.5%) across the cohorts. All-cause mortality correlated with risk at 30 days (0.9% vs. 2.2% vs. 4.3%) and 1 year (5.7% vs. 9.3% vs. 17.9%,  $p<0.001$ ). Readmissions correlated with risk at 30 days (4.7% vs. 5.7% vs. 10.7%) and 1 year (17.5% vs. 21.6% vs. 32.2%). Interestingly, rates of new pacemakers were considerably low across all risk groups of ViV TAVR at 30 days (1.8% vs. 1.9% vs. 2.9%) and at 1 year (3.1% vs. 2.9% vs. 3.9%).

The authors then compared each risk group of ViV TAVR to a propensity-score-matched cohort of native TAVR. Among high-risk patients, 1-year all-cause mortality was lower in the ViV TAVR group compared to the propensity-score-matched native TAVR group (18.0% vs. 24.8%,  $p<0.001$ ). Among intermediate-risk patients, 1-year all-cause mortality was lower in the ViV TAVR group than in the propensity-score-matched native TAVR group (9.0% vs. 12.0%,  $p=0.025$ ). The same was seen among low-risk patients, with 1-year all-cause mortality lower in the ViV TAVR group than in the propensity-score-matched native TAVR group (6.1% vs. 8.5%,  $p<0.001$ ). When stratifying patients as high risk or non-high risk, as determined by the heart team, 1-year all-cause mortality was again lower in the ViV TAVR group than in the propensity-score-matched native TAVR group (high-risk ViV 13.4% vs. high-risk native 16.7%;  $p=0.002$ ; non-high-risk ViV 5.8% vs. non-high-risk native 8.2%;  $p=0.06$ ). In a multivariate analysis, baseline moderate or severe tricuspid regurgitation (hazard ratio [HR], 1.78; 95% confidence interval [CI], 1.13-2.81;  $p=0.01$ ) and baseline hemoglobin (HR, 0.85; 95% CI, 0.75-0.97;  $p=0.01$ ) were found to be predictors of 1-year all-cause mortality in patients who underwent ViV

TAVR. Mean aortic gradients or the presence of patient-prosthesis mismatch were not found to be predictors of 1-year all-cause mortality in patients who underwent ViV TAVR with prior SAVR.

The limitations of the study are inherent to data derived from the TVT registry, as it carries a risk of missing data and miscoded data. Additionally, variables not routinely included in the STS predicted risk of mortality could have impacted outcomes. The authors attempted to mitigate some of the cofounders by including them in the heart team surgical risk stratification analysis. Furthermore, echocardiographic data was not core lab adjudicated. Future prospective studies are required to confirm these findings past 1 year.

Statistical analyses were performed by Edwards Lifesciences.

### *2.3. TAVR with Self-Expandable Supra-Annular Valves for Failed Surgical Bioprostheses:*

*Insights from the TVT Registry*

*Presenter: Dr. Guilherme F. Attizzani*

*Key Points: TAVR using supra-annular self-expandable Evolut R or Evolut PRO valves for the treatment of degenerated SAVR valves demonstrated favorable short-term outcomes and should be considered safe and effective for the treatment of a failing surgical aortic bioprosthesis.*

TAVR has been widely adopted for the treatment of failed SAVR valves. Smaller studies support the use of supra-annular, self-expandable TAVR valves for the treatment of failed SAVR valves, demonstrating low post-TAVR mean gradients and excellent 1-year outcomes. The purpose of this study was to offer a real-world experience using TAVR with supra-annular self-expandable valves for the treatment of failed SAVR valves using the STS/ACC TVT Registry.

Guilherme F. Attizzani, MD, of University Hospital Cleveland Medical Center, and co-investigators evaluated patients who underwent ViV TAVR in SAVR using the second-generation self-expanding Medtronic CoreValve Evolut R or the third-generation self-expanding Medtronic CoreValve Evolut PRO.[6] Additionally the investigators analyzed 30-day and 1-year echocardiographic data comparing patients who received the Evolut R valve versus those who received the Evolut PRO.

Baseline characteristics between both cohorts were similar, except prior myocardial infarction (MI). Patients who received an Evolut R valve were more likely to have had a prior MI than those who received an Evolut PRO valve (21.2% vs. 17.6%,  $p=0.021$ ). With regard to procedural parameters, patients who received an Evolut R valve were more likely to have received general anesthesia than Evolut PRO patients (59.9% vs. 53.5%,  $p<0.001$ ). This finding was not surprising, given that TAVR centers gain experience with time. Interestingly, the authors found that 50.7% of patients receiving the Evolut R had implantation of a 23-mm valve compared to 40.7% of patients receiving the Evolut PRO valve ( $p<0.001$ ). This was likely secondary to the additional PET skirt coverage found in the newer-generation Evolut PRO. Hospital length of stay was 2 days for both cohorts.

At 30 days, all-cause mortality (2.5% vs. 2.8%,  $p=0.524$ ), stroke (2.2% vs. 1.8%,  $p=0.481$ ), MI (0.3% vs. 0.6%,  $p=0.126$ ), major vascular complications (1.1% vs. 1.6%,  $p=0.259$ ), aortic valve re-intervention (0.6% vs. 0.1%,  $p=0.101$ ) and valve-related readmissions (0.4% vs. 0.2%,  $p=0.467$ ) did not differ between the two cohorts. The Evolut PRO group had a lower rate of need for new permanent pacemaker (3.0% vs. 5.3%,  $p=0.010$ ).

At 1 year, all-cause mortality (9.8% vs. 9.2%,  $p=0.974$ ), stroke (2.9% vs. 3.1%,  $p=0.819$ ), major vascular complications (1.1% vs. 1.6%,  $p=0.281$ ), aortic valve re-intervention (1.2% vs.

0.6%,  $p=0.133$ ) and valve-related readmissions (2.3% vs. 1.8%,  $p=0.404$ ) did not differ between the two cohorts. The Evolut PRO group had a higher rate of MI (0.8% vs. 1.8%,  $p=0.020$ ). The Evolut PRO group continued to have a lower rate of need for permanent pacemaker (4.5% vs. 7.4%,  $p=0.007$ ).

Hemodynamic improvements were sustained over time at 1 year with both the Evolut R (mean aortic gradient 15.5 mmHg [preprocedure] vs. 14.3 mmHg [1 year]) and the Evolut PRO (14.9 mmHg vs. 13.2 mmHg). There was a trend toward lower gradients using the Evolut PRO compared to the Evolut R immediately post-procedure (14.9 vs. 15.5 mmHg,  $p=0.058$ ), and significantly lower gradients using the Evolut PRO compared to the Evolut R at 30 days (13.8 vs. 14.5 mmHg,  $p=0.037$ ), and at 1 year (13.2 vs. 14.3 mmHg,  $p=0.0233$ ); however these differences were not seen when comparing patients within the valve sizes of each cohort. When examining rates of PVL, there were lower rates of trace or mild PVL in patients receiving an Evolut PRO valve compared to an Evolut R valve immediately post-procedure (14.5% vs. 17.9%,  $p=0.003$ ) and at 30 days (15.8% vs. 18.7%,  $p=0.024$ ) but not to 1 year (13.7% vs. 13.2%,  $p=0.598$ ).

Major limitations of this study are related to limited follow-up at 1 year, with only 66.5% of patients eligible for 1-year follow-up. Data regarding type of surgical valve implanted initially, type of bioprosthetic failure, percentage of valve fracture, or coronary obstruction were also lacking. Most Evolut R valves were implanted during an earlier period of time than Evolut PRO valves; thus, there was more experience among operators implanting Evolut PRO valves. Furthermore, there were no statistical adjustments for covariates in this analysis.

Statistical analyses were performed by Medtronic.

#### *2.4. TAVR Using Supra-Annular, Self-Expanding Valves in Low-Risk Patients*

*Presenter: Dr. Bruce Rutkin*

*Key Points: Real-world TAVR using the third-generation self-expandable Evolut PRO valve in low-risk patients yielded similar outcomes to the Evolut Low Risk Trial.*

The Evolut Low Risk randomized trial demonstrated similar outcomes in low-risk patients undergoing TAVR using the third-generation self-expandable Evolut PRO valve compared to surgery.[7] This trial randomized patients to receive either TAVR using the Evolut PRO valve or SAVR. Following enrollment of this randomized trial, the continued-access study (CAS) continued to enroll patients at study sites in a non-randomized fashion. Bruce Rutkin, MD, of North Shore University Hospital, Manhasset, New York, and co-investigators studied three cohorts in this study: the low-risk randomized controlled trial (RCT) patients, the CAS patients, and patients designated as low-risk in the STS/ACC TVT registry.[8]

Baseline clinical characteristics were similar across the three cohorts, with the exception of male sex, which was more frequent in the RCT and CAS cohorts than in the STS/ACC TVT registry patients (50.9% vs. 50.9% vs. 41.6%). Baseline New York Heart Association Functional Class (NYHA FC) III/IV symptoms were less prevalent in the RCT and CAS cohorts than in the STS/ACC TVT registry patients (20.5% vs. 29.7% vs. 49.5%). Not surprisingly, fewer patients had bicuspid aortic valves in the RCT and CAS cohorts than in the STS/ACC TVT registry (0.0% vs. 0.7% vs. 5.6%).

With regard to procedural data, more patients received general anesthesia in the RCT than in the CAS cohort or the STS/ACC TVT registry (56.5% vs. 38.1% vs. 40.5%). There were no differences in median hospital length of stay (all 2 days). At 30 days, rates of stroke (4.7% vs. 3.3% vs. 1.9%), life-threatening or major bleeding (6.4% vs. 3.2% vs. 4.3%), major vascular complications (2.9% vs. 0.7% vs. 0.7%) and need for new permanent pacemaker implantation

(15.2% vs. 12.8% vs. 10.5%) were higher in the RCT cohort than in the CAS or STS/ACC TVT registry. With regard to hemodynamics, the RCT and CAS cohorts saw similar improvements in gradients immediately post-procedure (44.5 to 9.7 mmHg vs. 46.1 to 10.1 mmHg), which were sustained at 30 days (9.7 to 8.4 mmHg vs. 10.1 to 8.5 mmHg). The rate of at least moderate aortic regurgitation was higher in the RCT cohort than in the CAS cohort immediately post-procedure (5.3% vs. 4.5%) and at 30 days (5.9% vs. 2.9%).

Limitations of this study relate to comparison of a strictly adjudicated randomized trial to the less-adjudicated data in the CAS cohort and the STS/ACC TVT registry. This may explain the observed differences in outcomes at 30 days among the cohorts. The review process for eligibility differs among the RCT, CAS, and STS/ACC TVT registry patients.

The primary Evolut Low Risk trial was sponsored by Medtronic.

### *2.5. First Prospective RCT Assessing Incidence of Reduced Leaflet Motion and its Clinical Impact Following TAVR*

*Presenter: Dr. Hasan Jilaihawi*

*Key Points: Reduced leaflet motion (RLM) occurs more frequently than hypoattenuated leaflet thickening (HALT) following TAVR at 30 days (15.9% vs. 31.2%) and at 6 months (15.5% vs. 33.2%) and does not appear to be affected by oral anticoagulation (OAC) use or affect valve hemodynamics over time.*

Subclinical leaflet thrombosis is a computed tomography (CT) finding in which there is HALT and RLM. This phenomenon was first described in the PORTICO US IDE trial in 2014 and found to be much less frequent in patients on OAC.[9] These findings led to the development of a nested prospective substudy. Hasan Jilaihawi, MD, of NYU Langone Health,

New York, and co-investigators evaluated the incidence of RLM and its impact on valve hemodynamics.[10] Furthermore, in a post hoc analysis, the authors sought to compare the frequency of RLM in each brand of transcatheter heart valve.

The original PORTICO US IDE trial randomized 750 patients to receive either the Portico valve or any of the FDA-approved commercial TAVR valves available at that time. Of those patients, the nested CT substudy included 364 consecutively enrolled randomized trial patients between August 2015 and April 2017 at 38 sites. Patients were included if they had a single transcatheter valve placed and evaluable CT or transesophageal echocardiogram (TEE) data. These patients had 30-day and 6-month 4D-CT or 3D-TEE to determine leaflet mobility. HALT was identified using the maximal intensity projection (MIP) on 2D-CT. The investigators defined HALT as the presence of any hypoattenuation in a leaflet. RLM was defined as a leaflet that opens with at least moderate reduction during systole. Furthermore, leaflet motion severity was graded as none, mild (<50% reduction in leaflet opening), moderate (50% to 70% reduction in leaflet opening), severe (>70% reduction in leaflet opening), or immobile. The primary outcome of interest was incidence of RLM at 30 days and 6 months. Additional endpoints included frequency of HALT (in the post hoc analysis), death, stroke, MI, atrial fibrillation, readmissions, structural valve deterioration, and mean aortic gradients.

Of the 364 patients enrolled in the nested CT sub-study, 187 received a Portico valve and 177 received a commercially available TAVR valve. Excluded were patients who did not have sufficient initial CT/TEE data, patients who had ViV TAVR, and those who died. At 30 days, 321 patients with available data and follow-up were analyzed, and at 6 months, 238 patients with available data and follow-up were analyzed.

When examining the primary outcome of interest, RLM across all valve types occurred in 15.9% of patients at 30 days (80.5% affecting one leaflet only) and in 15.5% of patients at 6 months (89.7% affecting one leaflet only). In the post hoc analysis of specific types of TAVR valves, at 30 days, RLM occurred more frequently in patients who received the Portico valve than in patients who received commercially available valves (24.6% vs. 6.9% vs. 5.8%,  $p<0.0001$ ). A similar numerical trend was also seen at 6 months, with RLM occurring more frequently in patients who received the Portico valve than in those who received commercially available valves (19.5% vs. 11.8% vs. 8.8%,  $p=0.21$ ). For patients who started OAC between 30 days and 6 months (with or without antiplatelet therapy), there was a numerical decrease in RLM in patients who received the Portico valve when compared to those who received commercially available valves (3.9% vs. 7.9% vs. 11.8%,  $p=0.20$ ). Presence or absence of OAC between 30 days and 6 months (with or without antiplatelet therapy) did not alter rates of regression of RLM (9.7% vs. 9.4%).

When examining rates of HALT across all valve types, HALT occurred in 31.2% of patients at 30 days (63.8% affecting one leaflet only) and in 33.2% of patients at 6 months (65.7% affecting one leaflet only).

In the post hoc analysis of specific types of TAVR valves, at 30 days, RLM occurred more frequently in patients who received the Portico valve than in those who received commercially available valves (24.6% vs. 6.9% vs. 5.8%,  $p<0.0001$ ). A similar numerical trend was also seen at 6-months, with RLM occurring more frequently in patients who received the Portico valve than in those who received commercially available valves (19.5% vs. 11.8% vs. 8.8%,  $p=0.21$ ).

At 6 months, there were no statistically significant differences in additional endpoints between the patients who had RLM and no RLM at 30 days. At 6 months, there were no

statistically significant differences in additional endpoints between the patients who had HALT and no HALT at 30 days. At 2 years, in patients who received any TAVR valve, there were no differences in the composite of death, stroke or transient ischemic attack in patients who had RLM at 30 days and 6 months compared to those who did not (15.4% vs. 13.9%,  $p=0.84$ ). When examining the subset of patients who received the Portico valve, there were no differences in the composite of death, stroke or transient ischemic attack in patients who had RLM at 30 days and 6 months compared to those who did not (14.3% vs. 13.3%,  $p=0.96$ ).

With regard to hemodynamics, patients who received any TAVR valve with persistent RLM at 30 days and 6 months did not have any significant changes in their mean aortic gradients from discharge to 30 days, 6 months, 1 year, or 2 years (8.8 mmHg vs. 10.4 mmHg vs. 8.2 mmHg vs. 8.8 mmHg vs. 8.8 mmHg). The same was seen across the separate valve types.

In a multivariate analysis of patients who received a Portico valve, the authors identified the presence of anticoagulation at 30 days (odds ratio [OR], 0.29; 95% CI, 0.10-0.82;  $p=0.019$ ), native aortic valve area (OR, 0.03; 95% CI, 0.002-0.35;  $p=0.006$ ) and STS risk score (OR, 1.14; 95% CI, 1.01-1.29;  $p=0.03$ ) as predictors of having RLM at 30 days.

The study was limited by the number of patients excluded at 30 days because of insufficient CT/TEE data. Additionally, CT/TEE imaging was only performed at 30 days and 6 months, thus limiting longer-term follow up of RLM and HALT. The study was not adequately powered to draw significant conclusions regarding RLM and clinical outcomes, valve performance, or differences between transcatheter valve types. The study population was predominantly extreme- and high-risk, given the study's time frame. Future studies should focus on the long-term impact of RLM and HALT on valve hemodynamics and durability.

The primary PORTICO US IDE trial was sponsored by Abbott.

*2.6. SAPIEN 3 TAVR versus Surgery in Intermediate-Risk Patients: A Propensity Score Matched Analysis of 5-Year Outcomes*

*Presenter: Dr. Susheel Kodali*

*Key Points: Patients at intermediate risk undergoing TAVR using the third-generation Edwards SAPIEN 3 valve, demonstrated similar rates of mortality, stroke, and significant PVL, but higher rates of new permanent pacemaker implantation, at 5 years in comparison with propensity-score-matched SAVR patients.*

Long-term outcomes following TAVR with the third-generation Edwards SAPIEN 3 valve are lacking. Susheel Kodali, MD, of Columbia University Medical Center, and co-investigators compared 5-year data from the PARTNER II trial on intermediate-risk patients who underwent TAVR using the S3 valve with SAVR using a propensity-score-matched analysis.[11] Excluded were patients with bicuspid aortic valves, significant pre-existing aortic regurgitation (>3+), severe left ventricular dysfunction (ejection fraction <20%), severe untreated coronary artery disease, or severe renal insufficiency. They propensity-score matched patients who received TAVR using an S3 valve to patients who had SAVR. Key endpoints in this study included death, disabling stroke, and rehospitalization (clinical endpoints committee adjudicated through 5 years). The authors included 25 baseline clinical characteristics in their multivariate analysis.

A total of 1566 patients were included in the propensity-score-matched analysis, of whom 783 received TAVR using an S3 valve and 783 received SAVR. In the TAVR arm, 52 patients were deceased at 1 year and 222 at 5 years; in the SAVR arm, 94 patients were deceased at 1 year and 203 at 5 years. In the TAVR arm, 16 patients at 1 year and 140 patients at 5 years either withdrew or were lost to follow-up. In the SAVR arm, 22 patients at 1 year and 81 patients at 5

years either withdrew or were lost to follow-up. The remaining 627 patients (80.1%) in the TAVR arm and 680 patients (86.8%) in the SAVR arm were analyzed.

Patients had a mean STS score of 5.5%. The following results are at 5-year follow-up. All-cause death (39.1% vs. 41.3%;  $p=0.20$ ) and cardiovascular death (26.3% vs. 27.6%;  $p=0.44$ ) did not differ between patients who received TAVR or SAVR. There was a numerical trend toward a lower rate of disabling stroke in patients who received TAVR versus those who received SAVR (5.8% vs. 7.9%;  $p=0.05$ ). Non-disabling stroke was higher at in patients received TAVR versus those who received SAVR (6.4% vs. 3.5%;  $p=0.04$ ). There were no differences in the composite of death, stroke or readmissions (55.4% vs. 52.9%;  $p=0.70$ ). Patients received TAVR had a higher rate of requiring a new permanent pacemaker versus those who received SAVR (16.2% vs. 11.7%;  $p=0.01$ ). There were no significant differences between the groups in endocarditis, aortic valve re-intervention, or valve thrombosis. Mean aortic gradients did not differ between the two groups (11.2 mmHg vs. 10.6 mmHg;  $p=0.17$ ).

When examining at least moderate PVL, there was a higher rate in patients who received TAVR versus those who received SAVR at 30 days (4.1% vs. 0.5%;  $p<0.0001$ ) and 1-year (1.9% vs. 0.4%;  $p=0.02$ ), but the difference was insignificant at 5 years (0.7% vs. 0.4%;  $p=1.0000$ ). Rates of stage 2 or 3 hemodynamic valve deterioration were similar at 5 years between the two groups (0.63% vs. 0.60%;  $p=0.86$ ) as was bioprosthetic valve failure at 5-years (0.63% vs. 0.37%;  $p=0.22$ ).

One limitation of this study was its non-randomized design. Despite propensity score matching, there could be unknown confounders not accounted for in the statistical analysis of outcomes. Additionally, neurological findings and diagnoses were not systematically performed

out to 5-years. There was a large proportion of patients who were lost to follow-up in the TAVR arm.

The primary PARTNER II trial was sponsored by Edwards Lifesciences.

*2.7. Incidence, Characteristics, Predictors, and Outcomes of Surgical Explantation After TAVR:  
A Population-Based, Nationally Representative Analysis*

*Presenter: Dr. Tsuyoshi Kaneko*

*Key Points: In the largest series to date, the incidence of TAVR explantation was extremely low but carried significant short-term mortality, which was not affected by timing of explantation, era of TAVR implant, or the presence of comorbid conditions.*

Surgical explantation of TAVR valves is increasing in frequency and predominantly performed for PVL. According to small case series and single-center reports, surgical explantation carries extremely high inpatient mortality. Tsuyoshi Kaneko, MD, of Brigham and Women's Hospital, and co-investigators performed a large multicenter study examining the incidence, predictors, and outcomes of patients undergoing surgical explantation of TAVR.[12] They examined incidence of surgically explanted TAVR, time to explant from TAVR, mortality at 30 days and 1 year. Additional outcomes included permanent stroke, hospital length of stay, etiology of surgical explant, and bleeding complications.

Using the Medicare provider analysis review, the investigators identified 137,354 patients who underwent TAVR. Excluded were patients who died as inpatients, patients discharged to hospice, and patients who had ViV TAVR. The remaining 132,515 patients were included in the analysis. Of those patients, only 227 (0.2%) required explantation of TAVR. When examining baseline clinical characteristics, patients who required explantation of TAVR were younger (73.7

vs. 81.7 years;  $p=0.001$ ), more likely to be male (64.8% vs. 53.0%;  $p=0.001$ ), less likely to have heart failure (55.9% vs. 65.8%;  $p=0.002$ ) and had lower Charlson comorbidity scores (high-risk [ $>12$ ] in 26.6% vs. 34.0%;  $p=0.001$ ). The mean time to explant from TAVR was 212 days, with 70.9% of patients having their explant within the first year post-TAVR. The most common etiology was bioprosthetic valve failure (79.3%) followed by endocarditis (20.7%). Permanent stroke occurred in 5.7% of patients, and complete heart block occurred in 11.5%. Median length of stay in the intensive care unit was 5 days and in the hospital was 11 days. Mortality was 13.2% at 30 days, 17.6% at 3 months, and 22.9% at 1 year. When compared to patients who did not require TAVR explant, mortality was higher if patients required explant (HR, 4.03; 95% CI, 1.81-8.98;  $p=0.001$ ). When examining timing of explant post-TAVR, there were no statistical differences in mortality if the explant was performed before or after 6 months post-TAVR ( $p=0.59$ ). When examining timing of initial TAVR, there were no statistical differences in mortality if the TAVR was performed before or after 2014 ( $p=0.20$ ). When examining Charlson comorbidity score, there were no statistical differences in mortality if the Charlson comorbidity score was high risk (above 11) or non-high risk ( $p=0.20$ ).

This study was limited by its use of the Medicare provider analysis review, which lacks important data points regarding echocardiography parameters, procedural data, and STS score. Surgical bias for proceeding with explantation of TAVR could not be accounted for in this analysis. Additionally, aortic root replacement is not infrequent in patients requiring TAVR explant, and thus, the true incidence of aortic root replacement could not be analyzed in this study. The exact etiology of bioprosthetic failure could not be determined.

## *2.8. Functional Status and Outcomes After TMVr in HF and Secondary MR: The COAPT Trial*

*Presenter: Dr. Gennaro Giustino*

*Key Points: MitraClip plus guideline-directed medical therapy (GDMT) is effective and should be offered to patients with heart failure and secondary mitral regurgitation (MR) irrespective of NYHA FC.*

The presence of secondary MR in patients with heart failure is associated with poor prognosis. The primary COAPT trial showed significant benefit of edge-to-edge transcatheter mitral valve repair (TMVr) with MitraClip in patients with heart failure and secondary MR.[13] However, the benefits of TMVr according to the baseline NYHA FC are unknown. Gennaro Giustino, MD, of Mount Sinai Hospital, New York, and co-investigators performed this secondary analysis of the COAPT trial to examine the outcomes of TMVr with MitraClip plus GDMT versus GDMT alone according to the baseline NYHA FC in patients with heart failure and severe secondary MR.[14]

A total of 240 patients had NYHA FC II symptoms, 322 had NYHA FC III symptoms, and 51 had NYHA FC IV symptoms. The patients' mean age was 73 years. Compared to patients with NYHA FC II and III symptoms, patients with NYHA FC IV symptoms had a higher prevalence of comorbidities and elevated biomarkers. MR severity and effective regurgitant orifice area was also higher in patients with NYHA FC IV symptoms. At 2 years, all-cause mortality and heart failure-related hospitalization was significantly higher in patients with NYHA FC IV symptoms than in patients with NYHA FC II or III symptoms. Death or heart failure hospitalization was significantly lower in all classes of NYHA FC in patients who received TMVr with MitraClip plus GDMT than in those receiving GDMT alone (NYHA FC II: TMVR+GDMT [39%] vs. GDMT [63%]; HR, 0.59; 95% CI, 0.45-0.78; NYHA FC III or IV: TMVR+GDMT [49%] vs. GDMT [68%]; HR, 0.53; 95% CI, 0.37-0.77). Secondary endpoints of

all-cause death and heart failure hospitalization were also significantly lower in patients who received TMVr with GDMT irrespective of NYHA FC. Functional status and MR severity demonstrated significant improvements in patients who received TMVr with GDMT compared to GDMT alone. The investigators also noted that the COAPT trial excluded patients with NYHA FC IV symptoms who were non-ambulatory or those who required advanced therapies. The investigators concluded by suggesting future studies for emerging TMVr technologies.

The primary COAPT trial was sponsored by Abbott.

### **3. PCR e-Course 2020**

*3.1. BASILICA vs. control in TAVI procedures at risk for coronary obstruction: Comprehensive core lab-adjudicated matched comparison*

*Presenter: Dr. Danny Dvir*

*Key Points: For patients undergoing TAVR at risk for coronary obstruction, use of a single bioprosthetic or native aortic scallop intentional laceration to prevent iatrogenic coronary artery obstruction (BASILICA) was associated with a significant improvement in survival and coronary obstruction, with a slight trend toward increased stroke at 30 days.*

Coronary obstruction following TAVR is a life-threatening complication. BASILICA is a novel technique using a transcatheter electrical surgical technique to lacerate a leaflet that might cause coronary obstruction post-TAVR.

In this study, Danny Dvir, MD, of the University of Washington Medical Center, and co-investigators describe the safety and efficacy of BASILICA in a large cohort of patients compared to a control group at risk for coronary obstruction.[15] Dvir and colleagues used a

multicentered registry and core lab CT analysis. The primary endpoint of interest was a composite of survival at 30 days without major stroke or coronary obstruction. The investigators examined 129 patients who underwent BASILICA and compared them to controls who underwent ViV TAVR without BASILICA.

Patients who underwent BASILICA were less likely to be female (38.6% vs. 57.3%;  $p<0.0001$ ), more likely to be diabetic (40.4% vs. 26.0%;  $p=0.001$ ) and less likely to have renal failure (33.9% vs. 50.4%;  $p=0.001$ ). Patients in the BASILICA group were more likely to have had externally mounted surgical valves (68.6% vs. 23.0%;  $p<0.001$ ), smaller valves (22.3 mm vs. 23.3 mm;  $p<0.001$ ) and lower STS risk scores (5.3% vs. 8.4%;  $p<0.001$ ). For those who had BASILICA, 102 (79.1%) were of the left coronary leaflet, 5 (3.9%) were of the right coronary leaflet and 22 (17.1%) were both. Patients who had BASILICA had lower 30-day mortality (6.0% vs. 18.9%;  $p=0.026$ ), similar rates of major stroke (7.5% vs. 0%;  $p=0.051$ ), a lower rate of coronary obstruction (4.5% vs. 32.2%;  $p<0.001$ ), and an overall lower rate of the composite of 30-day death, stroke, or coronary obstruction (12.3% vs. 35.6%;  $p<0.001$ ) as compared with the control group. Furthermore, survival at 1 year was higher in patients who received a single BASILICA than in those who received a double BASILICA and the control group (89.6% vs. 75.0% vs. 70.0%;  $p<0.001$ ). The authors conclude that BASILICA could be the therapy of choice in patients at high risk of single coronary artery occlusion post-TAVR.

Limitations of this study are inherent to its being a retrospective analysis of registry data. Although the authors examined numerous baseline clinical characteristics, there could have been additional significant covariates that were not accounted for in their analysis.

### *3.2. Non-invasive ultrasound therapy for aortic stenosis*

*Presenter: Dr. Sander Ijsselmuiden*

*Key Points: A novel non-invasive ultrasound therapy is a feasible and safe treatment for patients with severe aortic stenosis who are not eligible for valve replacement.*

Sander Ijsselmuiden, MD, PhD, of Hôpital Européen Georges Pompidou, Paris, and Amphia Hospital, Breda, Netherlands, presented the first-in-human study results from the first 10 patients treated with the Valvesoft Non-Invasive Ultrasound Therapy (NUIT) device developed by Cardiawave (France).[16]

The novel technology delivers short sequences of high-intensity ultrasound energy through the chest wall, creating microscopic cavitation bubbles within the calcified and narrowed aortic valve. As the bubbles burst, they release energy, producing shockwaves that cause micro-fragmentations in the valve calcium without damaging the soft tissue. This is thought to make the valve leaflets become more pliable, resulting in increased valve area and reducing the severity of stenosis.

The 6-month follow-up results of the first 10 patients treated were presented, examining the safety and feasibility of the technology. Patients who were deemed ineligible for SAVR or TAVR were enrolled and underwent up to 45 minutes of ultrasound therapy delivered at  $>180$  J/mm<sup>2</sup>.

Overall, the therapy appeared safe, with no reported deaths or stroke after 1 month. Eight of the 10 patients had improvements in aortic valve area, and seven patients had a reduction in mean gradient across the valve. Eight patients reported improvements in NYHA FC. The gains in aortic valve area and reduction in peak gradients were maintained in the seven patients who remained alive after 6 months. Encouraged by the safety profile of the technology, the investigators plan further studies with longer treatment durations and increased energy doses.

This study was supported by the French government.

### *3.3. First evaluation of long-term outcomes after aortic valve-in-valve procedures*

*Presenter: Dr. Danny Dvir*

*Key Points: A large registry study shows lower survival for ViV TAVR for small failed bioprosthetic valves than for larger prostheses.*

Currently, long-term data after ViV TAVR procedures are limited. Danny Dvir, MD, of the University of Washington Medical Center, presented long-term outcomes from the ViV International Data (VIVID) registry. The VIVID registry is a retrospective, multicenter database that includes ViV TAVRs performed before December 2014. A total of 1006 ViV TAVR procedures were included. Of these, 523 used self-expanding valves, and 435 used balloon-expandable valves.

The patients' overall mean age was 77.7 years, and 59% were men. Small bioprosthetic valves were defined as those with true internal diameter (ID) <20 mm. About 6% had pre-existing severe patient-prosthesis mismatch. The patients' mean STS score was 7.3%, and 70% underwent ViV TAVR via transfemoral access.

Significant differences in multiple baseline characteristics were noted between patients who received self-expanding valves and those who received balloon-expandable valves. Overall, patients who underwent ViV TAVR with a balloon-expandable valve were older, with a higher incidence of peripheral arterial disease and a higher rate of non-transfemoral approach. Long-term survival at 8 years was 38%. Survival was lower at 8 years in patients with small failed bioprostheses (ID  $\leq$ 20 mm) than in patients with large failed bioprostheses (ID >20 mm) (33.2% vs. 40.5%;  $p=0.01$ ). In a multivariable analysis, the investigators identified true ID, age, baseline

left ventricular ejection fraction, chronic kidney disease, non-transfemoral access, and diabetes as significant predictors of all-cause mortality.

There were 40 re-interventions performed after ViV TAVR. In a multivariable analysis, the investigators identified use of balloon-expandable valves, presence of malposition, and pre-existing severe patient prosthesis mismatch as positive predictors, and age as a negative predictor, for re-intervention. There were higher rates of re-intervention with balloon-expandable valves than with self-expanding valves (6% vs. 2%; HR, 3.34; 95% CI, 1.26-8.85; p=0.02).

The investigators concluded that the size of the original failed valve may influence long-term mortality, and type of valve may influence need for re-intervention after ViV TAVR. Decisions with regard to the size and type of valve made by the operator during original tissue valve implantation and during ViV procedures influence clinical outcomes.

#### *3.4. Early experience with the EVOQUE mitral valve replacement system*

*Presenter: Dr. John G. Webb*

*Key Points: First-in-human results presented Thursday show that the novel transseptal EVOQUE transcatheter mitral valve replacement (TMVR) system is feasible, with high implant success, low complication rates and reduced MR at 30 days.*

John G. Webb, MD, of St. Paul's Hospital, Vancouver, British Columbia, presented the initial experience of the first 14 patients treated with the EVOQUE system on behalf of the investigators at the PCR e-Course.[17] The results were simultaneously published online in *JACC: Cardiovascular Interventions*.[18]

In recent years, several new devices have been developed to allow a less-invasive option than surgery for the treatment of MR. The EVOQUE valve has a self-expanding nitinol frame, bovine

pericardial leaflets and fabric skirt to minimize paravalvular leak. In addition, the valve has a unique anchoring mechanism to utilize the annulus, leaflets, and chords for secure placement in the anatomy. Available in two sizes (44 mm and 48 mm), the valve is delivered through a 28-Fr delivery sheath via a transseptal puncture.

The study enrolled 14 patients between September 2018 and October 2019 with greater than moderate MR who were deemed to be at prohibitive risk for surgery. The median age of the patients was 84 years. Patients with degenerative, functional, and mixed mitral valve disease were included.

The authors report that technical success was achieved in 13 patients. One patient was converted to open surgery. At 30-day follow-up, the authors reported one non-cardiovascular death, two strokes, no Mis, and no repeat hospitalizations. Two patients had to undergo additional closure of a PVL, and one patient required an alcohol septal ablation to reduce a left ventricular outflow tract obstruction. More than 80% of patients had less than or equal to mild MR at follow-up, with an associated improvement in their NYHA FC. Webb added in his PCR e-Course presentation that an early feasibility study is currently enrolling.

The study was funded by Edwards Lifesciences.

### *3.5. Comprehensive mitral valve-in-valve and valve-in-ring analysis*

*Presenter: Dr. Matheus Simonato*

*Key Points: An analysis from the VIVID Registry demonstrates that significant residual MR and residual mitral stenosis (MS) are common after mitral ViV and valve-in-ring (ViR) procedures and are associated with poorer outcomes at 4 years.*

In patients who are deemed to be too high risk for surgical reoperation for a failing surgical mitral valve repair or replacement, mitral ViV and ViR are percutaneous options. However, there are limited data on the clinical significance of valve hemodynamics after the procedure.

Matheus Simonato, MD, of Instituto Dante Pazzanese de Cardiologia, São Paulo, and fellow investigators sought to examine midterm outcomes after mitral ViV and ViR.[19] A total of 1079 patients (857 ViV, 222 ViR; mean age  $73.5 \pm 12.5$  years; 40.8% male) from 90 centers between March 2006 and March 2020 were included in the analysis from the VIVID Registry. These patients' median STS score was 8.6%; median clinical follow-up was 492 days; and the median echocardiographic follow-up for patients who survived 1 year was 772.5 days.

There were no differences in 30-day mortality rates between ViV vs. ViR (8.6% vs. 6.5%;  $p=0.29$ ). At 4 years, Kaplan-Meier estimate of survival rate was 62.5% in ViV vs. 49.5% for ViR ( $p<0.001$ ). Mean gradient across the mitral valve (83% balloon-expandable) post-procedure was  $5.7 \pm 2.8$  mmHg ( $\geq 5$  mmHg, 61.4% of patients). Significant residual MS ( $\geq 10$  mmHg) occurred in 8.2% of the ViV and 12.0% of the ViR patients ( $p=0.09$ ). Significant residual MR ( $\geq$  moderate) was more common in ViR patients (16.6% vs. 3.1%;  $p<0.001$ ) and was associated with lower survival at 4 years (35.1% vs. 61.6%;  $p=0.02$ ).

The rates of Mitral Valve Academic Research Consortium (MVARC)-defined device success were low for both procedures (43.9% total; 32.0% ViR vs. 47.0% ViV;  $p<0.001$ ), mostly related to having post-procedural mean gradient of 5 mmHg or higher. Left ventricular outflow tract obstruction was seen in 5.9% of ViR and 1.8% of ViV patients ( $p=0.001$ ).

Correlates for residual MS were smaller true internal diameter, younger age, and larger body mass index. The only correlate for residual MR was ViR. Significant residual MS (sub-distribution hazard ratio (SHR), 4.67; 95% CI, 1.74-12.56;  $p=0.002$ ) and significant residual MR

(SHR, 7.88; 95% CI, 2.88 – 21.53;  $p < 0.001$ ) were both independently associated with repeat mitral valve replacement (MVR).

Despite being a retrospective study, this large registry demonstrates that mitral ViR patients had higher mortality and required more redo MVR at 4-year follow-up. Both residual MR and residual MS are relatively common after ViV and ViR. Residual MR was associated with higher mortality and need for repeat MVR. Residual MS did not predict patient mortality but was associated with repeat MVR. The investigators concluded that strategies to improve post-procedural hemodynamics in mitral ViV and ViR should be further explored.

### *3.6. 2-year Outcomes of Tendyne Transcatheter Mitral Valve Implantation to Treat Symptomatic, Severe Mitral Regurgitation*

*Presenter: Dr. David Muller*

*Key Points: The first report of the 2-year outcomes of TMVR using the Tendyne Mitral Valve System for the treatment of severe symptomatic MR in patients at prohibitive surgical risk demonstrated acceptable outcomes with sustained reduction in MR, which resulted in reduced heart failure re-admissions and improvements in quality of life and functional status.*

The Tendyne Mitral Valve System is a tri-leaflet porcine pericardial valve that is deployed apically and held in position by a tether attached to an epicardial pad over the left ventricular apex. David Muller, MD, of Mount Sinai Hospital, New York, and co-investigators presented the 2-year results from the first 100 patients with severe symptomatic MR treated with the Tendyne valve as part of the Tendyne ESC study.[20] Patients in this study were enrolled between 2014 and 2017 and followed for 2 years.

The patients' mean age was 74.7 years, and 69% were men. The mean STS score for mitral valve replacement surgery was 7.8%. Of the 100 patients enrolled, there were seven deaths at 30 days, 26 deaths at 1 month, and 40 deaths at 1 year. At 2 years, there were 49 patients who completed follow-up. Operators achieved 96% procedural success with 0% procedural mortality. Patients were discharged with less than moderate MR 98.9% of the time.

Mortality at 30 days was 6.0%, with mitral valve re-intervention occurring in just one patient. At 2 years, disabling stroke occurred in 5% of patients, MI in 8%, mitral valve re-intervention in 5%, endocarditis in 5%, major bleeding in 35%, new requirement for permanent pacemaker in 8%, and new-onset atrial fibrillation in 9%. Mortality at 2 years was 39.% (n=39, with 34 patients dying from cardiovascular causes).

MR was severe pre-TMVR in 92% of patients, which improved to none or trivial MR in 98.9% of patients pre-discharge, 98.8% at 30 days, 98.4% at 1 year, and 93.2% at 2 years. There was no evidence of structural valve dysfunction detected at 2 years. Early post-procedural functional class improvements were sustained, with 81.7% of patients having NYHA FC I/II symptoms at 2 years. Additionally, Kansas City Cardiomyopathy Questionnaire (KCCQ) scores continued to improve from pre-TMVR (49.0) to 30 days (58.0), 1 year (71.5), and 2 years (67.2) ( $p < 0.0001$ ). Annualized heart failure hospitalization rates were 1.3 events/patient-year, which improved to 0.69 events/patient-year at 6 months, 0.60 events/patient-year at 1 year, and 0.51 events/patient-year at 2 years ( $p = 0.01116$ ).

The Tendyne ESC study was sponsored by Abbott.

### *3.7. 6-month and 1-year outcomes with the novel PASCAL transcatheter valve repair*

*Presenter: Dr. John Webb*

*Key Points: The CLASP study shows low complication rates, with a sustained reduction in MR and improved clinical outcomes, with the PASCAL transcatheter valve repair system.*

John G. Webb, MD, of St. Paul's Hospital, Vancouver, British Columbia, and colleagues presented the results at the PCR e-Course.[21] The study was simultaneously published online in *JACC: Cardiovascular Interventions*. [22] MR is the most prevalent valvular disease worldwide, and the COAPT study showed significant benefit with TMVr using the MitraClip. The PASCAL transcatheter valve repair system (Edwards Lifesciences) uses two clasps and paddles to achieve plication of the mitral valve leaflets with an anatomical spacer to fill the regurgitant orifice. The 30-day outcomes of this novel device showed sustained MR reduction with improved functional status, increased exercise capacity, and improved quality of life.

CLASP is an ongoing multicenter, multinational, single-arm, prospective study of the safety, performance and outcomes of the PASCAL repair system. Eligible patients with at least moderate-to-severe MR who were receiving optimal medical therapy and were deemed candidates for TMVr were included in the study.

A total of 109 patients who were treated between June 2017 and September 2019 at 14 sites worldwide were included in the study. Their mean age was 75.5 years, 54% were men, and their mean STS score was 4.7%. All patients had at least moderate-to-severe MR; 67% had functional MR, and 33% had degenerative MR. Procedural success was achieved in 94% of the patients. The mean number of implants was 1.4 per patient, with 49% of patients receiving only one implant. The mean procedural time was 128 minutes.

The primary safety endpoint, defined as a composite of cardiovascular mortality, stroke, MI, new need for renal replacement therapy, severe bleeding and re-intervention, was 8.3% at 30 days. There was one cardiovascular death at 30 days and two additional deaths at 1 year. At 1

year, none or trace MR was achieved in 79% of patients, and all patients had less than moderate MR. The 1-year survival rate was 92%, with a high rate of freedom from rehospitalization (80% for functional MR and 100% for degenerative MR). Functional improvements were sustained at 1 year, with 88% of patients in NYHA FC I/II. The patients' average KCCQ score improved by 16 points at 30 days and a showed sustained improvement of 14 points at 1 year.

The authors concluded that the PASCAL transcatheter valve repair system shows high survival and low complication rates with excellent sustained MR reduction and significant improvement in functional status. However, additional studies showing a head-to-head comparison between the PASCAL system and fourth-generation MitraClip are needed. The PASCAL system might also be a good option in the treatment of tricuspid regurgitation because of its thinner leaflets and larger coaptation gaps. The investigators added that the CLASP IID/IIF randomized clinical trial, which compares the PASCAL system with MitraClip, is ongoing.

The study received funding from Edwards Lifesciences.

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## Highlights

- COVID-19 pandemic replaced face-to-face meetings with virtual ones.
- We give highlights of late-breaking trials presented at the TVT Connect 2020.
- We also report on selected structural trials presented at PCR e-Course 2020.

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