Original Studies

Continuous atrial pressure monitoring via steerable guide catheter in transcatheter mitral and tricuspid edge-to-edge repair

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Abstract
Transcatheter edge-to-edge repair (TEER) has emerged to address severe mitral and tricuspid valve regurgitation in patients who are at high perioperative risk for open-heart surgery. No clinical data is available for continuous left and right atrial pressure monitoring using the steerable guiding catheter (SGC) during TEER. In a prospective single-center study, 40 patients with severe mitral (n = 20) or tricuspid (n = 20) regurgitation underwent TEER with the registration of atrial pressure via the SGC. All patients had successful TEER using the PASCAL Ace repair system, while atrial pressure was monitored continuously via the SGC. Simultaneous right or left atrial pressure monitoring via the SGC and a pigtail catheter during mitral and tricuspid TEER showed excellent reliability for SGC pressure registration. While for mitral TEER the beneficial effects of continuous atrial pressure monitoring are well known, we further evaluated the outcome of patients with tricuspid TEER. Echocardiographic and clinical results after tricuspid TEER showed a reduction of quantitative echocardiographic tricuspid regurgitation parameters and improved New York Heart Association classification after 3-month follow-up. Also, qualitative tricuspid valve assessment showed improved tricuspid regurgitation classification postimplantation and at 3-month follow-up. Furthermore, right atrial pressure was reduced by 37.6% and mean right atrial pressure by 30.6% after successful tricuspid TEER using the PASCAL Ace device. Continuous atrial pressure monitoring using the SGC of the PASCAL Ace repair system is reliable during mitral and tricuspid TEER. Furthermore, successful tricuspid TEER leads to reduced right atrial pressure.

Keywords
left atrial pressure, right atrial pressure, transcatheter tricuspid valve repair
1 | INTRODUCTION

Mitral and tricuspid transcatheter edge-to-edge repair (TEER) have emerged to address severe mitral or tricuspid valve regurgitation in patients who are at high perioperative risk for open-heart surgery.1-2 Both approaches have proven to reduce mitral and tricuspid regurgitation (TR) effectively with a low rate of intraprocedural adverse events.1-2 Furthermore, heart failure symptoms could be reduced and exercise capacity could be significantly improved.1-2 Edge-to-edge mitral valve repair also showed reduced mortality compared to optimal medical therapy in patients with functional mitral valve regurgitation.2 Residual mitral regurgitation following mitral TEER is thought to be an important predictor of short- and long-term outcome.3 Therefore, continuous left atrial pressure (LAP) measurement has been proven to determine acute procedural success.4-5 Especially in the case of a complex valve repair, when multiple TEER devices are implanted, continuous atrial pressure monitoring is an important tool to improve the procedural and clinical outcome of TEER.4-5

How continuous right atrial (RA) pressure measurement influences tricuspid TEER is to date unknown. A decrease in RA pressure following transcatheter tricuspid valve repair might indicate a beneficial clinical outcome and improved clinical results.

The current standard approach to measure continuous atrial pressure is placing a separate catheter in the atrium.4 The MitraClip device (Abbott Vascular) allows registration of LAP via the sideport of the steerable guide catheter (SGC). A small case series compared the pressure measurement via a separate atrial catheter and guiding catheter sideport and found no difference in five patients undergoing mitral TEER.4 However, one might speculate that steering the guiding catheter might influence pressure measurement by dampening the pressure curve. This theory was supported by simultaneous LAP measurement via the SGC and a dedicated catheter with sideholes, which revealed atrial waveform overdamping and v-wave underestimation with the MitraClip device.2 The Pascal ACE implantation system (Edwards Lifesciences) is another transcatheter TEER system that includes the opportunity to measure atrial pressure via the sideport of the SGC. To date validation to pressure measurement via a separate catheter has not been reported. Therefore, we addressed the important clinical question, if atrial pressure registration using the sideport of the SGC of the PASCAL Ace system is accurate compared to a dedicated atrial catheter. Since the PASCAL Ace implantation system could be used for mitral and tricuspid valve repair, reliability of continuous atrial pressure monitoring using the SGC was tested in the setting of both mitral and tricuspid TEER. Different maneuvering conditions of the SGC and PASCAL Ace device were considered in our analysis to exclude relevant device-related pressure dampening.

2 | METHODS

2.1 | Study participants

The study was performed according to good clinical practice and in compliance with the Helsinki declaration. An individual written consent was obtained by every patient. The study was approved by the local ethics committee (Ethics committee of University Witten/Herdecke; approval number: 317/2020). This observational study comprises 40 consecutive patients mitral (n = 20) or tricuspid (n = 20) TEER using the PASCAL Ace System (Edwards Lifesciences) between September 1, 2020, and June 1, 2021. All patients were evaluated by a multidisciplinary heart team. Continuous RA pressure measurement via the SGC was performed in all patients during mitral or tricuspid TEER. To validate the pressure monitoring via the SGC we assessed continuous left or RA pressure simultaneously via the SGC and a separate atrial pigtail-catheter with sideholes. Furthermore, all patients with TEER received baseline, procedural, postprocedure, and 3 months transthoracic echocardiography including qualitative and quantitative tricuspid valve regurgitation assessment. Figure 1 shows the study flow chart.

2.2 | Mitral edge-to-edge repair

Patients with symptomatic (>NYHA II), severe mitral regurgitation, and high operative risk were eligible for percutaneous mitral TEER with the PASCAL Ace system. All patients were on optimal medical management (according to the guidelines). The clinical decision for mitral TEER was made by the local heart team. Mitral TEER was performed as previously described.4 It consists of femoral venous access, transseptal puncture, advancement of the SGC into the left atrium (LA) followed by positioning the PASCAL Ace device below the mitral valve leaflets into the left

![Figure 1](image-url) Study flow chart. LAP, left atrial pressure; LTFU, lost to follow-up; RAP, right atrial pressure; SGC, steerable guiding catheter; TEER, transcatheter edge-to-edge repair; TTE, transthoracic echocardiography
ventricle (LV) until it is oriented toward the origin of the regurgitant jet. The final step includes grasping the leaflet edges and releasing the TEER device after confirming its position. The procedure was guided by transesophageal echocardiography for mitral valve assessment.

### 2.3 Tricuspid edge-to-edge repair

Patients with symptomatic (>NYHA II), at least severe TR and high operative risk were eligible for percutaneous tricuspid TEER with the PASCAL Ace System. The clinical decision for tricuspid TEER was made by the local heart team.

Tricuspid TEER was performed under general anesthesia and activated clotting time was targeted to >250 s. The PASCAL Ace tricuspid repair system consists of an SGC and an implantation catheter. After right femoral venous access, the 22 French SGC was positioned in the right atrium and maneuvered to the tricuspid valve. Afterward, the PASCAL Ace implantation catheter was introduced into the right atrium via the guiding catheter. After adjusting the position in the right atrium, the device was moved into the right ventricle. Intervventional strategy and device positioning were dependent on the regurgitation jet localization. After leaflet grasping and closure of the paddles, the device was deployed in case of an adequate reduction of TR. Interventional strategy and procedural characteristics such as transtitrкусpid gradient, decided about the number of PASCAL Ace devices. After the procedure, patients received dual antiplatelet therapy with aspirin and clopidogrel or when indicated, oral anticoagulation. Tricuspid valve assessment was performed during the procedure by transesophageal echocardiography.

### 2.4 Atrial pressure monitoring using the PASCAL Ace repair system

Figure 2A shows the procedural setup of continuous atrial pressure monitoring via the PASCAL Ace repair system. Pressure acquisition is performed via the SGC. Of note, pressure registration must be...
performed with fully exposed distal tip of the implant catheter from the SGC. While for pressure registration with MitraClip the sideport of the SGC is used, PASCAL Ace with its three components uses the pressure port of the steerable catheter. Therefore, guiding catheters of both devices were cut and the space of the implant catheter/clip delivery system was investigated. The PASCAL Ace implant catheter revealed sufficient space within the steerable catheter, while the clip delivery system of the MitraClip has very limited space in the SGC, which might lead to pressure dampening when the SGC is bent using the M-knob. Figure 2B,C visualizes these findings.

2.5 | Continuous left atrial and ventricular pressure monitoring

Continuous LVP monitoring was performed using a 4 French pigtail catheter, which was inserted via the right or left femoral artery.4 Afterward, transseptal puncture via right femoral vein was performed and a second guidewire was placed via the transeptal sheaths. This guidewire allowed insertion of a left atrial 5 French pigtail catheter for continuous LAP monitoring after the SGC of the PASCAL Ace mitral repair system was placed in the LA.5 Afterward, both the pigtail catheter and the SGC were attached to a fluid-filled transducer system, leveled to the patients phlebostatic axis and calibrated. Both LAPs (pigtail and SGC) were simultaneously and continuously measured during the procedure in the first 10 patients. Afterward an interim analysis was performed to validate pressure registration via SGC. Since both atrial pressures (via pigtail and via SGC sideport) were measured simultaneously pressure curves could be compared and statistically tested for non-inferiority.

2.6 | Continuous RA pressure monitoring

Continuous atrial pressure monitoring via a pigtail catheter is the standard approach to monitor the atrial pressure during TEER.4 Therefore, after right femoral venous puncture, two guidewires were introduced to the right atrium via a 7 French sheath. After sheath removal, a 5 French pigtail was inserted to the right atrium via one of the guidewires. Afterward the SGC was introduced into the right atrium via the second wire. Afterward both the pigtail catheter and the SGC were attached to a fluid-filled transducer system, leveled to the patients phlebostatic axis and calibrated. Both RA pressures (pigtail and SGC) were simultaneously and continuously measured during the procedure in the first 10 patients. Afterward an interim analysis was performed to validate pressure registration via SGC. Since both atrial pressures (via pigtail and via SGC sideport) were measured simultaneously pressure curves could be compared and statistically tested for non-inferiority.

2.7 | Echocardiography

Baseline and follow-up transthoracic echocardiography were performed using a Philips EPIQ 7 echocardiography system (Philips).

2.7.1 | Mitral TEER

Vena contracta, effective regurgitant orifice area (EROA), and regurgitant volume were assessed for baseline regurgitation quantification. For grading the severity of mitral regurgitation the standard classification of the European Society of Cardiology was used.

2.7.2 | Tricuspid TEER

Vena contracta for quantitative tricuspid valve assessment was evaluated according to current recommendations.9 For grading the severity of TR the Hahn classification was used.9 Transthoracic echocardiography was used to determine RA and right ventricular (RV) size, vena cava inferior (VCI) diameter, tricuspid annular plane systolic excursion (TAPSE), and systolic pulmonary artery pressure (sPAP) prior and post tricuspid TEER. Jet localization at baseline was assessed using 2D and 3D transesophageal echocardiography.

2.8 | Statistical analysis

Statistical analysis was performed using PASW statistics 18 software (SPSS). All variables were tested for normal distribution with the Kolmogorov–Smirnov test. In the case of normal distribution, the results are given as mean ± standard deviation (SD) or ± standard error (SEM) as indicated, otherwise as median and 95% confidence interval. Differences between groups and subgroups were evaluated by χ² test for discrete variables and Student’s t test or one-way analysis of variance (ANOVA) with Scheffe posthoc testing for continuous variables. For ordinal data Mann–Whitney U test was used. Pearson correlation coefficient (PCC) was used for correlations between two variables. Since a high correlation does not necessarily indicate a good agreement between two diagnostic methods, we also performed Bland–Altman and Interclass Correlation Coefficient (ICC) analysis using MedCalc statistic software 18.10 (MedCalc Software). A p < 0.05 was considered as statistically significant.

3 | RESULTS

To evaluate SGC pressure monitoring using the PASCAL Ace repair system for mitral TEER 20 consecutive patients with mitral TEER were included in this study. The mean age accounted for 77.4 ± 2.3 years in this cohort. LAP and mean LAP were significantly reduced, when mitral TEER was successfully performed (LAP: baseline 37.5 ± 2.5 mmHg vs. mitral TEER 18.8 ± 1.5 mmHg, p < 0.001; mean LAP: baseline 19.6 ± 1.4 mmHg vs. mitral TEER 11.7 ± 1.1 mmHg, p < 0.001; Figure 3A). Systolic left ventricular pressure (LVP) remained unchanged throughout the mitral TEER (baseline: 124.6 ± 5.1 vs. postmitral TEER: 123.1 ± 3.9, ns), while left ventricular end-diastolic pressure was significantly reduced after successful mitral
TEER (baseline: 16.3 ± 1.3 vs. postmitral TEER: 12.4 ± 1.0, \( p = 0.03 \)). An increase of mean pressure mitral valve gradient after mitral TEER was observed (baseline: 1.0 ± 0.1 vs. 3.2 ± 0.2, \( p < 0.001 \)). In the first 10 patients of the cohort simultaneous LAP via the SGC and a pigtail catheter was obtained to investigate the accuracy of continuous pressure registration using the SGC in the setting of mitral TEER. In an interim analysis, we found no relevant differences in LAPs throughout the procedures (Figure 3B). PCC, Bland–Altman Analysis and ICC of LAP (v-wave) and mean LAP showed excellent reliability (PCC LAP: 0.95 and mean LAP: 0.90; ICC LAP: 0.99 and mean LAP: 0.98; Figure 3C,D). Due to the high reliability in the remaining 10 patients LAP was registered via the SGC exclusively, to avoid insertion of a separate catheter. Of note, no difference in LAP was observed in both groups (simultaneous registration: 35.2 ± 4.6 mmHg vs. SGC: 39.8 ± 2.1 mmHg, \( p = 0.36 \)).

All 20 patients with tricuspid TEER using the PASCAL Ace system had uncomplicated and successful index procedure. One patient had postinterventional acute renal failure and one patient had gastric bleeding due to an ulcer. Mean procedure time accounted for 74.8 ± 5.2 min. Patients’ baseline clinical, echocardiographic, and laboratory results are shown in Table 1. Logistic Euroscore was 18.7 ± 2.2 and Euroscore II 7.4 ± 1.2 indicating high operative risk in our patient cohort. Three patients had a transtricuspid device lead (15.0%) and eight patients had prior mitral TEER (40.0%).

Continuous RA pressure monitoring revealed a decrease in RA pressure when tricuspid TEER was successful with a marked reduction in TR (Figure 4A,B). RA pressure significantly decreased from 19.7 ± 2.05 to 12.3 ± 1.40 mmHg (\( p = 0.006 \)) and mean RA pressure from 13.7 ± 1.44 to 9.6 ± 1.16 mmHg (\( p = 0.04 \); Figure 5). RA pressure was reduced by 37.6% and mean RA pressure by 30.6% after successful tricuspid TEER using the PASCAL Ace device. All procedural details are listed in Table 2.

In the first 10 patients of the cohort simultaneous RA pressure via the SGC and a pigtail catheter was obtained to investigate the accuracy of continuous pressure registration using the SGC in the setting of tricuspid TEER. In an interim analysis, we found no relevant differences in RA pressures throughout the procedures (Figure 6A). Also, PCC, Bland Altman Analysis and ICC of LAP (v-wave) and mean LAP showed excellent reliability (PCC RAP: 0.99 and mean RAP: 0.98; ICC RAP: 0.99 and mean RAP: 0.98; Figure 6B,C). Due to the high reliability, in the remaining 10 patients, RA pressure was registered...
via the SGC exclusively to avoid insertion of a separate catheter. Of note, no difference in RA pressure was observed in both groups (simultaneous registration: 20.3 ± 3.1 mmHg vs. SGC: 19.0 ± 2.6 mmHg, p = 0.77). Therefore, continuous RA pressure monitoring using the SGC of the PASCAL Ace system is feasible and reliable in tricuspid TEER. To exclude pressure-dampening due to device maneuvering we compared pressure curves of the SGC and the pigtail catheter throughout the procedure. We found no relevant dampening of RA pressure acquisition throughout the procedure indicating high accuracy of pressure monitoring despite catheter and device movement (Figure 7).

The average number of TEER devices was 1.8 ± 0.1 (Figure 8A). In 83.3% of the cases, a PASCAL Ace device was implanted anteroseptal and in 16.7% posteroseptal (Figure 8B). Quantitative echocardiographic TR assessment following TEER showed a reduction in vena contracta postimplantation and at 3-month follow-up (Figure 8C). Furthermore, qualitative tricuspid valve assessment showed improved TR classification postimplantation and at 3 months follow-up (Figure 8D). After 3 months, the number of patients with NYHA III decreased from 85% at baseline to 13% (Figure 8E). Tricuspid annulus diameter showed no significant reduction 3-months after tricuspid TEER (47.7 ± 1.5 mm at baseline vs. 43.8 ± 0.9 mm at 3-month follow-up; p = 0.06). TAPSE remained also unchanged at 3-month follow-up compared to baseline (18.7 ± 1.5 mm at baseline vs. 17.6 ± 0.8 mm at 3-month follow-up; p = 0.59). All echocardiographic outcome data of tricuspid TEER after 3-month follow-up are listed in Table 3.

### 4 | DISCUSSION

Two important aspects of TEER were addressed in this study: (i) feasibility of continuous atrial pressure monitoring using the SGC of the PASCAL Ace system during mitral or tricuspid TEER. (ii) reduction of RA pressure after successful tricuspid TEER.
Atrial pressure was continuously monitored during mitral and tricuspid TEER using the SGC of the PASCAL Ace repair system. To demonstrate noninferiority to a standard approach using a separate pigtail catheter in the left or right atrium we simultaneously measured atrial pressure with both methods in the first 10 patients of each cohort (mitral or tricuspid TEER). According to Bland–Altman analysis and ICC atrial pressure monitoring using the SGC was feasible. This is also true for different catheter maneuvers including critical timepoints like leaflet grasping. Therefore, we validated SGC atrial pressure measurements for

**Figure 4** Echocardiography and right atrial pressure monitoring before and after tricuspid edge-to-edge repair using two PASCAL Ace devices. (A) Baseline echocardiography and right atrial pressure monitoring. (B) Echocardiography and right atrial pressure measurement after tricuspid transcatheter edge-to-edge repair (TEER) using two PASCAL Ace TEER devices [Color figure can be viewed at wileyonlinelibrary.com]

**Figure 5** Right atrial pressure and mean right atrial pressure before and after transcatheter tricuspid valve repair. (A,B) Right atrial pressure (RAP) reduction after tricuspid transcatheter edge-to-edge repair (TEER) using the PASCAL Ace tricuspid repair system. RAP (A) and mean RAP (B). Red line indicates mean right atrial pressure. *p < 0.05 versus baseline [Color figure can be viewed at wileyonlinelibrary.com]
the first time for the PASCAL Ace mitral und tricuspid repair system. A small case series compared the pressure measurement via a separate atrial catheter and guiding catheter sideport of the MitraClip system and found no difference in five patients, which is in line with our findings for a different TEER system in mitral and tricuspid valve repair. Furthermore, simultaneous LAP measurement via a separate atrial catheter and guiding catheter sideport of the MitraClip system revealed waveform overdamping and v-wave underestimation in a small cohort with the MitraClip device. In these cases, waveform dampening occurred depending on M-knob manipulation. This phenomenon was thought to be linked to the reduced space within the 24 French SGC once the delivery system bends. We did not observe any pressure dampening with the PASCAL Ace repair system, which is most likely due to different manufacturing of both systems. To explain the absence of pressure overdamping in the PASCAL Ace system it is important to highlight the different approaches for pressure registration in both systems. While for pressure registration with MitraClip the sideport of the SGC is used, PASCAL Ace with its three components uses the pressure port of the steerable catheter. This seems to be the major explanation for the difference in pressure acquisition in both devices. We found for the PASCAL Ace implant catheter sufficient space within the steerable catheter. Therefore, pressure registration is not affected by flexion (bending) of the steerable catheter. For MitraClip the clip delivery system has very limited space in the SGC, which leads to pressure dampening when the SGC is bent using the M-knob. Our observational data demonstrate that the SGC of the PASCAL repair system allows

| TABLE 2 Procedural details of transcatheter tricuspid edge-to-edge repair |
|--------------------------------------------------|-------|-----------|
| Procedure time (min)                             | n    | 20        |
| Number of clips                                  | n    | 20        |
| Clip localization                                | n    | 30        |
| Anterior–septal                                  | n    | 30        |
| Anterior–posterior                               | n    | 0         |
| Septal–posterior                                 | n    | 6         |
| Complications                                    | n    | 1         |
| Bleeding                                         | n    | 1         |
| Acute renal failure                              | n    | 1         |
| Cardiac decompensation                           | n    | 0         |

![FIGURE 6 Simultaneous RAP monitoring via a pigtail catheter and steerable guiding catheter of the PASCAL Ace tricuspid repair system.](A) Exemplary original registration of RAP via a pigtail catheter and the steerable guiding catheter placed in the right atrium of a patient undergoing tricuspid edge-to-edge repair. (B,C) Bland-Altman analysis of both pressure acquisition methods (pigtail vs. steerable guiding catheter) for RAP and mean right atrial pressure. RAP, right atrial pressure; SGC, steerable guiding catheter [Color figure can be viewed at wileyonlinelibrary.com]
atrial pressure registration throughout the procedure. Therefore, we believe that continuous atrial pressure registration should be performed throughout mitral and tricuspid TEER using the SGC sideport of the PASCAL Ace system.

As previously published, we showed in 20 patients a marked reduction in LAP, when successful mitral valve TEER was performed. While for mitral TEER the beneficial effects of continuous atrial pressure monitoring on procedure success are well known, to date no studies about the acute hemodynamic changes in RA pressure during tricuspid TEER are available.

Severe TR is associated with excessive morbidity and mortality. Patients deemed not to be suitable for surgical tricuspid valve repair due to high operative risk could be treated by tricuspid TEER. The Triluminate trial demonstrated that the TriClip system (Abbott Vascular) is safe and effective in reducing severe TR in these patients. Furthermore, successful tricuspid TEER reduces heart failure symptoms and increases exercise capacity. The PASCAL tricuspid repair system demonstrated sustained reduction of TR after TEER. Furthermore, significant improvement in functional status was associated with tricuspid TEER using the PASCAL tricuspid repair system. In our observational study we showed similar results regarding reduction in TR and NYHA classification compared to previously published studies.

Severe TR is associated with tricuspid annular dilation and leads to volume overload and increased RA and RV diastolic pressures. RA pressure ventricularizes, when the contour of the RA pressure mimics the contour of RV pressure determining progression in TR severity. Continuous RA pressure monitoring revealed a decrease in RA pressure, when tricuspid TEER was successful with a marked reduction in TR. RA pressure was reduced by 30.6% and mean RA pressure by 37.6% after successful tricuspid TEER using

**FIGURE 7** Catheter maneuvering during tricuspid TEER did not affect right atrial pressure monitoring via SGC. Simultaneous RA pigtail versus SGC pressure monitoring at baseline (A), during leaflet grasp with the PASCAL Ace device (B) and after implantation of a second PASCAL Ace with SGC deflected (C). Significant RA reduction after successful TEER with two PASCAL Ace devices. RA, right atrial; SGC, steerable guiding catheter; TEER, transcatheter edge-to-edge repair [Color figure can be viewed at wileyonlinelibrary.com]
the PASCAL Ace device. This indicates that RA pressure might be an indicator of acute procedural success, which might be useful especially when echocardiographic image quality is low. Due to the small patient cohort our results are hypothesis generating only and should encourage for further research. Therefore, it remains unclear, whether immediate reduction of RAP predicts long-term durability of TR reduction or durable clinical improvement.

**FIGURE 8** Procedural results and 3-month follow-up after transcatheter tricuspid valve repair. (A) Number of implanted PASCAL Ace devices. (B) Localization of the edge-to-edge repair device following transcatheter edge-to-edge repair (TEER). (B) Vena contracta at baseline, postimplantation (postimplant) and at 3-month follow-up (FU). *p < 0.05 versus baseline. (C) Reduction in tricuspid regurgitation classification postimplantation and at 3-month follow-up (FU) following tricuspid TEER compared to baseline. (D) Reduction in New York Heart Association classification postimplantation and at 3-month follow-up (FU) following tricuspid TEER compared to baseline [Color figure can be viewed at wileyonlinelibrary.com]

**TABLE 3** Echocardiographic outcome

|                      | Baseline | post-TTVR | 3-month FU |
|----------------------|----------|-----------|------------|
|                      | n        | % or mean ± SEM | n        | % or mean ± SEM | p value |
| Vena contracta       | 20       | 12.9 ± 0.6  | 20       | 5.1 ± 0.5       | <0.001  |
| TAPSE (mm)           | 20       | 18.7 ± 1.5  | 20       | 17.8 ± 0.9      | 0.59    |
| VCI diameter (mm)    | 20       | 27.6 ± 1.2  | 20       | 25.2 ± 1.2      | 0.09    |
| Right atrial area (cm²) | 20   | 34.0 ± 1.7  | 20       | 34.2 ± 1.7      | 0.41    |
| Tricuspid Annulus (mm) | 20   | 47.7 ± 1.5  | 20       | 45.9 ± 1.4      | 0.06    |
| RVEDD mid (mm)       | 20       | 37.1 ± 1.9  | 20       | 35.6 ± 1.7      | 0.11    |
| sPAP (mmHg)          | 20       | 45.8 ± 3.3  | 20       | 47.1 ± 2.8      | 0.72    |
| dPmax TV inflow (mmHg) | 20   | 2.3 ± 0.3    | 20       | 4.0 ± 0.3       | 0.004   |
| dPmean TV inflow (mmHg) | 20  | 1.2 ± 0.1    | 20       | 1.8 ± 0.1       | 0.01    |

Abbreviations: RVEDD, right ventricular end-diastolic diameter; sPAP, systolic pulmonary artery pressure; TAPSE, tricuspid annular plane systolic excursion; TV, tricuspid valve; VCI, vena cava inferior.
5 | CONCLUSIONS

Continuous atrial pressure monitoring using the SGC of the PASCAL Ace mitral and tricuspid repair system is feasible and safe during TEER. It demonstrated excellent reliability compared to the standard monitoring using a dedicated catheter with sideholes. Furthermore, successful tricuspid TEER leads to reduced RA pressure.

6 | STUDY LIMITATIONS

This study has potential limitations. It has enrolled a limited number of patients. Especially, the clinical results should be regarded as hypothesis generating and needs to be supported by larger scale randomized, multicenter trials. However, from a technical viewpoint the study demonstrated feasibility of continuous pressure monitoring using the sideport of the SGC of the PASCAL Ace mitral and tricuspid repair system.

CONFLICT OF INTERESTS

Peter Boekstegers: Proctoring and Center of Excellence for Abbott Vascular and Edwards Lifesciences. Harald Beucher: Proctoring and Center of Excellence for Abbott Vascular. The remaining authors declare that there are no conflict of interests.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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How to cite this article: Rottländer D, Beucher H, Ghaddioui KA, Boekstegers P. Continuous atrial pressure monitoring via steerable guide catheter in transcatheter mitral and tricuspid edge-to-edge repair. Catheter Cardiovasc Interv. 2022;99:1796-1806. doi:10.1002/ccd.30109