Structural Heart 8 (2024) 100226

Articles and Issues Available at ScienceDirect

Structural Heart

journal homepage: www.structuralheartjournal.org

Original Research

Valve Hemodynamics by Valve Size and 1-Year Survival Following Implantation of the Portico Valve in the Multicenter CONFIDENCE Registry

Helge Möllmann, MD [a,*], Axel Linke, MD [b], Luis Nombela-Franco, MD [c], Martin Sluka, MD [d], Juan Francisco Oteo Dominguez, MD [e], Matteo Montorfano, MD [f], Won-Keun Kim, MD [g], Martin Arnold, MD [h], Mariuca Vasa-Nicotera, MD [i], Stephan Fichtlscherer, MD [i], Lenard Conradi, MD [j], Anthony Camuglia, MD [k,l], Francesco Bedogni, MD [m], Keshav Kohli, PhD [n], Ganesh Manoharan, MD [o]

[a] *Department of Cardiology, St. Johannes Hospital, Dortmund, Germany*
[b] *Department of Internal Medicine/Cardiology, University Hospital of the Technical University of Dresden, Heart Center Dresden, Dresden, Germany*
[c] *Cardiovascular Institute, Hospital Clinico San Carlos, IdISSC, Madrid, Spain*
[d] *Department of Medicine-Cardiology, University Hospital Olomouc, Olomouc, Czech Republic*
[e] *Cardiology Department, Puerta de Hierro Hospital, Madrid, Spain*
[f] *Interventional Cardiology Unit IRCCS San Raffaele Scientific Institute, Milan, Italy*
[g] *Kerckhoff Heart and Thorax Centre, Bad Nauheim, Germany*
[h] *Department of Cardiology, Friedrich-Alexander-Universität Erlangen Nuremberg, Erlangen, Germany*
[i] *Department of Cardiology, University Hospital of the Johann Wolfgang Goethe University Frankfurt, Frankfurt, Germany*
[j] *Department of Cardiovascular Surgery, University Heart and Vascular Center, Hamburg, Germany*
[k] *University of Queensland, Brisbane, Australia*
[l] *The Wesley Hospital, Brisbane, Australia*
[m] *IRCCS Policlinico San Donato, Milan, Italy*
[n] *Abbott Laboratories, Santa Clara, California, USA*
[o] *Department of Cardiology, Royal Victoria Hospital, Belfast, UK*

ARTICLE INFO

Article history:
Submitted 4 January 2023
Revised 9 August 2023
Accepted 31 August 2023
Available online 11 November 2023

Keywords:
Aortic stenosis
Self-expanding
TAVI
TAVR
Transcatheter aortic valve implantation
Transcatheter aortic valve replacement

ABSTRACT

Background: The CONtrolled delivery For ImproveD outcomEs with cliNiCal Evidence registry was initiated to characterize the clinical safety and device performance from experienced transcatheter aortic valve implantation (TAVI) centers in Europe and Australia that use the Portico valve to treat patients with severe aortic stenosis. We herein report for the first time the valve performance at 30-day across all implanted valve sizes and the 1-year survival from this registry.

Methods: This was a prospective, multicenter, single-arm observational clinical investigation of patients clinically indicated for implantation of a Portico valve in experienced TAVI centers. Patients were treated with a commercially available valve (size 23, 25, 27, or 29 mm) using either the first-generation delivery system (DS) (n = 501) or the second-generation (FlexNav) DS (n = 500). Adverse events were adjudicated by an independent clinical events committee according to Valve Academic Research Consortium-2 criteria. Echocardiographic outcomes were assessed at 30 days by an independent core laboratory, and a survival check was performed at 1 year.

Results: We enrolled 1001 patients (82.0 years, 62.5% female, 63.7% New York Heart Association functional class III/IV at baseline) from 27 clinical sites in 8 countries across Europe and one site in Australia. Implantation of a single valve was successful in 97.5% of subjects. Valve hemodynamics at 30 days were substantially improved relative to baseline, with large aortic valve areas and low mean gradients across all implanted valve sizes (aortic valve areas were 1.7 ± 0.4, 1.7 ± 0.5, 1.8 ± 0.5, and 2.0 ± 0.5 cm^2, and mean gradients were 7.0 ± 2.7, 7.5 ± 4.7, 7.3 ± 3.3, and 6.4 ± 3.3 mmHg for 23, 25, 27, and 29 mm valve sizes, respectively). Across all implanted valve sizes, most patients (77.1%) had no patient-prosthesis mismatch. Death from any cause within 1 year occurred in 13.7% of the patients in the first-generation DS group as compared with 11.0% in the second-generation DS group ($p = 0.2$).

* Address correspondence to: Helge Möllmann, MD, St. Johannes Hospital, Johannesstrasse 9-17, Dortmund 44137, Germany.
E-mail address: moellmann@me.com (H. Möllmann).

https://doi.org/10.1016/j.shj.2023.100226

Conclusions: The Portico valve demonstrated excellent hemodynamic performance across all valve sizes in a large cohort of subjects implanted in experienced TAVI centers. One-year survival rates were favorable when using both the first-generation and second-generation (FlexNav) DSs in this high-risk cohort.
ClinicalTrials.gov Identifier: NCT03752866.

ABBREVIATIONS

CONFIDENCE, CONtrolled delivery For ImproveD outcomEs with cliNiCal Evidence; DS, delivery system; SAVR, surgical aortic valve replacement; TAVI, transcatheter aortic valve implantation; THV, transcatheter heart valve; VARC-2, Valve Academic Research Consortium-2.

Introduction

The gold standard treatment for severe, symptomatic aortic stenosis has historically been surgical aortic valve replacement (SAVR). Over the past decade, transcatheter aortic valve implantation (TAVI) has emerged as a safe and effective treatment option for patients with aortic stenosis. Randomized clinical trials have demonstrated noninferiority or even superiority of TAVI vs. SAVR, first in patients at high and extreme surgical risk and later in patients at intermediate and low surgical risk.[1–3] These randomized trials formally provide the highest level of scientific evidence. However, given their usually highly selected patient cohort, their results cannot necessarily be translated directly into daily clinical practice.

CONtrolled delivery For ImproveD outcomEs with cliNiCal Evidence (CONFIDENCE) was designed as a large-scale daily routine registry to assess the safety and efficacy of the Portico valve (Abbott, USA) implanted in experienced TAVI centers. The Portico valve is a self-expanding transcatheter heart valve (THV) that first received CE-Mark in 2012 and is the third THV to receive U.S. Food and Drug Administration approval with the FlexNav (Abbott, USA) delivery system (DS) in 2021.[4,5] The CONFIDENCE registry was designed with broad patient inclusion criteria to provide insight into real-world clinical outcomes. Valve hemodynamics were analyzed at baseline and 30 days postprocedure, and a survival check was performed at 1 year.

Valve hemodynamics are central to ensuring good clinical outcomes with TAVI. Achieving good valve hemodynamics can be a challenge, particularly when implanting smaller valve sizes given the smaller area for flow. However, hemodynamics by valve size have not previously been reported for the Portico valve. To better understand hemodynamic performance across a range of valve sizes, we herein report data on 30-day hemodynamic outcomes by valve size and the 1-year follow-up from the CONFIDENCE registry.

Methods

Study Design

The CONFIDENCE registry was initiated to characterize the procedural safety and device performance at experienced TAVI centers that commercially use the Portico THV to treat patients with severe symptomatic aortic stenosis at high or greater surgical risk. All patients being considered for a commercial Portico THV implant at participating implant centers were considered for inclusion into the registry (Supplement A includes all study inclusion/exclusion criteria). Details regarding the study design and methodology have been previously described.[6]

This was a prospective, multicenter, single-arm observational clinical investigation (ClinicalTrials.gov: NCT03752866), which included 27 sites in 8 countries across Europe and one site in Australia. All sites invited to participate in this study were comprised of experienced implanters, defined as those who had completed the commercial Portico implant training program and performed at least 20 Portico THV implants within the prior 12 months.

Between October 2018 and July 2021, a Portico THV was attempted in 1001 patients. The first cohort of subjects (N = 501) were implanted using the first-generation Portico DS, while the second cohort of subjects (N = 500) were implanted using the second-generation FlexNav DS. The FlexNav DS includes a hydrophilic-coated integrated sheath and stability layer to facilitate gradual, controlled deployment of the Portico THV.

The study collected 'standard of care' clinical and device performance data. The implant procedure was conducted per standard protocol established at each center. Postprocedure subject follow-up was performed at predischarge and 30 days, with a vital status/survival status check performed at 12 months. All study sites functioned in compliance with the Declaration of Helsinki, and approvals from ethics committees and local authorities were obtained. All patients provided written informed consent prior to participation. This study was sponsored by Abbott.

Study Device

The Portico THV is a fully repositionable, self-expanding intra-annular valve within a nitinol frame. The valve cuff is made from porcine pericardium and is sutured to the stent frame. The valve and valve cuff are processed using Linx anticalcification technology. During the study,

Table 1
Baseline characteristics

Characteristic	Portico DS % of subjects (N = 501)	FlexNav DS % of subjects (N = 500)	Total (N = 1001)
Age (y)	81.7 ± 5.4	82.3 ± 5.3	82.0 ± 5.3
Gender (female)	63.7%	61.4%	62.5%
NYHA class			
I	2.8%	0.8%	1.8%
II	31.9%	37.0%	34.5%
III	58.9%	58.6%	58.7%
IV	6.4%	3.6%	5.0%
EuroSCORE I (%)	16.4 ± 11.1	14.9 ± 10.3	15.7 ± 10.8
EuroSCORE II (%)	4.8 ± 3.8	4.7 ± 4.3	4.8 ± 4.1
STS Mortality Risk Score (%)	4.2 ± 2.9	4.2 ± 2.7	4.2 ± 2.8
Cardiac arrhythmia	49.1%	47.6%	48.4%
Carotid artery disease	12.6%	10.6%	11.6%
Chronic kidney disease	27.7%	26.0%	26.9%
Dialysis	2.9%	1.5%	2.2%
Chronic lung disease	19.4%	21.0%	20.2%
Coronary artery disease	57.9%	52.4%	55.1%
Diabetes	35.1%	36.4%	35.8%
Dyslipidemia	59.3%	64.4%	61.8%
Hematologic disorders	10.4%	10.8%	10.6%
Hypertension	87.8%	86.2%	87.0%
Liver disease or cirrhosis	3.4%	3.0%	3.2%
Mitral valve disease	61.7%	61.0%	61.3%
Myocardial infarction	13.6%	12.2%	12.9%
Peripheral artery disease	12.0%	11.8%	11.9%
Prior permanent pacemaker	9.4%	11.2%	10.3%
Prior CABG	7.4%	8.8%	8.1%
Prior PCI	31.7%	31.4%	31.6%
Prior stroke	10.6%	7.6%	9.1%
Prior TIA	4.4%	5.0%	4.7%
Mean aortic valve gradient (mmHg)	43.4 ± 14.5	42.2 ± 15.0	42.8 ± 14.7
Aortic valve area (cm^2)	0.71 ± 0.2	0.72 ± 0.2	0.72 ± 0.18

Abbreviations: CABG, coronary artery bypass graft; DS, delivery system; PCI, percutaneous coronary intervention; TIA, transient ischemic attack.

Table 2
Procedural characteristics

Characteristic	Portico DS	FlexNav DS	*p*-value	Total
	% (n) of subjects (N = 501)	% (n) of subjects (N = 500)		% (n) of subjects (N = 1001)
Portico valve implant success	97.4% (488)	97.6% (488)	0.8434	97.5% (976)
Procedural mortality	0.2% (1)	0.0% (0)	1.0000	0.1% (1)
Conversion to SAVR	0.4% (2)	0.0% (0)	0.4995	0.2% (2)
More than 1 valve implanted	1.8% (9)	2.0% (10)	0.8134	1.9% (19)
No portico valve implanted	0.2% (1)	0.4% (2)	0.6242	0.3% (3)
Anesthesia				
General anesthesia	30.1% (151)	16.4% (82)	<0.0001	23.3% (233)
Conscious sedation	69.9% (350)	82.6% (413)	<0.0001	76.2% (763)
Access method				
Transfemoral	98.2% (492)	99.2% (496)	0.1639	98.7% (988)
Subclavian/axillary	1.8% (9)	0.8% (4)	0.1639	1.3% (13)
Vessel diameter (mm)	7.42 ± 1.44	7.09 ± 1.36	0.0002	7.25 ± 1.41
Introducer sheath used	93.6% (469)	24.0% (120)	<0.0001	58.8% (589)
Predilatation balloon valvuloplasty	85.4% (428)	88.4% (442)	0.1635	86.9% (870)
Valve utilized				
23 mm	5.6% (28)	9.0% (45)	0.0380	7.3% (73)
25 mm	25.7% (129)	31.4% (157)	0.0478	28.6% (286)
27 mm	39.1% (196)	32.2% (161)	0.0223	35.7% (357)
29 mm	29.5% (148)	27.4% (137)	0.4530	28.5% (285)
Implant depth, noncoronary cusp (mm)	5.1 ± 3.0 (493)	4.5 ± 3.0 (491)	0.0043	4.8 ± 3.0 (984)
Postdilatation balloon valvuloplasty	37.7% (189)	37.4% (187)	0.9156	37.6% (376)
Total procedure time (first incision to closure, min)	64.6 ± 38.0	73.4 ± 39.8	0.0004	69.0 ± 39.1

Abbreviations: DS, delivery system; SAVR, surgical aortic valve replacement.

the Portico THV was available in 4 sizes (23, 25, 27, and 29 mm) that covered native aortic annulus diameters of 19 to 27 mm.

Study Assessments

We herein report valve hemodynamics at 30 days by valve size, pacemaker implantation at 30 days by valve implantation depth, and all-cause and cardiovascular mortality rates at 1 year from the index procedure.

An independent clinical events committee (Cardiovascular Research Foundation, NY, USA) adjudicated all mortality endpoints according to Valve Academic Research Consortium-2 (VARC-2) guidelines.[6] Implant success was defined as absence of procedural mortality and correct positioning of a single Portico THV in the proper anatomical location. Thirty-day echocardiograms were evaluated by an independent echocardiographic core laboratory (MedStar Health Research Institute, Washington, DC, USA). Paravalvular leak (PVL) was classified into 4 classes (none/trace, mild, moderate, and severe), and patient-prosthesis mismatch was classified into 3 classes (absent/insignificant, moderate, and severe) according to VARC-2 guidelines.[6] Patient-prosthesis mismatch was considered hemodynamically absent/insignificant if the indexed effective orifice area was >0.85 cm^2/m^2, moderate if between 0.65 and 0.85 cm^2/m^2, and severe if <0.65 cm^2/m^2. For obese patients with a body mass index ≥ 30 kg/m^2, lower criteria were used per the VARC-2 guidelines.[6]

Statistical Analyses

Continuous variables were summarized using mean ± standard deviation. Categorical variables were summarized using frequencies and percentages. Evaluation of all adverse events was based on clinical events committee-adjudicated outcomes. The analysis population for hemodynamic valve performance includes only patients with a functioning Portico valve implanted. A functioning Portico valve was defined as a Portico valve that was successfully deployed and functioning in the annulus, including those where more than one valve was implanted in the annulus.

Results

Baseline and Procedural Characteristics

The baseline and procedural characteristics of subjects from the CONFIDENCE registry have been recently reported.[6] Baseline characteristics are listed in Table 1. Subject mean age was 82.0 ± 5.3 years, 62.5% were female, mean Society of Thoracic Surgeons score was 4.19, and 63.7% were in NYHA class III/IV (Table 1). At least one frailty factor contributed to the estimation of surgical risk in 45.4% of subjects. Hypertension was present in 87.0% of subjects, coronary artery disease in

Table 3
Thirty-day outcomes

Characteristic	Portico DS	FlexNav DS	*p*-value	Total
	% (n) of Subjects (N = 501)	% (n) of Subjects (N = 500)		% (n) of subjects (N = 1001)
All-cause mortality	3.2% (16)	2.0% (10)*	0.6376	2.6% (26)
Cardiovascular mortality†	3.0% (15)	1.2% (6)	0.1270	2.1% (21)
Disabling stroke	1.6% (8)	2.0% (10)	0.5989	1.8% (18)
Nondisabling stroke	1.0% (5)	1.2% (6)	0.7320	1.1% (11)
Acute kidney injury (stage 3)	1.4% (7)	0.8% (4)	0.3841	1.1% (11)
Life-threatening bleeding	3.2% (16)	3.6% (18)	0.6755	3.4% (34)
Major vascular complication	6.4% (32)	8.2% (41)	0.2311	7.3% (73)
Overall permanent pacemaker implantation	17.4% (87)	16.8% (84)	0.9008	17.1% (171)
Naïve permanent pacemaker implantation‡	19.2% (87)	18.9% (84)	0.9777	19.0% (171)

Abbreviation: DS, delivery system.
* Includes 2 (0.2%) COVID-19 deaths adjudicated by the clinical events committee as noncardiovascular.
† Unknown mortality was classified as cardiovascular mortality.
‡ Among patients without a pacemaker at baseline.

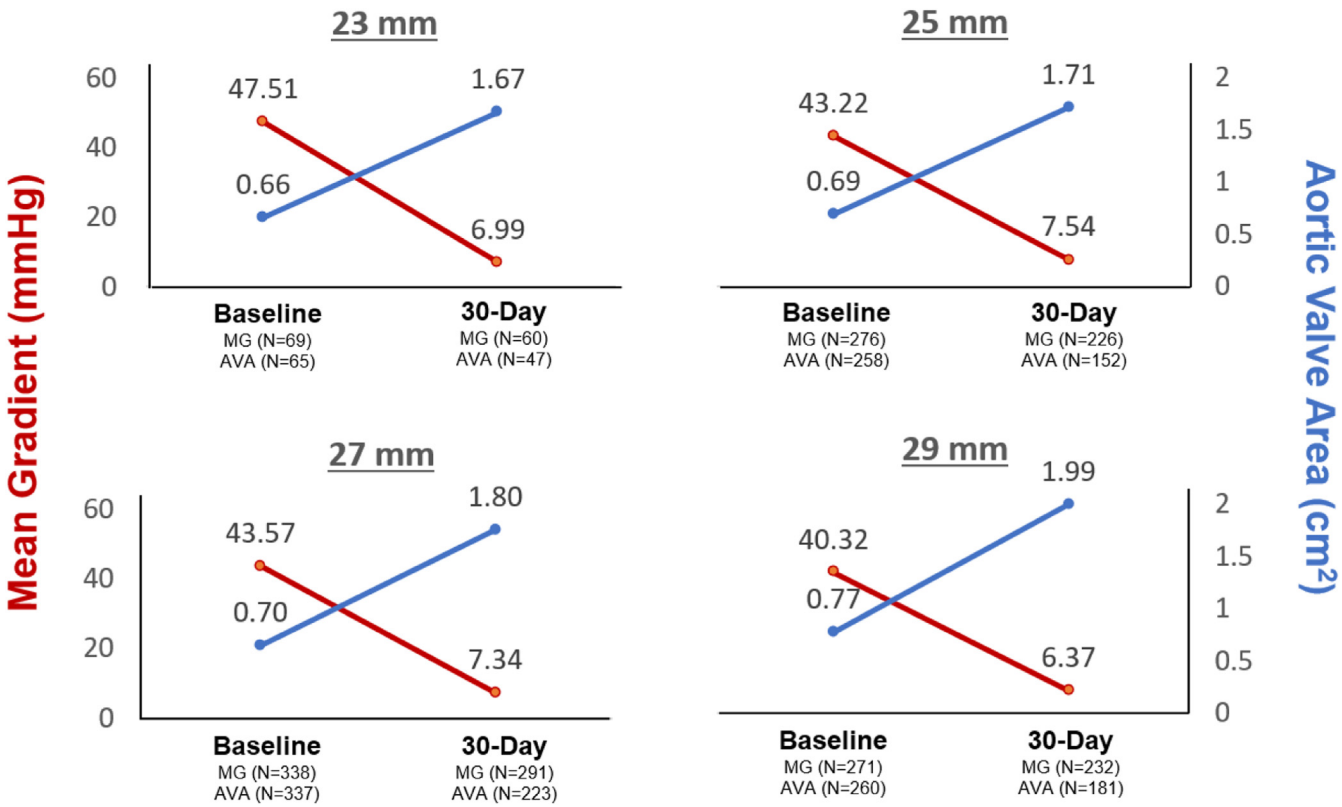


Figure 1. Valve hemodynamics by implanted valve size. Implanted valves included the 23, 25, 27, and 29 mm valve sizes.
Abbreviations: AVA, aortic valve area; MG, mean gradient.

55.1%, cardiac arrhythmia in 48.4%, and diabetes in 35.8%. Prior percutaneous coronary intervention and coronary artery bypass graft had occurred in 31.6 and 8.1% of subjects, respectively. Of the 1001 subjects implanted with a Portico THV, 4 had a prior Mitroflow (Sorin Group Inc, USA) surgical bioprosthesis (0.4%) at baseline.

Procedural characteristics are summarized in Table 2. Of the 1001 subjects, 976 (97.5%) were successfully implanted with a single Portico THV. Reasons for unsuccessful implants are described in Supplement B. Transfemoral access was obtained in the majority of subjects (98.7%), with the remaining subjects (1.3%) implanted via

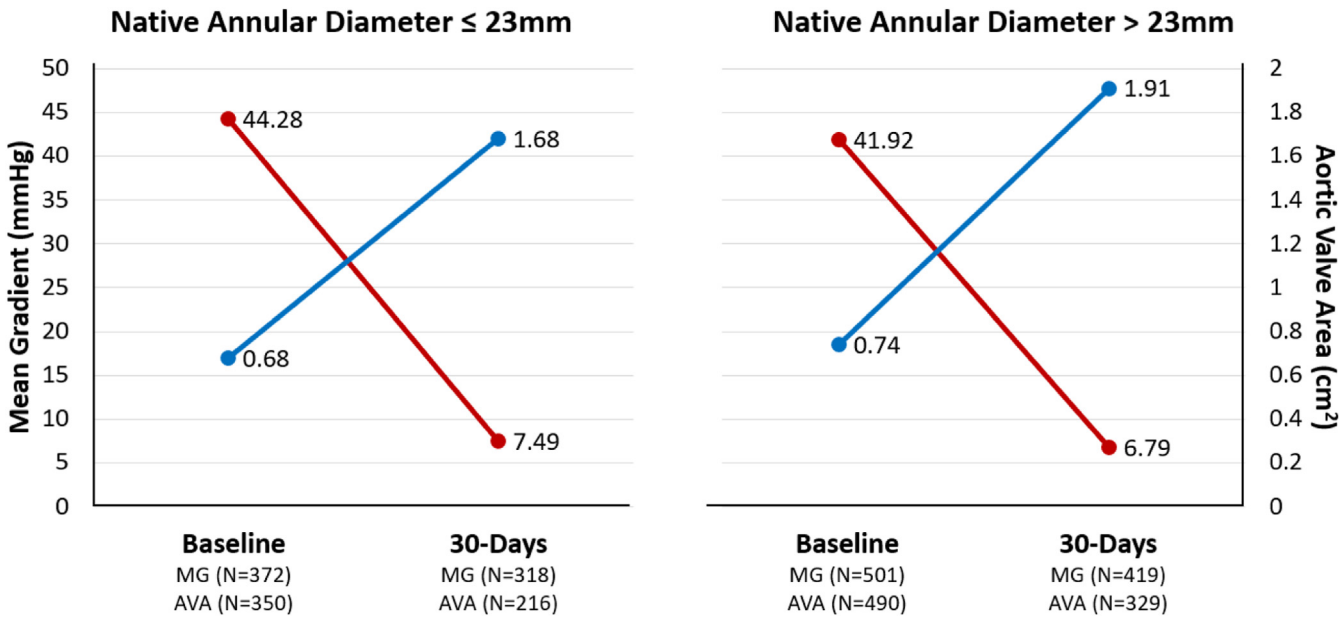


Figure 2. Valve hemodynamics by native annular diameter.
Abbreviations: AVA, aortic valve area; MG, mean gradient.

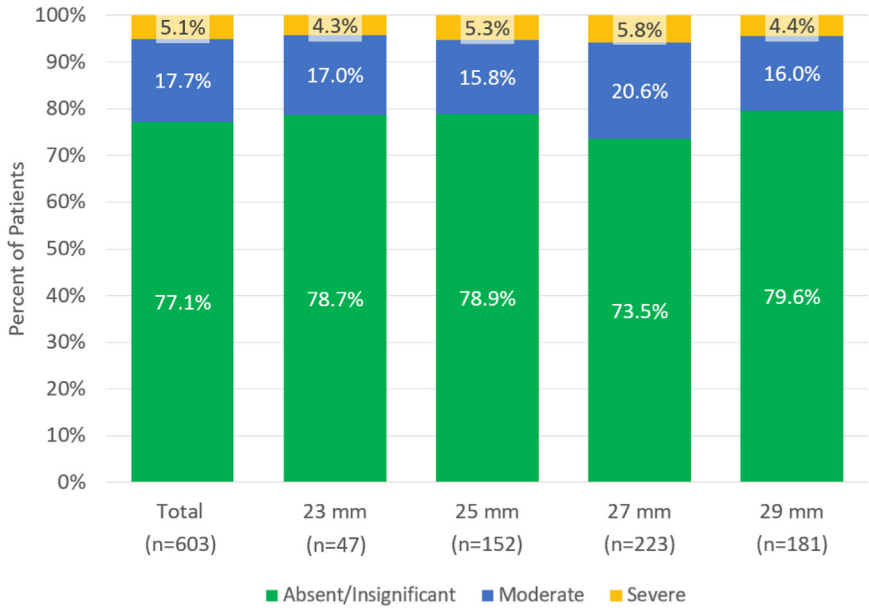


Figure 3. Patient prosthesis mismatch by implanted valve size.

subclavian or axillary access. The 27 mm valve size was used most often (35.7%), with the smaller valve sizes (23 and 25 mm) implanted more frequently in the second-generation DS cohort. The valve was implanted at a higher depth relative to the aortic annulus when using the second-generation DS as compared to the first-generation DS (4.5 vs. 5.1 mm, $p = 0.004$).

Thirty-Day Outcomes

The 30-day outcomes have been previously reported[6] and are briefly summarized in Table 3.

Hemodynamics by Valve Size

Valve hemodynamics at 30 days were substantially improved relative to baseline, with large aortic valve areas and low mean gradients across all implanted valve sizes (aortic valve areas were 1.7 ± 0.4, 1.7 ± 0.5, 1.8 ± 0.5, and 2.0 ± 0.5 cm^2, and mean gradients were 7.0 ± 2.7, 7.5 ± 4.7, 7.3 ± 3.3, and 6.4 ± 3.3 mmHg for 23, 25, 27, and 29 mm valve sizes, respectively) (Figure 1). Valve hemodynamics were substantially improved relative to baseline in both patients with large (>23 mm mean annular diameter) and small (≤23 mm mean annular diameter) native aortic annuli (Figure 2).

Patient-prosthesis mismatch was absent or insignificant in 77.1% of patients across all implanted valve sizes (Figure 3). There was moderate patient-prosthesis mismatch in 17.7% of patients and severe patient-prosthesis mismatch in 5.1% of patients across all implanted valve sizes.

Across all implanted valve sizes, PVL was none/trace or mild in over 97% of patients, and there were no cases of severe PVL (Figure 4).

Overall Permanent Pacemaker Implantation by Implant Depth

The overall rate of permanent pacemaker implantation decreased as the Portico valve was implanted at a higher depth relative to the aortic annulus (Figure 5). For valves implanted at an implant depth between 2

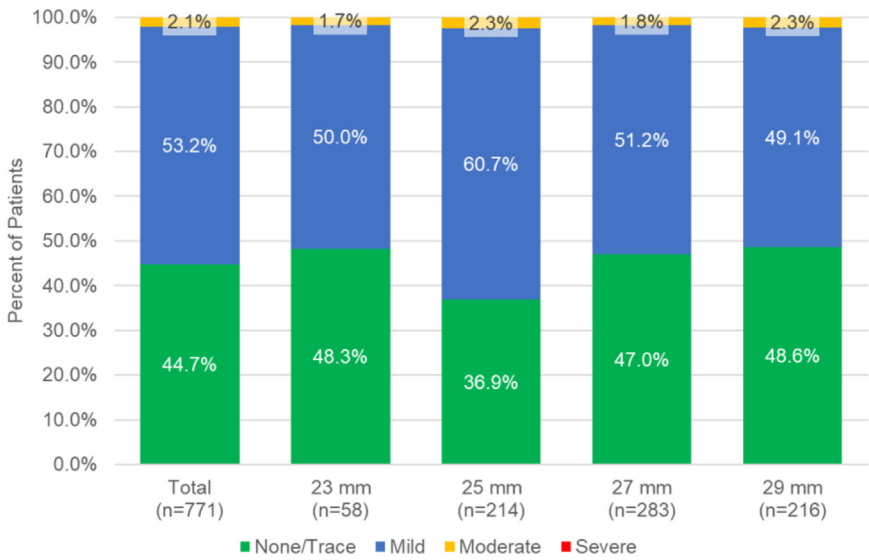


Figure 4. Paravalvular leakage by implanted valve size.

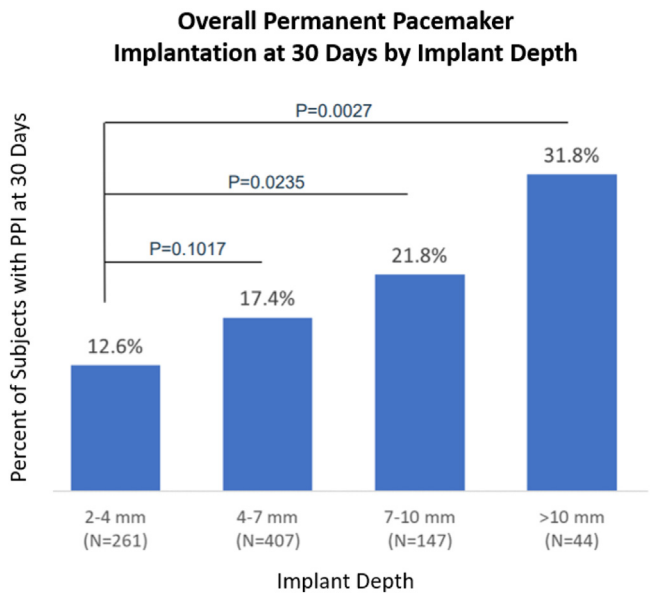


Figure 5. Rates of overall permanent pacemaker implantation by implant depth.

and 4 mm (measured at the noncoronary cusp), the overall rate of pacemaker implantation was 12.6%. There were statistically significant differences in the overall rate of permanent pacemaker implantation between patients with an implant depth of 2 to 4 mm and those with implant depths of 7 to 10 mm and greater than 10 mm ($p = 0.02$ and $p = 0.003$ for each comparison). Across all patients, the majority (78%) of valves were implanted at a depth between 2 and 7 mm.

One-Year Survival

Kaplan-Meier curves for all-cause and cardiovascular mortality at 1 year are shown in Figures 6 and 7, respectively. All-cause mortality at 1 year was 12.3% for the entire cohort. For patients implanted using the first-generation DS, all-cause mortality at 1 year was 13.7% compared to 11.0% for patients implanted using the second-generation DS ($p = 0.22$).

Cardiovascular mortality at 1 year was 8.3% for the entire cohort. For patients implanted using the first-generation DS, cardiovascular mortality at 1 year was 9.4% compared to 7.3% for patients implanted using the second-generation DS ($p = 0.24$).

Discussion

Transcatheter treatment of aortic valve stenosis has become the gold standard, especially for elderly high-risk patients. Different clinical trials have shown noninferiority or even superiority of this approach vs. SAVR. These randomized trials formally provide the highest level of scientific evidence. However, given their usually highly selected patient cohort, their results cannot necessarily be translated directly into daily clinical practice. Therefore, large-scale registries are an additional valuable tool for assessing the safety and efficacy of medical devices.

The CONFIDENCE registry enrolled patients in experienced heart valve centers. This fact may mitigate the effects of the learning curve,[7] making the interpretation of the data easier, especially in the setting when the first half of the cohort (first-generation DS) is compared to the second half (FlexNav DS). The main findings are (1) a very low overall 1-year mortality, (2) an excellent hemodynamic outcome in all valve sizes implanted, and (3) a clear trend towards an improved outcome in patients treated with the FlexNav DS.

All-cause mortality and cardiovascular mortality at 1 year were low: 12.3 and 8.3%, respectively. This holds especially true when taking into account that the enrolled patients were octogenarians with a number of additional risk factors, such as coronary artery disease in more than 50%, diabetes mellitus in more than 30%, and accompanying mitral valve disease in more than 60%. The low mortality nicely compares to that of other registries of patients treated with either other self-expanding or balloon-expandable THVs.[8–11]

Besides the low PVL rate that has been published recently,[6] an important factor that might have contributed to the low mortality is the excellent hemodynamic outcome of all valve sizes. The gradients were in the single-digit range even in patients with a very small annulus who had been treated with the 23-mm valve.[12,13] This finding is very remarkable for a valve with an intra-annular design and is rather comparable to supra-annular devices from a hemodynamic point of view.[14] Apart from that, the intra-annular design is usually associated with better accessibility of the coronary ostia.[15,16] Other intra-annular THVs have a considerably smaller effective orifice area, especially in small anatomies, which may lead to a higher risk of patient-prosthesis mismatch.[17,18] Indeed, a rate of close to 80% of none or insignificant patient-prosthesis mismatch with all sizes of the Portico valve clearly demonstrates the benefits of the valve design.

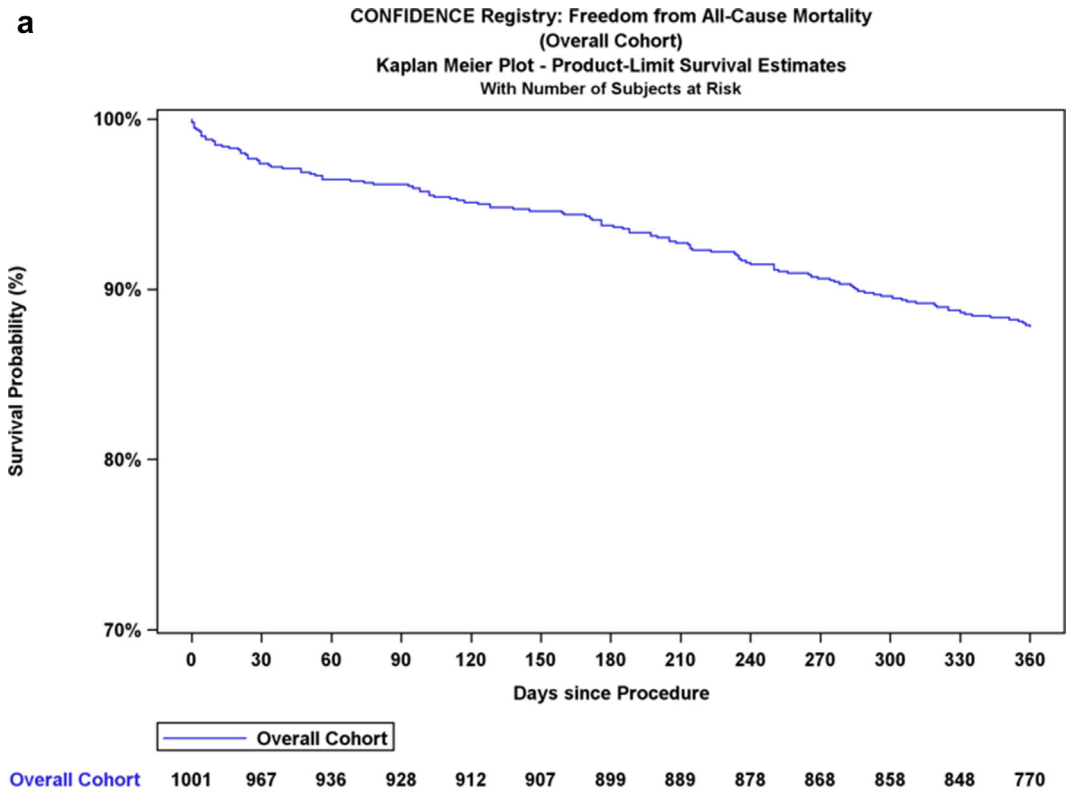
The CONFIDENCE registry additionally focused on 2 generations of DSs. The first-generation device was used in the first 501 patients, while the second-generation (FlexNav) DS was used in the second half of patients. The second-generation DS was designed for more stable implantation without the tendency of the first-generation system for ventricular migration of the valve during the release stage. The Kaplan-Meier analysis revealed an absolute mortality difference between the 2 delivery catheters of 2.7%. Although this difference is remarkable, especially in light of the low overall mortality of 12.3%, it did not reach statistical significance. Nonetheless, it shows a clear tendency toward an improved outcome by a more predictable and accurate valve placement with the second-generation DS.[19,20] The fact that the valves were implanted significantly higher with the second-generation DS underlines its benefit. A high implantation depth for self-expanding valves is associated with lower pacemaker rates.[21] This is obviously also true for the Portico valve, where the optimal implantation depth of 2 to 4 mm yielded a significantly lower pacemaker rate (12.6%) (Figure 5).

Limitations

This study had the limitations inherent to any nonrandomized registry study with standard-of-care treatment. The evaluation of echocardiographic data by an independent core laboratory helped to mitigate these limitations by providing consistent and unbiased hemodynamic outcome data. The large sample size and broad patient inclusion criteria allowed unique insight into the real-world performance of the Portico THV in daily clinical practice.

Conclusions

The Portico self-expanding, intra-annular valve demonstrated very good 1-year survival and excellent hemodynamic performance with very low rates of patient-prosthesis mismatch across all valve sizes in a large, real-world study of high surgical risk subjects. One-year survival rates were favorable when using both the first-generation and second-generation (FlexNav) DSs in this high-risk cohort.



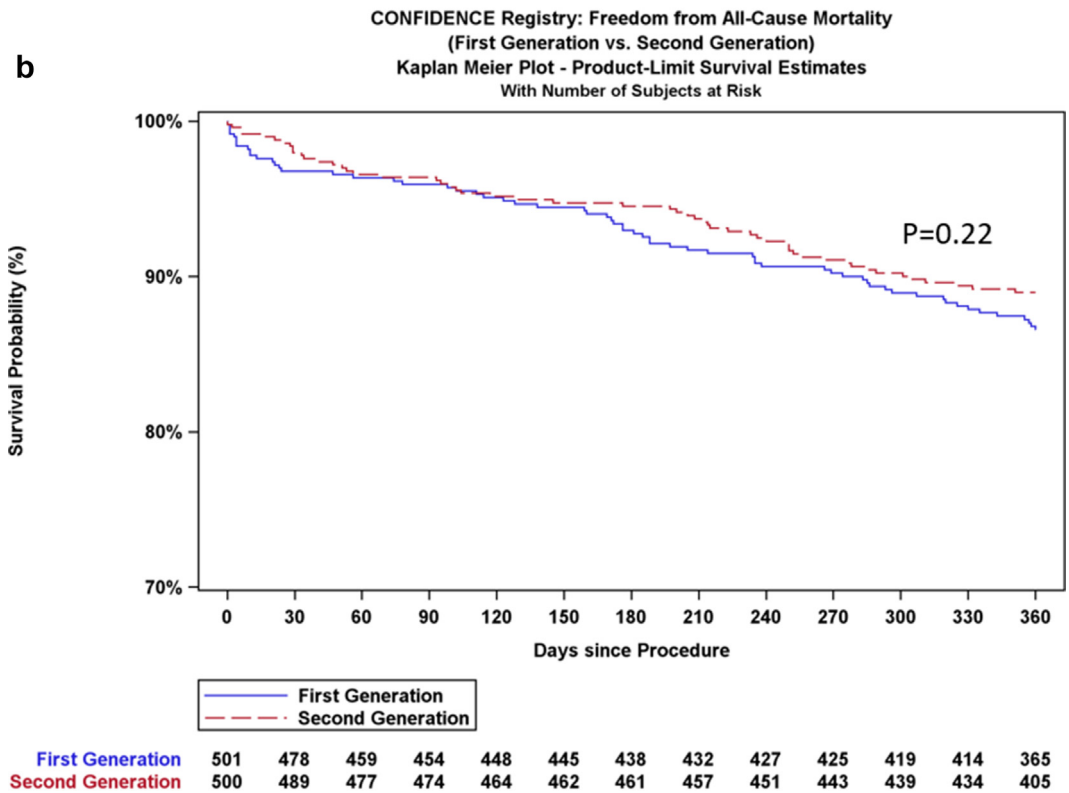
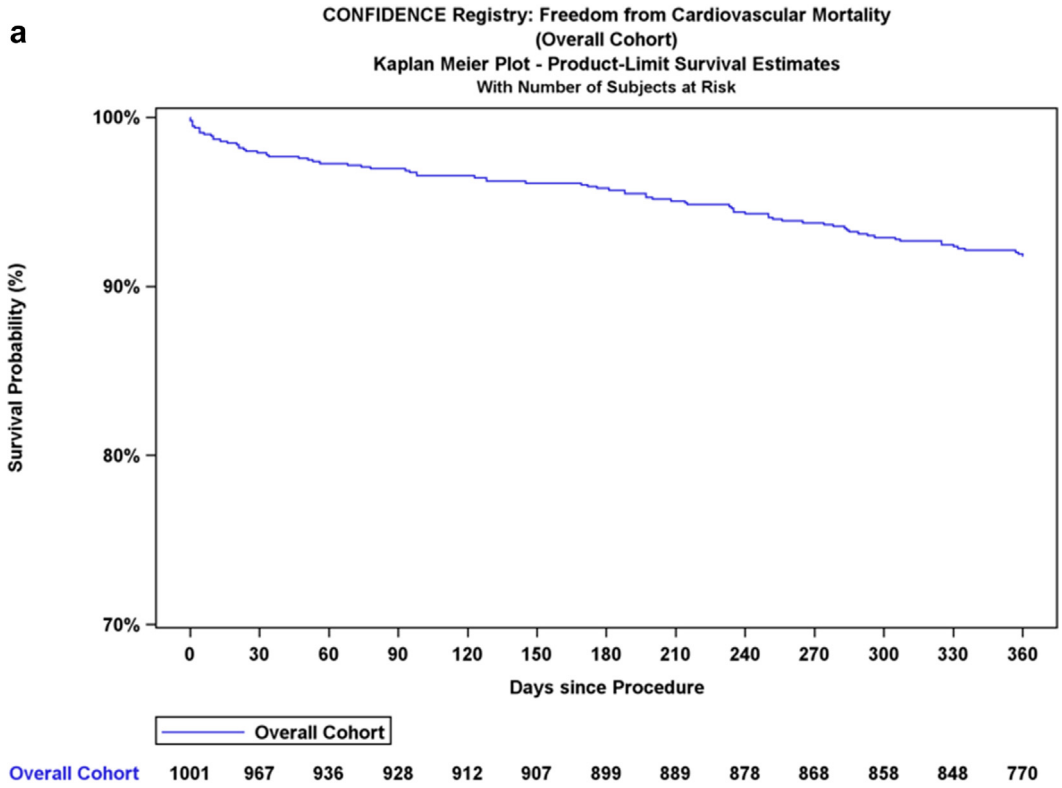


Figure 6. Freedom from all-cause mortality for the Portico valve. (a) Overall cohort, (b) first-generation vs. second-generation (FlexNav) delivery system.



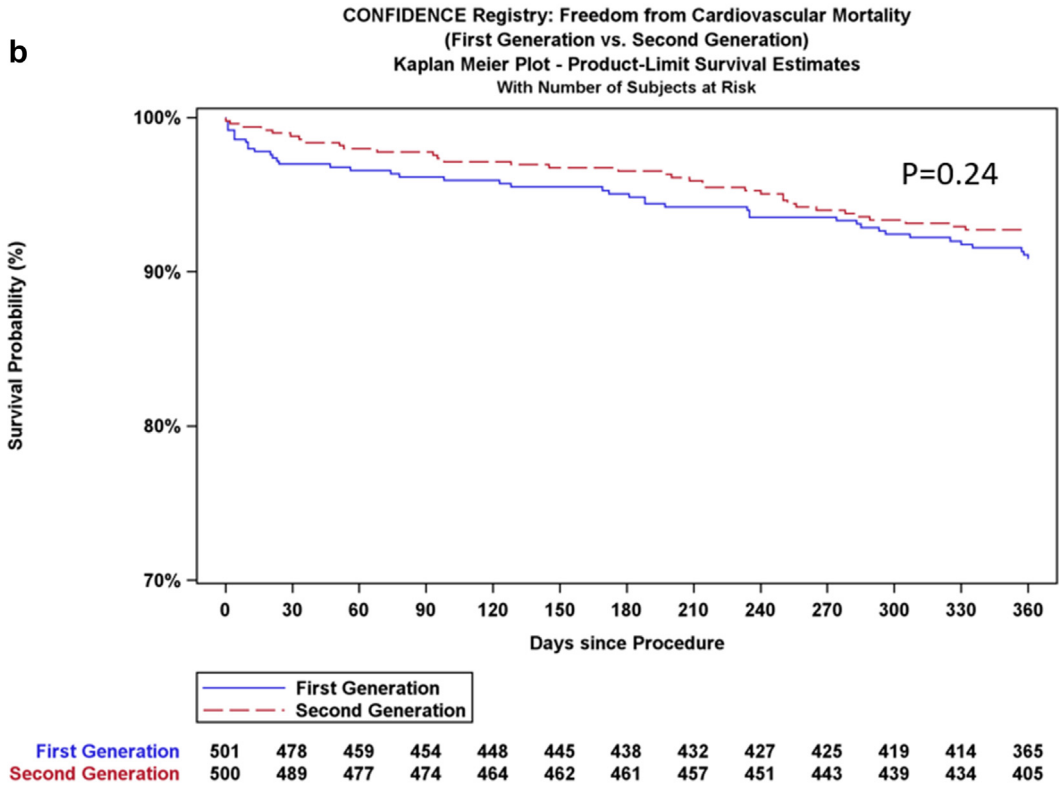


Figure 7. Freedom from cardiovascular mortality for the Portico valve. (a) Overall cohort, (b) first-generation vs. second-generation (FlexNav) delivery system.

ORCIDs

Martin Sluka https://orcid.org/0000-0002-2625-5445
Juan Francisco Oteo Dominguez https://orcid.org/0000-0002-2641-4135
Matteo Montorfano https://orcid.org/0000-0001-9732-9459
Keshav Kohli https://orcid.org/0000-0002-1469-4088

Ethics Statement

All study sites functioned in compliance with the Declaration of Helsinki, and approvals from ethics committees and local authorities were obtained. All patients provided written informed consent prior to participation.

Funding

This study was funded by Abbott Laboratories.

Disclosure Statement

H. Möllmann has received personal fees from Boston Scientific, Abbott, and Edwards Lifesciences; A. Linke has received speaker honoraria or served as a consultant for the following companies: Medtronic, Abbott, Claret Medical Inc, Boston Scientific, Edwards Lifesciences, Symetis, and Bard, and holds stock options from Claret Medical Inc. In addition, he received grant support from Medtronic and Claret Medical Inc; L. Nombela-Franco has received personal fees from Abbott and Edwards Lifesciences; M. Sluka has received personal fees from Abbott; M. Montorfano has received personal fees from Abbott, Boston Scientific, and Medtronic; W.-K. Kim has received personal fees from Boston Scientific, Abbott, Edwards Lifesciences, Medtronic., and Meril Life Sciences; M. Arnold has received personal fees from Edwards Lifesciences and Abbott; L. Conradi has received personal fees from Abbott, Boston Scientific, Medtronic and Edwards Lifesciences; A. Camuglia has received personal fees from Abbott; F. Bedogni has received personal fees from Abbott; K. Kohli is an employee of Abbott Laboratories; G. Manoharan has received personal fees from Boston Scientific, Medtronic, and Abbott. The remaining authors have no conflicts of interest to declare.

Supplementary Material

Supplemental data for this article can be accessed on the publisher's website.

References

1 Makkar RR, Fontana GP, Jilaihawi H, et al. Transcatheter aortic-valve replacement for inoperable severe aortic stenosis. *N Engl J Med*. 2012;366(18):1696-1704. https://doi.org/10.1056/nejmoa1202277
2 Leon MB, Smith CR, Mack MJ, et al. Transcatheter or surgical aortic-valve replacement in intermediate-risk patients. *N Engl J Med*. 2016;374(17):1609-1620. https://doi.org/10.1056/nejmoa1514616
3 Mack MJ, Leon MB, Thourani VH, et al. Transcatheter aortic-valve replacement with a balloon-expandable valve in low-risk patients. *N Engl J Med*. 2019;380(18):1695-1705. https://doi.org/10.1056/nejmoa1814052
4 Möllmann H, Linke A, Holzhey DM, et al. Implantation and 30-day follow-up on all 4 valve sizes within the Portico transcatheter aortic bioprosthetic family. *JACC Cardiovasc Interv*. 2017;10:1538-1547.
5 Makkar RR, Cheng W, Waksman R, et al. Self-expanding intra-annular versus commercially available transcatheter heart valves in high and extreme risk patients with severe aortic stenosis (PORTICO IDE): a randomised, controlled, non-inferiority trial. *Lancet*. 2020;396(10252):669-683. https://doi.org/10.1016/S0140-6736(20)31358-1. Erratum in: Lancet. 2020 Sep 5;396(10252):668.
6 Mollmann H, Linke A, Nombela-Franco L, et al. Procedural safety and device performance of the Portico™ valve from experienced TAVI centers: 30-day outcomes in the multicenter CONFIDENCE registry. *J Clin Med*. 2022;11(16):4839. https://doi.org/10.3390/jcm11164839
7 Wassef AWA, Rodes-Cabau J, Liu Y, et al. The learning curve and annual procedure volume standards for optimum outcomes of transcatheter aortic valve replacement: findings from an international registry. *JACC Cardiovasc Interv*. 2018;11(17):1669-1679. https://doi.org/10.1016/j.jcin.2018.06.044
8 Schymik G, Lefèvre T, Bartorelli AL, et al. European experience with the second-generation Edwards SAPIEN XT transcatheter heart valve in patients with severe aortic stenosis 1-year outcomes from the SOURCE XT registry. *JACC Cardiovasc Interv*. 2015;8:657-669.
9 Manoharan G, Van Mieghem NM, Windecker S, et al. 1-Year outcomes with the Evolut R self-expanding transcatheter aortic valve: from the International FORWARD study. *JACC Cardiovasc Interv*. 2018;11(22):2326-2334. https://doi.org/10.1016/j.jcin.2018.07.032
10 Kim WK, Hengstenberg C, Hilker M, et al. The SAVI-TF registry: 1-year outcomes of the European post-market registry using the ACURATE neo transcatheter heart valve under real-world conditions in 1,000 patients. *JACC Cardiovasc Interv*. 2018;11(14):1368-1374. https://doi.org/10.1016/j.jcin.2018.03.023
11 Blumenstein J, Eckel C, Husser O, et al. Multi-center comparison of two self-expanding transcatheter heart valves: a propensity matched analysis. *J Clin Med*. 2022;11(14):4228. https://doi.org/10.3390/jcm11144228
12 Voigtländer L, Kim WK, Mauri V, et al. Transcatheter aortic valve implantation in patients with a small aortic annulus: performance of supra-, intra- and infra-annular transcatheter heart valves. *Clin Res Cardiol*. 2021;110(12):1957-1966. https://doi.org/10.1007/s00392-021-01918-8
13 Nakashima M, Watanabe Y. Transcatheter aortic valve implantation in small anatomy: patient selection and technical challenges. *Interv Cardiol*. 2018;13(2):66-68. https://doi.org/10.15420/icr.2017:28:1
14 Mauri V, Kim WK, Abumayyaleh M, et al. Short-term outcome and hemodynamic performance of next-generation self-expanding versus balloon-expandable transcatheter aortic valves in patients with small aortic annulus: a multicenter propensity-matched comparison. *Circ Cardiovasc Interv*. 2017;10(10):e005013. https://doi.org/10.1161/CIRCINTERVENTIONS.117.005013
15 Blumenstein J, Kim WK, Liebetrau C, et al. Challenges of coronary angiography and intervention in patients previously treated by TAVI. *Clin Res Cardiol*. 2015;104(8):632-639. https://doi.org/10.1007/s00392-015-0824-5
16 Barbanti M, Costa G, Picci A, et al. Coronary cannulation after transcatheter aortic valve replacement: the RE-ACCESS study. *JACC Cardiovasc Interv*. 2020;13(21):2542-2555. https://doi.org/10.1016/j.jcin.2020.07.006
17 León Del Pino MDC, Ruíz Ortiz M, Delgado Ortega M, et al. Prosthesis-patient mismatch after transcatheter aortic valve replacement: prevalence and medium term prognostic impact. *Int J Cardiovasc Imaging*. 2019;35(5):827-836. https://doi.org/10.1007/s10554-018-01519-z
18 Eckel C, Sötemann D, Kim W-K, et al. Procedural outcomes of a self-expanding transcatheter heart valve in small annuli. *J Clin Med*. 2022;11(18):5313. https://doi.org/10.3390/jcm11185313
19 Fontana GP, Bedogni F, Groh M, et al. Safety profile of an intra-annular self-expanding transcatheter aortic valve and next-generation low-profile delivery system. *JACC Cardiovasc Interv*. 2020;13(21):2467-2478. https://doi.org/10.1016/j.jcin.2020.06.041
20 Corcione N, Morello A, Ferraro P, et al. The novel FlexNav delivery system for transcatheter aortic valve implantation with the Portico device: a case series. *J Invasive Cardiol*. 2021;33(6):E474-E478.
21 Costa G, Zappulla P, Barbanti M, et al. Pacemaker dependency after transcatheter aortic valve implantation: incidence, predictors and long-term outcomes. *EuroIntervention*. 2019;15(10):875-883. https://doi.org/10.4244/EIJ-D-18-01060