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Multicenter Comparison of Novel Self-Expanding Versus Balloon-Expandable Transcatheter Heart Valves

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ABSTRACT

OBJECTIVES This study sought to compare 2 next-generation transcatheter heart valves (THV), the self-expanding ACURATE neo (NEO) and the balloon-expandable SAPIEN 3 (S3), in terms of device failure and early safety at 30 days.

BACKGROUND Deployment of these THV showed promising initial clinical results. However, no comparative data are available.

METHODS Of 1,121 treated patients at 3 centers, a 1-to-2 nearest neighbor matching was performed to identify 2 patients treated with S3 (n = 622) for each patient treated with NEO (n = 311).

RESULTS In-hospital complications were comparable between NEO and S3, including stroke (1.9% vs. 2.4%; p = 0.64), major vascular complications (10.3% vs. 8.5%; p = 0.38), or life-threatening bleeding (4.2% vs. 3.7%; p = 0.72). Device failure with NEO was comparable with S3 (10.9% vs. 9.6%; odds ratio: 1.09 [95% confidence interval: 0.69 to 1.73]; p = 0.71) with more paravalvular leakage (PVL II+, 4.8% vs. 1.8%; p = 0.01), but less elevated gradients (≥20 mm Hg, 3.2% vs. 6.9%; p = 0.02) and pacemaker implantations (9.9% vs. 15.5%; p = 0.02). Thirty-day mortality (2.3% vs. 1.9%; p = 0.74) and the early safety composite endpoint (15.8% vs. 15.6%; hazard ratio: 0.97 [95% confidence interval: 0.68 to 1.39]; p = 0.88) were similar with NEO and S3.

CONCLUSIONS Very high success rates were achieved for both valves, and the clinical and procedural results were comparable. Compared with S3, NEO was associated with less new pacemaker implantations and less elevated gradients, but with more paravalvular leakage. (J Am Coll Cardiol Intv 2017;10:2078–87)
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The deployment of transcatheter heart valves (THV) in transcatheter aortic valve replacement (TAVR) is performed by self-expanding or balloon-expandable technologies in most available devices. Both technologies have been used in large clinical registries with very good clinical outcomes (1,2). Potential advantages of self-expanding technology include the possibility to reposition and to resheath, the option to retrieve, and a higher conformability to the individual aortic annular anatomy. Balloon-expandable THV are not repositionable, but may have advantages in calcified anatomy because of a higher radial force. The only randomized comparison between both technologies in earlier-generation devices showed superiority for device success with balloon-expandable over self-expanding THV (3); however, clinical outcome at 1 year was equivalent (4).

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Since then, a considerable development of balloon-expandable and self-expanding THV has taken place to address limitations of earlier-generation devices, such as paravalvular leakage (PVL), new permanent pacemaker implantations (PPI), and vascular complications. Among these novel devices are the balloon-expandable SAPIEN 3 (Edwards Lifesciences, Irvine, California) and the self-expanding ACURATE neo (SYMETIS S.A., Ecublens, Switzerland). Initial clinical results for SAPIEN 3 (5,6) and ACURATE neo (7) are promising, but no comparative data of both THV are available.

Therefore, in this multicenter study from 3 centers in Germany, we performed a propensity-matched comparison of ACURATE neo and SAPIEN 3 in terms of device failure and early safety at 30 days according to the updated criteria of the Valve Academic Research Consortium (VARC-2) (8).

METHODS

PATIENT POPULATION. Between January 2014 and January 2016, a total of 1,121 consecutive patients with symptomatic, severe stenosis of the native aortic valve were treated with transfemoral TAVR using ACURATE neo (n = 311) or SAPIEN 3 (n = 810) at 3 centers in Germany (Department of Cardiology, Deutsches Herzzentrum München, Munich; Kerckhoff Heart and Lung Center, Bad Nauheim; and University of Regensburg Medical Center, Regensburg) (**Figure 1,** Online Figure 1). The interdisciplinary heart team discussed all cases and consensus was achieved regarding the therapeutic strategy. All patients provided written informed consent for the procedures.

MULTISLICE COMPUTED TOMOGRAPHY DATA ANALYSIS. Multislice computed tomography was performed as part of the standard pre-procedural screening protocol. Aortic annulus measurements were assessed in multiple plane reconstructions according to the guidelines of the Society of Cardiovascular Computed Tomography (9). In short, area and perimeter of the virtual aortic annulus were obtained by direct planimetry and the minimum and maximum diameters were assessed. The eccentricity index was calculated and an eccentric annulus was assumed for an eccentricity index >0.25 (3). Calcification of the valvular apparatus was visually graded and dichotomized as mild/moderate versus severe. The final decision on prosthesis type and size was left at the discretion of the treating physician.

DEVICE DESCRIPTION. The ACURATE neo/TF (Online Figure 2A) is available in 3 sizes (small, medium, and large) and the technical features have been described elsewhere (7). The device consists of a self-expanding nitinol frame with a porcine pericardial leaflet valve in a supra-annular position and a pericardial sealing-skirt on the outer and inner surface of the stent body. The ACURATE neo is transfemorally delivered using the ACURATE neo/TF Delivery System compatible with a 15-F to 18-F catheter sheath (internal diameter).

The balloon-expandable SAPIEN 3 (Online Figure 2B) consists of a cobalt chromium alloy frame with bovine pericardial leaflets and is delivered with the Commander delivery system. At the time of the study period, the SAPIEN 3 is available in 23-, 26-, and 29-mm sizes and features an external polyethylene terephthalate fabric seal to reduce PVL, as has been previously described in detail (10,11). The technical features of the respective THV, associated delivery systems, sheath dimensions, and sizing recommendations are summarized in Online Table 1.

DEFINITION OF ENDPOINTS AND FOLLOW-UP. The endpoints of this study were device failure and the early safety composite endpoint at 30 days according to the VARC-2 criteria (8). Follow-up to 30 days was prospectively collected at each of the participating sites in the outpatient clinic, contacting the primary care physician, or by direct contact with the patient. Transthoracic echocardiography was performed at baseline, before discharge, and at 30 days.

STATISTICAL ANALYSIS. Continuous variables are expressed as the mean with the SD or the median with the interquartile range and compared using Student *t* test or the Mann-Whitney *U* test, respectively.

ABBREVIATIONS AND ACRONYMS

CI = confidence interval

PPI = permanent pacemaker implantations

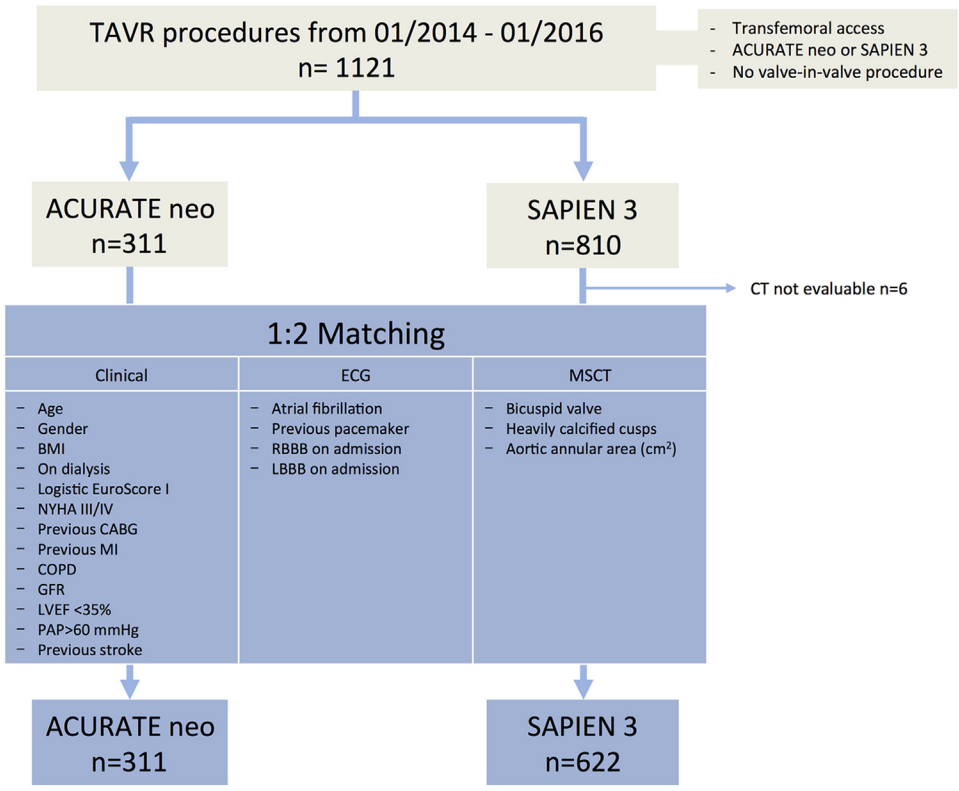
PVL = paravalvular leakage

TAVR = transcatheter aortic valve replacement

THV = transcatheter heart valve

VARC = Valve Academic Research Consortium

FIGURE 1 Study Flow and Variables Used for Propensity Matching



BMI = body mass index; CABG = coronary artery bypass grafting; COPD = chronic obstructive pulmonary disease; CT = computed tomography; GFR = glomerular filtration rate; LBBB = left bundle branch block; LVEF = left ventricular ejection fraction; MI = myocardial infarction; MSCT = multislice computed tomography; NYHA = New York Heart Association; PAP = pulmonary artery pressure; RBBB = right bundle branch block; TAVR = transcatheter aortic valve replacement.

To reduce imbalance in patient baseline characteristics and the effect of a potential selection bias on both endpoints for comparing ACURATE neo with SAPIEN 3, propensity matching was performed using R version 3.2.3 (The R Foundation for Statistical Computing, Vienna, Austria) and the package "MatchIt" (12). In short, a 1-to-2 nearest neighbor matching was used to identify 2 control cases treated with SAPIEN 3 (n = 622) for each case treated with ACURATE neo (n = 311). A 1-to-2 matching was chosen to minimize play of chance in the control group and thus to increase statistical power among the control subjects. Baseline, electrocardiogram, and multislice computed tomography characteristics with known prognostic impact or showing significant univariate differences between both groups were included in the matching algorithm. Figure 1 summarizes the study flow and variables used for propensity matching.

The occurrence of VARC-2 defined in-hospital complications was calculated for each group. The odds ratios with 95% confidence intervals (CIs) for device failure were computed using logistic regression analysis. Follow-up at 30 days was complete for 99% (310 of 311) of patients treated with ACURATE neo and for 99% (803 of 810) of patients treated with SAPIEN 3. The 30-day event rates were estimated using the Kaplan-Meier method and compared with the log-rank test. A Cox proportional regression with computation of hazard ratios and the 95% CI for the risk of the early safety composite endpoint was performed. To correct for a center-specific influence, all analyses were stratified by center and the interaction between THV and center was tested.

All analyses were conducted in the matched population and in the subgroups of heavily calcified anatomy and eccentric annulus. An analysis of the entire unmatched population is provided in the

TABLE 1 Baseline Characteristics of Patients Treated With ACURATE neo and of the Entire and the Matched Population Treated With SAPIEN 3

		Entire Population		Matched Population	
	ACURATE neo (n = 311)	SAPIEN 3 (n = 810)	p Value	SAPIEN 3 (n = 622)	p Value
Clinical					
Age, yrs	81 ± 6	81 ± 6	0.359	81 ± 6	0.982
Female	189 (60.8)	368 (45.4)	<0.001	344 (55.3)	0.112
Body mass index, kg/m^2	27 ± 5	27 ± 5	0.619	27 ± 5	0.660
Logistic EuroSCORE I	18 ± 10	18 ± 6	0.813	18 ± 12	0.999
NYHA functional class III or IV	256 (82.3)	606 (74.8)	0.008	489 (78.6)	0.184
COPD	42 (13.5)	144 (17.8)	0.085	92 (14.8)	0.597
Diabetes mellitus	103 (33.1)	261 (32.2)	0.774	201 (32.3)	0.805
Glomerular filtration rate, ml/min	59 ± 27	57 ± 25	0.156	57 ± 25	0.205
On dialysis	7 (2.3)	14 (1.7)	0.564	12 (1.9)	0.743
Peripheral vascular disease	33 (10.6)	97 (12.0)	0.523	70 (11.3)	0.768
Previous stroke, major/minor	43 (13.8)	103 (12.7)	0.621	78 (12.5)	0.581
Coronary artery disease	190 (61.1)	514 (63.5)	0.464	390 (62.7)	0.633
Previous myocardial infarction	31 (10.0)	98 (12.1)	0.317	63 (10.1)	0.939
Previous PCI	113 (36.3)	313 (38.6)	0.476	239 (38.4)	0.535
Previous CABG	33 (10.6)	67 (8.3)	0.219	54 (8.7)	0.339
Echocardiography					
LV ejection fraction <35%	18 (5.8)	79 (9.8)	0.034	34 (5.5)	0.840
Mean transaortic gradient	45 ± 15	43 ± 27	0.281	44 ± 16	0.590
Mitral regurgitation III+	5 (1.6)	18 (2.2)	0.516	13 (2.1)	0.614
Pulmonary hypertension*	24 (7.7)	80 (9.9)	0.264	60 (9.6)	0.332
Electrocardiogram					
Atrial fibrillation	77 (24.8)	241 (29.8)	0.097	163 (26.2)	0.634
RBBB	26 (8.4)	68 (8.4)	0.985	51 (8.2)	0.933
LBBB	27 (8.7)	45 (5.6)	0.060	43 (6.9)	0.334
Previous pacemaker	28 (9.0)	95 (11.7)	0.191	62 (10.0)	0.638
MSCT data†					
Aortic annular area, cm^2	4.4 ± 0.6	4.8 ± 1.0	<0.001	4.5 ± 0.8	0.003
Eccentricity index of aortic annulus	0.20 (0.16–0.24)	0.21 (0.16–0.25)	0.212	0.21 (0.17–0.25)	0.089
Severe aortic cusp calcification	69 (22.2)	239 (29.7)	0.012	164 (26.4)	0.164
Bicuspid valve	10 (3.2)	39 (4.9)	0.232	21 (3.4)	0.897

Values are mean ± SD, n (%), or median (interquartile range). *Pulmonary arterial pressure on echocardiography ≥60 mm Hg. †CT measurements available for 804 of 810 patients treated with SAPIEN 3.

CABG = coronary artery bypass grafting; COPD = chronic obstructive pulmonary disease; LBBB = complete left bundle branch block; LV = left ventricular; MSCT = multislice computer tomography; NYHA = New York Heart Association functional class; PCI = percutaneous coronary intervention; RBBB = complete right bundle branch block.

Online Appendix, because results were comparable with the matched sample.

A 2-sided p value of <0.05 was considered statistically significant for all analyses. STATA version 13.0 (STATA Corp., College Station, Texas) and R version 3.2.3 (The R Foundation) were used for analyses.

RESULTS

BASELINE CHARACTERISTICS AND PROPENSITY MATCHING. Baseline characteristics of the unmatched population are displayed in Table 1. Compared with patients treated with SAPIEN 3, patients treated with ACURATE neo were more frequently female (60.8% vs. 45.4%; p < 0.001), were more symptomatic (New York Heart Association functional class III/IV: 82.3% vs. 74.8%; p = 0.008), and had a lower prevalence of depressed left ventricular function (<35%; 5.8% vs. 9.8%; p = 0.034). Patients treated with SAPIEN 3 had significantly larger aortic annular anatomy and a higher percentage of severely calcified aortic annulus compared with patients treated with ACURATE neo.

After 1-to-2 matching for variables summarized in Figure 1, no baseline differences between the 2 groups were present (Table 1) except for aortic annular area remaining statistically larger in patients treated with SAPIEN 3 (4.5 ± 0.8 cm^2 vs. 4.4 ± 0.6 cm^2; p = 0.003). There were no unmatched patients treated with ACURATE neo (n = 311) and 622 control cases treated

TABLE 2 Procedural Characteristics and In-hospital Complications

	ACURATE neo (n = 311)	SAPIEN 3 (n = 622)	p Value
Procedural data			
Conscious sedation	147 (47.3)	286 (46.0)	0.710
Out of sizing range	22 (7.1)	33 (5.3)	0.280
Pre-dilatation	298 (95.8)	462 (74.3)	<0.001
Post-dilatation	131 (42.1)	148 (23.8)	<0.001
Procedural time, min	55 ± 30	54 ± 24	0.540
Contrast, ml	115 ± 54	104 ± 53	0.004
Fluoroscopy time, min	10 (6-14)	11 (7-15)	0.032
In-hospital complications			
All stroke	6 (1.9)	15 (2.4)	0.640
Disabling	5 (1.6)	10 (1.6)	0.999
Nondisabling	1 (0.3)	5 (0.8)	0.357
Major vascular complication	32 (10.3)	53 (8.5)	0.376
Life-threatening bleeding	13 (4.2)	23 (3.7)	0.718
Renal failure (AKIN 2/3, including dialysis)	10 (3.2)	17 (2.7)	0.679
Coronary artery obstruction with PCI	2 (0.6)	0 (0)	0.036
Myocardial infarction	0 (0)	0 (0)	–
New permanent pacemaker implantation*	28 (9.9)	87 (15.5)	0.024
Days in hospital	8 (6-11)	6 (5-10)	<0.001
Days on intensive care unit	1 (1-2)	1 (1-2)	0.336
In-hospital mortality	5 (1.6)	7 (1.1)	0.545

Values are n (%), mean ± SD, or median (interquartile range). *Excluding patients with pacemaker at baseline.

AKIN = Acute Kidney Injury Network; other abbreviation as in Table 1.

TABLE 3 Device Failure

	ACURATE neo (n = 311)	SAPIEN 3 (n = 622)	p Value
Device failure*	34 (10.9)	60 (9.6)	0.539
Procedural mortality	3 (1.0)	2 (0.3)	0.340
Correct position	308 (99.0)	616 (99.0)	0.999
Intended performance†	280 (90.0)	564 (90.7)	0.753
PVL II+	15 (4.8)	11 (1.8)	0.008
Elevated gradient (≥20 mm Hg)	10 (3.2)	43 (6.9)	0.021
Multiple valves	7 (2.3)	7 (1.1)	0.251
Conversion	5 (1.6)	4 (0.6)	0.170

Values are n (%). *Multiple events possible; counting only first event. †No prosthesis mismatch, mean aortic valve gradient <20 mm Hg, or peak velocity <3 m/s, without moderate or severe prosthetic valve aortic regurgitation of the first implanted prosthesis.

PVL = paravalvular leakage.

with SAPIEN 3. Online Figure 3 provides further information on the distribution of the propensity score across treatment and control cases before and after matching.

PROCEDURAL DATA AND IN-HOSPITAL OUTCOME. Procedural characteristics and in-hospital complications are displayed in **Table 2** (see Online Table 2 for unmatched population). Approximately one-half of both groups underwent TAVR in conscious sedation (ACURATE neo 47.3% vs. SAPIEN 3 46.0%; p = 0.710). Pre-dilatation was more frequently performed with ACURATE neo (95.8% vs. 74.3%; p < 0.001). The small, medium, and large sizes of ACURATE neo were used in 30.9%, 40.2%, and 28.9% of the cases, whereas the 23 mm, 26 mm, and 29 mm of SAPIEN 3 were used in 43.9%, 41.6%, and 14.5%, respectively. Fluoroscopy time was shorter and more contrast was used with ACURATE neo compared with SAPIEN 3. Post-dilatation was more often performed with ACURATE neo compared with SAPIEN 3 (42.1% vs. 23.8%; p < 0.001).

There was no difference in stroke, major vascular complications, life-threatening bleeding, renal failure, or myocardial infarction between both groups (**Table 2**). Patients treated with SAPIEN 3 had a higher rate of new PPI (15.5% vs. 9.9%; p = 0.024).

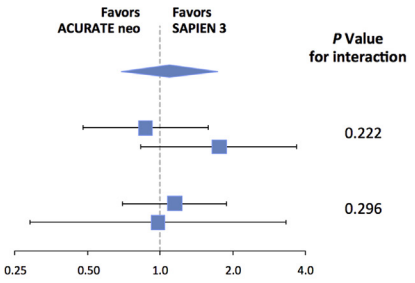
DEVICE FAILURE ACCORDING TO VARC-2. **Table 3 and Figure 2A** show the rate of device failure for ACURATE neo and SAPIEN 3 (see Online Table 3 and Online Figure 4 for unmatched population). There was no significant difference between both groups (10.9% vs. 9.6%; odds ratio: 1.09; 95% CI: 0.69 to 1.73; p = 0.708) and for the subgroups of heavily calcified or eccentric annuli. There was no significant interaction with THV type and center for device failure (p for interaction 0.196). Procedural mortality was 1.0% for ACURATE neo and 0.3% for SAPIEN 3 (p = 0.340). Although the incidence of PVL II+ was higher with ACURATE neo (4.8% vs. 1.8%; p = 0.008), the rate of elevated gradients (≥20 mm Hg) was lower (3.2% vs. 6.9%; p = 0.021) resulting in a similar intended performance of both THVs.

THIRTY-DAY OUTCOME AND EARLY SAFETY COMPOSITE ENDPOINT ACCORDING TO VARC-2. **Table 4 and Figures 2B and 3** show comparable rates of the early safety composite endpoint at 30 days for ACURATE neo and SAPIEN 3 (15.8% vs. 15.6%; hazard ratio: 0.97; 95% CI: 0.68 to 1.39; p = 0.879) (see Online Table 4 and Online Figure 5 for unmatched population). There was no difference in the individual contributors to the early safety composite endpoint at 30 days. The 30-day all-cause mortality was 2.3% for ACURATE neo and 1.9% for SAPIEN 3 (p = 0.742). The rate of new PPI at 30 days was significantly higher with SAPIEN 3 compared with ACURATE neo (16.4% vs. 10.2%; p = 0.018). **Figure 2B** shows early safety at 30 days with both THV and the hazard ratio according to the use of ACURATE neo in the matched population and in patients with severely calcified or eccentric annuli. In the case of eccentric annuli use of ACURATE neo was associated with a significantly higher hazard for the early safety composite endpoint at 30 days compared with SAPIEN 3 (hazard ratio: 2.24; 95%

FIGURE 2 Device Failure and Early Safety Composite Endpoint at 30 Days

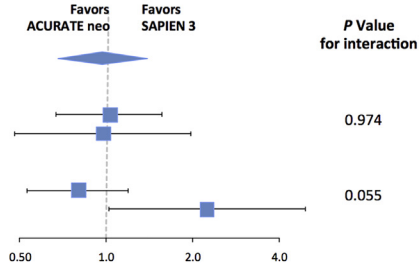
A Device failure

Subgroup	ACURATE neo Device Failure	SAPIEN 3 Device Failure	Odds Ratio [95% CI]	*P* Value	*P* Value for interaction
Matched Population	10.9% (34/311)	9.6% (60/622)	1.09 [0.69-1.73]	0.708	
Aortic cusp calcification					
mild/moderate	8.3% (20/242)	8.1% (37/458)	0.87 [0.48-1.58]	0.653	0.222
severe	20.3% (14/69)	14.0% (23/164)	1.75 [0.83-3.68]	0.144	
Aortic Annulus Eccentricity Index					
≤0.25	11.9% (30/253)	9.5% (47/494)	1.15 [0.70-1.88]	0.592	0.296
>0.25	6.9% (4/58)	10.2% (13/128)	0.98 [0.29-3.33]	0.968	



B Early safety composite endpoint at 30 days

Subgroup	ACURATE neo 30 Days Early Safety	SAPIEN 3 30 Days Early Safety	Hazard Ratio [95% CI]	*P* Value	*P* Value for interaction
Matched Population	15.8% (49/311)	15.6% (97/622)	0.97 [0.68-1.39]	0.879	
Aortic cusp calcification					
mild/moderate	15.7% (38/242)	14.9% (68/458)	1.03 [0.67-1.56]	0.902	0.974
severe	15.9% (11/69)	17.7% (29/164)	0.98 [0.48-1.97]	0.946	
Aortic Annulus Eccentricity Index					
≤0.25	14.2% (36/253)	16.4% (81/494)	0.80 [0.53-1.19]	0.272	0.055
>0.25	22.4% (13/58)	12.5% (16/128)	2.24 [1.02-4.93]	0.044	



(A) Rates and odds ratios for device failure according to use of ACURATE neo or SAPIEN 3 in the matched population. Subgroups of patients with eccentric and heavily calcified annular anatomy are depicted separately. **(B)** Rates and hazard ratios for early safety composite endpoint at 30 days according to use of ACURATE neo or SAPIEN 3 in the matched population and separately in subgroups of patients with eccentric and heavily calcified annular anatomy. All analyses are stratified by center. CI = confidence interval.

CI: 1.02 to 4.93; p = 0.044). There was no significant interaction with THV type and center for the early safety composite endpoint (p for interaction = 0.498).

Mean transvalvular gradients decreased after TAVR with both THVs, but were significantly lower with ACURATE neo compared with SAPIEN 3, before discharge (9 ± 5 mm Hg vs. 13 ± 5 mm Hg; p < 0.001) and at 30 days (8 ± 4 mm Hg vs. 12 ± 5 mm Hg; p < 0.001) (Figure 4A). Lower gradients with ACURATE neo were also observed across different prosthesis sizes of each THV (Figures 4B to 4D).

DISCUSSION

Of a total of 1,121 patients undergoing TAVR from 3 large German centers, we performed a propensity-matched comparison of the novel balloon-expandable SAPIEN 3 with the self-expanding ACURATE neo in terms of device success and 30-day outcome. The main finding is that there was no

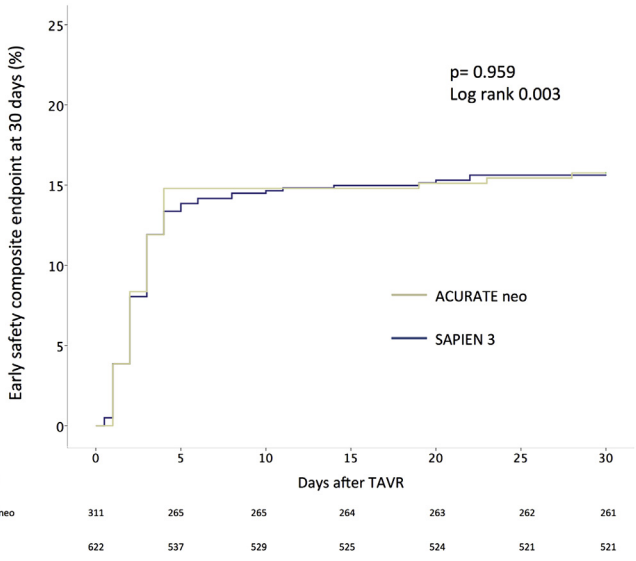
TABLE 4 Outcome at 30 Days

	ACURATE neo (n = 311)	SAPIEN 3 (n = 622)	p Value
Early safety composite endpoint at 30 days*	49 (15.8)	97 (15.6)	0.941
All-cause mortality	7 (2.3)	12 (1.9)	0.742
Stroke (disabling, nondisabling, transient ischemic attack)	7 (2.3)	19 (3.1)	0.484
Coronary artery obstruction requiring intervention	2 (0.6)	0 (0)	0.046
Major vascular complication	32 (10.3)	53 (8.6)	0.710
Life-threatening bleeding	13 (4.2)	27 (4.4)	0.910
Acute kidney injury (AKIN 2/3, including renal replacement)	10 (3.2)	17 (2.8)	0.669
Valve-related dysfunction requiring repeat procedure (BAV, TAVR, or SAVR)	1 (0.3)	0 (0)	0.159
New permanent pacemaker implantation†	29 (10.2)	92 (16.4)	0.018

Values are n (%). *Multiple events possible; counting only first event. †Excluding patients with pacemaker at baseline.

BAV = balloon aortic valvuloplasty; SAVR = surgical aortic valve replacement; TAVR = transcatheter aortic valve replacement; other abbreviation as in Table 2.

FIGURE 3 Kaplan-Meier Cumulative Rate of Early Safety Composite Endpoint



Cumulative event rate and number at risk for the early safety composite endpoint at 30 days according to ACURATE neo and SAPIEN 3. Abbreviation as in Figure 1.

difference of both endpoints between both THV. Although ACURATE neo was associated with a higher rate of PVL compared with SAPIEN 3, the incidence of elevated gradients and new PPI was significantly lower.

DEVICE FAILURE ACCORDING TO VARC-2. Device success is an important measure of procedural success and proper prosthesis function in TAVR (8). With ACURATE neo, device success rates have been reported in 95% (7). In the present study, in 311 patients treated with NEO, we observed a device success rate of 89%, which was comparable with SAPIEN 3 (90%). Data on device success with SAPIEN 3 are scarce, because the PARTNER II SAPIEN 3 trial (5) did not report this measure. A single-center study using SAPIEN 3 reported device success rates up to 97.6% (6).

Residual PVL after TAVR is associated with long-term mortality (13). Both SAPIEN 3 and ACURATE neo feature sealing skirts to minimize PVL. Consistent with previous studies using the SAPIEN 3 reporting PVL II+ in about 3.5% (5,6,11), we found a very low incidence of 1.8%. Although in the present study the incidence of more than mild PVL was significantly higher with ACURATE neo than with SAPIEN 3, the rate of elevated gradients was higher with SAPIEN 3, resulting in comparable rates of device success.

Randomized data comparing self-expanding and balloon-expandable technology only exist for older-generation devices (Medtronic CoreValve [Minneapolis, Minnesota] vs. Edwards Lifesciences SAPIEN XT [Irvine, California]) used in the CHOICE trial (3). In this trial, device success was significantly lower for the self-expanding device, namely 77% versus 96%. With next-generation THV we found no significant difference in device success between self-expanding and balloon-expandable devices in the matched population or in the subgroups with heavily calcified and eccentric aortic annuli. This finding may argue against a common perception of self-expanding THV being more effective in anatomically challenging patients or inferior in heavy calcification.

VARC-2-DEFINED EARLY SAFETY COMPOSITE ENDPOINT AT 30 DAYS. The early safety composite endpoint at 30 days has been proposed by the VARC for the assessment of patient safety in TAVR summarizing important measures of complications, prosthesis function, and mortality. Two recent meta-analyses in earlier-generation self-expanding and balloon-expandable devices reported freedom from the early safety composite endpoint at 30 days in about 75% of the cases (14). However, data regarding this endpoint especially for newer-generation THV are limited.

In the present propensity-matched comparison, clinical results with ACURATE neo were comparable with SAPIEN 3, with freedom of events at 30 days in 84% of the cases in both groups. In the ACURATE neo CE mark study and SAVI registry, freedom from the composite endpoint was 84% and 91%, respectively (15). Regarding the SAPIEN 3, data on early safety are scarce. Earlier results from a single European center have reported freedom of events in 90% of patients treated with SAPIEN 3 (6). U.S. data on this endpoint are not available, because this endpoint was not reported in the recently published PARTNER II SAPIEN 3 trial (5).

IN-HOSPITAL COMPLICATIONS. With the development of next-generation transfemoral THV, delivery systems have been optimized to minimize vascular complications and bleeding. Major vascular complications and bleedings have been reported in 3.8% and 1.5% with ACURATE neo (15) and in about 4% to 6% and 4% with SAPIEN 3 (6,16). ACURATE neo is compatible with delivery systems of 15F to 18F catheter inner diameter and a corresponding outer diameter of 22-F catheter. These dimensions are comparable with the introducer set of the SAPIEN 3 that uses a 14-F to 16-F catheter inner diameter sheath expanding to 24-F to 27-F catheter during passing of the crimped prosthesis. Accordingly, we found no difference between ACURATE neo and SAPIEN 3 for major vascular complications and for life-threatening bleeding.

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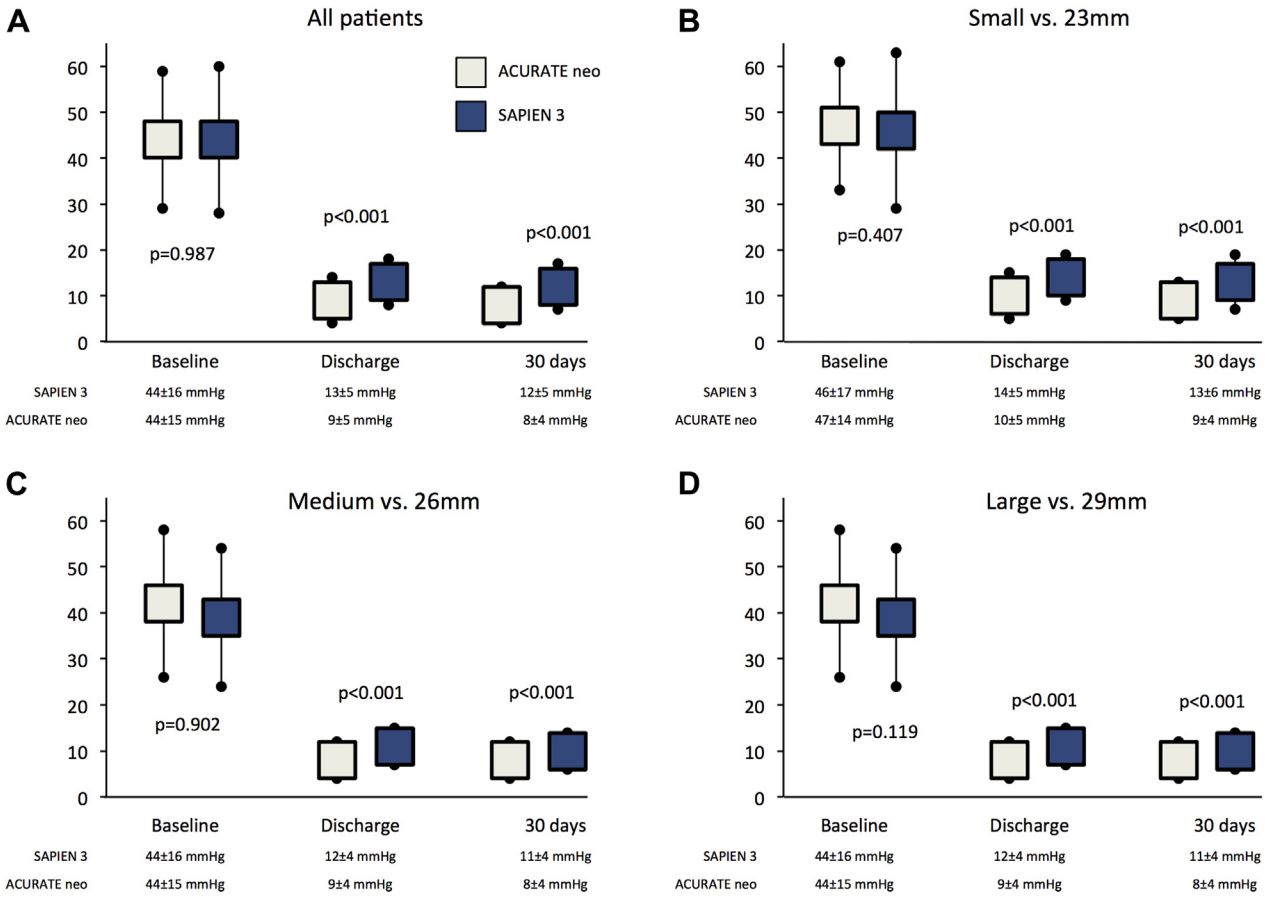
FIGURE 4 Mean Transaortic Gradients Before and After Transcatheter Aortic Valve Replacement for All Patients and According to Valve Size



Squares indicate mean and **error bars** indicate 1 SD of mean transaortic gradients in patients treated with ACURATE neo and SAPIEN 3 at baseline, at discharge, and at 30 days for all patients **(A)** and for different valves sizes: ACURATE neo small versus SAPIEN 3 23 mm **(B)**, ACURATE neo medium versus SAPIEN 3 26 mm **(C)**, ACURATE neo large versus SAPIEN 3 29 mm **(D)**.

In the present study, median hospital stay after TAVR was 7 days (5 to 10 days), which is in line with recent studies reporting similar duration of stay after TAVR with next-generation THV (16,17). However, these data stand in contrast to results from the PARTNER 2 trial where median hospital stay was 3 days (2 to 6 days) (5). One explanation for this observation may be that in Germany health care providers' regulations offer little incentive for early discharge.

The incidence of 30-day clinically apparent major stroke after TAVR ranges around 3% (18). Stroke has been reported in 2% of cases with ACURATE neo (15,19) and in 2.7% with SAPIEN 3 (20). In the present study, we observed a rate of 2.3% for ACURATE neo with no difference in the matched SAPIEN 3 population (3.1%).

New PPI after TAVR using earlier-generation ranged between 5% and 12% for balloon-expandable and 28% with self-expanding devices (21). In the case of SAPIEN 3, recent studies have reported rates of new PPI in 11.6% to 16% (5,20,22) and up to 19.7% at 1 year (22). The present study shows comparable rates with the SAPIEN 3 of 16.4% in the matched population. With ACURATE neo, new PPI was reported in 8.2% of the cases (15). In this study using ACURATE neo, this rate was 10.2%, which was significantly lower compared with SAPIEN 3. This stands in contrast to randomized data of earlier-generation devices, where the rate of new PPI was significantly higher with self-expanding compared with balloon-expandable devices (3). A possible explanation may be that ACURATE neo uses a supra-annular design with

potentially less interference with the cardiac conduction system.

STUDY LIMITATIONS. This is an observational study without core-laboratory analysis of procedural results and center-independent adjudication of outcomes. Despite propensity matching, the influence of unknown confounders cannot be excluded. Additionally, this registry-based study includes patients treated with the ACURATE neo and SAPIEN 3 according to the heart teams' decision and not according to predefined selection criteria as in a randomized comparison.

CONCLUSIONS

The clinical experience of 3 German high-volume centers with 2 latest-generation balloon-expandable and self-expanding THV was examined. In a propensity-matched comparison, we found equivalent rates of device failure and the early safety composite endpoint with ACURATE neo and SAPIEN 3. Use of ACURATE neo may be associated with a higher rate of PVL compared with SAPIEN 3; however, the incidence of elevated gradients and new PPIs may be significantly lower. Future studies are required to study the true effectiveness of ACURATE neo versus balloon-expandable THV, such as the SAPIEN 3, and other self-expanding devices, such as the Evolut R (Medtronic).

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PERSPECTIVES

WHAT IS KNOWN? To date, no data exist comparing the latest-generation self-expanding Symetis ACURATE neo and the balloon-expandable Edwards SAPIEN 3 transcatheter heart valves.

WHAT IS NEW? In this multicenter, propensity-matched comparison, we found equivalent rates of device failure and the VARC-2 defined early safety composite endpoint. Use of ACURATE neo was associated with a higher rate of paravalvular leakage compared with SAPIEN 3. However, the incidence of elevated gradients and new PPIs was significantly lower.

WHAT IS NEXT? The SCOPE I trial, a prospective, multicenter, randomized clinical trial, comparing the ACURATE neo and the SAPIEN 3 is ongoing and will determine the true effectiveness of each THV.

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KEY WORDS ACURATE neo, SAPIEN 3, transcatheter aortic valve replacement, VARC-2

APPENDIX For supplemental tables and figures, please see the online version of this article.

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