

## Thirty-Day Results of the SAPIEN Aortic Bioprosthesis European Outcome (SOURCE) Registry A European Registry of Transcatheter Aortic Valve Implantation Using the Edwards SAPIEN Valve

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**Background**—Transcatheter aortic valve implantation was developed to mitigate the mortality and morbidity associated with high-risk traditional aortic valve replacement. The Edwards SAPIEN valve was approved for transcatheter aortic valve implantation transfemoral delivery in the European Union in November 2007 and for transapical delivery in January 2008.

**Methods and Results**—The SAPIEN Aortic Bioprosthesis European Outcome (SOURCE) Registry was designed to assess the initial clinical results of the Edwards SAPIEN valve in consecutive patients in Europe after commercialization. Cohort 1 consists of 1038 patients enrolled at 32 centers. Patients who were treated with the transapical approach (n=575) suffered more comorbidities than the transfemoral patients (n=463), resulting in a significantly higher logistic EuroSCORE (29.1% versus 25.7%;  $P<0.001$ ). Therefore, these groups are considered different, and outcomes cannot be compared. Overall short-term procedural success was observed in 93.8%. The incidence of valve embolization was 0.3% (n=3), and coronary obstruction was reported for 0.6% (n=6 cases). Incidence of stroke was 2.5% and similar for both procedural approaches. Thirty-day mortality was 6.3% in transfemoral patients and 10.3% in transapical patients. The occurrence of vascular complications was not a predictor of <30-day mortality in the transfemoral population.

**Conclusion**—Technical proficiency can be learned and adapted readily as demonstrated by the short-term procedural success rate and low 30-day mortality rates reported in the SOURCE Registry. Specific complication management and refinement of patient selection are needed to further improve outcomes. (*Circulation*. 2010;122:62-69.)

**Key Words:** aorta ■ catheters ■ stenosis ■ valves ■ balloon valvuloplasty

Increased life expectancy has resulted in a growing elderly population and consequently an increase in the number of patients with aortic valve disease. Severe aortic stenosis represents the most common indication for aortic valve replacement (AVR).<sup>1</sup> The main cause of acquired aortic stenosis in the United States and Europe is now senile degenerative calcification; a minority of stenoses are a result of rheumatic heart disease. After the onset symptoms (angina, syncope, heart failure), average survival is 2 to 3 years with a high risk of sudden death.<sup>2</sup>

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AVR has been the only effective treatment in adults with severe symptomatic aortic stenosis that provides symptomatic

relief and long-term survival.<sup>3</sup> The overall operative mortality rate for isolated AVR surgery ranges from 2.5% to 4.0%.<sup>1,4,5</sup> However, the operative risk is higher in octogenarians and nonagenarians (4.9% to 9.6%)<sup>6</sup> and can be up to 25% in patients with comorbid conditions.<sup>6-9</sup>

Therefore, minimized-access AVR was developed to mitigate surgical trauma and morbidities associated with AVR through a full median sternotomy.<sup>10</sup> However, it still needs the support of extracorporeal circulation. Advancements in transcatheter therapeutics have led to the innovation of transcatheter aortic valve implantation (TAVI). The first patient was treated in 2002 by Cribier and colleagues.<sup>11</sup>

Recently, the Edwards SAPIEN valve was approved for commercial use in the European Union; the transfemoral delivery was approved in November 2007 and transapical

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delivery in January 2008. The Edwards SAPIEN Aortic Bioprosthesis European Outcome (SOURCE) Registry was created to obtain clinical data involving the commercially available Edwards SAPIEN valve during the first year of commercial activity in Europe. This article describes the 30-day results of cohort 1 of this registry.

## Methods

### Registry

A total of 34 centers participated in the initial commercial launch of the Edwards SAPIEN transcatheter valve in Europe. The total number of patients who underwent attempted TAVI at these centers between November 2007 and January 31, 2009, was 1123. Only centers that could provide data on all of their consecutively treated patients during this time were used for the analysis. Two centers (with 85 patients) were therefore excluded. The remaining 32 centers with 1038 patients made up cohort 1. Participating centers are located throughout Europe and enrolled between 8 and 89 patients (See the Appendix in the online-only Data Supplement). Twenty-three of the 32 sites (72%) had no prior experience with the Edwards SAPIEN valve, and these centers enrolled 578 patients (56%) in the registry. Anonymized data were collected and used to generate the analyses for this registry.

### Procedures and Devices

The Edwards SAPIEN valve is a biological heart valve manufactured with bovine pericardial tissue that is mounted into a balloon-expandable stent. The valve is available in 23 and 26 mm. As previously described,<sup>12–14</sup> a transfemoral or transapical approach may be used to deliver the valve. Patients at high risk for traditional AVR or those who are considered nonoperable are eligible to be treated. Generally, these patients have a EuroSCORE of >20. Patients being treated by the transfemoral approach must have femoral or iliac vessel diameters of >7 mm. Ultimately, the decision that the patient was best treated by TAVI, and by which approach, was based on the clinical judgment of a multidisciplinary team consisting of cardiac surgeons, interventional cardiologists, anesthesiologists, and imaging specialists.

### Training and Proctoring

All new sites underwent a structured program of training and proctorship. Teams from the new institution visited a training center for didactic and simulator training followed by compulsory visits to experienced centers to observe at least 1 transfemoral and 1 transapical case. Proctors attended at least the first 2 cases involving each approach at the new institution.

### Definitions and Data Collection

Patients were/will be assessed at discharge and at 30 days and 12 months after implantation. Data submission was high, with data available for 100% of patients at implantation and with survival data at the 30-day follow-up visit available for 98%.

Events and values collected are site reported, and there are no core laboratories. The principal investigators (M.T. and O.W.) reviewed and adjudicated all clinical and adverse events reported into the Medidata RAVE electronic database. Approximately half of the cohort 1 centers collected and reported data in a prospective manner. No functional assessment of the Edwards SAPIEN valve was reviewed for this article.

The principal measures of outcome in the SOURCE Registry are death and immediate procedural success (defined as deployment of an Edwards SAPIEN valve, retrieval of the delivery catheter, no conversion to conventional surgery, and the patient leaving the interventional room alive). Secondary measures of outcome include stroke, permanent pacemaker insertion, renal dysfunction requiring dialysis, myocardial infarction, coronary complications, device embolization, and vascular complications (major and minor). Major vascular complication were defined as limb-threatening ischemia,

**Table 1. Baseline Demographics and Risk Factors**

	Transfemoral (n=463)	Transapical (n=575)	P
Age, mean (SD), y	81.7 (6.7)	80.7 (7.0)	NS
Female, n (%)	255 (55.2)	320 (56.0)	NS
Pulmonary disease, n (%)	117 (25.4)	169 (29.4)	NS
Renal dysfunction, n (%)	121 (26.3)	189 (32.9)	0.024
Logistic EuroSCORE (SD)	25.7 (14.5)	29.1 (16.3)	<0.001
Peripheral vascular disease, n (%)	50 (10.9)	158 (27.5)	<0.001
Carotid artery stenosis >50%, n (%)	35 (7.6)	98 (17.1)	<0.001
Incidence of CAD, n (%)	218 (47.4)	321 (56.0)	0.006
Porcelain aorta, n (%)	21 (4.6)	66 (11.5)	<0.001
Prior CABG, n (%)	81 (17.6)	154 (26.9)	<0.001
Mitral valve disease, n (%)	74 (16.1)	188 (32.8)	<0.001

CAD indicates coronary artery disease; CABG, coronary artery bypass grafting. Percentages are based on the number of nonmissing values available.

vessel rupture requiring additional nonplanned vascular surgery, or additional interventional treatment. Major vascular complications are defined this way because all of the above complications are generally considered life-threatening. The residual vascular complications were defined as minor.

### Statistical Analysis

Continuous variables are presented as mean±SD and were compared between groups through the use of a 2-sample *t* test. Survival analysis was performed by the Kaplan–Meier method, with patients censored as of the last date known alive. Survival values are reported to 30 days because that is the time point of interest here. A logistic EuroSCORE cutoff of 20 was predetermined as a result of the patient selection criteria. Outcome comparisons are presented on the basis of this cutoff. Because of the potential that other cutoffs might be superior for predicting mortality, receiver-operating characteristic curves using logistic EuroSCORE to predict 30-day survival were computed. Categorical variables are given as frequencies and percentages and were compared by the Fisher exact test. A value of  $P<0.05$  was considered statistically significant. All statistical analyses were performed with SAS version 9.2 (SAS Institute Inc, Cary, NC).

The principal investigators had full access to the reported data and take responsibility for the integrity of the data presented here. All authors have read and agree to the manuscript as written.

## Results

### Demographic and Baseline Characteristics

Cohort 1 comprises 463 transfemoral patients and 575 transapical patients. Baseline demographics and risk factors are shown in Table 1. Although mean age, gender distribution, and presence of pulmonary disease were similar for both populations, statistically significant differences ( $P=0.024$  to  $<0.001$ ) were observed in respect to renal dysfunction, peripheral vascular disease, carotid artery stenosis >50%, incidence of coronary artery disease, porcelain aorta, prior coronary bypass grafting, and mitral valve disease. This resulted in logistic EuroSCOREs of 25.7% for the transfemoral and 29.1% for the transapical group ( $P<0.001$ ), indicating that the transapical cohort represents a higher-risk patient population. Therefore, these groups are considered different, and outcomes cannot be compared.

### Procedural Parameters and Outcomes

Procedural parameters and outcomes are summarized in Table 2. A total of 22 patients (3 transfemoral and 19 transapical)

**Table 2. Procedural Parameters and Outcomes**

	Transfemoral (n=463), n (%)	Transapical (n=575), n (%)	Total (n=1038), n (%)
Implanted valve size, mm			
23	210/466 (45.1)	214/594 (36.0)	424/1060 (40.0)
26	237/466 (50.9)	353/594 (59.4)	590/1060 (55.7)
Missing	19/466 (4.1)	27/594 (4.5)	46/1060 (4.3)
SAPIEN-in-SAPIEN valve	3/463 (0.6)	19/575 (3.3)	22/1038 (2.1)
Conversion to open AVR	8/463 (1.7)	20/575 (3.5)	28/1038 (2.7)
Short-term procedural success*	434/456 (95.2)	522/563 (92.7)	956/1019 (93.8)
AR>grade 2+	7/462 (1.5)	13/574 (2.3)	20/1036 (1.9)
Valve embolization	0/463 (0)	3/575 (0.5)	3/1038 (0.3)
Coronary obstruction	3/463 (0.7)	3/575 (0.5)	6/1038 (0.6)
Transfusion	46/463 (9.9)	51/575 (8.9)	97/1038 (9.3)

AR indicates aortic regurgitation.

\*Missing in 19 patients (1.8%): 7 transfemoral and 12 transapical patients.

underwent valve-in-valve implantation as a result of malposition or moderate/severe aortic insufficiency after placement of the first SAPIEN valve. Two of these patients (9.1%) died within 30 days of the procedure. In 28 patients (2.7%), complications during TAVI required conversion to open heart surgery.

Overall, short-term procedural success was observed in 93.8%. Aortic regurgitation more than grade 2+ was noted in 7 transfemoral patients (1.5%) and 13 transapical patients (2.3%) at the end of the procedure. The overall incidence of valve embolization was low (n=3 or 0.3%). Coronary obstruction occurred in only 6 patients (0.6%). The transfusion rate was 51 of 575 (8.9%) in the transapical group and 46 of 463 (9.9%) in the transfemoral group.

### Postprocedural Complications

Major complications are shown in Table 3. Overall 30-day mortality was 8.5% total, with 6.3% for the transfemoral cohort and 10.3% for the transapical group. The majority of deaths were caused by multiorgan and heart failure (39 of 88 or 44.3%); 7 patients (8.0%) died of sepsis, and 5 patients (5.7%) had a sudden or unexplained death on days 11 (n=2), 7 (n=2), and 15 (n=1).

The relation between 30-day mortality and EuroSCORE was examined. Figure 1 shows the receiver-operating characteristic curves and the accompanying C statistics. Each point on the receiver-operating characteristic curve shows the sensitivity and specificity of various cutoff points when logistic EuroSCORE is used as a predictor of 30-day death. Although the actual cutoff value is not directly part of the graph, selected EuroSCORE values are identified. A test of no value (eg, a coin flip) corresponds to the diagonal line; as a rule of thumb, a point farther from the diagonal line is a better predictor. The overall area under the curve (C statistics) is one formal measure of the value of the predictor. The C statistics are 0.612 for the transapical cohort and 0.641 for the transfemoral population, which were statistically significantly greater than the null value

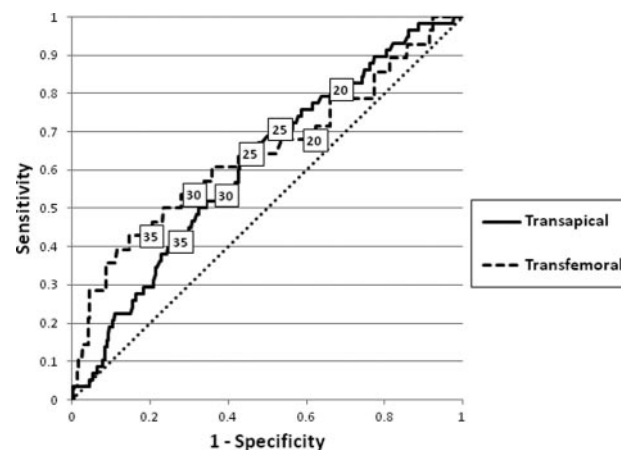
**Table 3. Major Complications (≤30 Days)**

	Transfemoral (n=463), n (%)	Transapical (n=575), n (%)	Total (n=1038), n (%)
Death	29 (6.3)	59 (10.3)	88 (8.5)
Stroke	11 (2.4)	16 (2.6)	27 (2.5)
Renal failure requiring dialysis	6 (1.3)	41 (7.1)	47 (4.3)
Permanent pacemaker	31 (6.7)	42 (7.3)	73 (7.0)
Vascular complications	106 (22.9)	27 (4.7)	133 (12.8)
Vascular access-related complications	91 (17.9)	15 (2.4)	106 (9.3)
Aortic dissection	9 (1.9)	5 (0.7)	14 (1.3)
Non-access-related complications	6 (1.1)	7 (1.2)	13 (1.2)
Vascular access and nonaccess complications stratified by major and minor event, events/patients (%)			
Major	55/49 (10.6)	17/14 (2.4)	72/63 (7.0)
Minor	51/48 (10.4)	10/10 (1.7)	61/58 (5.5)

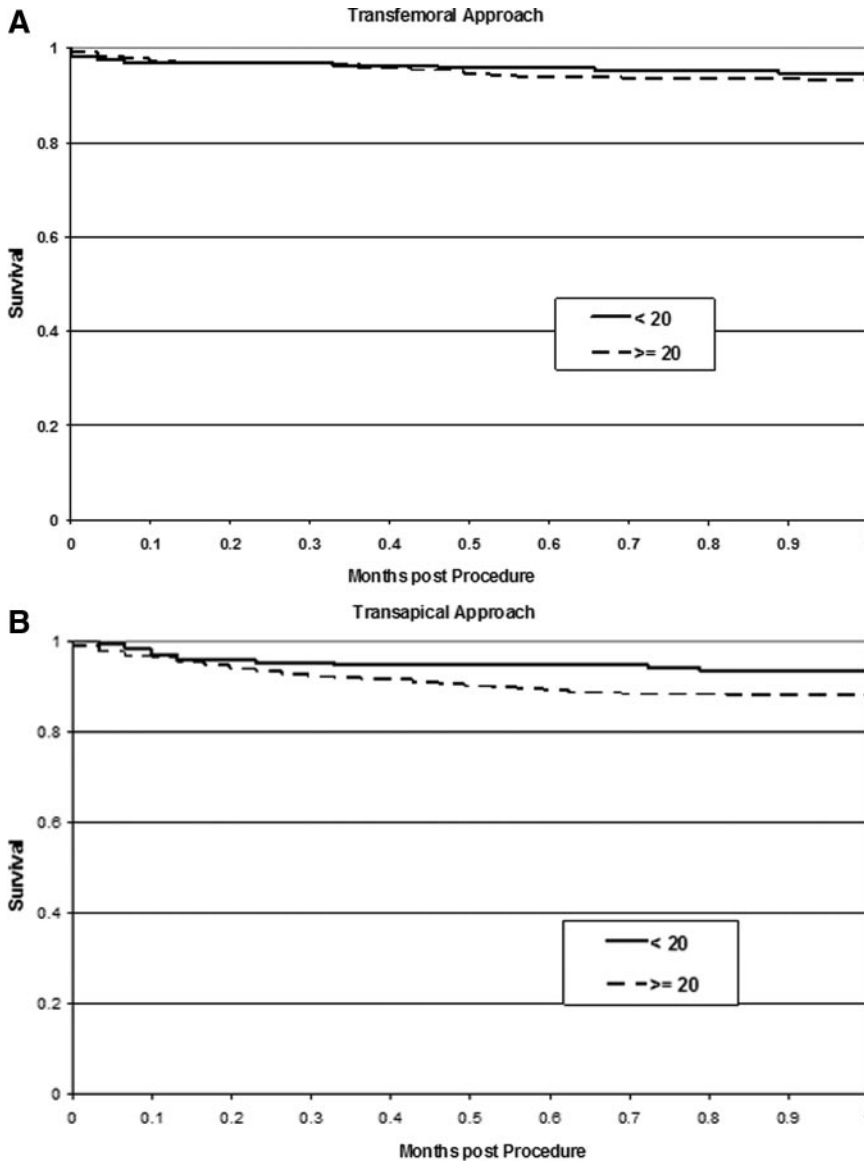
of 0.500. The graph indicates that EuroSCOREs in the range of 30 to 35 were a good predictor of 30-day mortality.

In accordance with the indications for use, we further stratified the 30-day mortality by preoperative EuroSCORE (Figure 2). A total of 339 patients (339 of 1019 or 33.3%) had a preoperative EuroSCORE of <20. The 30-day survival in these patients was 94.6% (161 of 170) in the transfemoral and 93.4% (158 of 169) in the transapical group. A preoperative EuroSCORE of ≥20 resulted in a 30-day survival of 93.3% (265 of 284) in the transfemoral cohort and 88.1% (349 of 396) in the transapical cohort.

The incidence of permanent pacemaker implantation was 7% in both groups. The overall incidence of stroke was 2.5% (transfemoral, 2.4%; transapical, 2.6%). The incidence of preprocedural carotid artery disease was significantly higher in the transapical group (17.1% versus 7.6%;  $P<0.001$ ). Worsening renal function requiring new dialysis occurred in 4.3%



**Figure 1.** EuroSCORE as a predictor of 30-day mortality: receiver-operating characteristic curve. C statistic=0.64 (transfemoral) and 0.61 (transapical). Selected EuroSCORE values are shown.



**Figure 2.** Kaplan–Meier curves of all-cause mortality for each cohort stratified by EuroSCORE (<20 vs ≥20). A, Transfemoral approach; B, transapical approach.

overall, in 1.3% of the transfemoral group, and in 7.1% of the transapical group. It should be noted that renal dysfunction before the procedure was statistically more prevalent in the transapical group (32.9% versus 26.3%;  $P=0.024$ ).

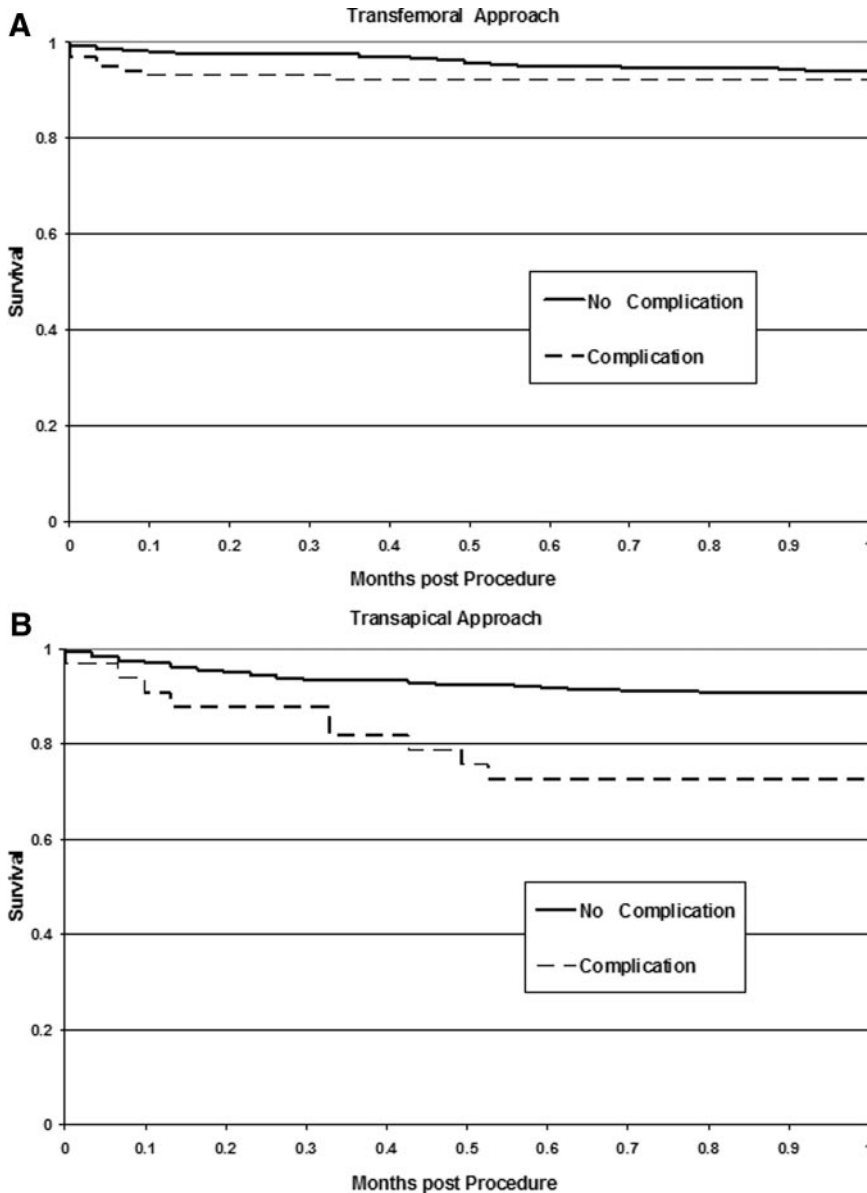
Vascular complications were divided into vascular access-related complications, aortic dissection, and non-access-related vascular complications and were reported for 17.9%, 1.9%, and 1.1% of the transfemoral patients and 2.4%, 0.7%, and 1.2% of the transapical patients, respectively (Table 3). To evaluate the relationship between the occurrence of vascular complications and mortality, stratification of actuarial survival (Kaplan–Meier) is shown in Figure 3 for each approach. In the transfemoral population, the Kaplan–Meier freedom from death at 30 days was 94.1% for patients without any vascular complications compared with 92.2% in patients who experienced vascular complication(s) ( $P=0.347$ ), whereas these results were 90.7% versus 72.8% in the transapical cohort, respectively ( $P<0.001$ ).

The proportion of patients with major vascular complications was 10.6% for the transfemoral cohort and 2.4% for the

transapical cohort. To further evaluate the impact of vascular complications on survival, 30-day mortality was stratified by the occurrence of major vascular complications for each approach (Figure 4). Six of the 49 transfemoral patients (12.2%) who experienced a major vascular complication died, whereas 23 of the 414 transfemoral patients (5.6%) without a major vascular complication died ( $P=0.108$ ). In the transapical cohort, the mortality rate in patients who experienced a major vascular complication was 50% (7 of 14), whereas the mortality rate in patients who did not experience a major vascular complication was 9.3% (52 of 561;  $P<0.001$ ).

### Discussion

Surgical AVR has been the only effective treatment of severe aortic stenosis with symptoms. However, there remains a group of patients who carry a very high risk for conventional surgery. Alternative therapeutic options for these patients are limited. Balloon aortic valvuloplasty has been studied for the treatment of calcific aortic stenosis in patients with severe coronary artery disease, reduced left ventricular function, or significant medical



**Figure 3.** Kaplan–Meier curves of all-cause mortality for each cohort stratified by vascular complications (no vascular complication vs all vascular complications). A, Transfemoral approach ( $P=0.347$ ). B, Transapical approach ( $P<0.001$ ).

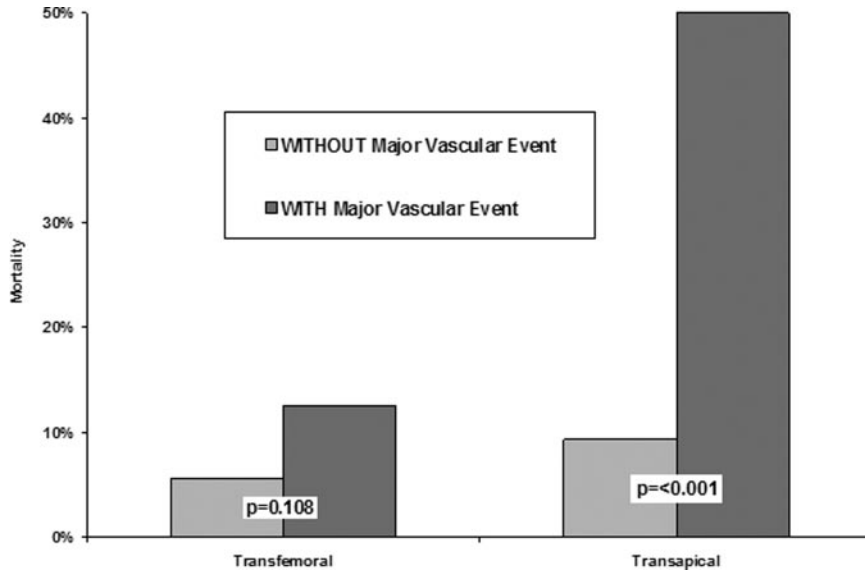
comorbidities. When applied in this setting, balloon aortic valvuloplasty results in a temporary improvement in valvular function and relief of symptoms as a result of a small increase in aortic valve area. Balloon aortic valvuloplasty has high rates of procedure-related complications and mortality.<sup>15</sup>

TAVI was introduced into clinical practice in 2002,<sup>11</sup> and commercial use with the Edwards SAPIEN valve began in November 2007. The SOURCE Registry provides the first results after commercialization of this device and reflects real-world experience supported by the current training program. Any registry, however, is only as good and credible as the quality of its data. In an effort to obtain robust data, we included only centers that were able to supply data on 100% of consecutive patients. The resulting cohort 1 consists of 32 centers with 1038 patients and is currently the largest group of consecutive TAVI patients to be reported. Of the 1038 patients, 575 were implanted transapically and 463 transfemorally, resulting in a 55%/45% split. Nine centers had a heavy majority of transapical over transfemoral cases, and 2

centers had a heavy majority of transfemoral compared with transapical cases. These centers represented 41% of transapical cases and 12% of transfemoral cases.

Baseline and demographic data revealed that transapical patients are significantly different from transfemoral patients. Transapical patients are higher-risk individuals because of the selection bias associated with the delivery approach. These differences in patient selection, resulting in a higher incidence of multiple comorbidities in the transapical group compared with the transfemoral group, are displayed in Table 1. The resultant logistic EuroSCORE was 29.1% in the transapical group compared with 25.7 in the transfemoral group ( $P<0.001$ ). This is consistent with other series in which the risk profiles of these groups were compared.<sup>16</sup> Therefore, the outcome and procedural parameters of nonrandomized transfemoral and transapical patients were not compared directly in this study.

The high rate of short-term procedural success (93.8%) indicates that technical proficiency of this novel and complex



**Figure 4.** Mortality rates stratified by the occurrence of major vascular complications and implantation approach.

technique can be safely introduced with the provided training and proctoring. The implantation success of the Edwards SAPIEN valve is further demonstrated by the low incidence of valve embolization (0.3%) and coronary obstruction (0.6%). It needs to be emphasized that these results were achieved despite the fact that >70% of institutions in this registry had just started their local TAVI experience and >55% of patients in this registry were treated at these institutions.

Overall mortality at 30 days was low in these high-risk patients at 8.5% with an overall expected mortality according to the logistic EuroSCORE of 27.6%. Although it is difficult to compare the outcome of the SOURCE Registry with pioneering series, it is impressive that despite the fact that many patients included in SOURCE underwent the first procedures performed at a particular center, results compare well with previously published series produced by experienced TAVI centers, ie, 30-day mortality rates of 8% to 17.5%.<sup>12,13</sup> A more recent report from Webb et al<sup>17</sup> demonstrated an improvement in mortality to <4% in the transfemoral cohort. The trend of the SOURCE data versus earlier published series is consistent with this recent report and suggests that the learning curve can be diminished if not eliminated.

Five (3 transfemoral, 2 transapical) of the patient deaths (5.8%) were reported as unexplained or sudden. There are 3 potential explanations for these deaths. One possibility is a sudden bradycardia or tachycardia with hemodynamic instability. A second possibility, given this relatively sick and elderly population, might be deaths of a noncardiac nature. Finally, although highly unlikely because there has never been such a report, the deaths could be valve related, ie, sudden valve thrombosis or catastrophic failure with severe aortic regurgitation.

Transfemoral patients had a lower 30-day mortality of 6.3% compared with 10.3% in the transapical patients. The reason for this difference is unclear, but we believe that the difference in mortality between the 2 approaches is partially explained by the different risk profiles of the patients. It is unknown what the 30-day mortality would be if the same patient groups had open AVR, although it is widely consid-

ered that the logistic EuroSCORE overestimates risk in high-risk patient populations after traditional AVR.<sup>18,19</sup>

The relation between 30-day mortality and logistic EuroSCORE revealed that the C statistics were 0.612 for the transapical cohort and 0.641 for the transfemoral cohort. To put these C statistics into context, it should be noted that the C statistic was 0.759 in the validation set of the original EuroSCORE publication.<sup>20</sup> Although the logistic EuroSCORE has been criticized as a risk measure for TAVI, there is a relationship that should not be ignored.

The permanent pacemaker rate, 7%, is higher than that in previously published controlled investigations using the Edwards SAPIEN prosthesis.<sup>21</sup> However, it is similar to the rates reported for surgical AVR<sup>22</sup> but much lower than rates currently reported for other TAVI technologies.<sup>23,24</sup> The reasons for this are unclear but may relate to the fact that the Edwards SAPIEN valve is shorter than the CoreValve device and that there is continued pressure on the conduction system in the septum by the self-expanding CoreValve. However, it is also important to note that the recommendations for prolonged monitoring and prophylactic pacing in the presence of new conduction abnormalities may differ between the 2 devices. Finally, as previously mentioned, 5 patients in cohort 1 had a sudden or unexplained death at 5 days, and it is impossible to know whether any of these deaths could have been related to late heart block.

It has previously been suggested that the stroke rate for the transfemoral group may be higher than for the transapical group because of the passage of the 22F or 24F sheath around the aortic arch.<sup>25</sup> However, in cohort 1, stroke rates were similar for both groups (transapical, 2.6%; transfemoral, 2.4%) and comparable to those reported for conventional AVR<sup>6,26</sup> and other contemporary TAVI series.<sup>16,27</sup> One has to be careful when interpreting this lack of difference because of the different stroke risk profiles, particularly the incidence of carotid artery stenosis. Nevertheless, the low stroke rate in the transfemoral group compared with other series may also be a result of an optimized selection process for the procedure and may reflect the advantage of having the transapical approach

as an alternative available. Further studies are required to identify the exact cause and timing of strokes in both groups.

In previous reports of TAVI investigations, there has been an important association between vascular complications and 30-day mortality in the transfemoral patients.<sup>27a</sup> However, in cohort 1, this relationship was not observed, suggesting that the improved management of vascular complications by early detection and improved interventional treatment techniques has reduced 30-day mortality. In contrast, the presence of major vascular complications in the transapical group is a significant predictor of mortality ( $P < 0.001$ ). If lessons learned from these data and techniques are identified to manage these transapical complications, there may be further improvements in the outcomes of the transapical patients.

The future of this new technology remains unclear. Long-term robustness of the prosthesis is unknown. However, it is important to note that thus far there have been no reports of structural valve failure in patients up to 4 years after the procedure. It appears likely that there will be some movement toward a lower-risk patient population. However, this should be done extremely cautiously<sup>28</sup> and only with the cooperation of the surgical community. Doing so will guarantee that this movement is made by comparing the midterm data of the TAVI approach in terms of survival, paravalvular leakage, hemodynamic function, durability, and incidence of endocarditis.

The Placement of Aortic Transcatheter Valve Trial Edwards SAPIEN Transcatheter Heart Valve (PARTNER US) randomized trial has now completed enrollment. This trial will provide important data in determining appropriate treatments by comparing the TAVI procedure with medical therapy in a group of patients unsuitable for open surgery and with open surgery in a group of patients considered “high risk” for the standard procedure. It is also important that registries such as SOURCE continue to be conducted and that procedural and outcome data are carefully collected in both the short and long term with a high degree of rigor.

Until these data are available, we must use the clinical results of the SOURCE Registry, which will include 12-month results by the beginning of 2010. In previous TAVI reports, there has been a significant 12-month mortality.<sup>14,16,17</sup> Much of the late, post-30-day, mortality was due to noncardiac causes and was related to comorbidities. This finding suggests that patient selection continually needs to be refined to identify the appropriate patients who should undergo the TAVI procedure.

Finally, data are being collected for cohort 2 (patients in the subsequent year of commercialization from European centers). These data will allow comparison with benchmark cohort 1 data and will provide insight into the changing outcomes with the technique.

### Limitations of the SOURCE Registry

The SOURCE Registry is a clinical registry and contains limited functional assessment of the Edwards SAPIEN valve. In addition, although designed as a prospective registry, approximately half of the cohort 1 centers collected and reported data in a retrospective manner, largely as a result of administrative delays. All adverse events were self-reported by the participating centers; no adjudication of adverse events

via source documentation was assessed. However, review and adjudication of all serious adverse events and adverse events in the electronic database were performed by the principal investigators. Although acknowledging its limitations, we believe that endeavors such as the SOURCE Registry are vital to ensure the safe and successful clinical rollout of this revolutionary technology. According to the recent “call to arms,”<sup>29</sup> physicians must demand and commit to obtaining top-quality, complete, consecutively treated patient data to provide a solid foundation to guide future development and clinical decisions. We hope the SOURCE Registry is one of the first steps along this path.

### Conclusions

Cohort 1 of the SOURCE Registry is the largest consecutive patient TAVI registry reported to date. The results suggest that this new technology can be introduced safely into a real-world environment with acceptable 30-day results. Cohort 1 provides a consistent group of patients who can be followed up in the medium and long term to demonstrate the robustness of the procedure and the device. It also provides benchmark data against which future patient groups and newer devices may be measured.

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### Disclosures

Drs Thomas and Wendler are the principal investigators of the SOURCE Registry and consultants to Edwards Lifesciences Inc. The Herzzentrum in Leipzig (Dr Walther) is an official Edwards training center. Drs Lefèvre, Himbert, and Eggebrecht are Edwards proctors. Dr Lefèvre is a principal investigator of the PARTNER EU study. Dr Anderson is a paid biostatistical consultant to Edwards. The other authors report no conflicts.

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### CLINICAL PERSPECTIVE

The 30-day SAPIEN Aortic Bioprosthesis European Outcome (SOURCE) Registry results represent the most contemporary results that can be expected with the Edwards SAPIEN valve. These data give the interventional community a benchmark from which they can assess future patient cohorts and results. In addition, they allow physicians performing this procedure to accurately refer these high-risk aortic valve patients for the transcatheter aortic valve implantation procedure. Thirty-day mortality was 8.5% overall, 6.3% for the transfemoral approach, and 10.3% for the transapical approach. The transapical patients were a higher-risk cohort; the logistic EuroSCORE was 29.1% in the transapical group and 25.7% in the transfemoral group. The stroke rate was 2.5%. The requirement for permanent pacemaker was 7%. The major vascular complication rate was 10.6% for the transfemoral approach, but unlike previous studies, this was not associated with an increased mortality. However, a major vascular complication of the transapical approach did result in increased mortality. Any future change in the technology or procedure will be able to be assessed against these results of a consecutive group of patients undergoing the procedure in centers with surgeons experienced in or new to the procedure.



**Thirty-Day Results of the SAPIEN Aortic Bioprosthesis European Outcome (SOURCE) Registry: A European Registry of Transcatheter Aortic Valve Implantation Using the Edwards SAPIEN Valve**

Martyn Thomas, Gerhard Schymik, Thomas Walther, Dominique Himbert, Thierry Lefèvre, Hendrik Treede, Holger Eggebrecht, Paolo Rubino, Iassen Michev, Rüdiger Lange, William N. Anderson and Olaf Wendler

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## SUPPLEMENTAL MATERIAL

### Appendix – Participating Investigators/Centres/Pt Numbers

<b>Site Name</b>	<b># of Patients</b>
<b>Karlsruhe/Städtisches Klinikum + Herzklinik</b> – G Schymik, H Schroefel	89
<b>Leipzig/Herzzentrum</b> – T Walther, G Schuler	87
<b>London/St Thomas’ + King’s</b> – M Thomas, O Wendler	75
<b>Paris/Bichat</b> – D Himbert, P Nataf	56
<b>Massy/Jacques Cartier</b> – T Lefèvre, M Romano	51
<b>Hamburg/University Heart Center</b> – H Treede, O Franzen	48
<b>Essen/Uniklinik</b> – H Eggebrecht, M Thielmann	47
<b>Mercogliano/Clinica Montevergine</b> – P Rubino, G Sorrosgo	47
<b>Milan/San Raffaele</b> – I Michev, F Maisano	41
<b>Munich/Deutsches Herzzentrum</b> – R Lange	41
<b>Athens/Onassis</b> – K Spargias, G Stavridis	36
<b>Milan/Monzino</b> – P Bigliogli, M Fusari	35
<b>Paris/HEGP</b> – D Blanchard, JN Fabiani	34
<b>Aarhus/Skejby</b> – HR Andersen, KE Klaaborg	34
<b>Zurich/Klinik im Park+Hirslanden</b> – W Amann, F Bernet	34
<b>Rouen/CHU</b> – H Eltchaninoff, JP Bessou	31
<b>Madrid/San Carlos</b> – C Macaya, E Rodriguez	31
<b>Bern/Inselspital</b> – P Wenaweser, T Carrel	31
<b>Münster/Uniklinik</b> – H Baumgartner, H Reinecke	30
<b>Jena/Uniklinik</b> – K Hekmat, M Ferrari	26
<b>Lund/Universitetssjukhuset</b> – G Olivecrona, P Johnsson	23
<b>Bruxelles/St Luc</b> – P Astarci, J Kefer	21
<b>San Sebastian/Gipuzkoa</b> – J Goiti, M Larman	20
<b>Leuven/Gasthuisberg</b> – C Dubois, P Herijgers	17
<b>Frankfurt/Uniklinik</b> – V Schächinger, M Doss	15
<b>London/Brompton</b> – M Mullen, N Moat	12
<b>Innsbruck/Uniklinik</b> – L Mueller, T Bartel	10
<b>Lübeck/Uniklinik</b> – ED Kraatz, H Sier	8
<b>Cambridge/Papworth</b> – C Densem, P Calvert	8