

Prosthetic valve endocarditis after surgical and transcatheter aortic valve replacement: infrequent, but poor outcome



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Transcatheter aortic valve implantation (TAVI) has become an accepted alternative to surgical aortic valve replacement (SAVR). TAVI has been carefully evaluated in head-to-head comparisons in the PARTNER studies, with the most recent PARTNER 3 study (1,000 patients) showing that TAVI was superior to SAVR in preventing death, stroke and repeat hospitalisation at one-year follow-up¹. Similarly, the EVOLUT Low Risk trial (1,403 patients) showed no difference in two-year outcomes (mortality, stroke) between SAVR and TAVI². More importantly, in both trials, the one-year/two-year event rates were extremely low.

In addition to these “traditional events”, other events include development of valve thrombosis and endocarditis. Recent studies have highlighted an increased TAVI (and, to a lesser extent, SAVR) thrombosis rate, ranging from 10% to 15% when computed tomography (CT) was used³. The definition of thrombosis was either thickened leaflets or reduced mobility of the leaflets. Valve thrombosis on CT, however, appears a subclinical finding, since these patients rarely show an increased gradient over the valve³.

The development of infective endocarditis after SAVR or TAVI is rare, with an estimated incidence varying between 0.1% and 2.3%, not different between SAVR and TAVI. Three larger studies have specifically reported on prosthetic valve endocarditis (PVE); the details of these studies are summarised in **Supplementary Table 1**⁴⁻⁷.

Amat-Santos and colleagues⁴ set up a large multicentre registry, including 21 centres in North America, South America, and Europe over a time period between 2007 and 2014. The diagnosis of PVE was based on the modified Duke criteria, or the findings during surgery. Out of 7,981 patients undergoing TAVI, 53 developed PVE over a mean follow-up of 1.1±1.2 years, yielding an incidence of 0.67%, with 0.50% in the first year after TAVI. The authors reported that the most frequent causal microorganisms were coagulase-negative staphylococci (24%), *Staphylococcus aureus* (21%) and enterococci (21%). In 77% of the patients with PVE, vegetations were noted on the transcatheter aortic valve – on the TAVI leaflets (39%), on the stent frame (17%) and on the mitral valve (21%). Complications of the PVE occurred in 87% of

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patients - heart failure (67.9%), acute kidney injury (54.7%), septic shock (20.8%), stroke (7.5%), systemic embolism (9.4%) and persistent infection (28.3%). Valve intervention was rare (11%), and the in-hospital mortality was 47.2%, with 66% one-year mortality, related to heart failure and septic shock.

Regueiro and colleagues⁷ reported on the TAVI international registry, which included 20,006 patients undergoing TAVI from 47 centres in Europe, North America, and South America during the period between 2005 and 2015. PVE occurred in 250 patients, with an incidence of 1.1% per person-years. The median time between TAVI implantation and symptoms was 5.3 months. Early PVE was diagnosed in 178 patients (71.2%), with an incidence of 0.9% (and included 72 patients [28.8%] diagnosed within two months of TAVI). Risk factors for developing PVE were younger age, male gender, diabetes and newly diagnosed moderate to severe aortic regurgitation. The authors reported that the most frequent causal microorganisms were enterococci species (24.6%) and *Staphylococcus aureus* (23.3%). The in-hospital mortality rate was 36%, and surgery was performed in 14.8%. The in-hospital mortality was related to higher logistic EuroSCORE, heart failure and acute kidney injury. The two-year mortality rate was 67%. In this study, the specific findings on echocardiography are highlighted - vegetations in 67%, either anchored to the stent frame or the leaflets of the transcatheter valve. Newly diagnosed mitral or aortic regurgitation was noted in 13.9% and 9.8%, respectively. Periannular complications included abscess, fistula or pseudoaneurysms in 18%.

Butt and co-workers⁵ used the Danish nationwide registries and included all patients undergoing TAVI (2,632 patients) and isolated SAVR (3,777 patients) during the period between 2008 and 2016, without previous infective endocarditis, and alive at discharge. During a mean follow-up of 3.6 years, 115 patients (4.4%) with TAVI and 186 patients (4.9%) with SAVR were admitted with PVE. The median time from TAVI/SAVR to hospitalisation with PVE was 352 days for TAVI (with a reported 25th to 75th percentile of 133 to 778 days) versus 625 days for SAVR (with a reported 25th to 75th percentile of 209 to 1,385 days). The authors reported an incidence of PVE of 1.6 per 100 person-years for TAVI, and 1.2 per 100 person-years for SAVR. The factors associated with greater risk of PVE in TAVI were male gender and chronic kidney disease, versus male gender and diabetes in SAVR. The cumulative one-year risk of PVE was not different in TAVI (2.3%) versus SAVR (1.8%); the cumulative five-year risks were also similar for TAVI (5.8%) and SAVR (5.1%).

In the current issue of EuroIntervention, Moriyama and co-workers⁶ report on a comparison between SAVR and TAVI for the development of PVE.

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The source of the data is the FinnValve registry, a nationwide registry which includes retrospective data from consecutive and unselected patients who underwent TAVI or SAVR (bioprosthesis

only) between January 2008 and October 2017 in any of the five university hospitals in Finland. In total, 6,463 consecutive patients were included, with 4,333 patients undergoing SAVR and 2,130 patients undergoing TAVI. The diagnosis of PVE was based on the modified Duke criteria. The incidence of PVE was 2.9/1,000 person-years in SAVR, and 3.4/1,000 person-years in TAVI, which was not significantly different. In total, 68 patients developed PVE, most frequently related to staphylococci (38.2%) as the causal microorganisms. On multivariate analysis, patients with PVE more often were male, had deep sternal wound infection, or active malignancy. On multivariate analysis, male gender and deep sternal wound infection remained significant. In-hospital death occurred in 19 patients (27.9%). Surgical treatment for PVE was the only independent predictor of in-hospital death. The mortality rate after PVE was 37.7% at one month, and 52.5% at 12 months.

All four of these studies confirm the low prevalence of PVE after TAVI⁴⁻⁷, which is comparable to SAVR. However, if PVE occurs, the mortality is high. Enterococci and staphylococci are the predominant causal organisms. Treatment with surgery or antibiotics is poor, with high mortality rates secondary to heart failure and acute kidney injury. It remains difficult to diagnose the patients, since the presentation is often aspecific and the echocardiographic findings are diverse. A relatively new diagnostic tool could be the use of fusion imaging with positron emission tomography-computed tomography (PET-CT): this technique permits anatomical assessment with CT (and anatomical co-registration) and particularly the assessment of inflammation with PET and F18-fluorodeoxyglucose⁸. The inclusion of PET-CT for diagnosis of endocarditis after SAVR is already included in recent European Society of Cardiology guidelines⁹, and may be expanded to use in patients with suspected PVE after TAVI.

Conflict of interest statement

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References

The complete list of references can be found in the online version of this paper.

Supplementary data

Supplementary Table 1. Registries reporting the incidence and outcomes of infective endocarditis after transcatheter aortic valve implantation.

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Supplementary data

Table 1. Registries reporting the incidence and outcomes of infective endocarditis after transcatheter aortic valve implantation.

Study	No. total population	No IE	Type AVR	Type of prosthesis	Year of intervention	Follow-up (years)	Main results
Amat-Santos et al [4]	7,944	53	TAVI	19 SE / 34 BE	2007-2014	1.1±1.2	<ul style="list-style-type: none"> • 0.5% incidence of IE at 1 year • Staphylococci and enterococci were the most common agents • Vegetations seen in 77% vs 15% abscess • 47.2% in-hospital death and 66% at 1 year
Regueiro et al [7]	20,006	250	TAVI	119 SE / 131 BE	2005-2015	2	<ul style="list-style-type: none"> • 1.1% incidence of IE at 1 year • Staphylococci and enterococci were the most common agents • Vegetations seen in 67% vs 18% periannular complication • 36% in-hospital mortality and 67% at 2 years
Butt et al [5]	6,409	301	TAVI/SAVR	115 TAVI 186 SAVR	2008-2016	3.7	<ul style="list-style-type: none"> • Crude incidence rate for TAVI was 0.016% person-year and for SAVR 0.012% person-year • TAVI was not associated with a statistically significant different risk of IE compared with SAVR (hazard ratio: 1.12; 95% CI: 0.84 to 1.49)
Moriyama et al [6]	6,643	68	TAVI/SAVR	15 TAVI 53 SAVR	2008-2017	3.5±2.6	<ul style="list-style-type: none"> • The incidence of IE after TAVI was 3.4/1,000 patient-years and after SAVR 2.9/1,000 patient-years

- Staphylococci and enterococci were the most common agents
- Vegetations were seen in 40% in TAVI vs 64% in SAVR whereas abscess was not seen in TAVI and in 32% in SAVR
- In-hospital death was 20% in TAVI and 32% in SAVR

BE: balloon-expandable; CI: confidence interval; IE: infective endocarditis; No.: number; SAVR: surgical aortic valve replacement; SE: self-expanding; TAVI: transcatheter aortic valve implantation

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