



# Transcatheter Aortic Valve Replacement With Different Valve Types in Elliptic Aortic Annuli

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**Background:** The aim of this study was to determine the influence of an elliptic annulus on acute device success rates following self-expanding (SE) transcatheter aortic valve replacement (TAVR) vs. balloon-expandable (BE) TAVR.

**Methods and Results:** Outcomes were assessed using Valve Academic Research Consortium-2 definitions. Aortic annulus ratio (AAR) was measured as short axis diameter/long axis diameter. Mean AAR was  $0.81 \pm 0.06$ . Patients were therefore divided into 2 groups:  $AAR < 0.82$  and  $AAR \geq 0.82$ . For circular annuli ( $AAR \geq 0.82$ ; 363 patients), high device success rates were achieved in both valve groups (SE valve, 90.5% vs. BE valve, 95.0%,  $P=0.14$ ). Conversely, for  $AAR < 0.82$  (374 patients), SE valves had lower device success rates than BE valves (82.5% vs. 95.3%,  $P=0.002$ ). For elliptic annuli, SE-TAVR was an independent predictor of unsuccessful device implantation (OR, 6.34,  $P<0.001$ ). Nonetheless, increased oversizing of SE valves for elliptic annuli was associated with an exponential rise in device success (threshold  $\geq 17.5\%$ ; area under the curve, 0.83) but not for BE-TAVR. Furthermore, optimally oversized SE valves and BE valves had a similarly high device success for elliptic annuli (SE valve, 96.2% vs. BE valve, 95.3%).

**Conclusions:** For circular annuli, similarly high device success was achieved for the 2 valve types. Conversely, for elliptic annuli, SE valves had a lower device success than BE valves. Device success following optimal oversizing of SE valves, however, was similar to that for BE valves.

**Key Words:** Device success; Elliptic annulus; Transcatheter aortic valve implantation; Transcatheter aortic valve replacement

Transcatheter aortic valve replacement (TAVR) is a well-established alternative to surgical aortic valve replacement for high-risk patients with aortic valve stenosis.<sup>1–3</sup> Historically, the transcatheter heart valve has been developed with balloon-expandable (BE) or self-expanding (SE) systems. The CHOICE study demonstrated that the use of BE valve resulted in a greater rate of device success than the use of SE valves.<sup>4</sup> Except for differences in valve design, device success depends on the anatomy of the aortic root (i.e., calcification of aortic-valvular complex, angulation of the aorta) or procedural technique (i.e., degree of oversizing, implantation depth).<sup>5–8</sup> Aortic annulus dimension measurements using 3-D cross-sectional imaging modalities reduces procedural complications.<sup>9</sup> Although the transcatheter heart valves are designed to expand circularly, the native aortic annulus is often oval in shape.<sup>9</sup> These different shapes give rise to gaps between the aortic annulus wall and the prosthesis frame. Device success is a well-defined outcome as a composite primary endpoint. Nevertheless, only a few studies have reported the frequency

of device success for both prostheses using the Valve Academic Research Consortium (VARC)-2 definitions.<sup>4,10</sup> Therefore, the interaction between the degree of non-circular annuli and device success is not well understood. The aim of this study was to determine the influence of elliptic annulus on acute device success rates following SE valve vs. BE valve implantation, and to evaluate pre-procedural predictors of acute device success for an elliptic annulus.

## Methods

### Subjects and Procedure

Between January 2013 and January 2016, a total of 796 consecutive patients with symptomatic severe aortic stenosis (aortic valve area  $< 1.0 \text{ cm}^2$ ) were treated with SE or BE valve at the present institution. These patients were prospectively included in the TAVR database. After excluding patients with previous bioprosthesis, aortic annulus measurements using diastolic phase, and patients with poor computed tomography (CT) quality, a total of 737 patients

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