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Review

Comparing TAVR and SAVR in the Treatment of Aortic Stenosis

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Abstract

Aortic stenosis (AS) is the most commonly treated valvulopathy worldwide, affecting more than 9.4 million patients. Surgical aortic valve replacement (SAVR) has long been the standard treatment for severe AS. As a less invasive approach that avoids open-heart surgery, transcatheter aortic valve replacement (TAVR) has rapidly gained popularity and is now a first-line treatment modality for many patients with AS. Multiple large prospective trials have demonstrated the non-inferiority of TAVR compared with SAVR with respect to survival and other key clinical endpoints. However, long-term data on valve durability and function after TAVR remain limited in select populations. This is particularly important for younger TAVR recipients, whose life expectancy may exceed the functional lifespan of the valve. Furthermore, the efficacy and safety of TAVR in certain patient subsets, such as those with bicuspid aortic valves (BAVs) or a small aortic annulus (SAA), remain uncertain. In contrast, SAVR continues to provide excellent outcomes across a broad range of valve anatomies. Additionally, surgical implantation of a mechanical valve or a pulmonary autograft via the Ross procedure remains an excellent option for appropriately selected younger surgical candidates. A surgical approach also allows for adjunct procedures, such as aortic annular enlargement, which can be particularly beneficial in patients with smaller aortic annuli. Overall, the data comparing SAVR and TAVR is extensive and continues to evolve. This manuscript aims to review the key studies and provide an overview of contemporary treatment options for AS.

Keywords: TAVR; SAVR; aortic valve replacement; aortic stenosis

1. Introduction

Affecting nearly 9.4 million people, aortic stenosis (AS) is the most common valvulopathy worldwide. In 2019, AS was responsible for more than 127,000 deaths globally and 1.8 million disability-adjusted life years lost [1,2]. Since its inception in the early 1960s, surgical aortic valve replacement (SAVR) has remained the touchstone treatment strategy for severe AS [3,4]. However, the advent of transcatheter technology has revolutionized the modern treatment paradigm. Since the first case in 2002, transcatheter aortic valve replacement (TAVR) has rapidly gained popularity and has become a primary treatment strategy [5]. Based on US Medicare Claims Data from 2012 to 2017, TAVR rates increased from 15.4 to 90.6 beneficiaries per 100,000 enrollees, while SAVR rates declined from 92.8 to 63.5 enrollees per 100,000 enrollees, with TAVR surpassing SAVR as the premier replacement strategy in 2017 [6]. Additionally, from 2012 to 2019, total aortic valve replacement volume increased by 60%, driven primarily by the increase of TAVR utilization [7]. During this time, a large body of evidence has been accumulated comparing outcomes of SAVR and TAVR in the treatment of various patient subsets. This article aims to review key studies on SAVR and TAVR in the modern-day treatment of AS.

2. Societal Guidelines & Recommendations

The 2020 American College of Cardiology/American Heart Association (ACC/AHA) guidelines provide several level 1 recommendations for choosing between SAVR and TAVR in certain populations. First, SAVR is recommended in patients with severe AS who are <65 years of age or who have a >20-year life expectancy. Next, for symptomatic patients ≥80 years old or for patients with a <10-year life expectancy, transfemoral TAVR is recommended in preference to SAVR. Between ages of 65 and 80 years, a shared decision-making approach is recommended. The same guidelines apply for asymptomatic patients <80 years old with severe AS and a left ventricular ejection fraction (LVEF) <50%. Additionally, for patients with asymptomatic AS with an abnormal exercise test, very severe AS, elevated B-type Natriuretic Peptide (BNP), and/or rapid disease progression, SAVR is recommended over TAVR. If a patient requires a bioprosthetic valve but does not have a suitable valve or vascular anatomy for TAVR, then SAVR is recommended. In contrast, if any symptomatic patient with severe AS demonstrates too high a surgical risk, TAVR is recommended over SAVR, provided the patient has a >12-month life expectancy with acceptable quality of life (QoL) (Table 1, Ref. [8]).

Likewise, the 2025 European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS) guidelines provide the following level 1 rec-

Table 1. 2020 ACC/AHA recommendations on AVR treatment modality [8].

Treatment	ACC/AHA recommendations	Class	Level
TAVR	Patients ≥80 years of age or younger if life expectancy <10 years with severe symptomatic aortic stenosis with no contraindication to TAVR	I	A
SAVR	Patients <65 years of age or >20-year life expectancy with severe symptomatic or asymptomatic aortic stenosis and any indication for aortic valve replacement	I	A
TAVR or SAVR	Patients 65 to 80 years of age with symptomatic severe aortic stenosis and no anatomic contraindication to transfemoral TAVR after shared decision-making about expected patient longevity vs valve durability	I	A
TAVR or SAVR	Patients <80 years of age with asymptomatic severe aortic stenosis and LVEF <50% without anatomic contraindications to transfemoral TAVR, the decision should follow the same 3 recommendations above for symptomatic patients	I	B
SAVR	Patients with asymptomatic severe aortic stenosis and an abnormal exercise test, very severe aortic stenosis, rapid progression, or elevated BNP	I	B
SAVR	Patients for whom bioprosthetic valve is preferred but anatomy or other factors are not suitable for transfemoral TAVR	I	A
TAVR	Patients with symptomatic severe aortic stenosis at any age and high surgical risk and predicted post-TAVR survival is >12 months with an acceptable quality of life	I	A
Palliative care	Patients with symptomatic severe aortic stenosis with post-SAVR or TAVR survival <12 months or without expected improvement in quality of life, palliative care is recommended after shared decision-making	I	C
Balloon valvuloplasty	Critically ill patients with severe aortic stenosis, percutaneous aortic balloon dilation may be considered as a bridge to SAVR or TAVR	IIb	C

ACC/AHA, American College of Cardiology/American Heart Association; AVR, aortic valve replacement; TAVR, transcatheter aortic valve replacement; SAVR, surgical aortic valve replacement; LVEF, left ventricular ejection fraction; BNP, B-type Natriuretic Peptide.

ommendations. First, the guidelines' age cutoff for SAVR versus TAVR has decreased from 75 to 70 years of age. SAVR is now recommended for patients <70 years old with low surgical risk (STS-PROM/EuroScore II <4%) and TAVR for patients ≥70 years old in high-risk patients (STS-PROM/EuroScore >8%). For intermediate risk patients, the type of intervention should be determined on an individual basis. Lastly, SAVR is recommended for patients with severe AS (I) who are undergoing cardiac surgery for other reasons as well as for patients with moderate disease (IIa) (Table 2, Ref. [9]).

3. Key Prospective Literature Comparing SAVR and TAVR

3.1 Non-Surgical Candidates

3.1.1 PARTNER 1B

The 2010 Placement of Aortic Transcatheter Valves (PARTNER) 1B trial compared the outcomes of transfemoral TAVR (n = 179) and standard medical therapy (n = 179) in patients of prohibitive surgical risk using a first-generation, balloon expandable (BE) SAPIEN device. Overall, TAVR recipients had lower all-cause mortality at 2-year (43.3% vs. 68%, $p < 0.001$) follow up [10,11]. Despite demonstrating decreased mortality with TAVR, absolute mortality with TAVR at 43% at 2 years follow-up, and further elevated for extremely high-risk patients. This indicated that a subset of inoperable patients would not benefit from intervention. This study also helped characterize the poor natural history of untreated severe AS.

3.1.2 CoreValve Extreme Risk Pivotal Trial

The 2014 CoreValve Clinical Investigators studied the CoreValve device, a self-expanding (SE), nitinol frame valve in patients with severe, symptomatic AS that were too high risk for surgery [12]. In this single-arm analysis, 489 patients were treated with TAVR (mean STS-PROM: 10.3%) and were compared to a pre-specified objective performance goal. TAVR demonstrated a lower composite all-cause mortality or major stroke rate at 1-year (TAVR: 26% vs. Goal: 43%). This trial demonstrated the safety and efficacy of SE TAVR devices in non-surgical candidates.

3.2 High Surgical Risk Patients

3.2.1 PARTNER 1A

In 2011, the PARTNER 1A trial compared the outcomes of SAVR (n = 351) and TAVR (n = 348; 244 transfemoral access, 104 transapical access) in high-risk patients. This trial demonstrated non-inferiority of TAVR in comparison to SAVR in a high-risk patient cohort. It also reiterated the favorable outcomes associated with SAVR (O:E: 0.68) [13]. On 2-year follow-up, TAVR and SAVR demonstrated similar rates of composite mortality and stroke (TAVR: 37.1% vs. SAVR: 36.4%, $p = 0.85$). TAVR recipients did demonstrate higher rates of major vascular injury (1-Year: $p < 0.001$), stroke (1-Year: $p = 0.07$),

Table 2. 2025 ESC/EACTS recommendations on AVR treatment modality [9].

Treatment	ESC/EACTS recommendations	Class	Level
TAVR	Patients ≥70 years of age with tricuspid aortic valve stenosis with suitable anatomy	I	A
SAVR	Patients <70 years of age with low surgical risk	I	B
TAVR or SAVR	Heart Team decision for all remaining candidates for a biologic aortic valve	I	B
Non-transfemoral TAVR	Consider for patients who are poor surgical candidates and have poor transfemoral access	IIa	B
TAVR	Consider for severe bicuspid valve aortic stenosis for patients with increased surgical risk and suitable anatomy	IIb	B
Balloon valvulo-plasty	Consider as bridge to SAVR or TAVR in hemodynamically unstable patients and in those with severe aortic stenosis who require urgent non-cardiac surgery	IIb	C
SAVR	Patients with symptomatic or asymptomatic severe aortic stenosis undergoing CABG or ascending aortic surgery	I	C
SAVR	Considered for patients with symptomatic or asymptomatic moderate aortic stenosis undergoing CABG or ascending aortic surgery	IIa	C
----	Aortic valve interventions should be performed at Heart Valve Centers that: - Report their local expertise and outcome data - Have on-site interventional cardiology and cardiac surgery - Have a collaborative Heart Team	I	C
----	Mode of intervention should be based on Heart Team consideration of: - Individual clinical, anatomical, and procedural characteristics - Lifetime management and life expectancy	I	A

ESC/EACTS, European Society of Cardiology/European Association for Cardio-Thoracic Surgery; CABG, Coronary Artery Bypass Graft.

and ≥moderate paravalvular regurgitation (PVL) (2-year: $p < 0.001$), which was associated with increased late mortality (HR: 2.11, $p < 0.001$) [14]. While this trial demonstrated similar outcomes from TAVR and SAVR therapy with first-generation TAVR devices, the results also revealed areas where TAVR technology required improvement.

3.2.2 U.S. CoreValve Pivotal High-Risk Trial

The 2014 CoreValve U.S. Pivotal High-Risk Trial compared the SE, CoreValve TAVR device (n = 394) with SAVR (n = 357) in high-risk surgical patients with severe AS. High-risk was defined as predicted 30-day mortality ≥15% and composite 30-day predicted morbidity and mortality ≤50%. At 1-year follow-up, TAVR demonstrated lower all-cause mortality ($p = 0.04$ for superiority) and major cardiovascular and cerebrovascular events (MACCE) ($p = 0.03$) compared to SAVR. TAVR also resulted in a higher major vascular complication ($p = 0.004$) and permanent pacemaker rate (PPM) ($p < 0.001$), reflecting the limitations of first-generation devices [15]. At 5-year follow-up, all-cause mortality was similar between groups (TAVR: 55.3% vs. SAVR: 55.4%, $p = 0.50$) [16]. Similar to the PARTNER 1A, the CoreValve study showed that BE TAVR is an alternative to SAVR in certain high-risk patients. The CoreValve trial did utilize a higher risk threshold for their study population when compared to the PARTNER 1A trial, which may have also affected outcomes.

3.3 Intermediate Risk

3.3.1 PARTNER 2A

The 2016 PARTNER 2A trial compared the effects of TAVR (n = 1011) and SAVR (n = 1021) in intermediate risk patients, defined by an STS-PROM between 4–8% or <4% with co-morbidities not covered in the STS risk model. The TAVR device used was the SAPIEN XT system, a 2nd-generation BE device. There was no difference between the TAVR and SAVR group in composite mortality or disabling stroke at 1-year ($p = 0.24$) [17]. After 5 years, rates of the composite endpoint remained similar between treatment groups (TAVR: 47.9% vs. SAVR: 43.4%, $p = 0.21$). However, on landmark analysis, TAVR demonstrated a higher incidence of the composite endpoint between 2 and 5 years. Additionally, recipients of TAVR had a higher rate of PVL ($p < 0.001$ at 30-day, 1-year, and 2-year follow-up) [18]. Cumulatively, these findings demonstrated non-inferiority of TAVR to SAVR in intermediate risk, AS patients, but also prompted further investigation into improving treatment longevity.

3.3.2 SURTAVI Trial

The 2017 Surgical Replacement and Transcatheter Aortic Valve Implantation (SURTAVI) Trial also compared TAVR (n = 864) to SAVR (n = 796) in patients with severe AS with an intermediate level of risk (mean STS PROM: 4.5%). The TAVR arm was composed of 84% SE CoreValve and 16% SE Evolut R devices. At 2-year follow-up, composite mortality and debilitating stroke rates

were similar between cohorts (TAVR: 12.6% vs. SAVR: 14%, 95% credible interval of difference (CID): –5.2–2.3%). However, TAVR patients had higher rates of residual PVL and PPM implantation, demonstrating the need for further innovation [19]. At 5 years, the composite endpoint remained similar between groups (TAVR: 31.3% vs. SAVR: 30.8%, $p = 0.85$). However, the re-intervention rate was higher in the TAVR group (3.5% vs. 1.9%, $p = 0.02$) [20]. Overall, the SUR-TAVI trial demonstrated the non-inferiority of SE TAVR devices to SAVR within intermediate risk patient groups spurring broader adoption of TAVR in the clinical setting.

3.4 Low Risk

3.4.1 PARTNER 3

The 2019 PARTNER 3 trial compared TAVR (n = 503) and SAVR (n = 497) in patients with severe AS and low surgical risk (STS PROM <4%). The transfemoral BE SAPIEN 3 TAVR device was used in this study. At 1-year follow-up, TAVR demonstrated a lower rate of the primary end point of all-cause mortality, stroke, or rehospitalization compared to SAVR (TAVR: 8.5% vs. SAVR: 15.1%, $p = 0.001$ for superiority), where the difference was mainly driven by increased re-hospitalization rates. Interestingly, the TAVR group also demonstrated lower stroke rates compared to SAVR (1.2% vs. 3.1%), surmounting a limitation with TAVR in older generation devices. On 7-year follow-up, TAVR was noninferior to SAVR in regard to the composite endpoint (TAVR: 22.8% vs. SAVR: 27.2%, $p = 0.07$) [21]. This trial showed improved outcomes with newer generation TAVR devices and extended the use of TAVR to elderly patients with low surgical risk.

3.4.2 Evolut Low Risk Trial

Next, the 2019 Evolut Low Risk trial compared TAVR (n = 734) with a supraannular, SE device to SAVR (n = 734) in patients with severe aortic stenosis and low surgical risk (mean STS PROM: 1.9%). After 5-years, TAVR demonstrated non-inferiority to SAVR in the primary endpoint of composite all-cause mortality or disabling stroke (TAVR: 15.5% vs. SAVR: 16.4%, $p = 0.47$) [22,23]. Similar to PARTNER 3, the TAVR group also demonstrated a lower stroke rate (2-Year: TAVR: 1.1% vs. 3.5%, $p = 0.03$). However, PPM rates remained elevated as seen in other SE devices. Regardless, Evolut Low Risk, together with PARTNER 3, helped extend the role of TAVR into elderly patients with low surgical risk.

3.4.3 NOTION 1

The NOTION (Nordic Aortic Valve Intervention) 1 Trial compared outcomes of first-generation CoreValve TAVR (n = 139) to SAVR (n = 135) for all randomizable patients regardless of surgical risk across three centers in Denmark and Sweden. Mean PROM score for the group was 3%. At 1-year follow-up, the composite endpoint of mortality, stroke, or MI was similar between treatment groups (TAVR: 16.1% vs. SAVR: 13.1%, $p = 0.43$) [24]. At 10-year follow-up, still no difference was shown between groups (composite end point: TAVR: 65.5% vs. SAVR: 65.5%, $p = 0.9$) [25].

3.4.4 DEDICATE-DZHK6 Trial

The DEDICATE-DZHK6 Trial, a multi-centered study from Germany, composed of 701 TAVR and 713 SAVR patients was the first non-industry sponsored, pragmatic, randomized trial comparing low to intermediate-surgical risk patients (median STS-PROM = 1.8%) undergoing TAVR versus SAVR in a real-world setting. Teams were allowed to use a TAVR device of their choice; 61.4% of TAVR recipients were treated with a BE device, while the remaining 35.1% were treated with a SE device. At 1-year follow-up, TAVR demonstrated non-inferior outcomes to SAVR with respect to the primary endpoint (all-cause mortality or stroke composite: TAVR: 5.4% vs. SAVR: 10.0%, HR = 0.53, 95% CI (0.35–0.79)) [26]. This trial added to the growing literature on TAVR versus SAVR in low-risk patients by reporting outcomes seen in the real-world setting.

3.4.5 UK TAVI

The 2022 UK TAVI Trial, compared TAVR (n = 458) and SAVR (n = 455) in low-risk patients (median STS-PROM: 2.6%) over 70 years of age at multiple centers across the United Kingdom. It reaffirmed the similarity of outcomes between treatment groups. This study was publicly funded and utilized a pragmatic design, leaving choice of the TAVR and SAVR device up to the discretion of the local heart team. At 30-days, all-cause mortality was low for both groups (TAVR: 1.8% vs. SAVR: 0.9%, $p = 0.33$). At 1-year follow-up, TAVR and SAVR demonstrated similar rates of all-cause mortality (SAVR: 4.6% vs. 6.6%, $p < 0.001$ for non-inferiority) [27]. Compared to the PARTNER 3 and EVOLUT Low Risk trials, this study demonstrated similar 30-day mortality, but elevated mortality rates at 1-year follow-up. This may reflect worse outcomes in real-world practice. However, longer-term follow-up is required before conclusions can be made.

3.5 Young Patients

NOTION 2

More recently, the 2024 NOTION 2 Trial compared the efficacy of TAVR (n = 187) and SAVR (n = 183) in younger, low risk patients (STS PROM: 1.1%, mean age: 71 years old). Additionally, this trial included both tricuspid and bicuspid valve anatomy patients. Treatment groups demonstrated similar outcomes on 1-year follow-up for the primary composite endpoint (all-cause mortality, stroke, or re-hospitalization: TAVR: 7.1% vs. SAVR: 3.1%, $p = 0.3$). While all-cause mortality was similar between groups ($p = 0.4$), TAVR recipients had a higher rate of non-disabling

stroke ($p = 0.03$). On sub-analysis of patients with bicuspid valves (n = 100), the risk of the primary endpoint was 14.3% in TAVR and 3.9% in the SAVR group ($p = 0.07$), resulting in a 10.4% absolute risk difference (ARD). This difference was much larger than what was observed in the tricuspid valve group ($p = 0.7$; ARD: 0.4%). Additionally, bicuspid valves demonstrated a three-fold higher risk of moderate or greater PVL compared to tricuspid valves after intervention (ARD 9.1%). While this trial is limited by sample size, the findings call for judicious management of young patients with bicuspid valves [28]. Hence, further study on the impact of valve morphology on TAVR outcomes is required.

3.6 Asymptomatic Aortic Stenosis

The efficacy of TAVR is also being explored in the treatment of severe AS in asymptomatic patients. Two smaller randomized trials demonstrated the efficacy of SAVR in the treatment of asymptomatic disease [29,30]. Due to the lower upfront risk profile associated with TAVR, a more aggressive stance on intervening on asymptomatic patients has been considered.

3.6.1 2025 EVOLVED Trial

The 2025 EVOLVED Trial, focusing on asymptomatic patients with severe AS and myocardial fibrosis, randomized 113 patients to early intervention (25% TAVR, 75% SAVR) and 111 patients to conservative management. At a median 42-month follow-up, the study found no difference in the composite endpoint of all-cause mortality or re-hospitalization when comparing recipients of early aortic valve replacement (AVR) to recipients of conservative management (Early AVR: 18% vs. Surveillance: 23%, $p = 0.44$) [31].

3.6.2 EARLY TAVR Trial

The 2024 EARLY TAVR trial randomized 901 low-risk patients (mean STS-PROM: 1.8%) with asymptomatic, aortic stenosis to early TAVR (n = 455) or clinical surveillance (n = 446). At 5-year follow-up, 35.1% of early TAVR patients and 51.2% of clinical surveillance patients met the primary endpoint of all-cause mortality, stroke, or rehospitalization ($p < 0.001$). This finding was mainly driven by the difference in rehospitalization between groups (TAVR: 26.3% vs. Surveillance: 46.7%). However, neither differences in all-cause mortality (TAVR: 13.4% vs. Surveillance: 13.6%) nor stroke rates (TAVR: 5.4% vs. Surveillance: 9.5%) reached statistical significance. Within the clinical surveillance group, 87% of patients were converted to aortic valve replacement during follow-up, with 26.2% of patients converted in the first 6 months. Of patients converted to AVR in the first 6-months, more than a third demonstrated new-onset symptomology prompting intervention [32]. These findings emphasize the unpredictable nature of aortic stenosis and the need for a more aggressive approach to asymptomatic disease. This stance is made even more appealing by the lower upfront risk of an endovascular approach (Table 3, Ref. [10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28]).

Up till this point, the prospective data accumulated on TAVR has demonstrated several key findings. First, while SAVR remains an effective procedure, TAVR has demonstrated non-inferiority to SAVR across all strata of surgical risk. TAVR also exhibits reduced early mortality compared to SAVR. Available long-term survival data shows comparable outcomes with each treatment modality. However, further study is required to address remaining challenges such as PVL, valve durability, and post-procedural pacemaker implantation. TAVR technology has rapidly advanced over the last decade. However, TAVR's popularity may have outpaced its rate of innovation, as younger patients are being considered for a transcatheter approach. Thus, further study is required on the role of TAVR in the lifetime management of aortic stenosis.

3.7 TAVR Registries- A Perspective on Real World Outcomes

Longitudinal data from various registries have also provided insight into TAVR outcomes. In the United States, the Society of Thoracic Surgery/American College of Cardiology Transcatheter Valve Therapy (STS/ACC-TVT) registry collects national outcomes of patients undergoing TAVR and provides a fresh perspective on how the role of TAVR has evolved. For example, from 2019 to 2022 the average STS-PROM for a TAVR recipient was 3.3%, decreasing from 3.7% in 2019 to 3% in 2022. This demonstrates how TAVR usage has been expanded to patients across all surgical risk strata [33]. The STS/ACC dataset has also been leveraged to create a clinically useful risk-calculator for TAVR candidacy [34]. Temporal trends can also be appreciated with the dataset. In 2025, the TVT registry reported that the risk-adjusted hazard of 1-year cardiac mortality (aHR: 0.95) and non-cardiac mortality (aHR: 0.92) decreased from 2012 to 2017, when TAVR usage expanded across broader risk strata. This may be attributable to improvements in TAVR technology and greater center experience with the procedure. However, from 2018 to 2022, the 1-year risk-adjustment hazard increased for both cardiac mortality (HR: 1.07) and non-cardiac mortality (1.22). This occurred despite a decrease in composite adverse events (11.9% to 9.2%) [33]. While the reason for this uptrend is unclear, it demonstrates the need for further surveillance, which the STS/ACC TVT Registry provides [35]. By tracking TAVR outcomes, the registry can also provide benchmarks for performance at TAVR centers nationwide to help optimize outcomes. In their 2021 report of 52,561 patients across 301 participating sites, the registry demonstrated that 11% of sites were not meeting expected peri-procedural performance metrics [36]. These insights allow practitioners to identify and workshop elements in their programs that re-

Table 3. Key trials comparing TAVR vs. SAVR across all risk strata.

Study	Population	Outcomes	Conclusion
	Non-surgical candidates with severe, symptomatic aortic stenosis		
2010 PARTNER 1B Trial: [10,11] Utilized First Generation SAPIEN heart valve system.	Randomized Controlled Trial: *Sample:* 21 sites total (17 sites in the United States). *Enrollment Period:* May 2007–March 2009 Transfemoral TAVR (n = 179) vs. Standard Therapy (n = 179) -150/179 of Standard Therapy patients received aortic valve balloon valvuloplasty.	*30-Day Mortality*: TAVR: 5% vs. Standard Therapy: 2.8% (p = 0.41). *1-Year Mortality:* TAVR: 30.7% vs. Standard Therapy: 50.7%, (p = 0.0001). *2-Year Mortality:* TAVR: 43.3% vs. 68%, (p < 0.001).	Standard therapy did not change the natural progression of aortic stenosis. A subset of patients deemed too high risk for surgery can benefit from TAVR.
2014 CoreValve Extreme Risk Study: [12] Utilized self-expanding, nitinol frame, First Generation CoreValve Device in patients of prohibitive surgical risk.	Single-Armed Prospective Study: *Sample:* 41 Centers Across the United States. *Enrollment Period:* February 2011–August 2012. Patients deemed too high risk for surgery (n = 489).	*30-Day Mortality*: 8.4%. *1-Year Mortality:* 24.3%.	Demonstrated safety and efficacy of the CoreValve device in inoperable patients.
	High-risk patients with severe, symptomatic aortic stenosis		
2011 PARTNER 1A Trial: [13,14] Utilized First Generation SAPIEN heart valve system.	Randomized Controlled Trial: *Sample:* 25 centers across the United States, Canada, and Germany. *Enrollment Period:* May 2007–August 2009 SAVR (n = 351) vs. TAVR (n = 348; 244 transfemoral access; 104 transapical access).	*30-Day Mortality:* TAVR: 3.4% vs. SAVR: 6.5%, (p = 0.07). *1-Year Mortality:* TAVR: 14.3% vs. SAVR: 13%, (p = 0.63). Sub-analysis for trans-femoral TAVR: 22.2% vs. 26.4%, (p = 0.25).	In the treatment of high surgical risk patients, TAVR was non-inferior to SAVR. SAVR was still a very safe treatment modality despite being performed in a high-risk group.
2014 CoreValve High Risk Study: [15,16] Utilized self-expanding, nitinol frame, First Generation CoreValve Device.	Randomized Controlled Trial: *Sample:* 45 Clinical Sites Across the United States. *Enrollment Period:* February 2011–September 2012 TAVR (n = 394) vs. SAVR: (n = 357).	*1-Year Mortality:* TAVR: 14.2% vs. SAVR: 19.1%, p = (0.04) for superiority. *5-Year Mortality:* TAVR: 55.3% vs. SAVR: 55.4%, (p = 0.50).	In high-risk patients, TAVR was non-inferior to SAVR in the treatment of symptomatic, severe aortic stenosis.
	Intermediate risk patients with severe, symptomatic aortic stenosis		
2016 PARTNER 2A Trial: [17,18] Utilized the 2nd Generation, SAPIEN XT system.	Randomized Controlled Trial: *Sample:* 57 Centers Across the United States and Canada. *Enrollment Period:* December 2011–November 2013 TAVR (n = 1011) vs. SAVR (n = 1021). -236/1011 TAVR patients underwent transthoracic valve deployment.	*30-Day Mortality & Stroke Composite:* TAVR: 6.1% vs. SAVR: 8%, (p = 0.11). *1-Year Mortality & Stroke Composite:* TAVR: 14.5% vs. SAVR: 16.4%, (p = 0.24). *2-Year Mortality & Stroke Composite:* TAVR: 19.3% vs. 21.1%, (p = 0.33). *Sub-analysis of transfemoral TAVR: 2-Year Mortality & Stroke Composite:* TAVR: 16.8% vs. SAVR: 20.4%, (p = 0.05). *5-Year Mortality & Stroke Composite:* TAVR: 47.9% vs. 43.4%, (p = 0.21).	Intermediate-risk patients with severe, symptomatic aortic stenosis randomized to SAVR or TAVR demonstrated similar outcomes with respect to death or disabling stroke.

Table 3. Continued.

Study	Population	Outcomes	Conclusion
2017 SURTAVI Trial: [19,20] Utilized the self-expanding CoreValve Bioprosthesis in 84% of patients and the Evolut R Bioprosthesis in 16% of patients.	Randomized Controlled Trial: *Sample:* 87 Centers Across the United States, Europe, and Canada. *Enrollment Period:* June 2012–June 2016 TAVR (n = 864) vs. SAVR (n = 796).	*30-Day Mortality & Stroke Composite:* TAVR: 2.8% vs. 3.9%, –2.8 to 0.7 95% Credible Interval. *1-Year Mortality & Stroke Composite:* TAVR: 8.1% vs. SAVR: 8.8%, –3.5 to 2.1 95% CI. *2-Year Mortality & Stroke Composite:* TAVR: 12.6% vs. SAVR: 14%, –5.2 to 2.3 95% CI. *5-Year Mortality & Stroke Composite:* TAVR: 31.3% vs. SAVR: 30.8%, (p = 0.85).	Intermediate-risk patients with severe, symptomatic aortic stenosis randomized to SAVR or TAVR demonstrated similar outcomes on short and mid-term follow-up.
Low-risk patients with severe, symptomatic aortic stenosis			
2019 PARTNER 3 Trial: [21] Utilized SAPIEN 3 TAVR device.	Randomized Controlled Trial: *Sample:* 71 sites across the United States, Canada, Australia, New Zealand, and Japan. *Enrollment Period:* March 2016–October 2017 TAVR (n = 503) vs. SAVR (n = 497).	*30-Day Mortality & Stroke Composite:* TAVR: 1% vs. SAVR: 3.3%, (p = 0.01). *1-Year Mortality, Stroke, & Re-Hospitalization Composite:* TAVR: 8.5% vs. 15.1%, (p = 0.001). *7-Year Mortality, Stroke, & Re-Hospitalization Composite:* TAVR: 34.6% vs. SAVR: 37.2%, 95% CI −9.0 to 3.7.	For low-risk patients with severe, symptomatic aortic stenosis TAVR demonstrated superior outcomes compared to SAVR with respect to the primary endpoint at 1-year follow-up. However, at 7-year follow-up, TAVR and SAVR demonstrated similar outcomes with respect to the primary endpoint.
2019 Evolut Low Risk Trial: [22,23] Utilized 1 of 3 self-expanding, supraannular bioprostheses (CoreValve, Evolut R, Evolut PRO).	Randomized Controlled Trial: *Sample:* 86 sites in Australia, Canada, France, Japan, the Netherlands, New Zealand, and the United States. *Enrollment Period:* March 2016–November 2018 TAVR (n = 734) vs. SAVR (n = 734).	*30-Day Mortality & Stroke Composite:* TAVR: 0.8% vs. 2.6%, 95% CI (–3.2 to –0.5). *1-Year Mortality & Stroke Composite:* TAVR: 2.9% vs. SAVR: 4.6%, 95% CI –1.8 (–4.0 to 0.4). *2-Year Mortality & Stroke Composite:* TAVR: 5.3% vs. SAVR: 6.7%, 95% CI (–1.4 (–4.9 to 2.1) (non-inferiority). *5-Year Mortality & Stroke Composite:* TAVR: 13.5% vs. SAVR: 16.4%, (p = 0.47).	For low-risk patients with severe symptomatic aortic stenosis, TAVR with a self-expanding, supra-annular valve was noninferior to SAVR at 2-year and 5-year follow-up with respect to the primary endpoint.
NOTION 1 Trial: [24,25] Utilized the first-generation CoreValve bioprosthesis.	Randomized Controlled Trial: *Sample:* Patients from Denmark or Sweden that met selection criteria. *Enrollment Period:* December 2009–April 2013 TAVR (n = 139) vs. SAVR (n = 135). Included patients with symptomatic severe aortic stenosis and asymptomatic severe aortic stenosis provided LV posterior wall thickness $\gtrsim$17 mm, decreasing LVEF, or new onset atrial fibrillation.	*1-Year Mortality, Stroke, & MI Composite:* TAVR: 16.1% vs. SAVR: 13.1%, (p = 0.43). *10-Year Mortality, Stroke, & MI Composite:* TAVR: 65.5% vs. SAVR: 65.5%, (p = 0.9).	For low-risk patients with severe aortic stenosis, TAVR and SAVR demonstrated similar outcomes with respect to the primary endpoint at all times of follow-up.

Table 3. Continued.

Study	Population	Outcomes	Conclusion
NOTION 2 Trial: [28] Choice of TAVR device or SAVR bioprosthesis was left to the discretion of the local Heart Team.	Randomized Controlled Trial: *Sample:* 9 Centers in Denmark, Norway, Sweden, Finland, and Iceland. *Enrollment Period:* June 2016–February 2023 TAVR (n = 187) vs. SAVR (n = 183). Included patients with bicuspid aortic valves (n = 100).	*1-Year Mortality, Stroke, & Re-hospitalization Composite:* TAVR: 10.2% vs. SAVR: 7.1%, (p = 0.3). *Sub-analysis for Tricuspid Leaflet Aortic Valve:* TAVR: 8.7% vs. SAVR: 8.3%. *Sub-analysis for Bicuspid Leaflet Aortic Valves:* TAVR: 14.3% vs. 3.9%.	Overall, for low-risk patients who were <75 years, outcomes were similar between SAVR and TAVR with respect to the primary endpoint. However, further investigation is required for outcomes in patients with bicuspid aortic valve disease.
DEDICATE-DZHK6 Trial: [26] Not industry-sponsored, practitioners used whatever TAVR device was at their disposal, which better reflects real-world outcomes. Balloon-expandable transcatheter heart valves were used in 61.4% (462/752) of patients, while self-expanding transcatheter heart valves were implanted in 35.1% (264/752).	Randomized Controlled Trial: Pragmatic Study *Sample:* 38 Participating Centers in Germany. *Enrollment Period:* May 2017–September 2022 TAVR (n = 701) vs. SAVR (n = 713).	*1-Year Mortality & Stroke Composite:* TAVR: 5.4% vs. SAVR: 10.0%, (p < 0.001). Data was collected during the Covid-19 Pandemic. Hence, mortality rates may be inflated.	At 1-year follow-up of low to intermediate-risk patients, TAVR was non-inferior to SAVR with respect to the primary endpoint.
2022 UK TAVI Trial: [27] TAVR device and procedural protocol was left to the discretion of local Heart Teams.	Pragmatic Randomized Controlled Trial: *Sample:* All National Health Service Hospitals performing TAVR in the UK. *Enrollment Period:* April 2014–April 2018 TAVR (n = 458) vs. SAVR (n = 455).	*30-Day Mortality:* TAVR: 1.8% vs. SAVR: 0.9%, (p = 0.33). *1-Year Mortality:* TAVR: 4.6% vs. SAVR: 6.6%, p = 0.23, p < 0.001 for non-inferiority.	Among moderate-risk patients with severe, symptomatic aortic stenosis, who are over the age of 70 years, TAVR was non-inferior to surgery with respect to all-cause mortality.

Table 3: Key prospective trials comparing TAVR and SAVR across all strata of surgical risk. PARTNER, Placement of Aortic Transcatheter Valves; SURTAVI, Surgical Replacement and Transcatheter Aortic Valve Implantation; NOTION, Nordic Aortic Valve Intervention.

quire improvement. Overall, the STS/ACC TVT Registry is a tool to track longitudinal outcomes as the role of TAVR evolves.

Similarly, other registries have accumulated longitudinal data in TAVR performance. Registries such as France-TAVI, UK-TAVI, WIN-TAVI, GULF-TAVI and others have led to data collection across various cohorts internationally [37,38,39,40]. In summary, registry data at the national and international level provide practitioners with insight into real-world trends in TAVR treatment.

3.8 Valve Function and Durability

TAVR candidacy is no longer determined by degree of surgical risk, but by the durability of the valve replacement in relation to patient's life expectancy and the anatomy of the valve. The current literature has demonstrated acceptable long-term TAVR valve durability in elderly patients [41,42,43,44]. However, these findings cannot be extrapolated to younger patients with longer life expectancy and higher activity levels.

Valve deterioration can greatly affect treatment longevity. When defined by rates of reintervention, newer generations of surgical valve prosthesis demonstrate low rates of structural valve degeneration on long-term follow-up, ranging from 2–10% at 10 years, 10–20% at 15 years, and 40% at 20 years [43,45,46].

In contrast, substantial long-term follow-up data on durability of transcatheter valves are still emerging. Mechanical differences between transcatheter and surgical valves may affect long-term performance. For example, valve crimping and loading into transcatheter delivery systems may impair leaflet mechanical properties and incite

tissue damage and sub-clinical thrombosis [47,48]. Furthermore, transcatheter valve deployment into an elliptical-shaped native aortic annulus in the presence of bulky calcifications can result in improper annulus-valve apposition and structural deformities [49]. This can lead to abnormal flow dynamics and shear stress, which all contribute to structural degeneration. Additionally, the practice of oversizing transcatheter valves, traditionally recommended to reduce risk of paravalvular leak, risks incomplete expansion of TAVR valves, resulting in leaflet pin wheeling and negative alterations to flow dynamics [50,51]. While these mechanical differences may theoretically affect valve performance, recently published 7-year follow-up data from the PARTNER 3 group showed similar valve failure rates of about 7% regardless of approach (95% CI 0.55–1.49) [21]. Hence, further analysis of the relation between valve structure, *in-vivo* hemodynamics, and long-term is required.

3.9 TAVR Valve Type

The choice between BE and SE valves has also been studied. The first randomized comparison was the 2014 CHOICE Trial from Germany, which compared outcomes of first-generation BE valves (n = 121) and SE valves (n = 120) in high-risk patients (STS-PROM: BE: 5.6% vs. SE: 6.2%) with severe AS. BE valves demonstrated higher device success than SE valves (BE: 95.9% vs. SE: 77.5%) [52,53]. After 5-years, there was no statistical difference between groups for mortality (BE: 53.4% vs. SE: 47.6%, p = 0.38), stroke (BE: 17.5% vs. SE: 16.5%, p = 0.73), or heart-failure related hospitalization (BE: 28.9% vs. SE: 22.5%, p = 0.75). However, rates of ≥moderate structural valve deterioration were higher in BE valves (p = 0.018) [54].

The 2020 SOLVE-TAVI Trial compared outcomes of second-generation BE (n = 218) and SE (n = 215) TAVR devices. At 30-day follow-up, the incidence of the primary composite endpoint was similar between treatment groups (mortality, stroke, prosthetic valve regurgitation, PPM implantation composite: BE: 26.1% vs. SE: 28.4%, p = 0.04 for equivalence) [55]. At 5-year follow-up, remained similar (BE: 63.4% vs. 67.7%, p = 0.34). However, stroke rates were lower with SE valves (SE: 2.2% vs. BE: 9.6%, p = 0.002) [56]. Patients experiencing stroke more often underwent pre-dilation and more often had a small annulus.

The 2024 SMART trial compared outcomes of BE (n = 361) and SE (n = 355) valves for symptomatic, severe AS in patients with a small annulus (≤430 mm^2). On 1-year follow-up, both valves demonstrated non-inferiority with respect to the composite endpoint (mortality, disabling stroke, or heart-failure rehospitalization: BE: 9.4% vs. SE: 10.6%, p < 0.001 for non-inferiority). However, BE valves demonstrated higher rates of bioprosthetic valve dysfunction compared to SE valves (BE: 41.6% vs. 9.4%, p < 0.001 for superiority). Similar differences were seen in mean gradient, mean EOA, hemodynamic structural valve dysfunction, and moderate or greater patient prosthesis mismatch (p < 0.001 for all) [57]. Hence, these findings suggest that TAVR candidates with a small annulus may benefit from SE valves over BE valves.

3.10 The Role of SAVR in the Modern Clinical Landscape

Despite the increasing popularity of transcatheter therapy for aortic valve disease, SAVR remains a safe and effective treatment option. Additionally, for certain patient subsets, it remains the gold-standard of care.

3.10.1 Surgical Aortic Replacement With Mechanical Prosthesis

As per the 2020 ACC/AHA guidelines, patients with severe AS under 50 years of age and without contraindication of anticoagulation should be considered for a mechanical valve over a bioprosthetic valve (Class IIa). For patients between 50–65 years of age, a shared decision should be made, considering the risk of repeat intervention with a bioprosthetic valve and the risk of life-long anticoagulation with a mechanical valve (Class IIa) [8]. The 2025 ESC/EACTS guidelines recommend a mechanical aortic valve for patients without contraindication to anti-coagulation who desire a mechanical valve, those with a long estimated expected life expectancy (Class IIa), those <60 years of age (Class IIa), and those already on anticoagulation for another mechanical valve (Class IIa), or other indication [9]. While specific valve type and age cut off may differ, many studies comparing mechanical and bioprosthetic valves have been conducted with outcomes for and against mechanical valve utilization [58,59,60,61,62,63,64,65,66,67]. Ultimately, for young patients wanting to avoid reoperation in the future, surgical implantation of a mechanical valve is an excellent treatment option.

3.10.2 The Ross Procedure

The Ross procedure, or surgical implantation of a pulmonary valve autograft, is also an excellent treatment choice for younger patients with AS [68,69,70]. The 2020 ACC Guidelines provide an IIb recommendation for Ross procedures at comprehensive valve centers for patients <50 years of age [8]. When implanted correctly, a pulmonary autograft provides excellent longevity due to its ability to adapt to left-heart hemodynamics [71,72]. Also, receipt of a Ross procedure avoids the need for long-term anticoagulation. Due to its technical complexity, the Ross procedure should be performed at high-volume valve centers.

Multiple studies have demonstrated long-term success with pulmonary autograft implantation. The original Pioneer series (131 cases from 1967 to 1984) reported <1% early mortality and 61% survival at 20 years [73]. Since then, 20-year survival rates as high as 93% have been reported [74,75]. These outcomes were markedly better compared to bioprosthetic valves in a younger demographic

[76,77]. When compared to mechanical valve replacement, the Ross procedure has also demonstrated relative improvements in quality of life, mortality, and valve durability [78,79,80]. Thus, the Ross procedure may provide the best option for select patients.

3.10.3 Aortic Stenosis Secondary to Bicuspid Aortic Valve Disease

AS secondary to bicuspid aortic valve (BAV) disease is another subset of patients who benefit from SAVR. BAV is the most common cardiac congenital malformation, occurring in up to 2% of the population [81]. Additionally, AS is the most common manifestation of BAV, associated with an incidence of up to 37% of patients [82]. Other presentations of BAV aortopathy include aortic valve regurgitation (AR) and aortic dilatation, aneurysmal degeneration, and/or coarctation. This further complicates treatment decision-making. The indications for aortic valve intervention for patients with BAV are the same as for patients with tricuspid aortic valves. However, the role of TAVR in BAV patients requires further study, as key TAVR trials excluded BAV patients from enrollment.

BAV patients present unique anatomic challenges. Presence of concomitant aortopathy may require up-front surgical treatment. Furthermore, increased valvular calcium with asymmetric distribution may prevent optimal TAVR valve-to-wall apposition. Larger valve orifice and non-tubular root anatomy in BAV disease may further complicate valve sizing as undersizing may result in PVL, while oversizing risks annular rupture. Other aspects such as presence of aortic regurgitation, bicuspid valve phenotype, and coronary anatomy should also be considered when considering TAVR candidacy. Lastly, since bicuspid disease is seen in a younger patient demographic, lifetime management of aortic valve disease should also be kept in perspective.

Early experiences suggest that recipients of TAVR with BAV had higher rates of PVL, device failure, annular rupture, and conversion to surgery [83,84]. However, this maybe attributed to usage of older generation TAVR devices. Registry data have demonstrated better outcomes in BAV patients with newer generation TAVR devices, but no definite conclusions can be made [84,85,86,87]. Comparison of TAVR with the SAPIEN 3 BE valve in bicuspid versus tricuspid aortic valves across the TVT registry from 2015 to 2018, demonstrated no difference in 30-day or 1-year mortality. Bicuspid valve demonstrated greater rates of stroke at 30-days ($p = 0.02$), but this difference was lost at 1-year follow up [85]. Newer generation self-expanding valves has also shown similar results [87]. Pooled analysis of the PARTNER 3 bicuspid registry and bicuspid continued access protocol showed no difference in 1-year composite of death, stroke, or cardiovascular rehospitalization in comparison to TAVR in tricuspid aortic valves [88]. However, 47% of submitted bicuspid valve patients were excluded from the study due to the study's anatomic exclusion criteria, demonstrating the effect of selection bias in these comparisons. Thus, while TAVR is feasible in select patients with bicuspid valves, its role remains uncertain until ample randomized data can be obtained.

3.10.4 Aortic Stenosis in the Setting of Small Annulus Size

AS in the presence of a small aortic annulus (SAA) represents another group where the role of transcatheter therapy requires further study. A smaller annulus size puts patients at a higher risk of patient-prosthesis mismatch and higher transvalvular gradients after valve replacement. Meta-analysis data has demonstrated that increased patient-prosthesis mismatch is associated with perioperative and long-term mortality risk [89,90]. Transcatheter valves can be oversized to mitigate the risk of patient-prosthesis mismatch. Post-hoc analysis of the PARTNER 1A trial showed that for patients with SAA, TAVR recipients demonstrated lower rates of PPM (TAVR: 19.7% vs. SAVR: 37.5%, $p = 0.05$) [91]. Furthermore, severe patient-prosthesis mismatch in the SAVR population was associated with reduced 2-year survival ($p = 0.041$) but not in the TAVR group ($p = 0.11$) [92]. Similarly, post-hoc analysis of the U.S. CoreValve Pivotal High-Risk trial demonstrated higher rates of severe patient-prosthesis mismatch in the SAVR recipients (SAVR: 25.7% vs. TAVR: 6.2%, $p < 0.001$). Additionally, no relation between annulus size and patient-prosthesis mismatch was demonstrated in recipients of TAVR patients ($p = 0.39$), while increasing patient-prosthesis mismatch rates was associated with decreasing annulus size in the SAVR population ($p = 0.01$). SAVR demonstrated higher rates of patient-prosthesis mismatch compared to the TAVR group for medium and small annular sizes (both $p < 0.001$) [93]. Cumulatively, these findings were attributed to appropriate valve sizing with computed tomography (CT) imaging guidance in the TAVR cohort and the serial under sizing of SAVR valves from dependence on manufacturer label valve measurements [94]. This difference was tested in the 2024 Valve in Small Annulus (VIVA) Trial, a small RCT comparing SAVR (n = 74) and TAVR (n = 77) in the treatment of severe AS and SAA (mean diameter <23 mm). Valve sizing was determined utilizing preoperative CT imaging in both groups. As expected, the study showed no difference in patient-prosthesis mismatch rates (SAVR: 10.3% vs. TAVR: 5.6%, $p = 0.30$) at 30-day follow-up [95]. These findings demonstrate that when valves are accurately sized, there is no difference in patient-prosthesis mismatch rates between TAVR and SAVR.

Lastly, surgical annulus enlargement is another important consideration when treating AS in the setting of small annulus size. The low incidence of annular enlargement in the available prospective literature does not reflect true real-world practice. While no prospective data exists, large retrospective series have demonstrated that added annular-enlargement reduces rates of moderate and severe patient-

prosthesis mismatch without increasing peri-operative mortality risk [96,97,98]. The Nicks and Manougian annular enlargement techniques can both provide 1–2 valve size increase and represent most of the available annular-enlargement literature. The recently developed Y-incision annular enlargement technique can provide greater valve upsizing [99]. While more data are required, preliminary findings suggest that the Y-incision technique can achieve even lower patient-prosthesis mismatch rates than self-expanding TAVR valve in small annuli [100]. Hence, the effects of surgical annular enlargement must be considered when deciding between transcatheter and surgical approaches to AS in SAA patients.

4. Lifetime Management of Aortic Stenosis

The right intervention for the treatment of AS considers not only the best intervention at present, but also what treatment options remain for the patient in the future. This is especially true for younger patients with AS, where patient life expectancy may be longer than durability of their valve. Based on analysis of the Vizient Trial Database (2015–2021), patients <65 years old have demonstrated that the largest relative increase in TAVR use [101]. Thus, long-term planning is vital for appropriate management.

A "SAVR-first" approach may be warranted in cases of unsuitable TAVR anatomy or in the presence of synchronous cardiac pathologies. A "SAVR-first" approach also allows for consideration of mechanical valve implantation. Lastly, with surgical implantation of a tissue valve, appropriate modifications to root anatomy can be made to support a transcatheter re-intervention in the future [102]. In a "TAVR-first" approach for younger patients, evaluation of root anatomy, coronary access, and patient prosthesis mismatch with subsequent intervention should be evaluated early on. For patients with favorable anatomy, redo TAVR can be done with similar procedural success to native-valve TAVR and TAVR-in-SAVR [103,104]. However, further study is warranted. Furthermore, for patients that are not candidates for repeat TAVR, surgical TAVR explant is required. Based on evaluation of the STS Database (2011–2021), TAVR-SAVR with TAVR explant was associated with higher mortality compared to SAVR-TAVR-SAVR with TAVR explant and SAVR-redo SAVR approaches (17% vs. 12% vs. 9%, $p < 0.001$) [105]. Thus, a "TAVR-first" approach may result in a higher risk of surgical explant in the future. Hence, risk appraisal should not be limited to index procedure but to the cumulative risk incurred across all procedures in a patient's lifetime [106]. Lifetime management of aortic valve disease should ultimately be individualized based on the goals and wishes of the patient. As more data accumulates, defined algorithms for treatment will arise.

5. Conclusion

The roles of TAVR and SAVR in the treatment of aortic stenosis will continue to change as technology advances and our understanding evolves. Based on data from prospective literature and large retrospective series, TAVR has demonstrated non-inferior outcomes compared to SAVR across all strata of surgical risk. For many patients TAVR has become the first-line, preferred approach by patients and heart teams. However, surgical valve replacement remains a safe and efficacious treatment modality for patients and is the first-line treatment modality for populations where TAVR's role is undefined. More long-term comparative data will provide clarity on what intervention is best for what patient. Currently, a collaborative decision-making model, which considers both patient preference and the latest evidence will result in the best care possible.

Author Contributions

RP, SR, MK, and GA made equally substantial contributions to review conceptualization and design. All authors were equally involved in data acquisition, analysis, and interpretation of data. All authors contributed to drafting and reviewing the final manuscript. All authors gave final approval to the manuscript and are accountable to all aspects of the work provided.

Ethics Approval and Consent to Participate

Not applicable.

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Conflicts of Interest

GA reports an advisory relationship with Edwards Lifesciences Corporation, Abbott, Medtronic, Anteris Technologies, W.L. Gore & Associates, and with Arthrex that includes consulting or advisory. RP, SR, and MK have no conflicts of interest to disclose.

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