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Original Research Article

Comparative Outcomes of Transcatheter vs Surgical Aortic Valve Replacement (TAVR vs SAVR)

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Abstract:

Background: AS is the most prevalent VHD in economically developed nations, according to the Euro Heart Survey on Valvular Disease. Its prevalence is rising as the population ages, and although aortic stenosis is present in about 40% of patients over 75, only 2% of these patients develop hemodynamically significant AS.

Objectives: Comparing the perioperative, intraoperative, and short-term clinical results of TAVR and SAVR among the participants with severe symptomatic AS was the goal of this study.

Materials and Methods: It was a retrospective, observational study. The study was carried out at a tertiary care centre. The study data that was retrieved was for one year. Data from 158 participants were retrieved for the study. The study comprised patients with severe symptomatic aortic stenosis who were 50 years of age or older, had been treated with either TAVR or SAVR during the study period, and had full clinical, surgical records.

Results: The mean age of patients undergoing TAVR was significantly higher with 78.6 ± 6.4 years compared with those in the SAVR group 69.2 ± 7.8 years, with a p-value of less than 0.01. Perioperative mortality was slightly lower in the TAVR group 03 (4.1%) in comparison to the SAVR group 06 (7.1%), p-value of 0.47.

Conclusion: According to the study's findings, individuals with severe symptomatic aortic stenosis had similar short-term survival results with TAVR and SAVR. Particularly for older and high-risk patients, TAVR is a safer and less intrusive option since it has been linked to noticeably shorter procedure times, shorter ICU and hospital stays, and fewer consequences such severe bleeding, acute renal injury, and wound infections.

Recommendations: Long-term follow-up studies are recommended to assess the durability of TAVR prostheses, and treatment decisions should be guided by a multidisciplinary heart team.

Keywords: Surgical aortic valve replacement, TARV, Aortic stenosis, SARV, Outcomes.

Introduction

It has been noted that among the reasons of mortality and morbidity due to diseases of cardiovascular, valvular heart disease (VHD) poses a serious risk to people's quality of life by increasing their risk of functional disability and shortening their life expectancy [1]. Aortic stenosis (AS) is the most prevalent VHD in economically developed nations, according to the Euro Heart Survey on Valvular Disease. Its prevalence is rising as the population ages, and although aortic stenosis is present in about 40% of patients over 75, only 2% of these patients develop hemodynamically significant AS [2, 3, 4].

According to the Global Burden of Disease study conducted in 2017, the number of DALYs has alarmingly grown by 101% for calcific aortic valve disease (CAVD). It has been observed that symptomatic AS that is severe among participants has been associated with prognosis poorly with survival rate of only three years [5, 6].

SAVR has been demonstrated to dramatically increase patient lifespan and quality of life, which is considered the most appropriate technique in treatment of AS [7]. SAVR involves removing a defective aortic valve surgically and replacing it with a mechanical or bioprosthetic valve. Even though SAVR has been the gold standard for many years, there are serious perioperative hazards associated with it, particularly for older patients who have a lot of comorbidities [8].

The less invasive TAVR was developed to address the limitations of SAVR, especially in high-risk and inoperable patients. By employing a catheter-based technique, TAVR eliminates the necessity for open cardiac surgery by allowing the insertion of a

replacement valve inside the damaged native valve [9].

By offering a feasible therapeutic option for patients who were previously thought to be unfit for surgery, TAVR has revolutionized the management of AS since its debut [10]. Among PARTNER studies, particularly PARTNER 2, were essential in determining both the efficacy along with safety among the TAVR patients. According to the key composite outcome of mortality from any cause or debilitating stroke at two years, TAVR was not less effective than SAVR, according to the PARTNER 2 trial [11].

Similar results were obtained from the DEDICATE trial, which examined the function of TAVR in a larger patient population, including individuals at moderate surgical risk [12].

Comparing the perioperative, intraoperative, and short-term clinical results of TAVR and SAVR among the participants with severe symptomatic AS was the goal of this study.

Methodology

Study Design: It was a retrospective, observational study.

Study Settings: The study was carried out at a tertiary care centre. The study data that was retrieved was for one year.

Study Population: Data of 158 participants were retrieved for the study. The study comprised patients with severe symptomatic aortic stenosis who were 50 years of age or older, had been underwent either TAVR or SAVR during the study period, and had full clinical, surgical, and follow-up records. Exclusion criteria included patients with active infective endocarditis, those who had previously had an aortic valve replacement, patients who were lost to follow-up within 30 days after the procedure, and patients undergoing concurrent cardiac surgery such as CABG or mitral valve replacement.

Data Collection: Patient demographic details including age, sex, baseline clinical parameters, like hypertension, diabetes mellitus, coronary artery disease, STS score, and intraoperative details, such as procedure time, type of valve implanted, blood transfusion requirement, conversion to open surgery, contrast volume were retrieved. Perioperative outcomes including mortality, stroke, major bleeding, acute kidney injury, need for implantation of pacemakers that are permanent, and length of ICU and hospital stay were recorded. Postoperative complications such as atrial fibrillation, wound infection, re-exploration for bleeding, respiratory complications, and vascular complications were also documented.

Study Procedure: The choice of valve type and size in TARV was based on pre-procedural imaging, including echocardiography and computed tomography. SAVR procedures were performed via median sternotomy under cardiopulmonary bypass, with either mechanical or bioprosthetic valve implantation, as decided by the surgical team after patient discussion.

Post-procedurally, all patients were managed in the intensive care unit (ICU) and received standard medical therapy according to institutional protocols. Patients were followed up during hospitalization and at 30 days post-procedure for assessment of mortality, complications, and clinical outcomes.

Statistical Analysis: SPSS version 26.0 was used for statistical analysis. Data were initially entered in Microsoft Excel. The data have been presented as either the number of participants (n) with percentages (%), or mean±SD.

The independent t-test was used for statistical analysis. Statistical significance was defined as a p-value of less than 0.05.

Results

The mean age of patients undergoing TAVR was significantly higher with 78.6 ± 6.4 years compared with those in the SAVR group 69.2 ± 7.8 years, with a p-value of less than 0.01. The prevalence of diabetes mellitus was nearly equal in both groups, affecting 31 (41.9%) in the TAVR group and 34 (40.5%) in the SAVR group, with a p-value of 0.87. The baseline characteristics of the individuals are shown in Table 1.

Table 1: Baseline Study Participant Characteristics

Parameter	TAVR (n=74)	SAVR (n=84)	p-value
Mean Age (years)	78.6 ± 6.4	69.2 ± 7.8	**<0.01**
Male (%)	42 (56.7%)	51 (60.7%)	0.62
Hypertension (%)	48 (64.8%)	45 (53.6%)	0.18
Diabetes Mellitus (%)	31 (41.9%)	34 (40.5%)	0.87
Coronary Artery Disease (%)	28 (37.8%)	26 (30.9%)	0.39
Mean STS Score (%)	6.8 ± 1.2	4.3 ± 1.5	**<0.05**

Of the 74 patients who participated in the TAVR group, the majority were between the ages of 70 and 79. Of these, 41 patients were between the ages of 60 and 69. The proportion of patients aged 50–59 and those aged ≥80 years was lower (10 and 16 cases, respectively). Likewise, the largest number of

participants (62 patients) in the SAVR group were in the 70–79 age group, with 46 patients in the 60–69 age group coming in second. The distribution of research participants by age group is displayed in Figure 1.

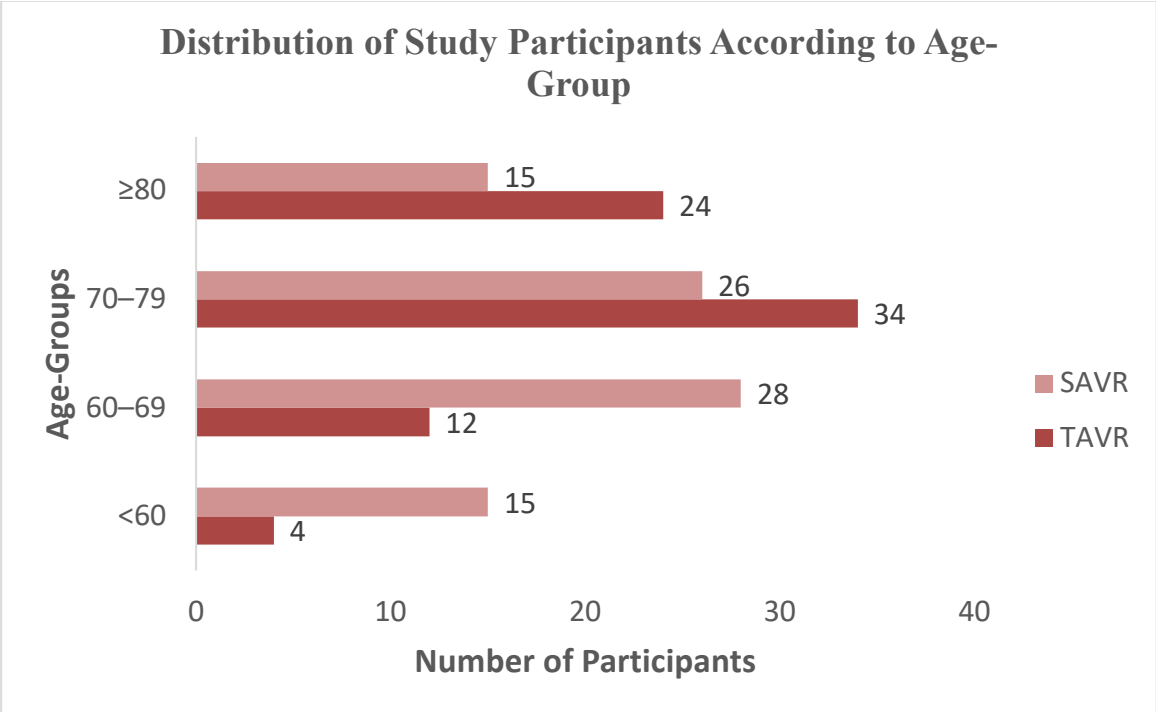

Figure 1: Distribution of Study Participants According to Age-Groups

In the TAVR group, the majority of participants were male, comprising 42 patients (56.7%), while 32 patients (43.3%) were female. Similarly, in the SAVR group, males were also predominant with 51 patients (60.7%), compared to 33 female patients (39.3%). The gender distribution of study participants is displayed in Figure 2.

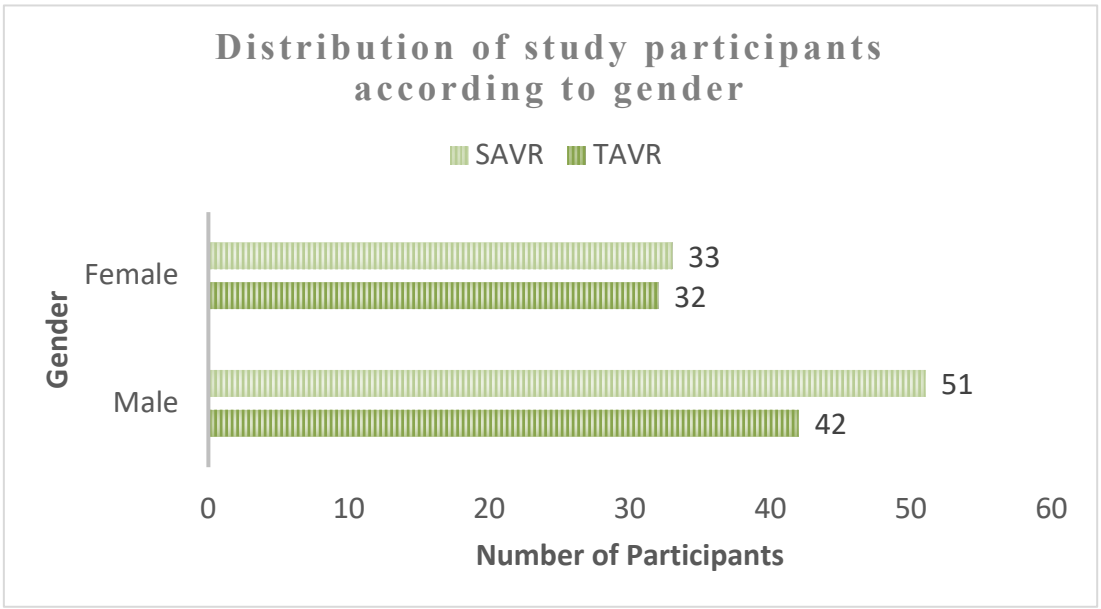

Figure 2: Gender Distribution of Study Participants

Perioperative mortality was slightly lower in the TAVR group 03 (4.1%) compared to the SAVR group 06 (7.1%), with a p-value of 0.47. Major bleeding was significantly less frequent in the TAVR group 05 (6.8%) compared to the SAVR group 16 (19.0%), with a p-value <0.05. Acute kidney injury also occurred less often in the TAVR group 04 (5.4%) than in the SAVR group 12

(14.3%), with statistical significance of p-value less than 0.05. Table 2 depicts perioperative and clinical outcomes among study participants.

Table 2: Perioperative and Clinical Outcomes among Study Participants

Outcome	TAVR (n=74)	SAVR (n=84)	p-value
Perioperative Mortality	03 (4.1%)	06 (7.1%)	0.47
Stroke	02 (2.7%)	03 (3.6%)	0.78
Major Bleeding	05 (6.8%)	16 (19.0%)	**<0.05**
Acute Kidney Injury	04 (5.4%)	12 (14.3%)	**<0.05**
New Permanent Pacemaker	09 (12.2%)	04 (4.8%)	**<0.05**
Length of ICU Stay (in days)	3.2 ± 1.1	6.7 ± 2.3	**<0.01**
Length of Hospital Stay (in days)	5.6 ± 1.8	10.2 ± 3.1	**<0.01**
30-day Survival	96%	93%	0.52

The mean procedure time was significantly lower in the TAVR group, 92 ± 24 minutes compared to the SAVR group, 162 ± 38 minutes, with a p-value of less than 0.01. Regarding prosthesis type, all patients in the TAVR group received bioprosthetic valves 74 (100%), while in the SAVR group, 68 (81.0%) received bioprosthetic valves and 16 (19.0%) received mechanical valves, a statistically significant difference of less than 0.01. Table 3 shows intraoperative outcomes among study participants.

Table 3: Intraoperative Outcomes among Study Participants

Parameter	TAVR (n=74)	SAVR (n=84)	p-value
Mean Procedure Time	92 ± 24	162 ± 38	**<0.01**
Contrast Volume	115 ± 25	-	-
Conversion to Open Surgery	1 (1.3%)	-	-
Blood Transfusion Required	7 (9.5%)	21 (25.0%)	**<0.05**
Valve Type- Bioprosthetic	74 (100%)	68 (81.0%)	**<0.01**
Valve Type- Mechanical	0 (0%)	16 (19.0%)	**<0.01**

Atrial fibrillation occurred more frequently after SAVR 17 (20.2%) compared to TAVR 08 (10.8%), which was not significant at p-value 0.09. Wound infections were significantly higher in the SAVR group (7.1%) compared with none in TAVR, with significant p-value of less than 0.05. Table 4 elaborates complications observed among study participants post-operatively.

Table 4: Complications observed among Study Participants Post-operatively

Complications	TAVR (n=74)	SAVR (n=84)	p-value
Atrial Fibrillation (%)	08 (10.8%)	17 (20.2%)	0.09
Wound Infection (%)	00 (0%)	06 (7.1%)	**<0.05**
Re-exploration for Bleeding (%)	02 (2.7%)	07 (8.3%)	0.14
Respiratory Complications (%)	03 (4.0%)	11 (13.1%)	**<0.05**
Vascular Complications (%)	06 (8.1%)	02 (2.4%)	0.12

Discussion

The only effective treatment for severe symptomatic AS is still aortic valve replacement, with both SAVR and TAVR being widely practiced. In our study, both interventions showed comparable short-term survival, consistent with findings from earlier randomized controlled trials. The PARTNER 1 trial demonstrated that TAVR was non-inferior to SAVR in terms of overall mortality among high-risk patients, establishing TAVR as a viable alternative in this population [13]. Similarly, the PARTNER 2 trial extended these results to intermediate-risk patients, showing equivalent mortality and disabling stroke rates [14].

In the cohort, TAVR was associated with shorter procedure duration, ICU stay, and overall hospitalization. This aligns with the findings of the CoreValve trial, which showed that TAVR reduces perioperative complications and accelerates recovery compared to SAVR [15]. TAVR also demonstrated lower rates of bleeding in the study, consistent with previous reports [16, 17]. These benefits can be particularly valuable for elderly patients with comorbidities who may not tolerate open-heart surgery.

However, it has been observed a higher requirement for permanent pacemaker implantation following TAVR, which has been consistently reported in the

literature [18]. The anatomical relationship between the aortic annulus and conduction pathways likely explains this complication. In contrast, SAVR allows for better long-term prosthesis durability, making it more suitable for younger patients who may require mechanical valves for extended survival benefit [19].

TAVR is typically more expensive up front than SAVR, according to studies by Baron et al. (2019b) and Galper et al. (2023). However, TAVR offers significant cost savings in other areas, such as hospitalization and physician fees. In both studies, TAVR's hospitalization and physician fees are significantly lower than SAVR's, indicating that even though TAVR has a greater upfront cost, these savings may balance out the entire financial burden. The total indexed admission costs, however, yield conflicting findings. Baron's analysis found that TAVR was somewhat less expensive than SAVR, whereas Galper's data showed that TAVR had higher overall costs [20, 21].

Overall, the results support the growing evidence that TAVR is an effective, less invasive alternative to SAVR, particularly for high- and intermediate-risk patients. Nonetheless, long-term durability data for TAVR devices remain limited, and SAVR continues to hold relevance in younger, low-risk populations. A heart team approach that integrates patient age, comorbidities, anatomical suitability, and life expectancy should guide decision-making.

Conclusion

According to the study's findings, individuals with severe symptomatic aortic stenosis had similar short-term survival results with TAVR and SAVR. Particularly for older and high-risk patients, TAVR is a safer and less intrusive option since it has been linked to noticeably shorter procedure times, shorter ICU and hospital stays, and fewer consequences such severe bleeding, acute renal injury, and wound infections. The increased prevalence of new permanent pacemaker implantation following TAVR, however, draws attention to a significant drawback. For younger, low-risk patients and those in need of mechanical prosthesis, SAVR is still a good choice.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations

Long-term follow-up studies are recommended to assess durability of TAVR prostheses, and treatment decisions should be guided by a multidisciplinary heart team.

List of Abbreviations

TAVR- Transcatheter Aortic Valve Replacement

SAVR- Surgical Aortic Valve Replacement

AS- Aortic Stenosis

VHD- Valvular Heart Disease

PARTNER- Placement of Aortic Transcatheter Valves

CAVD- Calcific aortic valve disease

ICU- Intensive Care Unit

AKI- Acute Kidney Injury

PPM- Permanent Pacemaker

STS- Society of Thoracic Surgeons

CAD- Coronary Artery Disease

CKD- Chronic Kidney Disease

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