

Echocardiographic Predictors of Elevated Gradients After Transcatheter Aortic Valve Replacement for Failing Bioprosthetic Aortic Valve Replacement

Robert L. Richmond DO, Daniel P. O'Hair MD, Daniel R. Harland MD, Tanvir K. Bajwa MD, Amanda Kirby NP, Tracy Hammonds PhD, Bijoy K. Khandheria MD, Renuka Jain MD
Aurora Health Care, Milwaukee, Wisconsin

BACKGROUND

• Valve-in-valve transcatheter aortic valve replacement (ViV TAVR) has emerged as a viable option for failing aortic bioprostheses (AVR)

• Mean gradient < 20 mmHg is considered a desirable result post procedure.

OBJECTIVES

- Evaluate the echocardiographic predictors and clinical outcomes of elevated mean gradient post ViV TAVR.
- Assess the clinical outcomes associated with elevated gradients post ViV TAVR

METHODS

• Retrospectively reviewed detailed clinical, fluoroscopic, and echocardiographic data of patients who underwent ViV TAVR at our institution.

• All analyses were performed using SAS 9.4. Descriptive statistics of mean and standard deviation were presented for continuous variables. Categorical variables were presented as percentage and frequency.

• Comparison testing to determine univariate differences between groups based on mean residual gradient was conducted. Student's Testing was used to compare continuous variables after ensuring that assumptions of normality were met. Chi-square analysis or Fisher's exact test (cell size ≤ 5) was used to compare categorical variables.

• A two-sided p-value of ≤ 0.05 was considered statistically significant.

Characteristic	Total Population Results (n=56)	Mean Residual Gradient Post-ViV TAVR			
		Gradient ≤ 20 n=34	Gradient > 20 n=22	p value	
Age	76.8 (10.6)	75.8 (11.5)	78.5 (9.1)	0.352	
Male	32 (57.1%)	20 (58.8%)	12 (54.5%)	0.752	
STS Score	9.6 (5.8, 42)	8.4 (4.3, 22)	11.0 (7.1, 20)	0.160	
CAD	44 (78.6%)	26 (76.5%)	18 (81.8%)	0.746	
PAD	20 (35.7%)	11 (32.4%)	9 (40.9%)	0.514	
CVA	10 (17.9%)	7 (20.6%)	3 (13.6%)	0.724	
COPD	21 (37.5%)	13 (38.2%)	8 (36.4%)	0.888	
DM	27 (48.2%)	15 (44.1%)	12 (54.5%)	0.446	
HTN	52 (92.9%)	31 (91.2%)	21 (95.5%)	0.940	
AVR size					
	19	3 (5.6%)	2 (6.3%)	1 (4.5%)	0.690
	21	13 (24.1%)	8 (25.0%)	5 (22.7%)	
	23	20 (37.0%)	10 (31.3%)	10 (45.5%)	
	25	12 (22.2%)	7 (21.9%)	5 (22.7%)	
	>27	6 (11.1%)	5 (15.6%)	1 (4.5%)	
Etiology of bioprosthetic failure					
	Stenosis	35 (62.5%)	19 (55.9%)	16 (72.7%)	0.194
	Regurgitation	12 (21.4%)	10 (29.4%)	2 (9.1%)	
	Mixed	9 (16.1%)	5 (14.7%)	4 (18.2%)	

Characteristic	Summary Statistics Results (n=56)	Mean Residual Gradient Post-ViV TAVR			
		Gradient ≤ 20	Gradient > 20	p value	
Patient Prosthesis Mismatch	20 (39.2%)	9 (31.0%)	11 (50.0%)	0.169	
Baseline mean gradient TAVR size	35.3 (15.1)	32.0 (15.1)	40.4 (14.0)	0.040	
	23	28 (50.0%)	11 (32.4%)	17 (77.3%)	0.006
	26	19 (33.9%)	14 (41.2%)	5 (22.7%)	
	29	8 (14.3%)	8 (23.5%)	0 (0.0%)	
	31	1 (1.8%)	1 (2.9%)	0 (0.0%)	
NYHA Class Post TAVR					
	Class 1	36 (73.5%)	23 (76.7%)	13 (68.4%)	0.524
	Class 2	13 (26.5%)	7 (23.3%)	6 (31.6%)	

RESULTS

- Evaluated 56 high-risk patients (mean STS score 9.6 ± 5.8) who underwent ViV TAVR. Baseline patient characteristics are described in Table 1.
- Majority of subjects were male (32, 57.1%) and mean age was 77 ± 10.6 . The primary indication for ViV TAVR was stenosis (n=35, 62.5%), regurgitation (n=12, 21.4%), and mixed disease (n=9, 16.1%).
- All patients successfully underwent ViV TAVR and noted improvement of New York Heart Association (NYHA) functional class.
- Twenty-two patients (39.3%) exhibited elevated gradient (mean > 20 mmHg) within 30 days of the procedure.
- Factors associated with elevated gradient after ViV TAVR were higher baseline mean gradient (40.4 mmHg in elevated group vs 32 mmHg, $p=0.040$) and small TAVR (23 mm) valve size ($p=0.006$).
- Patient prosthesis mismatch (PPM) was not associated with elevated gradient after ViV TAVR ($p=0.169$).
- Elevated gradient was not associated with pre-procedure left ventricular ejection fraction, initial prosthetic valve pathology, or severity of paravalvular leak.
- Eight patients died in follow-up (3.6 months ± 4). Elevated gradients were not associated with mortality or functional status at 1-month follow-up.

CONCLUSIONS

- In this single-center detailed study of echocardiographic variables, elevated gradients were prevalent post ViV TAVR.
- Elevated gradients were associated with higher gradient pre-procedure and smaller implanted TAVR size, but not the presence of PPM.
- Finally, elevated post-implantation gradients did not impact symptomatic improvement or mortality.