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Efficacy and Feasibility of Trans-Catheter Aortic Valve Implantation in Managing Rheumatic Aortic Valve Stenosis

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Abstract

Background: Rheumatic aortic valve disease is characterized by significant fibrosis, and calcification only appears at the end of the degenerative phase. Compared to degenerative aortic stenosis (AS), anatomical differences are linked to the technical impact on the anchoring and deployment of the transcatheter heart valve. Our objective is to ascertain whether transcatheter aortic valve implantation is a practical and efficient therapeutic option for patients with rheumatic valvular disease who have severe aortic stenosis.

Aim of Study: To evaluate the possible impact of renal replacement therapy in the form of regular dialysis provided to end stage renal disease patients on left ventricular diastolic function by implementing tissue doppler imaging.

Patients and Methods: The study included 100 ESRD patients on regular dialysis presenting to the dialysis unit in Ain Shams University Hospitals. The inclusion criterion was end stage renal disease patients with GFR <15 ml/min/1.73 m^2 on regular dialysis for more than 6 months. Excluded patients were those above than 80 yrs old, with hemodynamic instability, arrhythmias, valvular diseases, ischemic conditions, and LV systolic dysfunction. After the hemodialysis session, ECG gated echocardiography was done applying pulsed wave Doppler on mitral valveto detect E/A ratio, continuous wave Doppler on tricuspid valve to calculate TR vmax, and tissue Doppler on lateral mitral annulus to detect e' and E/e' ratio. Moreover, left atrial volume index (LAVI) and other standard echocardiographic parameters were measured. Full history and clinical examination including ECG recording was done and blood samples were taken to measure hemoglobin levels. Patients were then stratified according to their diastolic dysfunction grading.

Results: A total of 54 patients with rheumatic severe aortic stenosis who were referred to our center for TAVI were included in the current prospective cohort study. The mean age was 72.75±5.86 years, with a range of 65.00 to 83.00 years. It is noteworthy that pre-implantation balloon dilatation was performed in 63% of the cases. 31.4% of all new conduction disturbances included both temporary and permanent AVB and LBBB defects. In 3.7% of the cases, permanent pacemaker implantation was necessary. While 25.9% of cases had trace or mild leakage, none had moderate to severe PVL. We had two cases with significant vascular complications and one case of valve embolization. Within a 6-month follow-up, the all-cause death rate was 3.7%.

Conclusion: For patients with rheumatic severe aortic stenosis, TAVI is considered a practical, viable, and long-lasting option.

Key Words: *TAVI – Rheumatic – Aortic stenosis.*

Introduction

IN the industrialized world, aortic valve stenosis (AS) is a well-known type of cardiovascular disease that affects 0.3% to 0.5% of the population and is becoming more common as people age *[1]*.

Medical therapy has no effect on the progression of the disease, particularly once symptoms or left ventricular failure are evident, and surgical valve replacement continues to be the preferred course of treatment. However, individuals with aortic stenosis may become inoperable as a result of numerous co-morbidities, as the condition typically affects the elderly. For many individuals, therefore, aortic valve replacement via percutaneous technique is an option *[2]*.

Rheumatic aortic valve disease is characterized by significant fibrosis and late-stage calcification of the degenerative process. The deployment and anchoring of the transcatheter heart valve may be technically impacted by the anatomical differences when compared to degenerative AS (Fig. 1).

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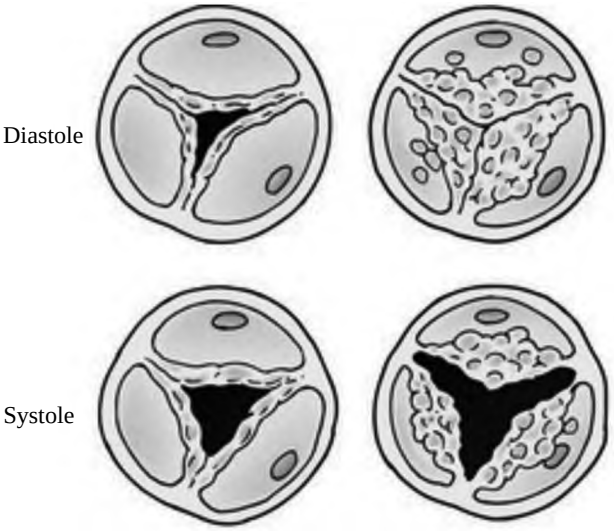


Fig. (1): Difference in pathologies between rheumatic and degenerative diseases. (A) Rheumatic AS includes fibrosis, cusp retraction, scarring, and minimal calcification sparing the base of the leaflets. (B) Degenerative AS consists of severe calcification affecting the base of the leaflet [22].

Patients and Methods

Using both prospective and retrospective observational methods, the study was conducted at the Cardiology Department of Ain Shams University Hospitals from January 2021 to January 2024. This study included a total of 54 patients who were sent to our center for TAVI. The method used to identify study participants was stratified convenience sampling. The VARC-3 criteria were used to document the patients' outcomes, and they were monitored for six months [3].

Aortic valve area <1 cm^2 or <0.6 cm^2/m^2, high gradient AS (mean gradient >40mmHg or jet velocity >4.0m/s), low flow low gradient AS with impaired functions, low flow low gradient AS with preserved functions, and aortic valve annulus diameter ≥18 and ≤30mm were the inclusion criteria (per the most recent ESC guidelines of VHD) for patients over 65, patients who met the 2012 World Health Federation (WHF) criteria 4 for rheumatic aortic valve affection by echocardiography, patients declined by surgeons, and the presence of symptoms associated with severe aortic stenosis.

The Ain Shams University Ethical Committee has approved this study. In a private setting, each patient in the cardiology department at Ain Shams University Hospitals was fully informed about the procedure and provided their consent. The study was carried out in complete confidentiality, and the patient's medical records were only accessible to the principal investigator. The activity was completely optional, and participants were free to stop at any time.

Pre-procedural data analysis:

The patients were assessed and categorized as high, intermediate, or low risk by a multidisciplinary heart team consisting of cardiac surgeons, interventional cardiologists, and imaging specialists. The European System for Cardiac Operative Risk Evaluation (EuroSCORE) II 5 and the Society of Thoracic Surgeons (STS) risk score 6 for estimated risk of mortality were calculated for each patient. A thorough pre-interventional evaluation was carried out in each case. The fundamental rhythm, axis deviation, PR interval, QRS morphology, and QRS duration were all recorded during each patient's ECG.

Standard 2-dimensional B-mode and Doppler transthoracic echocardiography (TTE) was performed on the cases prior to surgery, and standard parameters were measured in compliance with the American Society of Echocardiography's guidelines [7].

All CT images were processed using the Osirix MD version of the program. The measurements included the membranous septum (MS) length with indexed values to BSA (MSi), the height of the coronary ostium (LMCA and RCA) with indexed values to BSA (LMCAi, RCAi), the degree of calcification on the valve, and the basal septal calcification (Fig. 2). Additionally, calcification distribution, commissure fusion, and thickness were analyzed and confirmed with computed tomography in two and three dimensions. Grades of aortic valve calcification are as follows: Grade 1 has no calcification, Grade 2 has small, isolated areas of calcification, Grade 3 has many, larger spots of calcification, and Grade 4 has heavy calcification (extensive calcification over the entire circumference) [8].

Rheumatic mitral valve involved morphological features: (1) Commissural fusion; (2) thickening of the leaflets with or without calcification; (3) restricted mobility of the leaflets, which causes the anterior mitral leaflet to resemble a "hockey stick" or "doming" during diastole; and (4) thickening and shortening of the chords.

Rheumatic aortic valve involved morphological features: (1) Retraction of the leaflet margins; (2) Fibrotic thickening; (3) Commissural fusion; and (4) A triangular or rounded opening in systole.

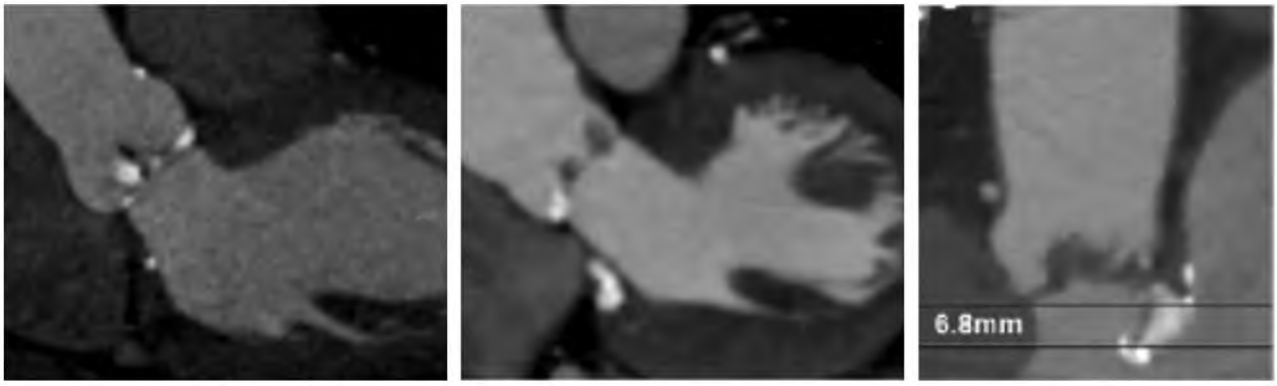
Procedure:

TAVI's standard procedural steps were followed. Prior to device insertion, balloon valvuloplasty under rapid pacing was carried out in majority of the patients. Serial evaluations of the hemodynamic results were conducted during the process. The evaluation of immediate post-procedural aortic regurgitation was done using echocardiography and aortic angiography. Angiograms were rated on a scale of 1 to 4 using Seller's criteria [9]. Medtronic's Evolut

R, Boston Scientific's Acurate Neo 2, Edward's Life Sciences' Sapien 3, and Meril Life's MyVal were among the valve options. In patients with moderate AR or a substantial pressure gradient that persisted across the valve, post-implantation balloon valvuloplasty was performed. The depth of implantation was defined as the separation between the native aortic annulus plane and the proximal border of the implanted valve. The relationship between the membranous septum and depth of implantation was measured using two methods: (1) The percentage of the membranous septum's depth of implantation (DIMS); and (2) The membrane's length divided by the depth of implantation (ΔMSID) **[10].**

Post-procedural outcomes:

At hospital discharge, 30 days following device implantation, and 6 months following the procedure, clinical follow-up, electrocardiogram, and transthoracic echocardiography were conducted with follow-up to the same variables. The criteria of the Valve Academic Research Consortium-3 were used to define procedural complications. 3



(A) (B) (C)

Fig. (2): Pre TAVI CT assessment of rheumatic severe AS. Difference in valve thickness is illustrated showing fibrous thickening of the leaflets **[10]**.

Statistical analysis:

IBM Inc.'s SPSS (Statistical Package for Social Sciences) version 26 was used to tabulate, statistically analyze, and enter the collected data into a database. Histograms and the Shapiro-Wilks test were used to determine whether the data distribution was normally distributed. The mean and standard deviation (SD) of quantitative parametric variables were reported. The frequency and percentage (%) of the qualitative variables were analyzed using the Chi-square test or Fisher's exact test, as applicable. Logistic regression was used to identify the independent variables affecting procedural outcomes. Significant is defined as $p \leq 0.050$, non-significant as $p \leq 0.01$ and extremely significant as $p<0.01$.

Results

Pre-procedural data of Rheumatic Severe AS patients:

In this study, a total of 54 patients (2 retrospectively and the rest prospectively collected) were included. The age ranged from 65.00 to 83.00 years (mean age 72.75±5.86 years). They were 16 males and 38 females. Patients with low surgical risk (Euroscore II or STS <4%) represented 54% of the study group, while those with intermediate risk (Euroscore II or STS 4%-8%) were 31% and those with high risk (Euroscore II or STS >8%) were 15%. Among the patients 27.8% had previous history of ischemic heart disease and 7.4% had history of CABG (Table 1).

There were 20% of patients with a history of permanent AF, and 3% with paroxysmal AF. There were 7% of patients with a history of LBBB, 4% with RBBB, and 4% with IVCD.

Mean ejection fraction of the cases was 57.5± 12.97. Only one case had significant grade III aortic regurgitation representing 1.9% of all cases. Mean AVA of the cases was 0.73±0.17.

Regarding annular size based on SMART trial, 59.3% of the patients had large annular sizes of >430 while the rest of 40.7% had small annular sizes of <430. Mean length of membranous septum is 9.07±1.93. Regarding grade of calcification 51.9% of the cases had grade of calcification 0-1; 35.2% of the cases had grade of calcification of 2; 11.1% of cases had grade of calcification of 3; only 1.9% had grade of calcification of 4 along with septal calcification.

Procedural details of the Rheumatic Severe AS patients:

Most of the patients had Evolut R implanted with a percentage of 79.6%. Acurate Neo 2 was implanted in 16.7% of the cases. Each of the sapien 3 and myval platform was implanted in one case of rheumatic severe AS (Table 2).

Table (1): It illustrate Demographic characteristics of all patients in both groups (A&B).

ECHO	No.=54
EF Mean ± SD (Range)	57.5±12.97 (27 – 78)
Septal wall thickness	12.36±1.28 (9 – 15)
SWT Mean ± SD (Range)	
SWTi Mean ± SD (Range)	6.69±0.9 (4.81 – 8.28)
Posterior wall thickness	12.26±1.22 (10 – 15)
PWT Mean ± SD (Range)	
PWTiMean ± SD (Range)	6.64±0.91 (4.82 – 8.88)
Left ventricular end diastolic diameter	51.54±5.23 (39 – 64)
LVEDD Mean ± SD (Range)	
LVEDDi Mean ± SD (Range)	27.85±3.46 (18.4 – 34.71)
Left ventricular end systolic diameter	34.7±6.71 (20 – 50)
LVESD Mean ± SD (Range)	
LVESDi Mean ± SD (Range)	18.76±3.9 (10.8 – 27.5)
Peak pressure gradient	75.42±18.01 (35 – 122)
PPG Mean ± SD (Range)	
Mean pressure gradient	45.63±11.86 (20 – 75)
MPG Mean ± SD (Range)	
Aortic valve area	0.73±0.17 (0.3 – 1)
AVA Mean ± SD (Range)	
AVAi Mean ± SD (Range)	0±0 (0 – 1)
Aortic Reguge (AR):	
I	28 (51.9%)
II	22 (40.7%)
III	1 (1.9%)
IV	0 (0%)
AF:	
Permanent	11 (20.4%)
Paroxysmal	3 (5.6%)
BBB:	
LBBB	4 (7.4%)
RBBB	2 (3.7%)
IVCD	2 (3.7%)
PR Mean ± SD (Range)	128.15±74.61 (0 – 240)
QRS Mean ± SD (Range)	95.56±18.29 (80 – 160)
RVSP Mean ± SD (Range)	44.43±11.94 (20 – 75)
CT TAVI	**No.=54**
Ann. Diam. Mean ± SD (Range)	22.91±2.64 (19 – 29.3)
Ann. Diam. I Mean ± SD (Range)	10.46±4.4 (0.4 – 15)
Ann. Perim. Mean ± SD (Range)	72.96±6.85 (60 – 88.7)
Ann. Perim. I Mean ± SD (Range)	39.40±4.39 (30.48 – 49.28)
Ann. Area Mean ± SD (Range)	409.78±79.16 (277 – 615.7)
Ann. Size:	
Area >430	32 (59.3%)
Area <430	22 (40.7%)
Ann. Area I Mean ± SD (Range)	216.84±51.74 (153 – 323.33)
LMCA Mean ± SD (Range)	12.11±2.26 (7.5 – 17)
LMCAi Mean ± SD (Range)	6.55±1.35 (3.87 – 9.77)
RCA Mean ± SD (Range)	14.03±3.08 (7 – 22.8)
RCAiMean ± SD (Range)	7.58±1.76 (4.09 – 13.18)
MS Mean ± SD (Range)	9.07±1.93 (6 – 14.4)
MS I Mean ± SD (Range)	4.9±1.15 (2.99 – 8.68)
Grade of Ca:	
Grade 1	23 (42.6%)
Grade 2	19 (35.2%)
Grade 3	6 (11.1%)
Grade 4	1 (1.9%)
Septal Ca	1 (1.9%)
Aortic Angulation Mean ± SD (Range)	44.22±7.68 (28 – 60)

Figures presented as mean ± SD and range; number (percentage).

Table (2): Procedural details of the Rheumatic Severe AS patients.

Procedure	No.=54
THV type:	
Evolut R	43 (79.6%)
Sapien 3	1 (1.9%)
Acurate Neo 2	9 (16.7%)
MyVal	1 (1.9%)
THV size Mean ± SD (Range)	28.82±3.54 (20 – 34)
DI Median (IQR), Range	3.25 (2.8 - 4), 1 – 7.11
DI I Median (IQR), Range	1.76 (1.52 - 2.08), 0.57 – 3.93
Pre-Dil	34 (63%)
Post-Dil	9 (16.7%)
DIMS Median (IQR), Range	38.73 (30 - 43.33), 8.33 – 88.88
AMSID Median (IQR), Range	5.6 (4.5 - 6.6), 0.89 – 11.7
Approach:	
Percutaneous	17 (31.5%)
Surgical	37 (68.5%)
Access Site:	
Femoral	53 (98.1%)
Carotid	0 (0%)
3rd part axillary	0 (0%)
1st part axillary	1 (1.9%)

Figures presented as mean ± SD and range.
Number (Percentage).

Noteworthy, 63% of the cases had undergone pre-implantation balloon dilatation. The mean implantation depth was 3.25. The median ratio of depth of implantation to membranous septum (DIMS) was 38.73; moreover, the difference between membranous septum and depth of implantation (MSID) was 5.6mm.

Regarding the vascular approach, 31.5% were tackled through percutaneous route; the remaining 68.5 % had their vascular access exposed by surgical approach.

Primary end-points according to VARC-3 and further secondary end-points:

Outcomes were categorized according to VARC-3 criteria. One case had cardiac structural complication of valve embolization and 3.7% of the cases had major vascular complication requiring vascular surgery intervention. Trace/mild cases of PVL were evident in 25.9%. One case was presented with acute kidney injury during the 6 months follow up. Moreover, one case had neurological insult after 2 month post-procedure. All cause death within 30 days comprised 3.7% of the cases (Table 3).

Table (3): Primary end- points according to VARC- 3 and further secondary end- points.

1ry outcomes	Within 30 days	FUP 6 months
New conduction disturbances	17 (31.4%)	0 (0%)
Permanent pacemaker implantation	3.7%	0 (0%)
Bio-prosthetic valve dysfunction (mild PVL)	14 (25.9%)	0 (0%)
Cardiac structural complications (valve embolization)	1 (1.85%)	0 (0%)
Major vascular complications	2 (3.7%)	0 (0%)
Bleeding and transfusions	1 (1.85%)	0 (0%)
Neurological manifestations	1 (1.85%)	1 (1.85%)
Acute kidney injury	0 (0%)	1 (1.85%)
Myocardial infarction	1 (1.85%)	0 (0%)
Mortality	2 (3.7%)	0 (0%)

2ry outcomes	No.=54
T Cond Dis	17 (31.5%)
LBBB:	
Transient	11 (20.4%)
Permanent	4 (7.4%)
AVB:	
Transient	5 (9.3%)
Permanent	2 (3.7%)
QRS widening	13 (24.5%)
PR Prolongation	7 (13.2%)
New onset AF	4 (7.4%)

Figures presented as mean ± SD and range; number (percentage).

Secondary end-points were also analyzed. Total conduction disturbances were 31.5% further classified into transient LBBB 20.4%, transient AVB (9.3%), permanent LBBB (7.4%) and permanent AVB (3.7%). The cases who developed transient AVB, also experienced transient LBBB have recovered back to narrow complex sinus rhythm with one to one conduction within 48 hours of continuous monitoring.

Two patients had early death within 30 days, Thus 52 patients were followed-up at 6 months.

Significant relation in comparison between total conduction disturbances and collected variables:

Total conduction disturbances were closely related to pre-procedural echocardiographic septal wall thickness,with a *p*-value of 0.041. However, they were not related to any pre-procedural ECG criteria, other echocardiographic parameters, nor CT data.Total conduction disturbances were related to procedural ratio between depth of implantation and membranous septum, with a *p*-value of 0.034,and were also related to the difference between membranous septum and depth of implantation, with a *p*-value of 0.034. However, they were not related to the type of the valve, valve size, nor balloon dilatation (Table 4).

Table (4): Significant relation in comparison between total conduction disturbances and collected variables.

	Total Conduction disturbances and ECHO		Test value	*p*-value	Sig.
	No No.=37	Yes No.=17			
SWT:					
Mean ± SD	12.12±1.27	12.88±1.17	–2.100•	0.041	S
(Range)	(9 – 15)	(11 – 15)			

	Total Conduction Disturbances and procedure		Test value	*p*-value	Sig.
	No No.=37	Yes No.=17			
DIMS:					
Median (IQR), Range	35.56 (29.09-40), 8.33 – 88.88	41.67 (38.82-64.29), 10 – 80	–2.115#	0.034	S
AMSID:					
Median (IQR), Range	5.9 (5.1-7), 0.89 – 11	4.9 (2.7-5.2), 1.5 – 11.7	–2.124#	0.034	S

p-value >0.05: Non significant. *: Chi-square test.
p-value <0.05: Significant. •: Independent *t*-test.
p-value <0.01: Highly significant. ≠: Mann-Whitney test.

Significant relation between PPI and collected variables:

Permanent AVB was found to be associated with pre-procedural existence of ECG conduction abnormalities, with a *p*-value of 0.006. Moreover, it were related with RCA height from the annulus, with a *p*-value of 0.033 along with RCAi height from the annulus with a *p*-value of 0.045. In addition, AVB was closely affected by CT grade of calcification and septal calcification with a *p*-value of 0.000 for both. However, AVB was not correlated to any echocardiographic parameter. Permanent AVB was not associated with procedural details regarding type and size of the trans-catheter heart valve used, balloon dilatation, depth of implantation, Depth of implantation to membranous septum ratio (DIMS), Membranous septum to implantation depth(MSID), nor the approach. However, permanent pacemaker implantation was associated with the occurrence of new onset atrial fibrillation (Table 5).

Trace and mild PVL was not related with the type, nor size of the transcatheter heart valve. In addition, it is not related to depth of implantation, balloon dilatation, DIMS, MSID, nor the approach.

Major vascular complications were related to percutaneous vascular access with the use of suture based devices in the absence of plug based devices having a *p*-value of 0.033.

Significant relation between occurrence of all-cause mortality (non-cardiac) within 30 days and demographic data along with pre TAVI CT and post-procedural outcomes of the studied patients.

Table (5): Significant relation between PPI and collected variables.

	AVB and ECG		Test value	*p*-value	Sig.
	Others No.=52	Permanent AVB No.=2			
BBB:					
None	45 (86.5%)	1 (50%)	12.552*	0.006	HS
LBBB	4 (7.7%)	0 (0%)			
RBBB	2 (3.8%)	0 (0%)			
IVCD	1 (1.9%)	1 (50%)			
	AVB and CT				
	Others No.=52	Permanent AVB No.=2	Test value	*p*-value	Sig.
Grade of Ca:					
Grade 0	5 (9.6%)	0 (0%)	27.437*	0.000	HS
Grade 1	23 (44.2%)	0 (0%)			
Grade 2	18 (34.6%)	1 (50%)			
Grade 3	6 (11.5%)	0 (0%)			
Grade 4	0 (0%)	1 (50%)			
Septal Ca:					
No	52 (100%)	1 (50%)	26.491*	0.000	HS
Yes	0 (0%)	1 (50%)			

p-value >0.05: Non significant. *: Chi-square test.
p-value <0.05: Significant. •: Independent *t*-test.
p-value <0.01: Highly significant. ≠: Mann-Whitney test.

Our mortality cases were related to non-cardiac causes as dense neurological insults and major high mortality vascular complications. Mortality within 30 days were found to be associated with low body surface area patients with a *p*-value of 0.044 (Table 6).

Mortality within 30 days was related to shortened membranous septum with a *p*-value of 0.037. However, it is not related to any pre-procedural ECG criteria, echocardiographic parameters, nor any other CT data.

Procedural mortality within 30 days was related to procedural outcomes regarding total conduction disturbances, AVB, and QRS widening with p values of 0.033, 0.009, and 0,011 repectively. Moreover mortality was associated with the occurrence of new onset atrial fibrillation with a *p*-value of 0.019 along with major vascular complications represented with a p value of 0.000.

Annular Area did not correlate with LBBB, transient conduction disturbance, new onset AF, major vascular complications, death within 30 days, follow-up in 1 months and follow-up in 6 months. However, it had a significant negative correlation with CHB, QRS widening and PR Prolongation (*r*=–0.40, –0.52 & –0.51 and *p*=0.003, <0.001 & <0.001 respectively). Ann. Area I did not correlate with LBBB, Transient Cond. Dist., New onset AF, Major Vascular Complications, Death within 30 days, FUP 1 months and FUP 6 months. However, it had a significant negative correlation with CHB, QRS widening and PR Prolongation (*r*=–0.32, -0.45 & –0.45 and *p*=0.005, <0.001 & <0.001 respectively) (Table 6).

Table (6): Significant relation between occurrence of 30-day mortality (non-cardiac) and demographic data along with pre TAVI CT and post-procedural outcomes.

	Death e/in 30d and demography		Test value	*p*-value	Sig.
	No No.=52	Yes No.=2			
BSA:					
Median (IQR)	1.82 (1.74 - 1.96)	1.67 (1.62 - 1.71)	–2.017#	0.044	S
Range	1.6 – 2.5	1.62 – 1.71			
	Death e/in 30d and CT				
	No No.=52	Yes No.=2	Test value	*p*-value	Sig.
MS:					
Median (IQR)	9.17±1.88	6.3±0.42	2.139*	0.037	S
Range	6 – 14.4	6 – 6.6			
	Death e/in 30d and outcomes				
	No No.=52	Yes No.=2	Test value	*p*-value	Sig.
T Cond Dis:					
No	37 (71.2%)	0 (0%)	4.520*	0.033	S
Yes	15 (28.8%)	2 (100%)			
AVB:					
None	46 (85.1%)	1 (50%)	12.482*	0.009	HS
Transient	5 (9.6%)	0 (0%)			
Permanent	1 (1.9%)	1 (50%)			
QRS widening:					
No	40 (78.4%)	0 (0%)	6.395*	0.011	S
Yes	11 (21.6%)	2 (100%)			
New onset AF:					
No	49 (94.2%)	1 (50%)	5.493*	0.019	S
Yes	3 (5.8%)	1 (50%)			
Major Vasc. Comp.:					
No	51 (98.1%)	1 (50%)	12.482*	0.000	HS
Yes	1 (1.9%)	1 (50%)			

p-value >0.05: Non significant. *: Chi-square test.
p-value <0.05: Significant. •: Independent *t*-test.
p-value <0.01: Highly significant. ≠: Mann-Whitney test.

Multiple Regression Analysis for QRS widening, PR prolongation, and all cause mortality within 30 days:

Septal Calcification was found to be the most significant determining factor of QRS widening with (*p*=<0.001) in multiple regression analysis.

Annular area and septal Ca were found to be the most significant determining factor of PR prolon-

gation with (p=0.043, and <0.001 respectively) in multiple regression analysis (Table 7).

Age, BSA, Ann. Area, Ann. Area I, septal Ca, AVB and PR prolongation were found to be the most significant determining factor of death within 30 days in multiple regression analysis.

Table (7): Multiple Regression Analysis for QRS widening and mortality within 30 days.

	QRS widening			
	β	B	*t*	*p*-value
Intercept		–0.12	–0.08	0.933
Septal Ca	0.99	99.42	8.57	<0.001
	Death within 30 days			
	β	B	*t*	*p*-value
Intercept		-2.89	-2.87	0.007
Age	0.18	0.01	2.37	0.023
BSA (body surface area)	1.20	1.31	2.64	0.012
Ann. Area	–3.84	-0.01	-3.21	0.003
Ann. Area I	3.79	0.01	3.06	0.004
Septal Ca	–45.91	-64.30	-9.05	<0.001
AVB	1.09	0.55	6.51	<0.001
PR Prolongation	45.48	0.63	8.20	<0.001

Regression Summary for Dependent Variable: QRS widening R = 0.99 R^2 = 0.99 Adjusted R^2 = 0.99 F(18,34)=33.p.

Regression Summary for Dependent Variable: Death within 30 days R=0.93 R^2 = 0.86 Adjusted R^2= 0.79 F(18,34)=11.838 p.

Discussion

Transcatheter aortic valve implantation (TAVI) has opened a new chapter in the treatment of valvular heart disease. Research has predominantly concentrated on managing calcific degenerative disease in populations, with rheumatic heart disease (RHD) remaining a poorly understood condition *[11]*. Our study aimed not only to identify the post-procedural outcomes of TAVI in rheumatic aortic stenosis in relation to VARC-33, but also to our knowledge, this is the first study to describe the relationship between the outcomes to pre-procedural and procedural data.

The gold standard of care for patients with severe stenosis caused by a rheumatic aortic valve is surgery. Mentias et al. *[12]* gathered data on the surgical outcomes of rheumatic aortic stenosis and discovered that in the propensity matched group, the incidence of acute renal injury following surgery was 22.3%, the rate of permanent pacemaker insertion was 7.2%, and the 30-day mortality rate was 3.2%. According to our research, the 30-day mortality rate was 3.7%, the incidence of permanent pacemaker implantation was 3.7%, and the incidence of acute renal injury was 1.9%. These findings show that TAVI is better than SAVR in patients with severe rheumatic aortic stenosis. Our small sample size and the different ages and mortality risks of the population treated in the Mentias et al group (higher age and mortality risk) were among the confounding factors, though.

Literature data indicated that patients with a superficial valve deployment had a lower risk of new conduction abnormalities, while patients with baseline bundle branch block, severe annular calcifications, and a deeper implant depth had an increased risk of conduction disturbances and new pacemaker implantation following TAVI *[13,14]*.This was in line with our findings, which showed that the ratio of implantation depth to membranous septum, DIMS, was positively correlated with total new conduction disturbances, and the difference between membranous septum and implantation depth, delta MSID, was negatively correlated. Additionally, AVB was linked to a number of pre-procedural CT and ECG data. We discovered a correlation between AVB and the presence of bundle branch block on the pre-procedural ECG. According to Baraka et al., the most potent independent pre-procedural predictor of conduction disturbances when multivariable logistic regression was used for the pre-procedural predictors was basal septal calcification, which showed a significant positive correlation with both permanent and transient AVB inrheumatic AS *[10]*.

Improved patient and prosthesis type and size selection, thorough pre-procedural evaluation, improvements in transcatheter cardiac technology, and growing expertise have all contributed to a significant decrease in the incidence of PVL after TAVI. However, research showed that a higher proportion of patients had mild PVL after TAVI than SAVR, and that moderate-to-severe PVL was found after balloon-expandable and self-expandable valves (0.6–3.7%) and 3.5–5.3%, respectively *[15,16]*. Without any moderate-to-severe PVL cases, our study found a 25.9% post-procedure trace and mild PVL rate, which is consistent with global statistics. Reduced incidences of significant PVL are indicated by the uniform and reduced calcification in rheumatic aortic stenosis and the increased understanding of how to predict when leaks will occur. It also relates to the deliberate enlargement of the transcatheter heart valve (THV) that we performed in order to make up for the decreased calcification linked to severe rheumatic aortic stenosis.

Vascular problems related to the access site are still the most common complication following TAVI and are linked to worse short- and long-term results. Of TAVI patients 9.6% experienced a vascular complication, and 7.6% experienced an access site bleeding incident, according to the STS/ACC TVT registry *[17]*. However, the incidence of complications related to the access site has decreased over time as a result of a decrease in the size, profile of the delivery system, and anti-thrombotic therapies used, as well as the implementation of percu-

taneous vascular closure devices and the use of CT and ultrasound imaging to determine the vascular access. As regards the major vascular complications in our study, the incidence revealed to be 3.7% of the cases. Vascular complications were related to the approach implemented during the procedure. In fact, it was more related to failure of percutaneous suture based closure device in the absence of plug based devices as bailout management, thus forcing us to proceed with vascular repair.

A clinically apparent stroke is associated with higher mortality and cognitive impairment, as well as significant functional and social implications. The chance of TAVI-related stroke has stayed constant at 2% incidence over the past ten years, despite a decrease in the risk of the majority of TAVI problems *[15,16,18,19]*. In our study, stroke incidence within 30-day post-procedure was 1.85% which is comparable to the international figure of stroke incidence. Often caused by the embolization of debris from the valve or the vasculature, TAVI-related stroke is less often related to arrhythmia.

A lower BSA, with a median of 1.67 among death cases, was observed to be associated with mortality within 30 days. Patients with small bodies are more likely to experience vascular problems, prosthesis patient mismatch (PPM), and annulus rupture following TAVI. Because there is a chance of PPM when operating on a patient with a small annulus, TAVI is preferable to SAVR. Nakashima et al., came to the conclusion that a small body size was connected to a difficult TAVI technique.20In concordance with this study, we found that mortality is related to decreased BSA and BMI. The term “obesity paradox” was originally used to define the higher early mortality following PCI in patients with low BMI. Furthermore, those receiving TAVI treatment have also reported this *[21]*. Moreover, mortality was also associated with smaller membranous septum length with a mean of 6.3mm. In fact, small membranous septum length does have increased risk of conduction disturbances which is an independent predictor of mortality.

In order to demonstrate the viability of TAVI in patients with rheumatic AS, our study is the largest cohort to date with specific clinical characteristics, ECG criteria, echocardiographic parameters, and CT data. The feasibility and effectiveness of TAVI in rheumatic cases are encouraging, despite the fact that the aforementioned anatomical differences are expected to reduce technical success with TAVI in RHD patients. Furthermore, similar outcomes with TAVI for rheumatic versus non-rheumatic AS in other registries validate the safety of TAVI in these RHD patients. When compared to the outcomes of the procedure in cases of degenerative aortic stenosis, TAVI actually offers a feasible and reasonable option for patients with rheumatic AS.

Limitations:

The small study population is the main issue with this study, which has the typical limitations of a single-center observational non-randomized investigation. Furthermore, to evaluate the efficacy and safety of TAVI in treating rheumatic aortic stenosis, a comparison with patients who also undergo TAVI but do not have rheumatic aortic stenosis is required. Longer follow-up is actually necessary to find long-term problems.

Conclusion:

TAVI is actually a practical and viable option for patients with rheumatic severe AS with acceptable outcomes.

Recommendations:

To gain a more comprehensive understanding of the Transcatheter heart valve behavior in rheumatic aortic valves, a larger prospective sample size is required. To compare TAVI in rheumatic severe aortic stenosis with TAVI in non-rheumatic severe aortic stenosis, more non-randomized controlled trials are required. Additional research is required to compare SAVR and TAVI as solutions for rheumatic aortic valves. Histopathological analysis is used to validate the echocardiographic and CT phenotyping of rheumatic aortic valves.

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فعالية وجدوى زراعة الصمام الاورطي عبر القسطرة في علاج تضيق الصمام الاورطى الروماتيزمى

دراستنا هى أكبر مجموعة حتى الآن مع الخصائص السريرية المحددة، ومعايير تخطيط القلب، ومعلمات تخطيط صدى القلب، وبيانات التصوير المقطعي المحوسب لتسليط الضوء على جدوى زرع الصمام الاورطى عبر القسطرة فى المرضى الذين يعانون من تضيق الصمام الاورطى الروماتيزمى. على الرغم من أنه يمكن للمرء أن يتوقع نجاحًا تقنيًا أقل في زرع الصمام الاورطى عبر القسطرة لدى هؤلاء المرضى بسبب الاختلافات التشريحية المذكورة أعلاه، إلا أن جدوى وفعالية زرع الصمام الاورطى عبر القسطرة فى الحالات الروماتيزمية أمر مشجع. علاوة على ذلك، فإن النتائج المماثلة لزراعة الصمام الاورطى عبر القسطرة في حالات تضيق الصمام الاورطى الروماتيزمى مقابل تضيق الصمام الاورطى غير الروماتيزمى تؤكد سلامة زرع الصمام الاورطي عبر القسطرة في هذه المجموعة. في الواقع، بالمقارنة مع نتائج زرع الصمام الاورطي عبر القسطرة فى تضيق الصمام التكلسية، يمكن أن يمثل زرع الصمام الاورطى عبر القسطرة خيارًا قابلاً للتطبيق ودائم للمرضى الذين يعانون من تضيق الصمام الاورطى الروماتيزمى.