PREDICTORS OF CARDIAC CONDUCTION DISTURBANCES AFTER TRANSCATHETER AORTIC VALVE IMPLANTATION USING SELF-EXPANDABLE VALVES

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ABSTRACT:

Background: *The advent of transcatheter aortic valve implantation (TAVI) represented a paradigm shift for treating patients with severe symptomatic aortic stenosis (AS) who are at high or prohibitive surgical risk. With the growing experience in this field, the rate of periprocedural complications has decreased over time and TAVI has been increasingly performed with a minimalist approach, evolving into a safe procedure with predictable outcomes. However, unlike other procedural complications, the incidence of conduction disturbances which could be in the form of bundle branch blocks, or atrioventricular blocks, has failed to decrease in recent times, with reports suggesting an increased risk associated with the use of some newer-generation transcatheter valves.*

Aim of the work: *To determine the predictors of cardiac conduction disturbances after transcatheter aortic valve implantation.*

Patients and Methods: *From January 2017 to April 2019, we included 38 consecutive patients with severe symptomatic AS underwent TAVI using self-expandable valves (CoreValve or Evolut R) or the balloon expandable Sapien XT valve at the Ain Shams University Hospitals. All patients were subjected to electrocardiographic evaluation pre- and post-TAVI and at 30 days. Several parameters were studied including preprocedural parameters: clinical, electrocardiographic, echocardiographic, and CT derived parameters, and procedural parameters: type and size of the valve, the use of balloon pre- and post- implantation dilatation, and depth of implantation. All quantitative parameters were indexed to body surface area (BSA).*

Results: *Conduction disturbances were seen in 16 patients (42.1%), in which 10 patients (26.3%) experienced left bundle branch block (LBBB), 6 patients (15.8%) experienced complete heart block (CHB), with only one of them (2.6%) experienced permanent CHB requiring permanent pacemaker implantation (PPI). Multivariate logistic regression analysis for pre-procedural predictors showed that the presence of basal septal calcification is the most powerful independent predictor (OR: 98.73, 95% CI: 7.63 to 1278.23, $p < 0.001$). Multivariate logistic regression analysis for procedural predictors showed that the relationship between depth of implantation and membranous septum expressed in percentage (DIMS) with cut-off >75.00% is the most powerful independent procedural predictor (OR: 16.00, 95% CI: 2.12 to 120.65, p 0.007).*

Conclusion: *Conduction disturbances remain a common complication of TAVI. Presence of basal septal calcification is a risk factor that increase patient propensity for developing such complication after TAVI. The relationship between depth of implantation and membranous septum is a strong independent procedural predictor and prospective validation of its cut-offs is needed.*

Key words: *Transcatheter aortic valve implantation, conduction disturbances, AV blocks, LBBB.*

INTRODUCTION:

Aortic valvular disease is a common disorder often affecting elderly patients with multiple co-morbidities. The most common type of aortic valvular disease today is senile calcific aortic stenosis (AS)[1]. Despite vigorous efforts for developing medical treatment options for patients with calcific AS, medical therapy has currently no role in modifying the course of the disease, especially once symptoms or left ventricular dysfunction become manifest, and surgical aortic valve replacement (SAVR) remains the mainstay of definitive treatment[2]. However, and because AS is generally a disease of the elderly, co-morbidities are a frequent concern that may render patients inoperable. A percutaneous approach to aortic valve replacement is, therefore, an attractive alternative for many patients.

Percutaneous balloon aortic valvuloplasty has only a limited role in the treatment of calcific aortic stenosis, as the results are not durable [3]. On the other hand, transcatheter aortic valve implantation (TAVI) has shown great promise in the treatment of severe aortic stenosis in patients regarded at high risk from or inoperable by conventional surgery [4]. Since the first in man implantation by Alain Cribier in 2002 [5], TAVI has become a dynamic field of research and development.

Despite these benefits, a growing clinical experience with TAVI has revealed several intra- and post-procedure complications. One of these complications is the occurrence of post-operative conduction disturbances, the most relevant and common are His' bundle branch blocks, atrio-ventricular blocks, and need for permanent pacemaker implantation. With the frequency at 10% to even 50%, conduction abnormalities are among the most important TAVI-related adverse events[6].

AIM OF THE WORK:

To determine the predictors of cardiac conduction disturbances after TAVI, propose a predictive model that might modify the implantation technique to limit such complication.

PATIENTS AND METHODS:

Study was conducted from January 2017 to April 2019 at the Ain Shams University Hospitals. We included 39 consecutive patients with severe symptommatic AS defined as AVA < 1 cm2 or < 0.6 cm2/m2, with or without aortic regurgitation and have aortic valve annulus diameter ≥18 and ≤29 mm. Patients with previous pacemaker insertion, pre-existing LBBB, estimated life expectancy < 1 year, active endocarditis, LV thrombus, excessive femoral, iliac or aortic tortuosity or calcification were excluded, one patient was excluded due to intra-operative mortality and postoperative ECG was not obtained, thus 38 patients were considered eligible for study.

TAVI was done using self-expandable valves (CoreValve or Evolut R) or the balloon expandable Sapien XT valve through femoral access using their corresponding sheaths and delivery systems. The procedure was performed with local anaesthesia in combination with a mild systemic sedative/analgesic treatment. Vascular access was obtained percutaneously through the common femoral artery (with or without pre-planned surgical cutdown according to availability of vascular closure devices at our center). At the start of each procedure, a temporary transvenous pacemaker was positioned in the right ventricle through transjugular or transfemoral access. This pacemaker remained in position for at least 24 hours after TAVI and was removed when there were no signs of AV block or bradycardia. Electrocardiographic outcomes were assessed continuously during the procedure. After the procedure, the patients were transferred to the intensive care unit for continuous monitoring of heart rhythm for average of 3 days.

Studied parameters were classified into pre-procedural and procedural parameters (see tables). The Pre-procedural parameters include clinical parameters, base line ECG parameters, echocardiographic parameters using GE Vivid machines, and CT-derived parameters using OsiriX MD v.9.0 (figure). Procedural parameters include type and size of the valve, the use of pre or post-implantation balloon dilatation, depth of implantation (DI), and relationship between depth of implantation and membranous septum which was expressed as numerical difference between them (MSID) or percentage (DIMS).

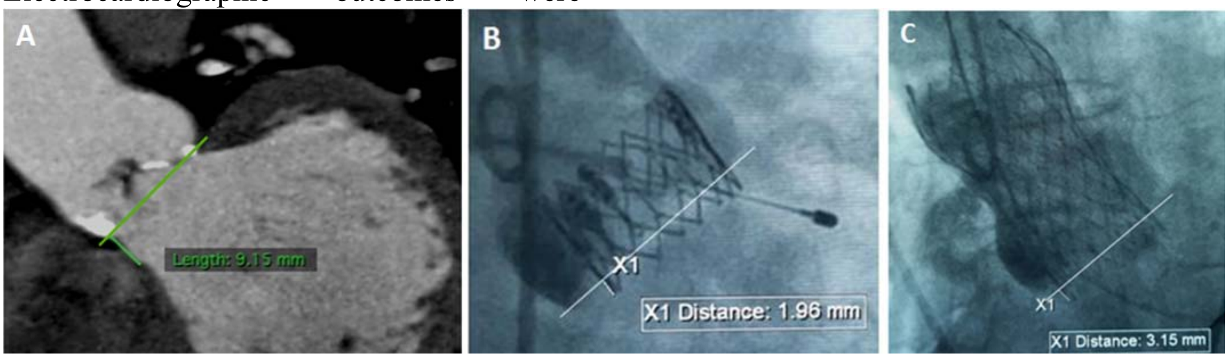

Figure: (A) CT coronal view showing measurement of membranous septum length, (B and C) Fluoroscopy views showing measurement of depth of implantation of Sapien XT and Evolut R valves respectively.

RESULTS:

The collected data were coded, tabulated, and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 18.0, IBM Corp., Chicago, USA, 2009. Conduction disturbances were seen in 16 patients (42.1%), 10 patients (26.3%) experienced LBBB, 6 patients (15.8%) experienced AV block, with only one patient (2.6%) experienced permanent CHB requiring permanent pacemaker implantation (PPI). Summary of the studied parameters, distribution of results, univariate analysis are seen in tables 1, 2, 3, and 4. Pre-procedural predictors that showed significance on univariate analysis are: pre-existing RBBB ($p = 0.009$), baseline QRS duration ($p = 0.03$), moderately severe aortic regurgitation ($p = 0.049$), and the presence of basal septal calcification ($p = 0.001$). As regards the procedural parameters, depth of implantation (DI), and its indexed value (DIi), as well as percentage of DI from the MS (DIMS) showed highly significant positive correlation ($p < 0.001$). On the other hand, the difference between MS and DI (ΔMSID) showed highly significant negative correlation (p <0.001).

Table 1: Distribution of results and univariate analysis of clinical parameters

Parameters	Present (N=16)	Absent (N=22)	P Value
Age (years)	74.6±7.1	76.3±7.3	†0.463
Body mass index (kg/m^2)	29.5±9.0	27.6±3.4	†0.437
Body surface area (m^2)	1.89±0.28	1.87±0.19	†0.817
EuroSCORE II	11.2±7.5	9.1±6.7	†0.357
Creatinine clearance (ml/min)	52.8±28.5	53.1±23.2	†0.964
Male	12 (75.0%)	16 (72.7%)	φ1.000
Smoking	3 (18.8%)	8 (36.4%)	φ 0.296
Diabetes Mellitus	8 (50.0%)	12 (54.5%)	ϕ 0.782
Hypertension	10 (62.5%)	16 (72.7%)	ϕ 0.503
Ischemic heart disease	9 (56.3%)	12 (54.5%)	ϕ 0.917
Previous cerebrovascular stroke	6 (37.5%)	9 (40.9%)	ϕ 0.832
CABG	1 (6.3%)	3 (13.6%)	φ 0.624
Chronic lung disease	5 (31.3%)	7 (31.8%)	ϕ 0.970
Valve-in-Valve (ViV)	2 (12.5%)	0 (0.0%)	φ 0.171
†Independent t-test, ϕ Chi square test, φ Fisher's Exact test; CABG: coronary artery bypass graft			

Table 2: Distribution of results and univariate analysis of ECG and echocardiographic parameters

Parameters	Present (N=16)	Absent (N=22)	p value
ECG parameters			
Atrial fibrillation (AF)	4 (25.0%)	1 (4.5%)	φ 0.141
RBBB	5 (31.3%)	0 (0.0%)	φ 0.009*
PR interval duration (msec)	198.3±21.2	177.1±39.4	† 0.096
QRS duration (msec)	105.6±27.8	88.6±8.3	† 0.030*
Echocardiographic Parameters			
Ejection Fraction (%)	57.6±14.4	60.0±13.4	† 0.595
SWT (mm)	13.9±2.2	13.6±2.3	† 0.674
SWTi (mm/m2)	7.4±1.0	7.3±1.3	† 0.793
PWT (mm)	13.1±2.0	12.7±1.7	† 0.528
LVEDD (mm)	52.3±6.1	53.1±6.5	† 0.695
LVEDDi (mm/m2)	28.1±3.9	27.7±7.6	† 0.851
LVESD (mm)	34.1±7.2	35.0±7.8	† 0.694
LVESDi (mm/m2)	18.3±4.5	19.0±5.2	† 0.705
Mean pressure gradient (mmHg)	49.4±6.9	51.9±14.0	† 0.510
Aortic valve area (cm)	0.80±0.17	0.78±0.14	† 0.662
AR grade III	6 (37.5%)	2 (9.1%)	φ 0.049*
†Independent t-test, φ Fisher's Exact test, * significant SWT and SWTi: septal wall thickness and indexed; PWT: posterior wall thickness; LVEDD, LVEDDi, LVESD and LVESDi: left ventricular end diastolic and systolic diameters and indexed values.			

Table 3: Distribution of results and univariate analysis of CT-derived parameters

Findings	Present (N=16)	Absent (N=22)	p value
Annulus mean diameter	23.1±3.1	24.1±1.9	† 0.274
Annulus mean diameter indexed (mm/m^2)	12.4±2.0	13.0±1.4	† 0.340
Annulus perimeter	7.3±0.9	7.7±0.6	† 0.085
Annulus perimeter indexed (mm/m^2)	3.9±0.6	4.1±0.5	† 0.201
Annulus area	4.0±1.0	4.5±0.7	† 0.124
Annulus area I (mm/m^2)	2.2±0.5	2.4±0.4	† 0.123
LMCA	12.5±1.2	13.4±2.2	† 0.081
LMCAi (mm/m^2)	6.7±1.1	7.2±1.2	† 0.206
RCA	13.7±2.0	13.7±2.9	† 0.981
RCAi (mm/m^2)	7.4±1.2	7.4±1.6	† 0.982
MS	7.1±1.9	8.1±2.9	† 0.211
MSi (mm/m^2)	3.8±1.1	4.4±1.7	† 0.228
Basal septal calcification	14 (87.5%)	2 (9.1%)	ϕ <0.001*
Aortic valve calcification grade IV	11 (68.8%)	12 (54.5%)	ϕ 0.376
†Independent t-test, ϕ Chi square test, *significant LMCA: left main coronary artery; RCA: right coronary artery; MS and MSi: length of membranous septum and indexed value.			

Table 4: Distribution of results and univariate analysis of procedural parameters

Characteristics		Present (N=16)	Absent (N=22)	p
Valve type	CoreValve	2 (12.5%)	1 (4.5%)	φ 0.287
	Evolut R	12 (75.0%)	13 (59.1%)	
	Sapien XT	2 (12.5%)	8 (36.4%)	
	Self-expandable valves	14 (87.5%)	14 (63.6%)	φ 0.143
	Balloon-expandable valves	2 (12.5%)	8 (36.4%)	
Balloon predilatation		2 (12.5%)	10 (45.5%)	ϕ 0.131
Balloon Postdilatation		5 (31.3%)	2 (9.1%)	&0.108
Valve size > 29 mm		9 (56.3%)	13 (59.1%)	ϕ 0.861
Depth of implantation (mm)		7.1±1.8	3.7±1.6	†<0.001*
Depth of implantation indexed (mm/m^2)		3.8±1.1	2.0±0.8	†<0.001*
DIMS		101.5±17.9	49.2±17.2	†<0.001*
ΔMSID		0.1±1.1	4.4±2.5	†<0.001*
†Independent t-test, ϕ Chi square test, φ Fisher's Exact test, *significant DIMS: percentage of depth of implantation from membranous septum; ΔMSID: difference between membranous septum and implantation depth				

Among the studied parameters, it has been found that basal septal calcification was the best preprocedural predictor of development of conduction disturbances after TAVI with sensitivity 87.5%, and specificity 90.9%. And that DIMS with cut off ≥75.00%, and **Δ**MSID with cut off ≤1.75 mm are the best postprocedural predictors with sensitivity 100%, and specificity 95.5% as shown in table 5.

Table 5: Diagnostic performance of the significant parameters in predicting conduction abnormalities

Factors	AUC	SE	P	95% CI	Cut off
QRS width	0.658	0.100	0.101	0.462–0.854	--
DI	0.909	0.047	<0.001*	0.814–1.000	≥ 4.87
DIi	0.909	0.047	<0.001*	0.817–1.000	≥2.30
DIMS	0.996	0.006	<0.001*	0.000–1.000	≥75.00
ΔMSID	0.994	0.008	<0.001*	0.000–1.000	≤1.75
AUC: Area under curve, SE: Standard error, CI: Confidence interval, *significant DI: depth of implantation; DIi: depth of implantation indexed; DIMS: percentage of DI of membranous septum (MS); ΔMSID: difference between MS and DI					

Variables with p values <0.1 on univariate analysis were entered into 2 multivariate logistic regression models: Preprocedural prediction model and procedural prediction model. Basal septal calcification emerged as the most powerful independent preprocedural predictor of conduction disturbances, while the procedural prediction model revealed DIMS ≥75.00% as the most powerful independent procedural predictor (table 6).

Table (6): Multivariate logistic regression analysis models

Parameters	β	SE	P	OR (95% CI)
Preprocedural model				
Basal septal calcification	4.59	1.31	**<0.001***	98.73 (7.63–1278.23)
Procedural model				
DIMS ≥75.00%	2.77	1.03	**0.007***	16.00 (2.12–120.65)
β: Regression coefficient; SE: Standard error; OR: Odds ratio; CI: Confidence interval; *significant; DIMS: percentage of DI of membranous septum				

DISCUSSION

Whilst efforts to reduce the incidence of complications after TAVI have generated improvements in valve technology with a substantial reduction of their severity and their clinical impact [7-9], the development of conduction disturbances after TAVI has failed to decrease significantly in recent times with reports suggesting an increased risk associated with the use of some newer-generation valves[10-15].

Previous studies have showed that the most encountered conduction disturbances after TAVI are the new onset LBBB which occurs in up to 50-70% (with a wide range of 25% to 85% after implantation of the CoreValve system and from 8% to 30% after the implantation of a Edwards Sapien valves), and third-degree AV block with a subsequent need for PPI ranging from 5.7 % to 42.5 % (with a median of 28% for the Medtronic CoreValve System and 6% for the Edwards Sapien valves) [16-22] .

Incidence of conduction disturbances in our study was 26.3% for new onset LBBB (28.6% for the CoreValve system, and 20% for Sapien XT), and the incidence of complete heart block was 15.8% (21.4% for the CoreValve system, and absent with Sapien XT). These results match the international rates, putting in consideration the relatively small study population especially with Sapien XT.

As regards the procedural –modifiable-risk factors and depth of implantation, a Spanish study (n = 65; CoreValve only) reported a frame depth in the LVOT of 11.1 mm as an independent predictor of PPI with

81% sensitivity and 84.6% specificity[23]. Similarly, another study revealed that if the proximal end of the valve frame was positioned < 6.7 mm from the lower edge of the noncoronary cusp, no prosthesis-related left bundle branch block would occur[24].

The new repositionable Evolut R offers potential benefits compared to the preceding CoreValve. A study by Giannini, C., et al. [25] comparing the performance of the Evolut R with the CoreValve showed that the recapture and reposition maneuvers allowed a less implantation depth for the Evolut R, and as a consequence, the rate of PPI was lower in patients receiving the Evolut R. The manufacturer recommends optimal DI between 4 - 6 mm for the CoreValve and 3 - 5 mm for the Evolut R.

As regard the Sapien prosthesis, Urena, M., et al. [26] demonstrated that new-onset LBBB correlated with DI and each 1-mm increase in the DI corresponded to a 1.37 increase in the odds ratio for developing new LBBB.

Our study has reached a cut-off of DI ≥ 4.87 mm to be a strong predictor of conduction disturbances after TAVI with sensitivity 93.8%, and specificity 81.8%. Moreover, indexed DI (DIi) was shown to have a strong predictive ability and that a cut-off of DIi ≥2.30 mm/m^2 had sensitivity of 93.8% and specificity 72.7% in predicting conduction disturbances after TAVI. To the best of our knowledge, DIi has not been studied before and further studies are needed for verification.

Studying the relationship between depth of implantation (DI) and membranous septum length (MS) was the core of our study. This relationship was previously studied and expressed as the numerical difference between them (ΔMSID) in a study (N= 73) by Hamdan, A., et al.[27] using self expandable valves, ΔMSID was shown to be the strongest independent procedural predictor of high degree AV block (OR: 1.4, 95% CI: 1.2 to 1.7, p < 0.001). Furthermore, he reached a cut–off of ΔMSID of 0.4 mm to be able to predict high degree AV block with sensitivity 92.3%, specificity 76.7% and negative predictive value (NPV) close to 97.8%.

Our study has shown that ΔMSID is a strong predictor of conduction disturbances after TAVI (p <0.001) and we reached a cut-off of ≤1.75 mm to be a strong procedural predictor of conduction disturbances with sensitivity reaching 100%, specificity 95.5%, and NPV 100%. The difference between cut-offs may be attributed to different study populations.

However, this was opposed in a study (n=61; Sapien 3 only) by Oestreich, B., et al. [28] showing that neither the MS nor ΔMSID, predicts conduction disturbance (p= 0.09, and 0.64 respectively) and that only DI and basal septal calcification are the strongest predictors of conduction disturbances (p= 0.02, and 0.04 respectively). In concordance with this study, we also concluded that MS is not a predictor (p=0.211) but we found that ΔMSID is a strong procedural predictor. This difference in results could be attributed to different valves used.

Moreover, we expressed the relationship between DI and MS in the form of percentage (DIMS) which also turned out to be a strong predictor (p <0.001), and that a cut-off ≥75.00% is a strong procedural predictor with the same predictive power as ΔMSID. On applying multivariate regression analysis for procedural predictors, DIMS emerged as the most powerful independent procedural predictor (OR: 16.00, 95% CI: 2.12 to 120.65, p 0.007). We are proposing that expressing this relationship in the form of percentage rather than numerical difference in millimetres might be more practical and easier for use especially in situations in which the membranous septum length is short, at that point estimating and foreword planning the

DI in percentage will be more convenient and feasible.

As regards preprocedural predictors, our study concluded that basal septal calcification is a strong predictor of conduction disturbances (p= 0.001), and when applying multivariable logistic regression for the pre-procedural predictors, the basal septal calcification emerged as the most powerful independent preprocedural predictor of conduction disturbances (OR: 98.73, 95% CI: 7.63 to 1278.23, p < 0.001). These results are in concordance with Hamdan, A., et al. [27] who also concluded that basal septal calcification is a strong independent predictor (OR: 4.9, 95% CI: 1.2 to 20.5, p = 0.031). Similarly, A study (N=81; CoreValve) by Latsios, G., et al.[29] has found basal septal calcification as the most powerful independent predictor of conduction disturbances (OR: 1.06, 95% CI: 1.02-1.11, p 0.004). This could be attributed to the fact that the presence of calcium at the basal interventricular septum could result in direct injury to the conduction system when it is sandwiched between the valve frame and the septum.

Conclusion:

Conduction disturbances remain a common complication of TAVI. Presence of basal septal calcification is a risk factor that increase patient propensity of development such complication after TAVI. The relationship between depth of implantation and membranous septum is a strong independent procedural predictor and prospective validation of its cut-offs is needed.

Limitation:

This study was a single-center observational non randomized study with all its inherent limitations, most importantly the relatively small study population. Larger size valves (CoreValve 31/34) were rarely used due to availability at the time of our study. Presence of basal septal calcification was included qualitatively rather than graded or quantified.

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المتنبئات لحدوث اضطرابات في التوصيل الكهربائي بالقلب بعد زرع الصمام الأورطي بواسطة القسطرة بإستخدام الصمامات ذاتية التمدد

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الخلفية: يمثل ظهور زرع الصمام الاورطى بالقسطرة (TAVI) تحولا نموذجيا لعلاج المرضـي الذين يعانون من أعراض بسبب الضيق الشديد فى الصمام الاورطى وهم في خطر جراحي مرتفع. ومع الخبرة المتزايدة في هذا المجال، فبمرور الوقت, انخفض معدل حدوث عواقب نتيجة هذه القسطرة، وأصبح اللجوء اليها فى تزايد مستمر و بوسائل بسيطة، حتى أصبحت من الإجراءات الآمنة و التى يمكن التنبؤ بنتائجها. ومع ذلك، وخلافا لغيرها من العواقب، فان نسبة حدوث إضطرابات التوصيل التي يمكن ان تكون في شكل إنقطاع فى إحدى الضفائرالكهربائية أو انقطاع تام فى الضفيرة الكهربائية(His)، والحاجة إلى زرع منظم ضربات القلب الدائمة لم تنخفض في الاونه الاخيره ، مع وجود تقارير تشير إلى زيادة العواقب المرتبطة باستخدام بعض صمامات الجيل الحديث.

الهدف من الدراسة: لتحديد التنبؤات التى تؤدى لحدوث اضطرابات فى التوصيل الكهربائى بالقلب بعد زرع الصمام الاورطى بالقسطرة.

المرضي وطرق الدراسة: من يناير ٢٠١٧ إلى ابريل ٢٠١٩ ، اشتملت ٣٩ من المرضي الذين يعانون من أعراض بسبب الضيق الشديد فى الصمام الاورطى و خضعوا لزرع الصمام الأورطى عن طريق القسطرة (TAVI) باستخدام الصمامات القابلة للتوسيع الذاتي (CoreValve أو Evolut R) أو الصمام القابل للتوسيع عن طريق البالون Sapien) (XT في مستشفيات جامعه عين شمس. وخضع جميع المرضي لرسم قلب قبل وبعد TAVI وبعد ٣٠ يوما. وتم دراسة عدة معايير بما في ذلك المعايير التمهيدية: الفحص الإكلينيكى ، رسم القلب ، موجات صوتية على القلب ، والأشعة المقطعية ، والمعايير الاجرائيه: نوع وحجم الصمام ، واستخدام البالون للتوسيع قبل وبعد الزرع ، وعمق زرع الصمام. وقد تم وضع سطح الجسم فى الإعتبار بالنسبة لجميع المعايير الكمية.

النتائج: وجدت اضطرابات فى التوصيل الكهربائى بالقلب في ١٦ مريضا (٤٢.١%) ، منهم ١٠ مرضى أصيبوا بقطع فى الضفيرة الكهربائية اليسرى (٢٦.٣%) و ٦ من المرضي (١٥.٨%) أصيبوا بقطع تام فى الضفيرة الكهربائية،و واحد فقط من الستة مرضى (٢.٦ ٪) أصيب بقطع دائم CHB مما تتطلب زرع منظم ضربات القلب الدائم . واظهر تحليل الانحدار اللوجستي المتعدد المتغيرات للتنبؤات السابقة للإجراءات تكلس الحاجزبين البطينين القاعدي باعتباره اقوي متنبئ مستقل (p< ٠.٠٠١). وفي حين اظهر تحليل الانحدار اللوجستي المتعدد المتغيرات للتنبؤات الاجرائيه العلاقة بين عمق الزرع وطول الحاجز الغشائي المعبر عنها بالنسبة المئوية (DIMS) مع القطع > ٧٥.٠٠% كاقوي توقع اجرائي مستقل (p=. ٠.٠٠٧).

الخلاصة: لا تزال اضطرابات التوصيل الكهربائى من المضاعفات الشائعة لزرع الصمام الاورطى عن طريق القسطرة . وجود تكلس الحاجز القاعدي هو أحد عوامل الخطر التي تزيد من نسبة حدوث هذه المضاعفات بعد الزرع . والعلاقة بين عمق الزرع وطول الحاجز الغشائي هو مؤشر اجرائي مستقل قوي وهناك حاجه إلى تأكيد النتائج عن طريق دراسات أخرى.