A New Way to Avoid the Pitfall of the Paravalvular Leakage in Patients With Rapid Deployment Valve

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Backgound

Rapid deployment and sutureless prosthesis have become widely used in the recent years, due to ease of implantation as well as excellent hemodynamics.

Paravalvular leak following rapid deployment sutureless prosthesis is a very small incidence (1-2%), howevere this leak is well-recognized complication and requires close monitoring for checking the LV dysfunction and severe hemolytic anemia.

Sutureless and rapid deployment implantation in bicuspid aortic valve: results from the sutureless and rapid-deployment aortic valve replacement international registry

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Table 5 Rate of pacemaker implantation and aortic regurgitation

Variables	Pacemaker implantation	Overall AR	Mild AR	Moderate AR	Severe AR
Perceval (n=88)	5 (5.7%)	8 (9.1%)	6 (6.8%)	2 (2.3%)	–
Small (n=7)	0	1 (1.1%)	1 (1.1%)	–	–
Medium (n=26)	1 (1.1%)	3 (3.4%)	2 (2.3%)	1 (1.1%)	–
Large (n=32)	3 (3.4%)	4 (4.5%)	3 (3.4%)	1 (1.1%)	–
Extra-large (n=23)	1 (1.1%)	1 (1.1%)	–	–	–
EDWARS INTUITY/INTUITY Elite (n=103)	10 (9.7%)	11 (10.7%)	6 (5.8%)	4 (3.9%)	1 (1.0%)
19 mm (n=12)	0	5 (4.9%)	3 (2.9%)	2 (1.9%)	–
21 mm (n=14)	2 (1.9%)	0	–	–	–
23 mm (n=33)	1 (1.0%)	1 (1.0%)	1 (1.0%)	–	–
25 mm (n=26)	5 (4.9%)	3 (2.9%)	1 (1.0%)	1 (1.0%)	1 (1.0%)
27 mm (n=18)	2 (1.9%)	2 (1.9%)	1 (1.0%)	1 (1.0%)	–

AR, aortic regurgitation.

Rate of pacemaker implantation and moderate-severe aortic regurgitation (AR) were 7.9% and 3.7%, respectively. **BAV is not considered a contraindication for the implantation of SURD valves**.
However, detailed information of aortic root geometry as well as the ***knowledge of some technical considerations*** are mandatory for a good outcome.

The technique that prevents paravalvular leakage

Ferrari et al: Innovations (Phila). 2015;10:360 - 362.
The aortic annulus stabilization technique based on an already performed annuloplasty of the aortic annulus that uses a running 3–0 polypropylene suture

Andreas M et al: Eur J Cardiothorac Surg. 2019;55:527 - 533.
An extra stitch in the non-coronary sinus. W shaped stitch

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Data collection:

All 41 consecutive patients underwent successful isolated or combined RD-AVR between May 2019 and March 2021 in the Department of Cardiac Surgery at the Juntendo University Hospital.

Ethics approval and consent to participate
Written consent was obtained from the patient for publication of the case report. The Clinical Ethics Committee of Juntendo University Hospital approved this study (JHS20-341), and the study was conducted in accordance with the principles of the Helsinki Declaration.

Preoperative baseline

Preoperative baseline	
Age (year)	74.4 ± 7.0 (49-84)
Female gender	12 (29.2%)
Body mass index (kg/m^2)	23.51 ± 3.62
Body surface area (m^2)	1.63 ± 0.16
Euro Score II	2.78 ± 2.55
STS Score	4.92 + 3.85
Brain natriuretic peptide (pg/mL)	331 + 581
Diabetes Mellitus	15 (36.6%)
Hypertension	33 (80.5%)
Hyperlipidemia	30 (73.2%)
Estimated glomerular filtration rate (mL/min/1.73 m2)	47.2 + 29.3
Hemodialysis	11 (26.8%)
Cerebrovascular accident	6 (14.6%)
Peripheral vascular disease	2 (4.8%)
Malignancy	6 (14.6%)
Hemoglobin(mg/dl)	12.5 ± 1.8
Albumin(mg/dl)	3.9 ± 0.5
Chronic lung disease	5 (12.2%)
Coronary artery disease	14 (34.2%)
Previously PCI	6 (14.6%)
Previous cardiovascular interventions	6 (14.6%)
Previous cardiac surgery	2 (4.8%)
Previous pacemaker implantation	1 (2.4%)
Previous rhythm abnormalities	3 (7.3%)

Preoperative UCG	
Left ventricular ejection fraction (%)	66 ± 8
Valsalva (mm)	32.3 ± 3.8
Sinotubular junction (mm)	26.0 ± 3.6
Annulus (mm)	21.4 ± 2.4
Aortic valve area (cm^2)	0.8 ± 0.2
Mean pressure gradient (mmHg)	39.2 ± 15.3
Velocity (m/s)	4.1 ± 0.8

Intraoperative patient characteristics and early results

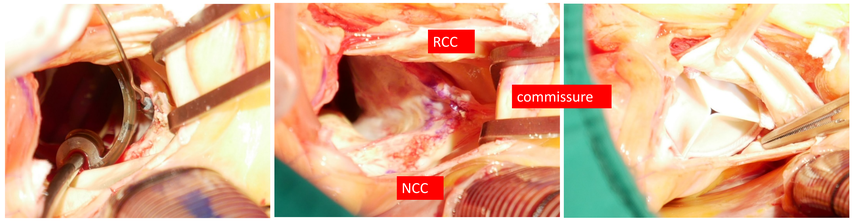
Full sternotomy access	26 (63.4%)
Hemi-sternotomy access	15 (36.5%)
Concomitant procedures	
CABG	9 (22.0%)
Aortic surgery (total arch replacement)	2 (4.8%)
Mitral valve plasty	2 (4.8%)
Atrial fibrillation surgery	4 (9.7%)
Left atrial appendage amputation	21 (97.5%)
Morrow procedure	1 (2.4%)
Implanted valve size (mm)	
19	4 (9.8%)
21	10 (24.4%)
23	16 (39.0%)
25	11 (26.8%)
Operative time (min)	194 ± 69
Cross-clamp time (min)	65 ± 22
Cardiopulmonary bypass time (min)	94 ± 41
Hospital mortality	0
Low output syndrome	0
Cerebrovascular accident	1 (2.4%)
Respiratory trouble	1 (2.4%)
Infection	1 (2.4%)
Renal failure	1 (2.4%)
Revision for bleeding	2 (4.8%)
New pacemaker implantation	1 (2.4%)
New onset of atrial fibrillation	11 (26.8%)
ICU stay (hours)	31 ± 19
Hospital stay (days)	11.8 ± 6.1

Echocardiographic data 12 months postoperatively

Size	19 mm	21 mm	23 mm	25 mm
Number of cases	4	10	16	11
Mean aortic gradient (mmHg)	13.4 ± 6.4	10.8 ± 3.2	9.5 ± 3.2	8.0 ± 3.8
Effective orifice area (cm^2)	1.38 ± 0.39	1.67 ± 0.44	1.98 ± 0.37	2.43 ± 0.51
Effective orifice area index (cm^2/m^2)	0.95 ± 0.27	1.14 ± 0.26	1.21 ± 0.26	1.41 ± 0.32
Paravalvular leakage	0	0	2 (12.5)	2 (18.2)
AR mild	0	0	1	2
AR moderate	0	0	1	0
New PM implantation	1 (25%)	0	0	0
New LBBB	0	1	3	0

AR: aortic regurgitation; LBBB: Left bundle branch block; PM: pacemaker

How to apply the additional stitch.



ST-junction is smaller than annulus, and the gap is recognized below the commissure.

The red arrow line is the line of sawing cuff and the blue line is commissure. Also, there is a gap in the vertical direction.
The yellow arrows are the additional stitch line.

We apply the additional stitch which is everted horizontal mattress suture without pledget.

Durability, paravalvular leakage, and arrhythmia between the first 20 cases and the last 21 cases

	First 20 cases	Last 21 Cases
Effective orifice area index (cm2/m^2)	1.19 ± 0.20	1.34 ± 0.25
Paravalvular leakage	4 (20.0)	0
New PM implantation	1	0
New LBBB	1	3

LBBB: Left bundle branch block

Conclusion

We conclude that PVL is more likely to occur if there is a gap below the R-N commissure, especially in cases with large annulus sizes. In such cases, applying an additional stitch to the R-N commissure is extremely useful.