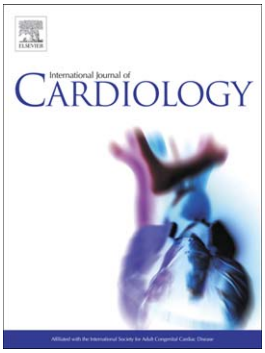

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Transcathether aortic valve implantation with the new repositionable self-expandable Evolut R versus CoreValve system: a case-matched comparison

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Conflict of interest statement

AS. Petronio, F. Bedogni, F. Ettori, A. Latib, are consultants for Medtronic Inc. All others author have no potential conflict of interest for this paper.

Brief title: second-generation versus first generation self-expandable transcatheter heart valves.

Abstract

Background Despite promising results following transcatheter aortic valve implantation (TAVI), several relevant challenges still remain. To overcome these issues, new generation devices have been developed. The purpose of the present study was to determine whether TAVI with the new self-expanding repositionable Evolut R offers potential benefits compared to the preceding CoreValve, using propensity matching.

Methods Between June 2007 and November 2015, 2148 consecutive patients undergoing TAVI either CoreValve (n=1846) or Evolut R (n=302) were prospectively included in the Italian TAVI ClinicalService® project. For the purpose of our analysis 211 patients treated with the Evolut R were matched to 211 patients treated with the CoreValve. An independent core laboratory reviewed all angiographic procedural data and an independent clinical events committee adjudicated all events.

Results Patients treated with Evolut R experienced higher 1-year overall survival (log rank test p=0.046) and a significantly lower incidence of major vascular access complications, bleeding events and acute kidney injury compared to patients treated with the CoreValve. Recapture manoeuvres to optimize valve deployment were performed 44 times, allowing a less implantation depth for the Evolut R. As a consequence, the rate of more than mild paravalvular leak and new permanent pacemaker was lower in patients receiving the Evolut R.

Conclusion In this matched comparison of high surgical risk patients undergoing TAVI, the use of Evolut R was associated with a significant survival benefit at 1 year compared with the CoreValve. This was driven by lower incidence of periprocedural complications and higher rates of correct anatomic positioning.

Keywords: self-expandable transcatheter aortic valve, transcatheter aortic valve implantation

Introduction

Transcatheter aortic valve implantation (TAVI) is now the treatment option of choice for symptomatic severe aortic stenosis in patients judged inoperable or at high surgical risk, demonstrating excellent procedural results with sustained clinical outcomes (1) (2). Although TAVI has been proven to be non-inferior or even superior to surgical aortic valve replacement in terms of all-cause mortality, challenges such as paravalvular leak, requirement for permanent pacemaker implantation, vascular access complications and stroke still exist and add significant morbidity to TAVI recipients (3) (4) (5) (6) (7) (8). First-generation devices with the use of larger diameter catheters (18-F to 24-F) may explain the higher incidence of procedure-related complications in the early phase of TAVI (9) (10). In the last few years the increasing operator experience with the development of second generations device and smaller profile delivery system have resulted in a significant improvement of procedural outcomes (11) (12) (13) (14) (15) (16).

Recently, the latest generation of the CoreValve, the resheathable Evolut R, with enhanced features that allow the valve to be recaptured and repositioned during deployment, might further enhance TAVI performance (17) (18) (19). Despite initial promising results from the CE mark trial evaluating the safety and clinical performance of the Evolut R, it is not well established whether the new capabilities of Evolut R will translate into improved procedural and clinical outcomes compared with its predecessor in extensive clinical use (18). Therefore the aim of the present study was to analyse and compare all patients who underwent TAVI with the Corevalve or Evolut R in the prospective national Italian TAVI registry using propensity matching.

Methods

Patient population. Starting from June 2007, all consecutive patients with severe aortic stenosis undergoing TAVI with either the CoreValve or the resheathable CoreValve Evolut R were prospectively included in the Italian ClinicalService® Project. This is an on-going nation-based clinical data repository and medical care project aimed at describing and improving the use of implantable devices in Italian clinical practice already described elsewhere (20) (21). From June 2007 to November 2015 patients were treated with the CoreValve, whereas the Evolut R was used from November 2014 until November 2015. For the purpose of the analysis, first 3 CoreValve implants and first 3 Evolut implants per center were excluded. Patients receiving the CoreValve 31 mm were also excluded from the analysis due to lack of a larger than 29 mm Evolut R device.

Clinical follow-up was performed either by phone or in the outpatient clinic. Each patient signed an informed consent form for participation in the ClinicalService® project.

Implantation Procedure. TAVI procedures were mainly performed under local anesthesia with mild systemic sedative/analgesic treatment, according to patient collaboration (22). The trans-femoral route was the default access site, with percutaneous puncture sites closed with suture-based closure device (one Prostar XL or two ProGlide systems, Abbott Vascular Inc.). Other access sites including trans-aortic and trans-subclavian were considered if the trans-femoral route was contraindicated.

Valve devices. The Medtronic CoreValve (Medtronic Inc, Minneapolis, Minnesota) is a self-expandable valve that consists of a trileaflet porcine pericardial valve mounted on a nitinol frame and requires the insertion of an 18 Fr sheath for delivery (4).

The latest CoreValve generation, the EvolutR with inLine Sheath EnVeo R delivery catheter, is a novel transcatheter heart valve system with enhanced features that allow to resheath or recapture the partially deployed prosthesis (up to 80% of maximal deployment) in order to reposition or retrieve the implant (18). The reduced outflow height helps prevents valve interference from the ascending

aorta that may influence valve position within angulated anatomies, while the extended skirt and a more cylindrical shape of the lower part frame create a longer landing zone for better sealing reducing significant paravalvular leak. Furthermore, the built-in inline sheath allows for the whole system to be inserted into a patient without the need for a separated access sheath, reducing the overall profile of the system, equivalent to the outer diameter of a 14-Fr. As a consequence, the minimal access vessel diameter suitable for Evolut R implantation is 5 mm compared to 6 mm for the CoreValve.

Definitions. Primary outcome of interest was freedom from 12 months all-cause mortality after TAVI. Secondary endpoints were periprocedural adverse events including paravalvular leak, bleeding, vascular access sites complications, stroke, acute kidney injury and new permanent pacemaker implantation.

Events were defined according to the Valve Academic Research Consortium-2 (VARC-2) (23). Measurements of implantation depth were performed on angiographic images as previously described (24). "Correct implantation" was defined as a depth ≤6 mm below the annulus plane, and a depth >6 mm was considered to be a low implantation. Angiographic assessment of post-procedural aortic regurgitation severity was performed according to Sellers classification (25). The grade of paravalvular leak at discharge was assessed by transthoracic echocardiography according to VARC-2 guidelines (23). An independent core laboratory reviewed all angiographic procedural data (implantation depth, final angiographic aortic regurgitation, number of full and partial recaptures), and an independent clinical events committee adjudicated all events.

Statistical analysis. Continuous data were summarized as mean and standard deviation or median and 25^{th}-75^{th} percentiles in case of skewed distributions. Absolute and relative frequencies were reported for categorical variables. Continuous variables were compared using the Wilcoxon test. Normality of distribution was tested, calculating skewness and kurtosis values. Comparisons of categorical variables were performed using Chi-square test. A 2-tailed value of $p<0.05$ was considered significant. Overall survival was studied by means of a Cox model and Kaplan–Meier

curves were reported. Proportionality of hazards was tested using the Shoenfeld residuals. Propensity score matching was performed to adjust for differences in baseline characteristics between the CoreValve and the Evolut groups. The propensity score was calculated by using a logistic regression model that included the following variables: sex, hypertension, diabetes mellitus, renal disease, coronary artery disease, peripheral artery disease, chronic obstructive pulmonary disease, atrial fibrillation, left bundle branch block, mean transaortic pressure gradient and NYHA III-IV. Matching was performed by randomly selecting a patient treated with Evolut R and looking for the patient treated with the CoreValve with the nearest logit-transformed propensity score. The C-statistic was 0.67 showing good discrimination of the propensity-matching model.

For statistical analysis, SAS 9 for Windows (SAS Inst. Inc., Cary, NC) was used.

Results

Patient population. Of 2148 patients undergoing TAVI with a self-expanding valve, between June 2007 to November 2015, 1846 were treated with the CoreValve and 302 patients were treated with the Evolut R. After propensity analysis, a total of 211 patients (Evolut R group) receiving Evolut R (31.8% male, 82±7 years, STS score 7.5±6.9) were matched to 211 patients (CoreValve group) receiving CoreValve (28.9% male, 83±6 years, STS score 7.3±5.4). All baseline characteristics of propensity-matched groups were well balanced (Table 1).

Procedural data. Detailed procedural data are summarized in table 2. The majority of Evolut R and CoreValve patients were treated via the transfemoral route (86.2% vs. 82.5%; p=0.41) and under local anaesthesia (77.3% vs. 75.9%; p=0.75) without significant differences between the two groups. Device success according to VARC2 definitions tented to be lower in the Evolut R group (99.1% vs. 96.7%; p=0.09). Overall procedural time was similar in both groups whereas patients treated with the Evolut R received less contrast dye (156.4±69.0 ml vs. 184.6±81.9 ml; p=0.002). Evolut R patients were more likely to receive smaller sized valves (p=0.001) and were less frequently treated with balloon pre-dilatation (49.3% vs.. 71.6%, p<0.001) with a higher need for balloon post-dilatation after implantation (36.4% vs.. 18.9%, p<0.001), compared to the CoreValve patients.

Evolut R valve repositioning was successfully performed 44 times by either resheating or recapturing, mostly due to initial deep positioning of the valve. There were 12 completed recaptures without valve related dysfunction requiring a repeat procedure. As consequence, the option to optimize valve position allowed a less ventricular implantation depth at the non-coronary cusp in the Evolut R group (Figure 1 A). In particular, in only on third of Evolut R patients the implantation depth was > 6 mm, while this was observed in more than half of CoreValve patients (26.2% vs. 50.4%; p<0.001). Although not statistically significant, final angiography showed a clear trend toward lower grade of aortic regurgitation in Evolut R group (p=0.139; Figure 1 B).

In-hospital outcomes. Detailed in hospital clinical outcomes are presented in table 3. In hospital death was lower in the Evolut R group compared to CoreValve group (0.5% vs. 2.8%; p=0.054). Significant lower rate of life-threating bleeding (0.4% vs. 5.7%; p<0.001), major bleeding (1.4% vs. 9.9%; p<0.001), major vascular access site complications (2.0% vs. 16.1%; p<0.001), need for transfusion >2 units of blood (1.4% vs. 8.1%; p=0.001) and acute kidney injury (9.4% vs. 22.2%; p<0.001) were observed for the Evolut R patients. No differences in myocardial infarction, any cerebrovascular events and device failure requiring reintervention were noted among the two groups. On the contrary, the incidence of major or disabling stroke tented to be higher in the Evolut R group, although not statistically different (1.4% vs.. 0.0%; p=0.089). New permanent pacemaker implantation rate and the length of hospital stay were significantly lower for patients treated with Evolut R (22.7% vs. 35.3%; p=0.008 and 7.5 days vs. 8.8 days; p=0.002, respectively).

One hundred and fifty (71.1%) patients in the Evolut R group and 174 (82.2%) patients in the CoreValve group underwent predischarge transthoracic echocardiography (table 3). Peak and mean aortic transvalvular gradients decreased significantly in both groups (both p<0.001), with no cases of residual stenosis. There was a significant difference in predischarge paravalvular leak severity, with lower rate of moderate to severe paravalvular leak in Evolut R group compared with CoreValve group (9.0% vs. 16.7%; p=0.048) (Figure 1 C).

Long-term outcomes. One year follow-up data were available in 96.9% of patients, with survival status reported as of November 15, 2016. Median follow-up in the Evolut R and CoreValve groups was 365 (range 1 to 551) days and 365 (range 1 to 2671) days, respectively. The Kaplan-Meier survival curve for the 2 groups is shown in Figure 2. Patients treated with the Evolut R had a better long-term prognosis than patients treated with the CoreValve (HR 1.80, 95% CI 1.01 to 3.23, p=0.046). Survival curves began to diverge early, with significantly lower 30-day mortality in the Evolut R group compared to CoreValve group (1.0% vs. 7.2%; p=0.001). Actuarial survival rate at 1 year was 91.9% in the Evolut R compared with 85.8% in the CoreValve group.

Discussion

This study was sought to describe the differences in procedural and clinical outcomes of patients undergoing TAVI with the new self-expanding repositionable Evolut R versus the preceding CoreValve in the real clinical practice using propensity matching.

The main findings of our report are: 1) Evolut R prosthesis was associated with a significant survival benefit with regard to 30 days and 1 year all cause mortality compared to CoreValve prosthesis; 2) this benefit was mainly driven by a reduction in vascular complications, bleeding and acute kidney injury; 3) the need for new pacemaker implantation was significantly lower for patients receiving the Evolut R; 4) the rate of moderate to severe paravalvular leak at discharge was decreased in Evolut R compared to CoreValve patients.

Although the outcomes following TAVI have improved over the past years, challenges such as vascular access complications, bleeding, paravalvular leak, requirement for permanent pacemaker implantation and stroke still remain (5) (26). First generation devices have been extensively enhanced with refinement of delivery system in order to improve procedural and clinical outcomes. So far, studies comparing the use of newer second generation devices with first generation devices are currently of small sample size, mostly focused on balloon-expandable prosthesis and on short-term follow-up (12) (13) (14) (15) (16). Recent studies, including a modest number of patients, have demonstrated promising data regarding the acute performance of the Evolut R reporting substantially reduced rate of paravalvular regurgitation while 30-day clinical outcomes were similar to the CoreValve system (27) (28) (29) (30). However, these findings should be interpreted with caution, because of higher risk profiles (higher predicted mortality, lower ejection fraction, higher incidence of revascularization procedures) in the CoreValve than Evolut R population (28) (27). Moreover, long term clinical outcome data for the Evolut R are limited to the CE mark trial, demonstrating excellent clinical results with the highest reported survival at 30 days and 1 year (100% and 93.3%, respectively) (18) (19).

Thus, we have compared the emerging new generation device, the Evolut R valve with its predecessor, the CoreValve, aiming to explore if this step in technology translates to clinical outcome differences in the clinical daily routine.

After propensity analysis, we proved that Evolut R is superior to CoreValve in terms of overall survival (p=0.046). In our analysis, 30 days and 1-year survival rates were 99.0% and 85.8%, in CoreValve group versus 92.8% and 91.9% in Evolut R group, respectively. For the CoreValve group similar survival rate were reported in the self-expanding transcatheter aortic valve U.S. High Risk Pivotal Trial: 95.5% at 30 days and 85.1% at 1 year (4). Whereas, for the Evolut R patients, survival rates are in line with results of the new generation balloon expandable Sapien 3 valve (Edwards Lifesciences) for transfemoral patients: (97.8% at 30 days and 87.7% at 1 year) (31).

Vascular adverse events resulting in major or life-threatening bleeding requiring blood transfusion are independent predictors of mortality (32). With the first generation device, major vascular complications and major bleeding occurred in 16.2% and 16.8% of patients in the PARTNER IB (Placement of Aortic Transcatheter Valve) trial (9). Recently the development of low-profile sheath has resulted in decreased vascular complications and procedure related bleeding after transfemoral TAVI (11). Our study confirms these findings reporting a lower incidence of major vascular complications (2.0% vs. 16.1%) and major bleeding (1.4% vs. 9.9%) in patients receiving the new self-expanding Evolut R prosthesis compared to patients treated with its predecessor, the CoreValve. Notably, comparable results have been described with the new generation balloon expandable Sapien 3 valve, showing significantly lower rates of major vascular complications (4.5% vs. 16.7%) and major bleeding (2.3% vs. 6.1%) compared to first generation balloon expandable Sapien XT (14). Recent reports, including few patients, support our findings reporting a numerically (but not significant) less chance to suffer major vascular complication and bleeding among patients treated with the Evolut R compared to CoreValve (30) (29).

Stroke remains a major risk in the TAVI population. Results from the PARTNER trials showed an

almost 2-fold increase in stroke rate in the TAVI arm compared with surgery (3). However, this difference disappeared at 2 years follow-up (33). Recent experiences with newer generation devices show that the rate of stroke has been decreasing significantly after TAVI (5) (6) (15). Unfortunately, we observed a higher incidence of periprocedural major stroke in the Evolut R group compared to CoreValve group, although not statistically different (1.4% vs. 0.0%). Recent studies have confirmed our result reporting a numerically increased cerebrovascular accident rate for the new repositionable valves respect to first generation devices (34) (13) (28) (30) . The resheathing and recapture of repositionable valves in ascending aorta can potentially lead to the higher risk of embolic events. In our experience another contributing factor to cerebrovascular events for the repositionable valve may have been the higher need for postdiltation in the Evolut R cohort. Postdilatation is a known predictor of acute cerebrovascular events after TAVI and it has been associated with a higher incidence of mortality at 30 days (35). According to our results, a recent report suggests that performing predilatation may avoid the need for postdilatation and the possible increased risk of embolic events (36).

Our matched analysis found a significantly lower pacemaker implantation rate for the Evolut R compared to the CoreValve (22.3% vs. 35.0%). A recent meta-analysis included 11.210 patients demonstrated that the need for permanent pacemaker implantation ranged from 1% to 51% and was in median 28% with the CoreValve device and 6% with the Edwards Sapien device (37). In this study, the lower pacing rate for the Evolut R could be attributed to the repositionable and recapturable capability enabling more precise valve positioning in order to evade conduction disturbances associated to deep implantation. In particular, the ADVANCE II study (the CoreValve Prospective International Post-Market Advance II) highlighted the importance of a shallow implantation depth to limit the need of permanent pacemaker after TAVI, identifying a cut-off value of 4 mm (24). Furtheromore the more conformable nitinol frame design resulting in a reduced outward force at the inflow portion of the valve might reduce trauma to the conduction system as compared with the CoreValve system (18). According to our findings recent studies have reported a

numerically lower chance to require a new permanent pacemaker with the Evolut-R compared with the CoreValve, although it was not found to be statistically significant (30) (27).

Moderate to severe paravalvular leak is frequently observed after TAVI and is associated with worse survival (21). In a randomized study comparing the balloon expandable Edwards Sapien XT with the self-expandable CoreValve device the risk for moderate or severe paravalvular leak was 12.4% versus 42.5% immediately after valve placement, which fell to 4.1% and 18.3% after post-dilatation (38). Potential causes of paravalvular leak include suboptimal positioning, undersizing and severe calcification. New devices have been designed to target post TAVI paravalvular leak with the introduction of adaptive seal surrounding the ventricular portion of the prosthesis (eg, Sapien 3 and Lotus valves) or with the ability to reposition the valve in cases of suboptimal deployment (eg, Evolut R and Lotus valves). Recently, authors have reported rates of moderate to severe paravalvular leak <2% both for the latest generation of balloon expandable S3 and the repositionable Lotus valve (14) (15) (39) (40). Our study confirmed these findings reporting a decreased frequency of moderate to severe paravalvular leak at discharge in the Evolut R group compared to CoreValve group (9.0% vs. 16.7%; p=0.048). Similar lower rates of clinically relevant paravalvular leak for the Evolut R were also observed in recent reports: ranging from 0 to 5% (29) (27). A more adaptive frame with an extended skirt and the possibility for a precise positioning may explain the downward trend in paravalvular leak rate for the Evolut R respect to the CoreValve.

Limitations. The principal limitations of this study are the relative small sample size and the retrospective non-randomized design. Although propensity score matching is a well-accepted approach in observational research to address differences in baseline characteristics, it cannot account for unmeasured bias. In addition, the echocardiographic assessment of paravalvular leak at discharge was not performed by core laboratory evaluation.

Conclusion In this retrospective, propensity score-matched analysis, TAVI with the Evolut R was associated with a significant survival benefit at 1 year and reduction of vascular access complications, bleeding, acute kidney injury and need for permanent pacemaker implantation. The clinical significance of these differences needs to be tested in a large randomized, controlled trial.

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Figures.

Figure 1: A) Implantation depth evaluated by angiographic images. B) Final aortic regurgitation grade evaluated by angiographic images. C) Predischarge paravalvular leak severity evaluated by transthoracic echocardiography.

Figure 2: Kaplan-Meier estimates of 1 year survival. Red line= Evolut R group; blue line= CoreValve group.

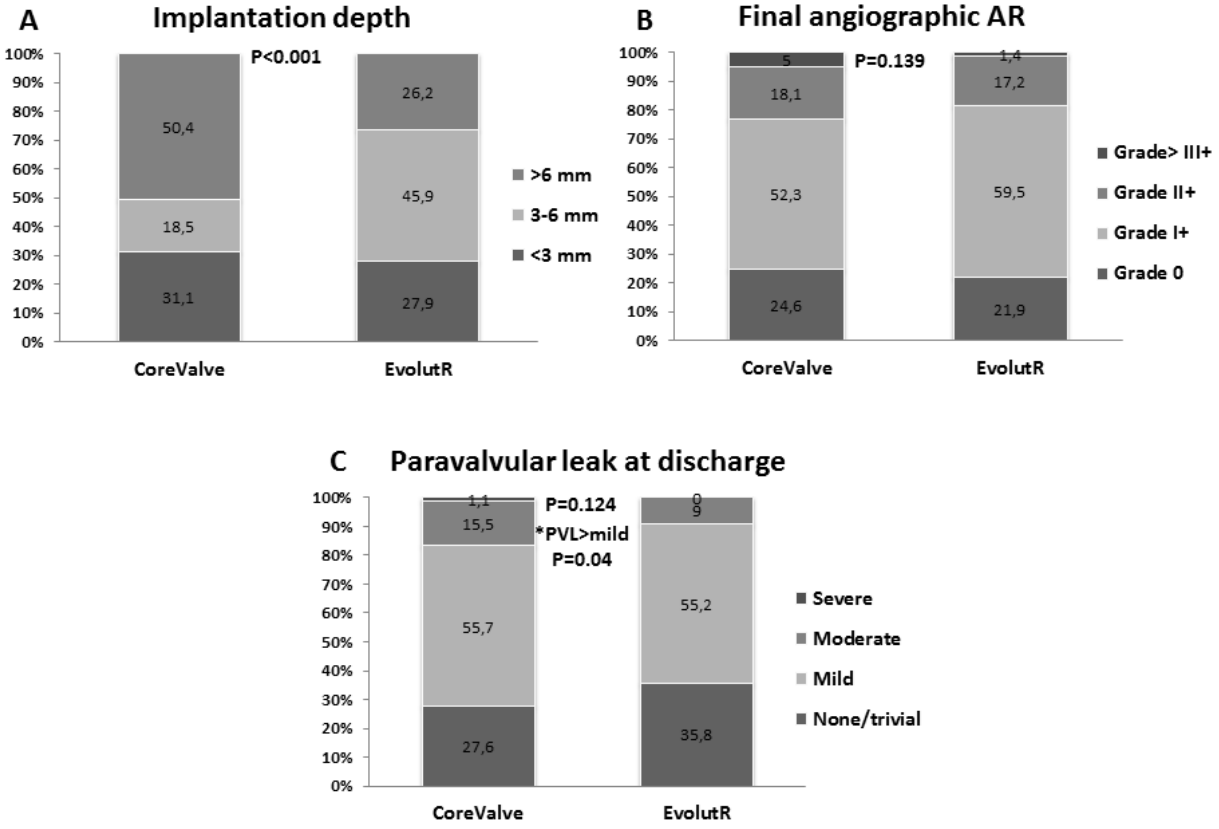

Figure 1

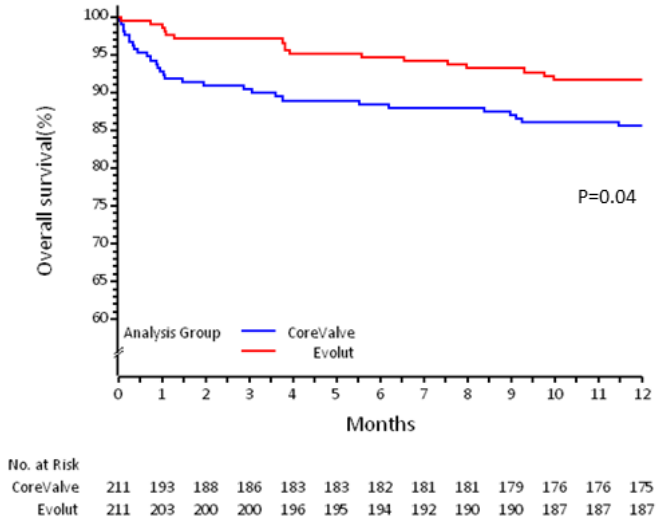

Figure 2

Table 1: Baseline characteristics

	CoreValve group N=211	**Evolut R group** N=211	***p*-value**
Age, yrs	83 ± 6	82 ± 7	0.252
Male sex	61 (28.9)	67 (31.8%)	0.525
Logistic Euroscore, %	20.7 ± 13.4	21.1 ± 12.8	0.546
STS PROM score, %	7.3 ± 5.4	7.5 ± 6.9	0.609
Arterial hypertension	189 (89.6%)	184 (87.2%)	0.447
Diabetes mellitus	23 (10.9%)	25 (11.8%)	0.759
Coronary artery disease	79 (37.4%)	82 (38.8%)	0.676
History of myocardial infarction	28 (13.3%)	24 (11.3%)	0.566
History of percutaneous coronary intervention	52 (24.6%)	44 (20.8%)	0.458
History of aorto-coronary bypass graft surgery	20 (9.5%)	21 (10.0%)	0.869
Cerebrovascular disease, n (%)	25 (11.8%)	25 (11.8%)	1.000
Creatinine (mg/dL)	1.04 (0.9- 1.4)	1.10 (0.9- 1.4)	0.720
GFR<30 mL/min	41 (19.4%)	46 (21.8%)	0.617
Atrial fibrillation	16 (7.6%)	23 (10.9%)	0.239
Peripheral vascular disease	36 (17.1%)	36 (17.1%)	1.000
Chronic obstructive pulmonary disease	31 (14.7%)	28 (13.3%)	0.674
Left bundle branch block	13 (6.2%)	11 (5.2%)	0.296
Right bundle branch block	11 (5.2%)	15 (7.1%)	0.296
Left anterior hemiblock	21 (10.0%)	15 (7.1%)	0.296
Prior permanent pacemaker implantation	27 (12.7%)	26 (12.3%)	0.883
New York Heart Association class ≥ 2	148 (70.1%)	145 (68.7%)	0.751
Echocardiography data			

Left ventricle ejection fraction, %	52.9 ± 11.8	54.1 ± 11.6	0.061
Left ventricle ejection fraction <35%	189 (90.9%)	182 (92.9%)	0.465
Peak aortic gradient, mmHg	79.7 ± 21.3	81.1 ± 20.4	0.501
Mean aortic gradient, mmHg	48.6 ± 13.5	48.8 ± 13.2	0.959
Aortic valve indexed, cm^2/m^2	0.39 ± 0.12	0.36 ± 0.45	0.982
Moderate or severe aortic regurgitation	64 (30.1%)	67 (31.7%)	0.514
Moderate or severe mitral valve regurgitation	92 (43.6%)	82 (38.8%)	0.778
Systolic pressure of pulmonary artery>60 mmHg	15 (7.1%)	13 (6.2%)	0.841

Data shown as n (%) and as means ± (SD); GFR, glomerular filtration rate; STS PROM, STS Predicted Risk of Operative Mortality.

Table 2: Procedural data and in hospital outcomes

	CoreValve group N=211	**Evolut R group** N=211	***p*-value**
Device success	204 (96.7%)	209 (99.1%)	0.092
Procedural access			0.410
Femoral	174 (82.5%)	182 (86.2%)	
Subclavian	27 (12.8%)	19 (9.0%)	
Aortic	10 (4.7%)	8 (3.7%)	
General anesthesia	51 (24.1%)	48 (22.7%)	0.750
Procedural time, min	104.0 (60- 142)	100.0 (75- 128)	0.780
Fluoroscopy time, min	20.3 (16- 28)	22.4 (17- 30)	0.110
Contrast media, ml	180.0 (120- 230)	150.0 (110- 200)	0.002
Prosthesis size			0.001
- 23 mm	10 (4.7%)	27 (12.7%)	
- 26 mm	114 (54.0%)	83 (39.3%)	
- 29 mm	87 (41.2%)	98 (46.4%)	
Predilatation	151 (71.6%)	104 (49.3%)	<0.001
Postdilatation	40 (18.9%)	77 (36.4%)	<0.001
Second valve deployment	2 (0.9%)	1 (0.4%)	0.585
Conversion to surgery	1 (0.4%)	0 (0.0%)	0.316
Coronary obstruction	0 (0.0%)	0 (0.0%)	---
Cardiac tamponade	8 (3.7)	3 (1.4%)	0.123
Valve malpositioning	2 (0.9%)	0 (0.0%)	0.154

In hospital death	6 (2.8%)	1 (0.5%)	0.054
Any vascular access site complications	47 (22.2%)	20 (9.4%)	<0.001
Major vascular access site complications	34 (16.1%)	5 (2.0%)	<0.001
Life-threatening bleeding	12 (5.7%)	1 (0.4%)	<0.001
Major bleeding	21 (9.9%)	3 (1.4%)	<0.001
Transfusion > 2 blood units	17 (8.1%)	3 (1.4%)	0.001
Stroke or TIA	3 (1.4%)	5 (2.4%)	0.475
Major stroke	0 (0.0%)	3 (1.4%)	0.089
Myocardial infarction	2 (0.9%)	0 (0.0%)	0.156
Any Acute kidney injury	49 (22.2%)	22 (9.4%)	0.003
Permanent pacemaker implantation	74 (35.0%)	47 (22.3%)	0.008
Re-intervention	2 (0.9%)	0 (0.0%)	0.156
Hospital stay, days	8.8 ± 5.1	7.5 ± 4.6	0.002
Echocardiography data predischarge	(n=174)	(n=150)	
Peak aortic gradient, mmHg	17.8 ± 7.9	16.5 ± 9.1	0.041
Mean aortic gradient, mmHg	9.4 ± 4.3	9.2 ± 5.3	0.376
Aortic valve area, cm^2	2.23±3.82	2.86±5.51	0.306
Moderate or severe paravalvular leak	26 (16.7%)	12 (9.0%)	0.048

Data shown as n (%) and as means ± (SD). TIA, transient ischemic attack.