Outcomes of Tricuspid Valve Repair and Replacement: A Propensity Analysis

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Background. **The purpose of this study was to compare operative mortality and long-term outcome of patients undergoing tricuspid valve replacement versus tricuspid valve repair.**

Methods. **From February 1986 to July 2006, 315 patients underwent tricuspid valve surgery including 93 replacements (72 biologic, 21 mechanical) and 222 repairs. To control for selection bias and varying comorbidities, a matched cohort of patients undergoing repair versus replacement was selected using propensity score analysis (68 patients in each group).**

Results. **In the propensity-matched cohorts, operative mortality was similar for tricuspid valve replacement (13% ± 4%) and repair (18% ± 5%; $p = 0.64$). Intensive care unit length of stay was similar between cohorts (replacement, 4 days; repair, 3 days; $p = 0.45$), but the replacements had a significantly longer hospital lengths of stay (9 days versus 6 days; $p = 0.01$). In the replacement cohort, survival was 85% at 1 year, 79% at 5 years, and 49% at 10 years. In the repair cohort, survival rates were similar with 80% at 1 year, 72% at 5 years, and 66% at 10 years ($p = 0.66$ versus replacement).**

Conclusions. **Surgical treatment of tricuspid valve disease, regardless of the operative approach, is associated with significant early and late mortality. However, there is no difference favoring tricuspid valve repair over replacement. Thus, we should not hesitate to consider tricuspid valve replacement for patients in whom we believe there is a reasonable chance for recurrence of regurgitation after repair.**

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Although several previous investigators have purported the potential benefit of repair over replacement in the tricuspid position, it has been difficult to develop firm conclusions as to the optimal procedure, given the small number of patients in most series and the significant number of comorbid conditions that exist in these often critically ill patients [1–5]. The purpose of this study was to compare operative mortality and long-term outcome of patients undergoing tricuspid valve replacement versus tricuspid valve repair. To accomplish this goal, propensity score analysis was performed to best match these two distinct groups and minimize the effect of confounding variables on patient outcome.

Material and Methods

This retrospective review includes 315 consecutive patients who underwent tricuspid valve surgery between February 1986 and July 2006 at Washington University School of Medicine (Barnes-Jewish Hospital) by 19 different surgeons. The study was approved by the Washington University Institutional Review Board. There were 196 women (62%) and 119 men (38%) in the study with a mean age of 56.6 ± 16.5 years (range, 18 to 85). Of these patients, 222 underwent tricuspid valve repair and 93 underwent tricuspid valve replacement with either a bioprosthesis (n = 72) or a mechanical prosthesis (n = 21). Selected preoperative patient characteristics are summarized in Table 1. Six baseline patient variables were not balanced in the two groups: age, pulmonary hypertension, history of infectious endocarditis, valve etiology, previous cardiac surgery, and New York Heart Association (NYHA) class. Operative details are summarized in Table 2. In the repair group, 36% had previously undergone cardiac surgery, compared with 66% in the replacement group ($p < 0.001$). In the repair group, tricuspid valve repair alone was performed in 73 patients (33%), whereas 149 (67%) underwent concomitant procedures, most commonly, intervention on another valve. In the replacement group, tricuspid valve replacement alone was performed in 56 patients (60%), and 37 (40%) underwent concomitant procedures, again most commonly, intervention on another valve. Cross-clamp and cardiopulmonary bypass times were not significantly different between the two groups. To control for selection bias and varying comorbidities, a matched cohort of patients in each group (repair versus replacement) was selected using propensity score analysis [6–8].

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Table 1. Preoperative Characteristics for All Patients Undergoing Tricuspid Valve Replacement or Tricuspid Valve Repair

Variable	Replacement (n = 93)	Repair (n = 222)	*p* Value
Age (years)	52.2 ± 16.2	58.4 ± 16.4	0.002
Sex (female)	58 (62%)	138 (62%)	1.00
Urgent/emergent procedure	8 (9%)	15 (7%)	0.64
Pulmonary hypertension	34 (37%)	125 (56%)	0.002
Diabetes mellitus	19 (20%)	47 (21%)	1.00
Hemodialysis	2 (2%)	16 (7%)	0.11
Cerebrovascular accident	14 (15%)	20 (9%)	0.16
History of infectious endocarditis	30 (32%)	27 (12%)	<0.001
Active infection at surgery	16 (17%)	27 (12%)	0.28
Valve etiology			<0.001
Endocarditis	28 (30%)	23 (10%)	
Myxomatous/annular dilation	28 (30%)	133 (60%)	
Rheumatic	11 (12%)	34 (15%)	
Prosthetic valve failure	8 (9%)	10 (5%)	
Congenital	18 (19%)	22 (10%)	
Previous cardiac surgery	61 (66%)	80 (36%)	<0.001
Previous TV operation	21 (23%)	10 (5%)	<0.001
Prior TV replacement	14 (15%)	NA	
Prior TV repair	7 (8%)	10 (5%)	
Time since previous TV procedure (years)	16 ± 10	8 ± 6	0.28
NYHA			<0.001
Class I	11 (12%)	16 (7%)	
Class II	14 (15%)	32 (14%)	
Class III	28 (30%)	99 (45%)	
Class IV	40 (43%)	75 (34%)	

NYHA = New York Heart Association; NA = not applicable; TV = tricuspid valve.

Propensity Score Analysis

The decision to repair or replace the valve was made by the operating surgeon, often in consultation with the referring cardiologist, based on the patient's preoperative echocardiogram, cardiac catheterization, and clinical status. The resulting selection bias toward replacing versus repairing the valve was addressed by propensity matching. Logistic regression analysis was used to identify significant, independent covariates among the seven baseline patient variables that were imbalanced in the two groups of interest. Three variables—age at surgery, preoperative NYHA classification, and history of infectious endocarditis—were not significant in the logistic regression analysis in predicting group assignment. In contrast, the logistic regression analysis identified four variables as significant predictors for performing a tricuspid valve repair; these were presence of preoperative pulmonary hypertension, no prior history of cardiac surgery, myxomatous or annular dilation etiology, and presence of an additional valve replacement or repair during the tricuspid valve operative procedure.

Using the significant regression coefficients, a propensity score was calculated for all 315 patients who underwent a tricuspid valve procedure. The total population was ranked by propensity score, and patients were selected in a 1:1 match for inclusion in either the repair cohort or replacement cohort on the basis of this score. The short- and long-term outcome of the patients was masked during the matching process. This process matched 68 of the 93 patients who underwent replacement of their tricuspid valve with 68 of the 222 patients who had their tricuspid valve repaired. Twenty-five of the 93 patients who received a tricuspid valve replacement were not able to be matched with the repair patients because their propensity scores were extreme outliers. The resulting 136 matched patients were analyzed for differences in selected postoperative outcomes: postoperative morbidity, length of mechanical ventilation, intensive care length of stay, hospital length of stay, operative mortality, and late survival. Selected important, preoperative clinical patient characteristics for the tricuspid valve repair and replacement groups are summarized in Table 3, which demonstrates no significant differences between the groups.

Table 2. Operative Details for All Patients Undergoing Tricuspid Valve Replacement or Tricuspid Valve Repair

Variable	Replacement (n = 93)	Repair (n = 222)	*p* Value
Operative procedure			<0.001
TV procedure only	56 (60%)	73 (33%)	
TV procedure plus valve(s)	28 (30%)	140 (63%)	
TV procedure plus other cardiac procedure	9 (10%)	9 (4%)	
Cross-clamp time (min)[a]	91 ± 57 (n = 51)	98 ± 52 (n = 222)	0.39
Cardiopulmonary bypass time (min)	159 ± 85	172 ± 75	0.18
Biologic valve	72 (77%)	NA	
Size of valve	30.8 ± 2.3	NA	
Annuloplasty ring	NA	101 (46%)	
Size of ring	NA	29.3 ± 2.6	

[a] Forty-two replacements were performed without clamping.

NA = not applicable; TV = tricuspid valve.

Table 3. Preoperative Characteristics for Patients Undergoing Tricuspid Valve Replacement or Repair Matched Using Propensity Score Analysis

Variable	Replacement (n = 68)	Repair (n = 68)	*p* Value
Age (years)	51 ± 16	51 ± 19	0.85
Sex (female)	42 (62%)	34 (50%)	0.22
Urgent/emergent procedure	6 (9%)	8 (12%)	0.78
Pulmonary hypertension	22 (32%)	26 (38%)	0.59
History of infectious endocarditis	22 (32%)	22 (32%)	1.00
Valve etiology			0.08
Endocarditis	28 (29%)	23 (34%)	
Myxomatous/annular dilation	13 (19%)	26 (38%)	
Rheumatic	10 (15%)	5 (7%)	
Prosthetic valve failure	8 (12%)	4 (6%)	
Congenital	17 (25%)	10 (15%)	
Previous cardiac surgery	42 (62%)	35 (52%)	0.30
NYHA			0.29
Class I	9 (13%)	11 (16%)	
Class II	13 (19%)	14 (21%)	
Class III	21 (31%)	28 (41%)	
Class IV	25 (37%)	15 (22%)	
Operative procedure			0.12
TV procedure only	38 (56%)	27 (40%)	
TV procedure plus valve(s)	27 (40%)	39 (57%)	
TV procedure plus other cardiac procedure	3 (4%)	2 (3%)	

NYHA = New York Heart Association; TV = tricuspid valve.

Statistical Analysis

Operative mortality included any death that occurred during the initial hospitalization or within 30 days of operation for discharged patients. Late survival was determined using the Social Security Death Index as of March, 2007. Cumulative survival rates were calculated using Kaplan-Meier analysis, and survival curves were compared using the log rank test. Variability of the actuarial estimates is expressed as ± 1 SEM. Continuous data are reported as mean ± 1 SD or median with intraquartile range (IQR) where appropriate for variables without normal distribution. Clinically important ratios are reported with 70% confidence intervals (CI). Comparisons were performed using paired, two-tailed *t* tests for means of normally distributed continuous variables and Wilcoxon rank sum tests for skewed data. Either χ 2 or Fisher exact tests were used to compare categorical data. All data analyses were done using SPSS (SPSS 11.0 for Windows; SPSS, Chicago, IL).

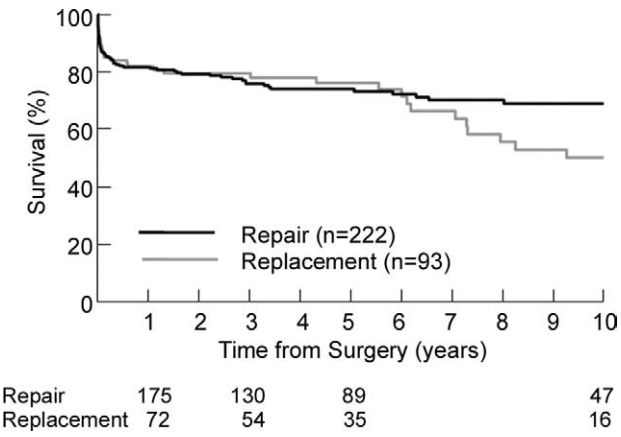

Fig 1. Long-term survival estimates for all patients undergoing tricuspid valve replacement (gray line [n = 93]) or repair (black line [n = 222]). The numbers of patients at risk for each group are reported at 1, 3, 5, and 10 years.

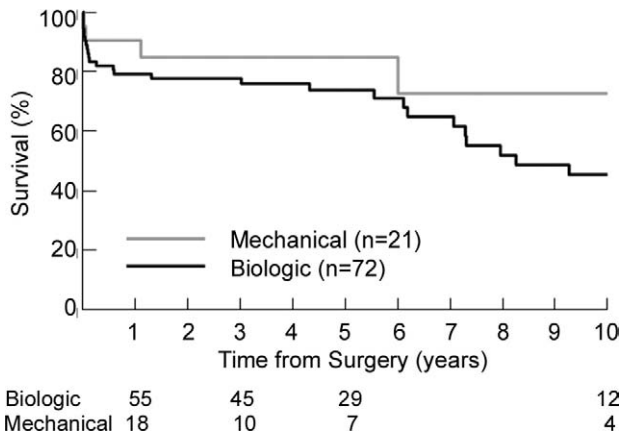

Fig 2. Long-term survival estimates for all patients undergoing tricuspid valve replacement with a biologic prosthesis (black line [n = 72]) or a mechanical prosthesis (gray line [n = 21]). The numbers of patients at risk for each group are reported.

Results

Analysis of All Patients Undergoing a Tricuspid Valve Procedure

TRICUSPID VALVE REPAIR. Operative mortality was 16% ± 3% (36 of 222) with tricuspid valve repair. At late follow-up, there were 60 deaths (27%), and mean follow-up was 5.5 ± 5.4 years. Survival was 82% at 1 year (175 patients at risk), 76% at 3 years (130 at risk), 74% at 5 years (89 at risk), and 69% at 10 years (47 patients at risk; Fig 1).

TRICUSPID VALVE REPLACEMENT. Operative mortality was 13% ± 4% (12 of 93) with tricuspid valve replacement. At late follow-up, there were 33 deaths (36%), and mean follow-up was 5.2 ± 5.3 years. Survival was 82% at 1 year (72 patients at risk), 79% at 3 years (54 at risk), 76% at 5 years (35 at risk), and 50% at 10 years (16 at risk; Fig 1).

BIOLOGIC VERSUS MECHANICAL TRICUSPID VALVE REPLACEMENT. Operative mortality was similar among patients undergoing biologic (14% ± 4%) or mechanical (10% ± 7%) replacement ($p = 0.73$). At late follow-up, there were 28 deaths (39%) in the biologic group and 5 (24%) in the mechanical group ($p = 0.31$). Mean follow-up was similar at 5.2 ± 4.8 years for the biologic group and 5.8 ± 6.9 years for the mechanical group ($p = 0.91$). In the biologic group, survival was 79% at 1 year (patients at risk, 55), 78% at 3 years (45 at risk), 74% at 5 years (29 at risk), and 45% at 10 years (12 at risk; Fig 2). In the mechanical group, survival was 91% at 1 year (18 patients at risk), 85% at 3 years (10 at risk), 85% at 5 years (7 at risk), and 73% at 10 years (4 at risk), and the rate was not significantly different than after biologic replacement ($p = 0.27$; Fig 2). Propensity score matching could not be used to compare the biologic and mechanical valve groups; the groups were too small to identify univariate or multivariate predictors for prosthesis selection.

In the biologic group, 7 patients required reoperation, yielding Kaplan-Meier freedom from reintervention rates of 100% at 1 year (55 patients at risk), 98% at 3 years (44 at risk), 95% at 5 years (29 at risk), and 95% at 10 years (12 at risk). In the mechanical group, 2 patients required reoperation, yielding reintervention rates of 95% at 1 year (17 patients at risk), 95% at 3 years (9 at risk), 83% at 5 years (6 at risk), and 83% at 10 years (4 at risk), and the rate was not significantly different than it was after biologic replacement ($p = 0.90$). Follow-up data in regard to bleeding complications in relation to warfarin use postoperatively were available for 29 of 44 late biologic survivors (18 receiving warfarin, 11 not receiving warfarin) and for 9 of 16 late mechanical survivors (all receiving warfarin). Significant bleeding complications occurred in 11% of mechanical valves, 33% of biologic valves with warfarin, and 0% of biologic valves without warfarin.

Analysis of Propensity-Matched Cohorts

The tricuspid valve replacement and repair propensity-matched cohort had similar intensive care unit length of stay (3 versus 4 days, $p = 0.45$), but the replacements had significantly longer hospital lengths of stay (9 versus 6 days, $p = 0.01$). Operative mortality was similar between cohorts (repair, 18% ± 5%; replacement, 13% ± 4%; $p = 0.64$). At late follow-up, there were 23 deaths (34%) in the replacement cohort and 20 (29%) in the repair cohort ($p = 0.71$). Mean follow-up was similar at 5.5 ± 5.5 years for the replacement cohort and 5.6 ± 5.4 years for the repair cohort ($p = 0.95$). For the replacement cohort, survival was 85% at 1 year (54 patients at risk), 84% at 3 years (42 at risk), 79% at 5 years (27 at risk), and 49% at 10 years (12 at risk; Fig 3). In the repair cohort, survival was 80% at 1 year (51 patients at risk), 76% at 3 years (40 at risk), 72% at 5 years (31 at risk), and 66% at 10 years (17 at risk); and the rate was not significantly different between cohorts ($p = 0.66$; Fig 3).

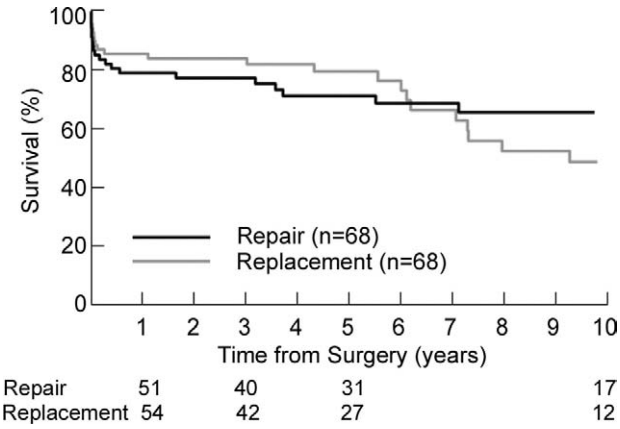

Fig 3. Long-term survival estimates for all patients undergoing tricuspid valve replacement (gray line [n = 68]) or repair (black line [n = 68]) matched using propensity score analysis. The numbers of patients at risk for each group are reported.

Comment

Clinically significant tricuspid valve disease requiring consideration for surgical intervention is uncommon, usually manifesting in patients with medically refractory congestive heart failure, endocarditis, or severe, irreversible pulmonary hypertension with secondary tricuspid regurgitation [9]. Presently, the optimal surgical approach, either tricuspid valve repair or replacement, remains controversial owing to the presence of multiple confounding preoperative comorbidities, the high frequency of reoperation, and the variety of concomitant cardiac procedures required for these often critically ill patients, all of which may contribute to the relatively poor outcomes demonstrated in this series and in previous reports from other investigators [1–5, 10–12]. In the current study, the goal was to match confounding variables among patients undergoing tricuspid valve repair versus replacement, utilizing a propensity analysis, to compare long-term results with these two surgical strategies.

Tricuspid Valve Replacement

Although a relatively simple technical operation, especially when performed as an isolated procedure, tricus-

pid valve replacement remains associated with significant operative mortality and suboptimal long-term survival. In the current series of tricuspid valve replacements, operative mortality was 13% with survival at 1, 5, and 10 years of was 82%, 76% and 50%, respectively. These results are consistent with the largest series of tricuspid valve replacements from the United Kingdom Heart Valve Registry, comprising 425 patients operated on between 1986 and 1997, that reported survival rates at 1, 5, and 10 years of 72%, 60%, and 43%, respectively [1]. Operative mortality for biological and mechanical prostheses in the UK series was 19% and 16%, respectively, compared with 14% and 10% in the current report.

Other investigations have attempted to identify the best prostheses, mechanical or biologic, in the tricuspid position. Proponents of the bioprosthestic valve cite a higher incidence of thrombosis with the mechanical valve, despite anticoagulation therapy. Potential contributors to thrombosis of tricuspid prostheses include low velocity of blood across the tricuspid valve and lower levels of prostacyclin (PGI_2), a potent platelet aggregate inhibitor produced by the lungs, within venous blood [13]. However, other groups have preferred the mechanical valve because of the relatively young age of the patients (mean age in our series, 56 years) and the noted risks for reoperation being the highest for any valve [14]. Similar to our current report, other series examining tricuspid valve replacements found no difference in survival at 1, 5, and 10 years between either valve type [15–17]. In one large series of 138 tricuspid valve replacements (35 bioprosthetic and 103 mechanical), during a 25-year period, freedom from reoperation at 15 years was 66% $\pm$ 19.4% (bioprosthestic, 55.1% $\pm$ 13.8%; mechanical, 86.0% $\pm$ 6.2%), and there were 10 valve-related thromboses, all within the mechanical group. The linearized incidences of valve-related thrombosis in all patients was 1.28% per patient-year (bioprosthestic, 0; mechanical, 1.92) [14]. A meta-analysis of 11 published series including 1,160 tricuspid valve replacements (bioprosthetic, 646; mechanical, 514) demonstrated no difference in freedom from reoperation and only slight differences in survival favoring the mechanical prostheses at 1 and 5 years and the biologic prostheses at 10 years [17]. These results are comparable to the current report in which no difference in the reoperation or reintervention rates between either valve types was identified.

Tricuspid Valve Repair

In an attempt to decrease the morbidity and mortality associated with tricuspid valve surgery, there has been a shift in most surgical centers toward tricuspid valve repair when technically feasible. In the current report, operative mortality for all 222 patients undergoing tricuspid valve repair was 16%, increasing to 18% among the 68 patients selected using propensity-matching techniques for comparison with the replacement group. Furthermore, 1-, 5-, and 10-year survival in the repair group was 82%, 74%, and 69% overall, respectively, and 79%, 72%, and 66% in the propensity-matched cohort. Several groups have reported similar long-term and event-free survival with tricuspid valve repair, including Borger and associates [18], who in 2006 reported the first contemporary series comparing the results of tricuspid valve repair with tricuspid valve replacement. In that series consisting of 178 repairs and 72 replacements, the Toronto group demonstrated improved perioperative, midterm, and event-free survival with repair over replacement. The Borger study was, however, limited by the presence of important, clinically significant variability in the preoperative characteristics between the two surgical groups. When compared with the tricuspid valve repair group, the replacement group had a higher incidence of preoperative cardiogenic shock (7% versus 0%; $p < 0.001$), more urgent operations (43% versus 23%; $p < 0.003$), and more redo cardiac surgery (57% versus 44%; $p = 0.06$). All of these differences may have contributed to the higher mortality rate noted in the replacement group, at least in the short term. In addition, follow-up echocardiography demonstrated recurrent moderate-to-severe regurgitation in 38% of repair patients compared with 5% of replacement patients.

Although we did not investigate the incidence of recurrent regurgitation after tricuspid valve repair in the current report, others have demonstrated similar findings to those of Borger and coauthors [18]. In 2004, McCarthy and colleagues [19] from the Cleveland Clinic reported a retrospective series of 790 patients who underwent tricuspid valve annuloplasty for functional regurgitation and documented a recurrence rate for 3 to 4+ regurgitation of 10% at 1 month and nearly 20% at 8 years. Other investigators have reported rates of recurrent tricuspid regurgitation after repair approaching 40%, especially for repairs without ring annuloplasty [20–23]. Recurrent tricuspid regurgitation can be a significant problem resulting in heart failure and diminished survival. In a retrospective series including more than 5,000 patients, increased tricuspid regurgitation severity was associated with diminished survival, regardless of the patient's left ventricular ejection fraction or the degree of pulmonary hypertension [24]. In addition, the severity of tricuspid regurgitation was associated with a poor prognosis independent of age, biventricular systolic function, and right ventricle size. An important recent series documented a 35.1% hospital mortality rate (30 days) for 74 patients who underwent valve reoperations for dysfunction of previous tricuspid valve repair [14].

Thus, the relatively disappointing long-term durability of tricuspid valve repair and the high risks of reoperation call into question our recent obsession with repair in these otherwise high-risk patients. In the current report, the goal was to match this difficult cohort of patients to determine whether replacing the tricuspid valve was the most important factor impairing survival, or whether the patient's underlying comorbid state, and potentially selection bias, played a significant role. By matching the preoperative variables in patients undergoing tricuspid valve repair versus replacement, the current analyses demonstrated similar cross-clamp and cardiopulmonary bypass times, intensive care unit days, hospital length of stay, operative mortality rates, and long-term survival

with both tricuspid valve repair and tricuspid valve replacement.

In summary, the current study reveals that surgical treatment of tricuspid valve disease, regardless of the operative approach, is associated with significant morbidity and mortality. Using cohort-matched propensity analysis, we were unable to identify any beneficial outcomes favoring tricuspid valve repair over replacement. Thus, we should not hesitate to consider tricuspid valve replacement for patients in whom we feel there is a reasonable chance for recurrence of regurgitation after repair.

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DISCUSSION

DR WALTER MERRILL (Cincinnati, OH): Dr Moraca and his colleagues have presented a large series of 315 patients who underwent tricuspid valve repair or replacement. They have demonstrated similar operative and long-term survival in both groups. Since many patients had concomitant procedures, I will ask Dr Moraca to inform us, what were the specific indications to perform a tricuspid procedure? If tricuspid valve repair was attempted, was it deemed successful in all cases or did some patients undergo repair and then immediate replacement if the results of repair were considered unsatisfactory?

The mean size of the ring implanted was 29. Would you and your colleagues speculate as to whether or not placing a smaller ring might lead to different long-term results in terms of recurrence of tricuspid regurgitation late postoperatively?

And finally, given the results demonstrated in your study, has the approach to tricuspid regurgitation changed at your institution? Thank you.

DR MORACA: Thank you, sir. Recent reports have demonstrated that significant tricuspid regurgitation reduces survival. Thus many centers, as illustrated by the STS database, have been more aggressive at treating tricuspid regurgitation with either tricuspid repair or replacement.

As far as using a smaller ring annuloplasty size, a ring annuloplasty was utilized in only 46% of the repairs and the median size was 29 mm. Most of the ring annuloplasties were done in the last 10 years, as evidence has come out to show that ring annuloplasty may reduce recurrent tricuspid regurgitation.

Our retrospective database review did not contain information about patients who had attempted tricuspid valve repairs that were converted to a tricuspid replacement. Approximately 5 of the tricuspid repair patients had recurrent regurgitation and subsequently underwent tricuspid valve replacement. As a general rule, patients who undergo a tricuspid valve repair who have greater than 2+ regurgitation will have the valve replaced.

DR CONSTANTINE MAVROUDIS (Cleveland, OH): Your presentation seemed counterintuitive in so far that tricuspid valve replacement and repair have the same complications related to thrombus formation. In addition, I did not notice whether you reported complications related to heart block. In other words, was the incidence of heart block greater in one group or another? And I wonder if it were possible, even in the postoperative period, if you can go back and look at the data regarding whether the central venous pressure was more elevated in one group or another, because if it were, then the outcome might be worse in the replacement group for exercise tolerance rather than the repair group. In addition, do you think that the difference in the patient-year accrual rate might have skewed your excellent results toward the repaired group?

DR MORACA: Thank you sir. The incidence of heart block requiring a pacemaker in the replacement group was 9%. (excluding the 10% of patients with preoperative pacemakers) In the repair group, 12% of the patients required a pacemaker (excluding the 9% of patients with preoperative pacemakers). Now, that is somewhat higher than what has been reported in previous series. In the UK Heart Registry, which is the largest registry of tricuspid valves, the incidence of heart block for the replacements requiring a pacemaker for an isolated tricuspid procedure is near 6%; for repairs, it is about 1.6%. In our series, the most likely reason for a higher incidence of heart block is that nearly 60% of the tricuspid repairs had a concomitant valve replacement.

Recent literature has suggested that tricuspid valve replacements are associated with approximately 20% operative mortality whereas repairs may be as low as 5%. Thus, many surgeons have opted to "settle" for a repair with 1 to 2+ regurgitation for fear of replacing the valve. However, the data for these assumptions are limited by small patient numbers and a very diverse patient population examined over a long time period. Therefore, the aim of our study today was to try and better compare tricuspid valve replacements and repairs by using a propensity analysis to control for confounding preoperative variables. In essence, take out the extreme outliers to identify the impact of procedure on outcome. We know that there are clear indications for tricuspid valve replacement (prior failed repairs, destroyed valve with endocarditis) and tricuspid valve repair with a ring annuloplasty (ischemic dilation). Our current study implies that replacing the tricuspid valve, when a repair is not feasible, may not be associated with a significantly higher operative mortality or long-term survival.

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