

Functional tricuspid regurgitation at the time of mitral valve repair for degenerative leaflet prolapse: The case for a selective approach

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Objectives: It is not clear whether clinically silent tricuspid valve regurgitation should be addressed at the time of mitral valve repair for severe mitral regurgitation due to leaflet prolapse. We examined the clinical and echocardiographic outcomes of patients with tricuspid regurgitation who underwent only mitral valve repair.

Methods: We retrospectively analyzed records of patients undergoing mitral valve repair for isolated mitral valve prolapse who had coexistent tricuspid valve regurgitation during an 11-year period at our institution. Echocardiographic data were compared preoperatively, intraoperatively, and postoperatively at less than 1, 1 to 3, 3 to 5, and more than 5 years.

Results: In 699 patients who underwent mitral valve repair for severe mitral regurgitation, mean age was 60.4 years and 459 (66%) were male. At the time of mitral valve repair, tricuspid valve regurgitation was grade 3 or more in 115 (16%) patients and less than grade 3 in 584 (84%) patients. After mitral valve repair, overall grade of tricuspid valve regurgitation decreased significantly within the first year ($P = .01$). In patients with grade 3 regurgitation or more, the grade decreased at dismissal and until the third year ($P < .001$). Female sex, preoperative atrial fibrillation, and diabetes mellitus were independent risk factors for increased tricuspid valve regurgitation with time; preoperative regurgitation of grade 3 or more independently predicted decreased grade with time. Only 1 patient required tricuspid reoperation 4.5 years after mitral repair.

Conclusions: Clinically silent nonsevere tricuspid valve regurgitation in patients with degenerative mitral valve disease is unlikely to progress after mitral valve repair. Tricuspid valve surgery is rarely necessary for most patients undergoing repair of isolated mitral valve prolapse. (J Thorac Cardiovasc Surg 2011;142:608-13)

Functional tricuspid valve regurgitation (TR) is common in patients with left-sided cardiac valve disease.^{1,2} Although early reports suggested that TR may resolve after the diseased mitral valve (MV) is replaced,¹ subsequent data have shown that severe TR may develop late after MV surgery for rheumatic or ischemic disease, even in the absence of significant residual mitral stenosis, regurgitation, or other causes of left-sided heart failure.²⁻⁴ Severe symptomatic residual TR compromises long-term outcomes after MV surgery and is associated with increased early and midterm morbidity and mortality, despite adequate MV correction.²⁻⁶ However, previous studies have focused mainly on patients with ischemic, rheumatic, or mixed heart valve disease undergoing MV replacement,⁷⁻¹⁰ and their conclusions

cannot be readily extended to patients undergoing isolated repair for degenerative MV disease. Specifically, few data have addressed the progression of clinically silent, functional TR and the need for reoperation after repair of mitral leaflet prolapse. It is therefore unclear whether the tricuspid valve (TV) should be addressed at the time of isolated MV repair. We analyzed the clinical and echocardiographic outcomes of patients with clinically silent functional TR in whom only MV repair was performed.

PATIENTS AND METHODS

We searched our prospective patient database for the records of patients who underwent MV repair for isolated MV prolapse and who had coexistent, clinically silent, functional TR between January 1, 1995, and January 1, 2006, at Mayo Clinic, Rochester, Minnesota. The study was reviewed and approved by the Mayo Clinic Institutional Review Board. The need for individual patient consent was waived because relevant identifiers were not included in the dataset. We excluded patients who declined involvement in clinical research, who had concomitant coronary artery bypass grafting surgery, or who had other concomitant cardiac procedures other than closure of a patent foramen ovale. Also excluded were patients with an initial diagnosis of MV regurgitation (MR) caused by congenital, rheumatic, or ischemic heart disease or cardiomyopathy and those with endocarditis causing leaflet defects or subvalvular abscess. Patients with primary pulmonary disease, significant right ventricular dysfunction, or structural TV abnormalities (including stenosis) were also not included. Fifty-two patients who had TR associated with right heart failure

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Abbreviations and Acronyms

MR	= mitral valve regurgitation
MV	= mitral valve
SD	= standard deviation
TR	= tricuspid valve regurgitation
TV	= tricuspid valve

symptoms and/or TV leaflet disease underwent TV surgery over the same interval, and these patients were analyzed in a separate report.

All patients underwent MV repair for severe MR owing to leaflet prolapse. The techniques used during MV repair have been described elsewhere.¹¹ The most common method of surgical correction for posterior leaflet prolapse was triangular resection and suture reconstruction of the involved scallop, supplemented by a standard-length (63-mm) flexible posterior annuloplasty band. For repair of anterior leaflet prolapse, artificial polytetrafluoroethylene neochordae were used. Chordal shortening, chordal transfer, commissural annuloplasty, and leaflet plication were used infrequently.

TR in each patient was quantified echocardiographically as follows: grade 1, trivial; grade 2, mild; grade 3, moderate; and grade 4, severe. TR data were analyzed during the following time periods: preoperatively, intraoperatively, and postoperatively at less than 1 year, 1 to 3 years, 3 to 5 years, and more than 5 years. Clinical follow-up data were collected through routine postoperative surveys (at 1, 3, 5, 10, 15, and 20 years) and contact with referring cardiologists.

STATISTICAL ANALYSIS

Descriptive statistics for categorical variables are reported as frequency and percentage, and continuous variables are given as mean (standard deviation [SD]). The Kaplan–Meier method was used to estimate 5-year and 10-year survival. Changes in TR from preoperative values to those at dismissal and postoperatively at less than 1 year, 1 to 3 years, 3 to 5 years, and more than 5 years of follow-up were analyzed on the basis of the subgroup of patients whose data were available at the corresponding time periods. Changes were compared using paired *t* tests or the Wilcoxon rank sum test as appropriate. Predictors of echocardiographic change in TR after 5 years of follow-up were identified by fitting linear regression models. The multivariate model considered univariately significant variables ($P < .05$) with model selection using the stepwise method (backward and forward techniques were similar). Cox regression models were used to determine univariate and multivariate predictors of late mortality. All statistical tests were 2-sided, with the α level set at .05 for statistical significance.

RESULTS

A total of 699 patients undergoing isolated MV repair met the inclusion criteria for the study. The mean (SD) age was 60.4 (13.7) years, and 459 (65.7%) were male. Preoperatively, most patients (457, 65.4%) had New York Heart Association class I–II symptoms, whereas 242

(34.6%) had class III–IV symptoms. The baseline characteristics of the patients are shown in Table 1. MV leaflet prolapse was posterior in 377 patients (53.9%), whereas 280 (40.1%) had bileaflet prolapse and 42 (6%) had isolated anterior leaflet prolapse. No patients had right heart failure, and although all patients had some degree of coexistent functional TR, none was deemed by the surgeon to require TV intervention at the time of MV repair. According to preoperative echocardiography, 115 (16%) patients had grade 3 or higher TR, and the remaining 584 (84%) had less than grade 3 TR.

Intraoperative TR Evaluation

In the 115 patients with grade 3 or higher TR preoperatively, we compared TR grade at different time points related to surgery: preoperative, intraoperative prebypass, intraoperative postbypass, and predismal (Figure 1). Mean intraoperative TR grades while patients were under general anesthesia (both prebypass and postbypass) were significantly lower than both preoperative and predismal levels ($P < .001$ for both).

Change in TR During Follow-up

The mean (SD) duration of follow-up for the group was 5.5 (3) years. TR grade was compared at different time periods after surgery (Figure 2, A). The mean preoperative TR grade was 1.84 (0.71). Compared with the preoperative value, overall mean TR grade decreased significantly within the first year ($n = 248$; 1.72 [0.79]; $P = .01$) and increased slightly only after 5 years of follow-up ($n = 108$; 2.11 [0.92]; $P = .03$). There was no significant change from preoperative levels at the other time periods examined.

TABLE 1. Patient baseline characteristics

Characteristic	Value* (N = 699)
Age, y	60.4 (13.7)
Male sex	459 (65.7)
Preoperative EF, %	65.12 (7.57)
Preoperative TR grade	
1	233 (33.3)
2	351 (50.2)
3–4	115 (16.5)
Preoperative AF	122 (17.5)
Preoperative dilatation	
RA	203 (29.0)
RV	31 (4.4)
NYHA class	
I	199 (28.5)
II	258 (36.9)
III	220 (31.5)
IV	22 (3.1)

EF, Ejection fraction; TR, tricuspid valve regurgitation; AF, atrial fibrillation; RA, right atrium; RV, right ventricle; NYHA, New York Heart Association. *Values are no. (%) or mean (standard deviation).

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