# Conduction disorders after tricuspid annuloplasty with mitral valve surgery: Implications for earlier tricuspid intervention

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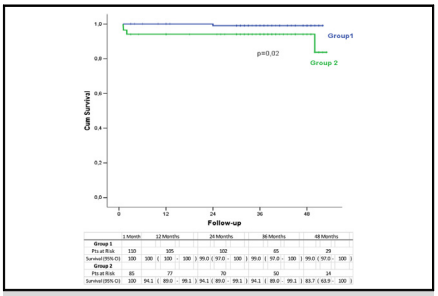
## ABSTRACT

**Objective:** Tricuspid valve repair has been recently advocated in patients undergoing mitral valve surgery who have mild to moderate secondary tricuspid regurgitation. However, the incidence of heart conduction disorders after combined mitral valve and tricuspid valve interventions has not been evaluated. We sought to analyze the incidence of permanent pacemaker implantations and heart conduction disorders in patients undergoing mitral valve surgery with and without tricuspid valve annuloplasty.

**Methods:** In 2011 and 2012, among 201 consecutive patients referred to the Hôpital Européen Georges Pompidou for isolated nonischemic mitral valve disease, 113 underwent an isolated mitral valve procedure (group 1) and 88 had a concomitant tricuspid valve ring annuloplasty (group 2).

**Results:** Patients' mean age was 59.7 ± 16.5 years in group 1 and 60.7 ± 14.9 years in group 2 ($P = .5$). Mean crossclamp time and bypass time were 78 ± 35 minutes and 105 ± 47 minutes in group 1 and 92 ± 36 minutes and 128 ± 50 minutes in group 2, respectively ($P = .001$ and .005, respectively). Operative mortality was 3% (2.7% in group 1 and 3.2% in group 2, $P = .4$). Incidence of high-grade heart conduction disorders lasting more than 3 days postoperatively was 14.5% in group 1 and 41.2% in group 2 ($P = .001$). At 3 years, freedom from permanent pacemaker implantation was 99% ± 2% in group 1 and 94.1% ± 5% in group 2 ($P = .02$). For the entire cohort, longer crossclamp time ($P = .02$) and tricuspid ring annuloplasty (hazard ratio, 3.8; $P = .001$) were independent predictors of heart conduction disorders.

**Conclusions:** The need for permanent pacemaker implantation is increased after concomitant tricuspid ring annuloplasty in the setting of mitral valve surgery. A clinical period of observation up to 14 days after postoperative heart conduction disorders should be observed before recommending permanent pacemaker placement. (J Thorac Cardiovasc Surg 2016;151:99-103)




Freedom from permanent pacemaker implantation.

**Central Message**

In MV surgery, the risk for permanent pacemaker requirement was increased after concomitant tricuspid annuloplasty.

**Perspective**

The risk for permanent pacemaker implantation after combined MV surgery and prophylactic tricuspid ring annuloplasty is increased but remains overweighed by the hazard of developing late secondary TR.

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ACD

Secondary tricuspid regurgitation (TR) is due to annular dilatation and leaflet tethering in relation to pressure or volume overload of the right chambers. Right ventricular pressure overload is mainly seen in pulmonary hypertension resulting from left-sided valve diseases. However, the reduction of TR after surgical correction of the left-sided lesion may be incomplete.[1] Secondary TR may develop after successful left heart valve correction, leading to progressive heart failure and death.[2] Subsequent surgical corrections of late isolated functional TR carry a high surgical risk and poor long-term prognosis.[3] Thus, concomitant tricuspid valve (TV) annuloplasty has been proposed in cases of annular dilatation independently of the severity of TR.[4,5] Nevertheless, the impact on postoperative complications of this aggressive approach has not been evaluated in the literature. In this regard, many authors have demonstrated that combined valve

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**Abbreviations and Acronyms**
CI = confidence interval
MV = mitral valve
POD = postoperative day
TR = tricuspid regurgitation
TV = tricuspid valve

operations are correlated with increased rate of permanent pacemaker implantations.[6] However, although heart conduction disorder represents a classic complication of tricuspid ring annuloplasty, the specific risk of pacemaker implantation after concomitant TV annuloplasty is not well known. Therefore, we sought to evaluate the incidence and consequences of postoperative heart conduction disorders after combined mitral valve (MV) surgery and TV annuloplasty compared with isolated MV intervention.



## PATIENTS AND METHODS

Between January 2011 and December 2012, we identified 201 consecutive adult patients who underwent nonemergency MV surgery for nonischemic disease. Of these, 113 underwent isolated MV surgery (group 1) and 88 had a concomitant TV annuloplasty performed using a Carpentier-Edwards Classic ring or Physio ring (group 2) (Edwards Lifesciences, Irvine, Calif). Patients who underwent additional procedures, such as aortic valve surgery, septal defect closure, or septal resection, and patients who preoperatively had a permanent pacemaker or second-degree or greater atrioventricular block were excluded. All surgeries were performed via median sternotomy using cardiopulmonary bypass and cardiac arrest. Tricuspid annuloplasty was performed under aortic crossclamping or heart-beating conditions depending on the surgeon's preference. The myocardial preservation technique was also at the discretion of surgeons, who used crystalloid or warm blood and antegrade or retrograde cardioplegia. In-hospital data were collected retrospectively from medical records. Follow-up was performed by direct phone contact with each patient and the referring cardiologist. The study was approved by our local ethics committee, and informed consent was obtained for all patients.

### Statistical Analysis

Data analyses were performed with SPSS software (SPSS Inc, Chicago, Ill) and SAS software (SAS Institute Inc, Cary, NC). Descriptive statistics are expressed as mean ± standard deviation or 95% confidence interval (CI) for continuous variables and percentage or frequencies for categoric variables. Daily postoperative electrocardiograms were reviewed by 2 physicians to identify heart conduction disorders and sinus node dysfunction. The primary clinical end point was defined as the implantation of a permanent pacemaker at any time during the follow-up period. The secondary end point included high-grade heart conduction disorders and sinus node dysfunction persisting 3 days postoperatively among survivors. High-grade heart conduction disorders were defined as second- and third-degree atrioventricular block. To identify significant differences in baseline characteristics and intraoperative variables as in clinical end points, groups 1 and 2 were compared using a chi-square or Fisher exact test for categoric data and Student *t* test for continuous data. Comparisons between groups for freedom from permanent pacemaker implantation (primary clinical end point) were made by using the Kaplan–Meier method. By considering the total study cohort, data were entered into a binary logistic regression analysis to highlight independent predictors for the secondary clinical end point. The appropriateness of tested variables was first determined by univariate analysis using a chi-square or Fisher exact test for categoric data and Student *t* test for continuous data with a *P* value less than .2.

## RESULTS

In group 2, indications for concomitant TV annuloplasty were moderate to severe TR in 31.8% (n = 28) and prophylactic (defined as annular dilatation associated with mild or less TR) in 68.2% (n = 60). Baseline and intraoperative characteristics of the 2 groups are summarized in Table 1. Concomitant TV procedure was done under cardioplegic cardiac arrest in 85.2% (n = 75) and on the beating heart in 14.8% (n = 13). Postoperative data are described in Table 2. Mean hospital length of stay was significantly increased in group 2 compared with group 1: 16 days (95% CI, 14.1-17.8) and 12.6 days (95% CI, 10.6-14.5), respectively ($P = .01$). Overall operative mortality was 3% (n = 6): 3.4% in group 2 and 2.7% in group 1 ($P = .53$). There were also 2 late deaths during follow-up at 10 and 12 months, 1 in each group, but neither was related to heart conduction disorder. Mean follow-up was 36 ± 12 months.

### Primary Clinical End Point

Among operative survivors, early permanent pacemaker implantations (<3 months) were performed in 5 patients. Two patients required late permanent pacemaker implantation at 24 and 48 months. At 36 months, freedom from permanent pacemaker was 94.1% (95% CI, 87-99) for group 2 compared with 99% (95% CI, 97-100) for group 1 ($P = .02$) (Figure 1). Indications for pacemaker implantation were third-degree atrioventricular blocks in all but 1 patient, who presented with sinus node dysfunction.

### Secondary Clinical End Point

A total of 51 patients (26.1%) experienced a secondary clinical end point. Patients in group 2 had significantly more persistent postoperative high-grade heart conduction disorders than patients in group 1 (41.2% and 14.5%, respectively, $P < .01$). Beating heart conditions during TV annuloplasty in group 2 were not associated with less occurrence of the secondary clinical end point ($P = .51$). Conduction recovery was obtained before postoperative day (POD) 7 in 42 patients. Among the remaining patients, 4 additional recoveries from high-grade to lower-grade heart conduction disorders or restorations to normal conduction patterns were observed up to POD 21. For the whole cohort, TV annuloplasty and longer crossclamp