



ORIGINAL CLINICAL SCIENCE

Concomitant tricuspid valve surgery during implantation of continuous-flow left ventricular assist devices: A Society of Thoracic Surgeons database analysis

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Left ventricular assist device;
tricuspid;
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BACKGROUND: Performing concomitant tricuspid valve procedures (TVPs) in left ventricular assist device (LVAD) patients with significant pre-operative tricuspid regurgitation (TR) is controversial, and no studies have been large enough to definitively guide therapy.

METHODS: Between January 2006 and September 2012, 2,196 patients with moderate to severe pre-operative TR from 115 institutions underwent implantation of a continuous-flow left ventricular assist device (LVAD) as reported by The Society of Thoracic Surgeons National Database. Of these, 588 (27%) underwent a concomitant TVP. Inverse probability weighting based on propensity score was used to adjust for differences between the LVAD alone and LVAD+TVP groups, and outcomes were compared.

RESULTS: Most patients in the LVAD+TVP group underwent an annuloplasty alone (81.1%). Concomitant TVP did not affect risk of post-operative right VAD insertion (risk ratio [RR], 0.81; 95% confidence interval [CI], 0.49–1.36; $p = 0.4310$) or death (RR, 0.95; 95% CI, 0.68–1.33; $p = 0.7658$). However, TVP was associated with an increased risk for post-operative renal failure (RR, 1.53; 95% CI, 1.13–2.08; $p = 0.0061$), dialysis (RR, 1.49; 95% CI, 1.03–2.15; $p = 0.0339$), reoperation (RR, 1.24; 95% CI, 1.07–1.45; $p = 0.0056$), greater total transfusion requirement (RR, 1.03; 95% CI, 1.01–1.05; $p = 0.0013$), and hospital length of stay > 21 days (RR, 1.29; 95% CI, 1.16–1.43; $p < 0.0001$). Time on the ventilator and intensive care unit length of stay were also significantly prolonged for the LVAD+TVP group.

CONCLUSIONS: Performing a concomitant TVP for continuous-flow LVAD patients with moderate to severe TR did not reduce early death or right VAD requirement and was associated with worse early post-operative outcomes. These data caution against routine concomitant TVP based solely on degree of pre-operative TR and suggest that additional selection criteria are needed to identify those patients in whom concomitant TVP may prevent post-operative right ventricular failure.

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Patients referred for management with left ventricular assist devices (LVADs) often have some degree of pre-operative right-sided heart failure and frequently present with significant tricuspid regurgitation (TR). Some of these patients have right ventricular (RV) failure that persists

post-operatively. Despite improvements with continuous-flow LVADs (cfLVADs), post-operative RV dysfunction complicates up to 22% of cases and is associated with significant increases in morbidity and mortality.¹

A number of authors have advocated performing TV repair or replacement in the presence of moderate to severe TR as a strategy to reduce post-operative RV failure. The rationale for performing a concomitant tricuspid valve procedure (TVP) during LVAD insertion in patients with significant TR is sound, but the currently available data are limited to reports from relatively small, retrospective, single-institution studies that have been underpowered to address the issue.²⁻⁹ Moreover, reports on the prognostic significance of pre-operative TR have produced mixed conclusions, likely due to changes in right heart hemodynamics that occur with insertion of a cfLVAD.¹⁰⁻¹² Some have argued that a sub-set of patients with TR will improve from mechanical unloading with an LVAD alone, thereby negating their need for a concomitant TVP.¹³ As a result, the decision to perform concomitant TVPs remains controversial.

This study used The Society for Thoracic Surgeons (STS) Adult Cardiac Surgery Database to address how concomitant TV repair or replacement at the time of LVAD implantation affects short-term outcomes for patients with cfLVADs. This analysis of TVP in a large number of patients with moderate to severe TR undergoing cfLVAD implantation should provide insight about the utility of performing concomitant TV procedures according to the degree of pre-operative TR.

Methods

Approval for this study was granted by the STS Database Access and Publications Committee.

Patient population

The study population consisted of patients from the STS Adult Cardiac Surgery Database who underwent insertion of a cfLVAD that was indicated for bridge to recovery, bridge to transplant, or destination therapy between January 2006 and September 2012 (Figure 1). Exclusions included patients (1) with a prior VAD, (2) with an isolated right VAD (RVAD) implantation, (3) for whom pre-operative TR data were missing, (4) with no, trivial, or mild TR, (5) who had a concomitant aortic or mitral valve procedure, (6) who received a heart transplant at the time of initial LVAD insertion, or (7) with active endocarditis. This resulted in 2,196 cfLVAD patients with moderate to severe TR, and concomitant TV repair or replacement was performed in 588.

Adjustments for between-group differences

Propensity scores to estimate the probability of undergoing a TVP were developed with the use of logistic regression to adjust for between-group differences in baseline characteristics of the patients and hospitals. Variables included in the model were based on previously published valve models and clinical relevance.¹⁴ These included annual volume of LVAD implantations; annual volume of TVPs; patient demographics (i.e., age, race, sex, body

surface area); medical history and risk factors (i.e., diabetes, hypertension, cardiovascular disease, cerebrovascular accident, peripheral vascular disease, dialysis, ejection fraction, last creatinine measurement, immunosuppression, chronic lung disease); cardiac status at the time of operation (i.e., myocardial infarction [MI] < 21 days, unstable angina without MI, cardiogenic shock, atrial fibrillation, congestive heart failure/New York Heart Association class IV); presence of a pre-operative intraaortic balloon pump (IABP) or inotrope infusions; degree of aortic, mitral, and tricuspid valvular insufficiency; pre-operative coronary catheterization data (number of diseased vessels, \geq 50% left main disease) and operative variables (i.e., reoperation, other concomitant procedures, categorization of operative urgency, and year of surgery). We also included multiplicative interaction terms between age and reoperation, age and operative status, and sex and body surface area.

Missing categoric variables were imputed to the most common category, and missing continuous variables were imputed by

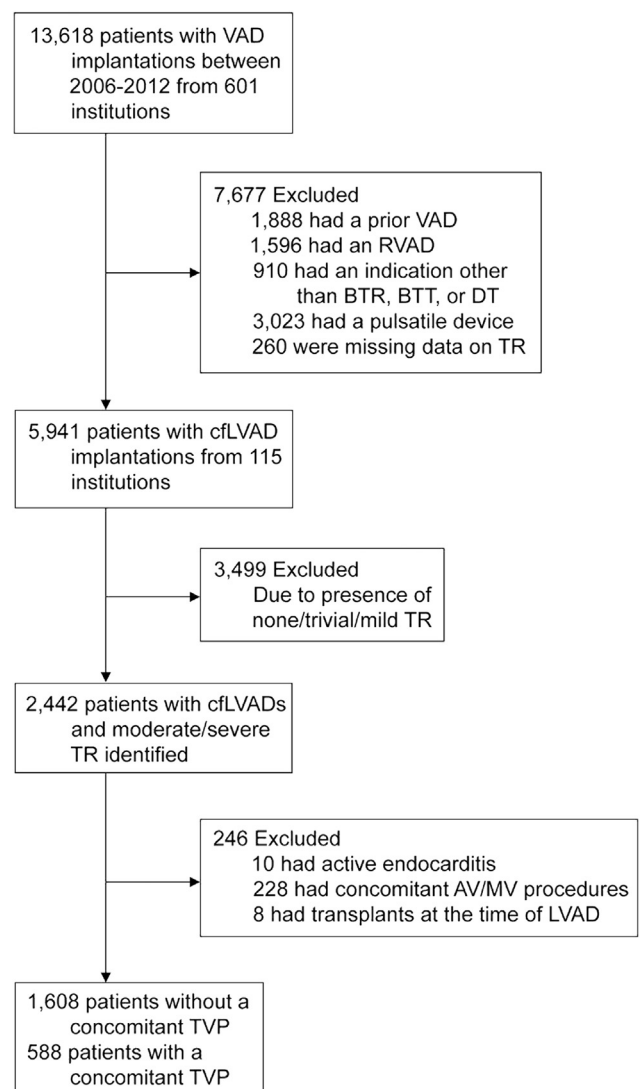


Figure 1 Study population. AV, aortic valve; BTR, bridge to recovery; BTT, bridge to transplant; cfLVAD, continuous-flow left ventricular assist device; DT, destination therapy; MV, mitral valve; RVAD, right ventricular assist device; TR, tricuspid regurgitation; TVP, tricuspid valve procedure; VAD, ventricular assist device.

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