High-risk cardiac surgery as an alternative to transplant or mechanical support in patients with end-stage heart failure

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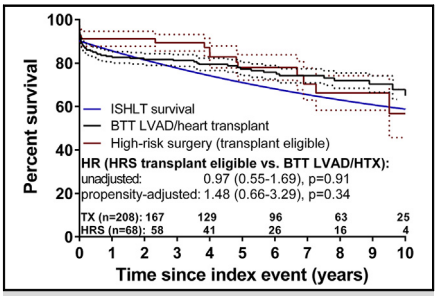
ABSTRACT

Objective: Although the results of cardiac surgery in patients with poor left ventricular function have been widely published, the outcomes in patients with end-stage heart failure who meet criteria for advanced therapies are not well investigated. As access to transplantation and ventricular assist device therapy remains limited, we explored the possibility of conventional surgery as an alternative option for highly selected patients with end-stage heart failure.

Methods: We identified patients with left ventricular ejection fraction <20% and VO_2 max <14 mL/min/m^2, who were initially referred for advanced therapies but were instead offered a conventional procedure from 2002 to 2012. We examined the short- and midterm outcomes and compared survival with that after our advanced therapies in the same era.

Results: A total of 133 patients were identified; 68 were deemed to be transplant-eligible, whereas 65 were transplant-ineligible. Seventy-nine percent were in New York Heart Association class III/IV. In-hospital mortality was 12%. Actuarial survival at 5 and 10 years was 72% ± 4% and 39% ± 8%, respectively. Nonischemic etiology was identified as a predictor of late mortality. In the propensity-adjusted model, our transplant-eligible patients had comparable long-term survival to our transplantation patients (HR 1.48 [95% confidence interval, 0.66-3.2], $P = .34$), whereas the survival in our transplant-ineligible subset was comparable to the survival after our left ventricular assist device therapy (HR 0.49 [95% confidence interval, 0.16-1.50], $P = .21$).

Conclusions: Despite high perioperative risk, the midterm survival after conventional surgery in patients eligible for advanced therapies seems to be acceptable and may be an alternative option for highly selected patients with end-stage heart failure. (J Thorac Cardiovasc Surg 2017;154:517-25)



Long-term survival after conventional surgeries for end-stage heart failure patients.

Central Message

High-risk conventional cardiac surgery provides acceptable midterm survival for highly selected patients with end-stage heart failure.

Perspective

There is a spectrum of patients with poor left ventricular ejection fraction who present for surgical consideration, a subset of whom are initially referred for transplantation or ventricular assist device. We found that conventional cardiac surgery in this subgroup of patients provided acceptable midterm survival and may be a suitable option for highly selected patients with end-stage heart failure.

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Although many preventive and pharmacological approaches have been introduced, more than 650,000 new patients with heart failure (HF) are diagnosed annually in the United States and the prevalence is still rising.[1] The most definitive treatment for refractory end-stage HF has been heart transplantation (HTx); however, donor scarcity still remains a critical issue and waiting times to transplantation continue to increase.[2] Left ventricular assist devices (LVAD) were initially introduced as a bridge to transplantation, but more recently most LVAD recipients represent

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Abbreviations and Acronyms

AV = aortic valve
BTT = bridge-to-transplant
CABG = coronary artery bypass grafting
CI = confidence interval
DCM = dilated cardiomyopathy
DT = destination therapy
HF = heart failure
HR = hazard ratios
HRS = high-risk conventional surgery
HTx = heart transplantation
IABP = Intra-aortic balloon pump
INTERMACS = Interagency Registry for Mechanically Assisted Circulatory Support
ISHLT = International Society for Heart and Lung Transplantation
LVAD = left ventricular assist devices
LVDd = left ventricular end-diastolic diameter
LVEF = left ventricular ejection fraction
MV = mitral valve
NYHA = New York Heart Association
VO_2 max = maximal oxygen consumption

"destination therapy (DT)" and are HTx ineligible.[3,4] Although DT-LVAD is now widely accepted as an alternative advanced surgical option for patients with end-stage HF, they remain associated with a high adverse event rate and few patients survive event-free beyond 5 years.[5]

Because of the marked limitations in both of these advanced surgical therapies, surgeons are often forced to make a difficult decision when they encounter patients with end-stage HF who have cardiac lesions amenable to conventional surgery. Although the immediate perioperative risk is widely recognized, the long-term benefit of conventional surgeries for this extreme subset is less well characterized.[6] In addition, most of the studies investigating the outcomes of "high-risk" cardiac surgeries used only left ventricular ejection fraction (LVEF) as an inclusion criteria,[7-15] but LVEF alone may not be adequate to identify end-stage HF.[1,16] Therefore, we investigated the outcomes of conventional cardiac surgery in patients who met the criteria for advanced surgical therapies to explore its possibility as an alternative option for end-stage HF.

METHODS

Patient Enrollment

We reviewed our institutional database to find all surgical patients who had a preoperative LVEF <20% (n = 648) from May 2002 to Apr 2012. Among them, we identified 377 patients who were initially referred to our HF team for advanced surgical therapies, including HTx or any strategy of LVAD therapy. Although the 271 excluded patients who were directly referred for conventional cardiac surgeries were not specifically reviewed, these likely represented patients with acute-onset disease in whom myocardial function was expected to recover after surgical intervention (ie, stunned myocardium after acute myocardial infarction or high-gradient aortic stenosis). Alternatively, these patients may have not met inclusion criteria for transplantation (maximal oxygen consumption [VO_2 max] >14). The remaining 377 patients underwent 434 procedures, which were classified according to primary therapy and intention-to-treat. A first group of 133 patients underwent high-risk conventional surgery (HRS) of whom 68 were transplant candidates and 65 were not. Those operations included coronary artery bypass grafting (CABG), valve intervention, and LV reconstruction; 2 of these patients eventually underwent HTx. The second group included 208 patients who were eligible for transplant and underwent HTx or bridge-to-transplant (BTT-) LVAD as their primary therapy (155 HTx and 53 BTT-VAD). Twenty-eight patients with BTT-VAD eventually underwent HTx during their follow-up. The third and final group included 36 patients who were not eligible for transplantation and underwent LVAD implantation as DT (Figure 1).

Eligibility for Advanced Surgical Therapies

All 377 (133 HRS, 208 HTx/BTT-VAD, 36 non-BTT-VAD) enrolled patients were initially referred for advanced surgical therapies and their eligibility for these therapies was preoperatively evaluated by our multidisciplinary HF team based on standard criteria.[1,6,17] Briefly, patients were subjected to formal cardiopulmonary testing to determine functional capacity. A VO_2 max of 14 mL/min/m^2 was used as a cutoff to determine the need for advanced therapies. HTx eligibility was assessed by additional screening for peripheral vascular disease, pulmonary hypertension, and other comorbidities. Among the 133 patients in the HRS group, 65 patients (49%) were deemed to be HTx-ineligible, and 68 (51%) were HTx-eligible (Figure 1).

Patient Selection for HRS

Patient selection for HRS was made on a case-by-case basis during our multidisciplinary HF team conference in consideration of the risk, patient's body habitus, and the potential of myocardial recovery. In patients with ischemic cardiomyopathy, myocardial viability was assessed by late gadolinium-enhanced magnetic resonance imaging or single-photon-emission computed tomography to determine the potential of recovery. We considered revascularization if patients had at least 1 good coronary target with a tight proximal lesion. Nonviable myocardium in a left anterior descending artery distribution was not necessarily an exclusion criterion if there was viable myocardium in other coronary distributions and/or LV reconstruction was possible. In valve surgery patients, our accrued experience during this time frame led us to avoid mitral valve (MV) surgery in patients with an LV end-diastolic diameter (LVDd) >65 mm.[18] Dobutamine stress echocardiography was performed for aortic valve (AV) surgery patients to determine their functional reserve and to stratify their risk. Patients who had a history of myocardial infarction and akinetic or dyskinetic LV aneurysms were considered for LV reconstruction as previously described.[19,20]

Data Collection

All perioperative and demographic data were routinely abstracted from the patient chart and collected prospectively in our institution's surgical database. Follow-up data were obtained from the surgeon's office chart, our electronic medical record, or by contact with the patient's referring cardiologist. Clinical follow-up was 100% complete.

Statistical Analysis

In-hospital mortality was defined as any death occurring during the index hospital admission or within 30 days of surgery.[21] All data are described as means with standard deviations, median with 25th and 75th percentiles, and frequencies, as appropriate. A prespecified subgroup