Heart Transplantation Versus Continuous-Flow Left Ventricular Assist Device: Comprehensive Cost at 1 Year

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ABSTRACT

Background: With health care reform firmly on the horizon, it is critical to understand the costs associated with new technologies such as continuous-flow left ventricular assist device (CF-LVAD) compared with well established treatments such as heart transplantation (HT). Scarce data exist describing the costs of these 2 therapies after 1 year of support.

Methods and Results: The study population consisted of 20 consecutive subjects who underwent implantation of a CF-LVAD and 20 consecutive subjects who underwent HT and survived ≥1 year. Comprehensive cost calculation included all direct and indirect costs from day of operation through 365 days and were inflation adjusted to 2010 US dollars. Hospital charges were converted to costs with the use of hospital-specific cost-to-charge ratios and were analyzed by time segment as well as cost center. The total 1-year cost was higher in the CF-LVAD group, although this difference did not reach statistical significance ($369,519 [interquartile range [IQR] $321,020−$520,395] vs $329,648 [IQR $278,924−$395,456]; $P = .242$). In both groups, the index admission constituted >50% of the total 1-year cost and the major drivers of expense by cost center were organ/device acquisition, room and board, and professional fees.

Conclusions: Patients surviving to 1 year on CF-LVAD support accrued costs similar to those of HT recipients; however, the total cost, at more than one-third of a million dollars, remains high. Reduction in the postoperative length of stay offers an avenue for significant cost savings. (*J Cardiac Fail 2015;21:160−166*)

Key Words: Mechanical circulatory support, heart transplantation, costs.

In 2011, health care expenditures totaled 2.7 trillion dollars, accounting for 21% of the federal budget and 17.9% of the gross domestic product in the United States.[1] Although clinicians have traditionally left willingness-to-pay recommendations to the policy makers, the economic realities of health care can no longer be ignored. In the discussion of cost containment, heart failure (HF) plays a major role because it represents the second most costly disease for Medicare.[2] Its epidemiologic foot print is vast, with 6.6 million Americans carrying the diagnosis and 1 million admissions per year, resulting in an estimated $44 billion of cost to the health care system.[3]

Heart failure is a progressive disease and, as classified by the American Heart Association, advances from stage A (at risk) to stage D (advanced/end stage).[4] Although stage D represents the minority of patients, it accounts for the largest expenditure.[5] For patients with stage D HF, the best treatment option is transplantation; however, organ availability dictates that only a fraction receive this therapy. This has led to the growth of mechanical circulatory support as an alternate cardiac replacement therapy. Exponential improvement in survival with the use of miniaturized left ventricular assist devices (LVADs) offers hope that it may soon be a therapy with results similar to transplantation.[6]

Cardiac transplantation has historically been deemed to be financially acceptable, with best estimates placing the

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effect at $76,000 per life year gained.[7] Although data on quality-adjusted life-years and incremental cost-effectiveness ratios (ICERs) in adult transplantation are not available, the aforementioned figure is likely to be in line with the World Heath Organization's recommendation of a cost-effectiveness range of 1−3 times gross domestic product per capita.[8] Unfortunately, current estimates for LVAD therapy suggest a much higher cost-effectiveness ratio.[9] In the current economic climate, for LVAD therapy to be a viable alternative to transplantation, it must be not only medically but also financially similar.

With this in mind, we sought to analyze the raw cost data for transplant and LVAD patients at our institution, an inner-city academic center, to identify differences and offer avenues for cost containment with LVAD. Because expenses for both therapies are front loaded, the present analysis was limited to the 1st year after intervention.

Materials and Methods

The present analysis included 20 consecutive patients followed at the Center for Advanced Cardiac Therapy at Montefiore Medical Center who underwent continuous-flow (CF) LVAD implantation and were alive on device support for >1 year starting in November 2008. The comparison group was composed of 20 consecutive patients who underwent heart transplantation at our center and were alive for >1 year starting in March 2010. Baseline and preoperative demographics were collected by means of retrospective chart review. The Montefiore Medical Center Institutional Review Board approved this study.

Montefiore mandates that all medical follow-up for 1 year after either LVAD or transplantation be performed at our institution, which allows comprehensive cost analysis. Cost calculation included both direct (expenses directly related to patient care) and indirect (shared expenses related to administration, facility services, hospital maintenance, and graduate medical education) expenses. Consistent with earlier cost studies, total costs were calculated from all billed charges with the use of the hospital's specific cost-to-charge ratio as determined by the Centers for Medicare and Medicaid Services.[10] Charges were retrieved from the hospital's financial management services system. All costs were inflation adjusted to 2010 US dollars with the use of the Consumer Price Index.[11]

To explore the determinants of the total 1-year values, cost was analyzed by 2 different methods. The 1st was time related, which segmented costs into 3 time points: index admission for implantation, outpatient, and readmissions (Fig. 1). The 2nd was by cost center/department, which analyzed the relative contributions of 10 unique categories as detailed in Table 1. For the purposes of this analysis, costs accumulated before implantation were excluded.

Because outpatient medication costs were not captured by our financial management services, these values were estimated from the average wholesale price based on typical medical regimens for transplant and CF-LVAD patients (Table 2). The average monthly outpatient medication costs were multiplied by 11 months for the LVAD group and 11.5 months for the transplant group to account for the average time in hospital for the 1st year. According to our institutional protocol, prednisone as well as cytomegalovirus and *Pneumocystis jiroveci* prophylaxis are maintained for 6 months after transplantation, and those medication costs were calculated.

Finally, a number of patient-specific clinical events were analyzed, including postoperative length of stay, time to first readmission, number of readmissions, and days out of the hospital. The latter (calculated as percentage of 365 days) was chosen because it has been suggested as a comprehensive tool summarizing the effect of treatment in HF and is a reasonable surrogate for quality of life assessment.[12]

All statistical analysis was performed with the use of SPSS 20 (Chicago, Illinois). Owing to non-normal distributions, continuous variables are expressed as median and interquartile range and were compared with the use of the Mann-Whitney test. Categoric variables are expressed as number of patients and percentage of total. For all tests, P values of $<.05$ were considered to be significant.

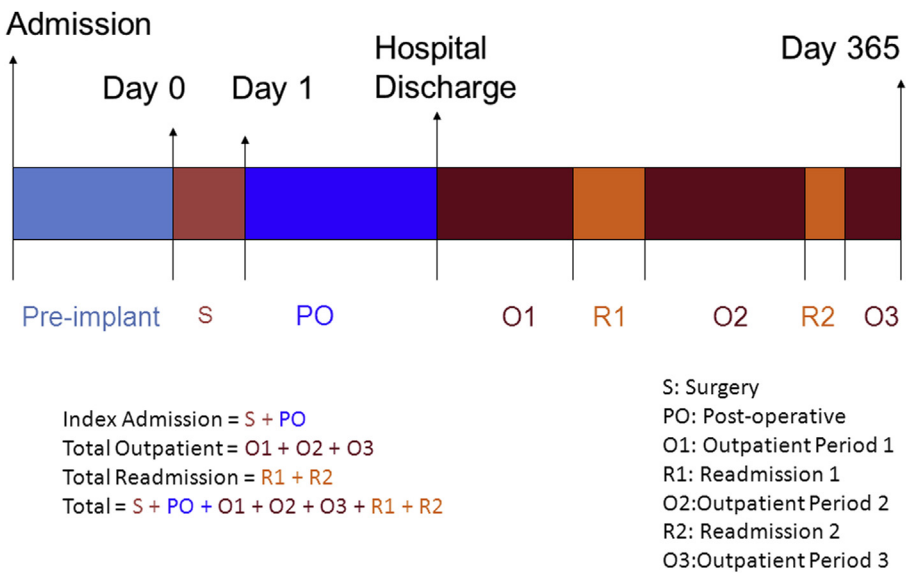

Fig. 1. Time-related costs.