Bridging to transplantation with left ventricular assist devices: Outcomes in patients aged 60 years and older

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With the rapid growth in the elderly segment of the population, an increasing number of older patients will have end-stage heart failure and require cardiac surgery.¹ The demographic of patients undergoing left ventricular assist device (LVAD) implantation is expected to shift toward older and sicker patients in parallel. This study was designed to determine the effect of advanced age on postimplantation complications, bridge-to-transplantation rates, and posttransplantation survival in LVAD recipients.

Patients and Methods

Two hundred one patients undergoing LVAD implantation at a single center from July 1996 through April 2004 were retrospectively reviewed. Patients were categorized according to 3 age cohorts: group 1, less than 40 years; group 2, 40 to 59 years; and group 3, 60 years or older. These groups were then compared with regard to baseline characteristics, LVAD scores,² postoperative complications, bridge-to-transplantation rates, and posttransplantation survival.

Data were represented as frequency distributions and percentages. Values of continuous variables were expressed as means $\pm$ SD. Continuous variables were compared by the analysis of variance test, whereas nominal variables were compared using χ^2 tests. Kaplan-Meier analysis was used to calculate long-term survival along with log-rank *P* values when comparing groups.³ Significant predictors of bridge to transplantation were identified by logistic regression models. All data were analyzed with SPSS 11.5 software (SPSS, Inc, Chicago, Ill).

Results

Demographics. Clinical characteristics of patients are shown in Table 1. The number of patients in groups 1, 2, and 3 was 41 (20.4%), 104 (51.7%), and 56 (27.9%), respectively. There were

no significant differences in sex, mean body mass index, and mean LVAD score among the 3 groups. Coronary artery disease as the cause of heart failure was significantly more common in older patients, whereas idiopathic cardiomyopathy and other causes were significantly more common in younger cohorts. There was a greater incidence of hypertension in older patients undergoing LVAD implantation.

Postoperative complications and bridge-to-transplantation rates. LVAD pocket infections and any type of infection in general were more frequent in group 2 compared with in groups 1 and 3. Postoperative stroke occurrence did not differ between groups, whereas acute renal failure necessitating continuous venovenous hemodialysis was significantly more common in group 3 than in groups 1 or 2. Mean intensive care unit (ICU) length of stay was significantly longer in group 3 compared with the younger cohorts. Overall bridge-to-transplantation rates were comparable among the 3 age groups (Table 1).

Posttransplantation survival. Posttransplantation actuarial survivals at 1, 3, and 5 years were 93.6%, 86.4%, and 81.1% for group 1; 90.1%, 86.7%, and 78.6% for group 2; and 84.1%, 76.9%, and 69.6% for group 3 (*P* = .505, log-rank test; Figure 1).

Predictors of bridge to transplantation. Univariate analysis revealed cause of heart failure (*P* = .015 for coronary artery disease and *P* = .004 for idiopathic cardiomyopathy), LVAD score (*P* < .001), and female sex (trend toward significance, *P* = .066) as predictors of bridge to transplantation. Multivariate analysis revealed only LVAD score as a significant independent predictor of bridge to transplantation (hazard ratio, 0.730; 95% confidence interval, 0.631-0.845; *P* < .001). Patients with low LVAD scores demonstrated higher bridge-to-transplantation rates compared with those with high LVAD scores. Age of 60 years or older was not a significant predictor of bridge to transplantation in either univariate or multivariate analyses.

Discussion

In our review older patients exhibited significantly higher rates of heart failure caused by coronary artery disease, as well as a higher preoperative incidence of hypertension. These findings are consistent with previous reports.³ The mean intensive care unit stay was significantly longer for elderly patients, an outcome likely related to a corresponding increased incidence of postoperative renal failure requiring continuous venovenous hemodialysis. Interestingly, advanced age had no effect on either bridge to transplantation or posttransplantation survival. This might be expected, however, because several recent reports demonstrate comparable posttransplantation survivals for older recipients as a result of improvements in surgical technique, anesthesia management, and perioperative care of patients.⁴

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TABLE 1. Demographics and clinical characteristics

		Age <40 y	Age 40-59 y	Age ≥60 y	P value
Age (y)		26.6 ± 8.8	52.2 ± 5.6	63.1 ± 2.7	<.001
Sex	Female	24.4%	17.4%	14.3%	.428
Race	White	51.2%	71.2%	78.6%	.011
	Black	26.8%	14.3%	16.0%	.197
	Other	22.0%	13.5%	5.4%	.054
Cause of HF	CAD	17.1%	60.6%	76.8%	<.001
	ICM	56.1%	33.6%	17.8%	<.001
	Other	26.8%	5.8%	5.4%	<.001
LVAD score*		4.3 ± 3.4	4.3 ± 3.5	4.9 ± 3.5	.611
Hypertension		10.0%	33.3%	37.3%	.009
BMI (kg/m ²)		27.5 ± 6.5	27.1 ± 5.2	26.5 ± 4.8	.640
Infection	Driveline	5.0%	6.1%	4.0%	.858
	Pocket	17.5%	17.3%	8.0%	.279
	Pump	2.5%	9.2%	0.0%	.042
	Any	35.0%	55.1%	37.3%	.034
CVVHD		14.6%	35.3%	38.2%	.028
Stroke		7.3%	4.8%	7.1%	.771
ICU LOS (d)		13.1 ± 14.9	14.5 ± 11.6	22.6 ± 28.7	.020
Bridge to transplantation		82.5%	73.5%	66.7%	.228

HF, Heart failure; CAD, coronary artery disease; ICM, idiopathic cardiomyopathy; LVAD, left ventricular assist device; BMI, body mass index; CVVHD, continuous venovenous hemodialysis; ICU, intensive care unit; LOS, length of stay. *Of 10 possible points.

Figure 1. Posttransplantation actuarial survival.

Preimplantation LVAD score, which has previously been shown to correlate with mortality, was the only independent predictor of outcome but was otherwise comparable among the different age cohorts.

Limitations of this study include those inherent with a retrospective analysis. Data were collected retrospectively by means of chart review and might not be as accurate as data obtained in a prospective and controlled fashion.

In conclusion, LVADs can successfully bridge older patients to transplantation, with posttransplantation survivals equivalent to those achieved by younger LVAD recipients. Decisions to implant LVADs should not be based solely on age; rather, individualized preoperative patient status should be more heavily considered in the decision-making process.

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