Obesity as a Risk Factor for Consideration for Left Ventricular Assist Devices

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ABSTRACT

Background: Obesity is a major risk factor for cardiovascular outcomes and is prevalent in patients with advanced heart failure requiring left ventricular assist devices (LVADs). The understanding of high body mass index (BMI) and outcomes after LVAD implantation continues to evolve. In this study we investigated the effects of obesity on post−LVAD implantation outcomes.

Methods and Results: In this retrospective study, 288 patients with both Heartmate II and Heartware HVADs, implanted as bridge to transplantation (BTT) and destination therapy (DT), were enrolled. Patients were stratified according to BMI ≥30 kg/m^2. Baseline demographics were obtained. Post−LVAD implantation incidence of readmissions and major adverse events were tabulated. The cohort comprised of 95 (33%) obese and 193 (67%) nonobese patients, as well as, 63 (25%) female and 225 (75%) male patients; 48 (20%) were implanted as BTT and 240 (80%) as DT. The mean BMI in the obese group was 35.2 kg/m^2 compared with 24.3 kg/m^2 ($P < .001$) in the control group. There was no difference in survival between the two groups. Incidence of post−LVAD implantation heart failure readmissions was higher in the obese cohort. (29% vs 16% $P = .009$). Multivariate analysis confirmed that BMI was an independent predictor for post−LVAD heart failure readmissions (odds ratio 2.47, 95% confidence interval 1.15−5.32; $P = .02$) Obese patients had a higher mean total number of hospitalizations compared with nonobese patients, (4.2 vs 3.4; $P = .03$) as well as higher median total length of stay after LVAD implantation (28 vs 14 days; $P = .05$), but these were not significant when adjusted for covariates.

Conclusions: Obese patients had higher incidence of post−LVAD implantation heart failure readmissions. There was no difference in overall survival or outcomes between the 2 groups. There was no difference in total rehospitalizations or length of stay between obese and nonobese patients. Our analysis suggests that obesity should not preclude LVAD candidacy. (*J Cardiac Fail 2015;21:800−805*)

Key Words: Obesity, BMI, left ventricular assist device, LVAD, outcomes, mortality, hospitalizations.

Obesity is a risk factor for major adverse cardiovascular outcomes and increased mortality in patients with cardiovascular disease.[1−3] The prevalence of obesity, defined as body mass index (BMI) >30 kg/m^2, continues to increase worldwide, with coincident increases in associated comorbidities.[4−6] Chronic obesity, even in the absence of traditional risk factors for heart failure, can lead to structural changes to the myocardium, causing worsening diastolic and systolic left ventricular dysfunction.[7] In the United States, >72 million, or one-third of the adult population, are considered to be obese.[8,9] Similarly, the prevalence of congestive heart failure (CHF) in obese patients, some of whom require advanced heart failure treatment in the forms of left ventricular assist devices (LVADs) or orthotropic heart transplantation (HT), is increasing.[10]

Although HT is now considered to be a gold standard treatment for patients with end-stage cardiomyopathy, obesity is a relative contraindication to transplantation. Obese patients are thought to have adverse perioperative morbidity, adverse post-transplantation cardiovascular outcomes, increased long-term complications, and poor survival after transplantation compared with nonobese patients.[11,12] Additionally, owing to a paucity of donor organs and strict listing criteria, many obese patients are not eligible for HT.[13] With the advent and advancement of LVADs, many patients are receiving

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implants as bridge to transplantation (BTT) or as destination therapy (DT) candidates. Unfortunately, obese patients are conventionally thought to be at a high risk for more adverse outcomes, such as right ventricular failure (RVF), increased ventilation time, and driveline infections, after LVAD placement compared with nonobese patients.[14–17] This is the first single-center study to evaluate readmissions and survival in a large continuous cohort for 3 years after LVAD implantation.

Methods

This retrospective, Institutional Review Board–approved study included 288 consecutive patients who underwent LVAD placement from 2006 to 2013. Patients were stratified into 2 groups. The obese cohort comprised of patients with body mass index ≥30 kg/m^2, and the nonobese group consisted of patients with BMI <30 kg/m^2.

Demographic information including sex, race, height, and weight was obtained by means of retrospective chart review. Baseline medical information at the time of LVAD placement was tabulated. These data included cardiac risk factors, prior cardiac history, and hemodynamic and echocardiographic data on admission. Pre-LVAD laboratory parameters were collected. Information on post–LVAD implantation major adverse outcomes including mortality and hospitalizations for heart failure, gastrointestinal (GI) bleeding, stroke/transient ischemic attack (TIA), intracranial hemorrhage, hemolysis, thrombosis, pump exchanges, infections, and postoperative RVF was obtained. RVF was defined as need for RVAD implantation or inotropic requirements for 14 days after LVAD implantation. Time from LVAD implantation to index rehospitalization, total hospitalizations, and total duration of hospitalization stay were also collected.

Statistics

Data were analyzed with the use of the SPSS 19 statistical software package (IBM, Chicago, Illinois). Continuous variables were summarized as mean ± SD and categoric variables as percentages. Student *t* tests, Mann-Whitney analysis, and chi-square testing were used to analyze differences between the groups. A *P* value of ≤.05 was considered to be significant. Kaplan-Meier survival analysis was used to compare survival in the obese and nonobese groups. Binary logistic regression models were used to analyze the effect of multiple covariates on dichotomous outcomes variables, and univariate general linear models were used for continuous outcome variables. For both models, covariates were selected from univariate analyses with $P < .05$.

Results

Baseline Data

A total of 288 patients implanted with Heartmate II (HMII) and Heartware (HVAD) LVADs from 2006 to 2013 were enrolled in this study; 48 patients (17%) were implanted as BTT and 240 (83%) as DT. The obese cohort consisted of 93 patients (33%) with BMI ≥30 kg/m^2, and the nonobese group comprised of 193 nonobese patients (67%) with BMI <30 kg/m^2. The mean BMI in the study population was 35.2 kg/m^2 compared with 24.2 kg/m^2 in the control group ($P < .001$; Table 1). Obese patients were, on average, 7 years younger than the nonobese patients (55 vs 62 y; $P < .001$). There were no statistically significant differences in sex or race between the 2 groups.

Baseline tabulation of comorbidities (Table 2) revealed no major statistical difference between the 2 groups except for increased incidence of atrial fibrillation (Afib) in the nonobese group (43% vs 31%; $P = .04$) and increased incidence of diabetes mellitus (DM) (54% vs 37%; $P = .006$) and obstructive sleep apnea (OSA) (39% vs 12%; $P < .001$) in the obese group. There were no differences in baseline incidence of ischemic etiology of cardiomyopathy, hypertension, ventricular tachycardia, chronic kidney disease, cerebrovascular accidents, or chronic obstructive pulmonary disease between the 2 cohorts (Table 2). Similarly, laboratory data in the 2 populations indicated that, other than lower B-type natriuretic peptide (BNP) in the obese group compared with the nonobese group (576 vs 878 pg/mL; $P < .001$), there were no statistically significant differences between the 2 patient groups (Table 3).

Echocardiographic information showed no difference between the study and control groups in left ventricular dimensions or ejection fractions (Table 4). Hemodynamic data confirmed elevated central venous pressures and pulmonary capillary wedge pressures, as well as a low cardiac index, in both groups, but no significant differences between groups (Table 4). Obese patients had statistically significantly higher mean pulmonary arterial pressures (MPAP) and mean arterial pressures (MAP) compared with nonobese patients (Table 4).

Outcomes

There was no difference in 3-year survival between the 2 groups (Table 5). Obese patients had a higher number of total rehospitalizations compared with the control group (4.2 vs 3.4; $P = .03$) over a mean follow-up time of 741.2 ± 686.5 days. The mean total length of stay was higher in obese patients (29 vs 14 d; $P = .05$). In obese patients, compared with nonobese patients, there was a statistically significant increase in heart failure readmission (29% vs 16%; $P = .009$), and hemolysis (11% vs 4%; $P = .02$;

Table 1. Baseline Demographics Information for Obese and Nonobese Groups

Parameter	Obese (n = 95)	Nonobese (n = 193)	*P* Value
Age (y)	55.08 ± 12.74	62.43 ± 12.38	<.001
Male	73 (76.8%)	152 (78.8%)	.712
Weight (kg)	107.18 ± 19.26	75.36 ± 13.69	<.001
Body mass index (kg/m^2)	35.26 ± 4.71	24.40 ± 3.18	<.001
White	47 (49.5%)	106 (54.9%)	.384
Device type			.225
Heartmate II	77 (81.1%)	167 (86.5%)	
Heartware	18 (18.9%)	26 (13.5%)	