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Care of Patients With Heart Failure

Clinical outcomes in overweight heart transplant recipients

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ABSTRACT

Background: Few studies have examined the impact of patient weight on heart transplant (HT) outcomes.
Objectives: Nine outcomes were compared in 2 groups of HT recipients ($N = 347$) based on their mean body mass index (BMI) during the first 3 years post-HT.
Methods: Group 1 consisted of 108 non-overweight patients (BMI <25; mean age 52; 29.6% females; 16.7% minorities). Group 2 consisted of 239 overweight patients (BMI ≥25; mean age 52; 15.9% females; 13.8% minorities). Outcomes were: survival, re-hospitalization, rejections, infections, cardiac allograft vasculopathy (CAV), stroke, renal dysfunction, diabetes, and lymphoma.
Results: Non-overweight patients had shorter survival, were re-hospitalized more days after the HT discharge, and had more lymphoma and severe renal dysfunction. Overweight patients had more CAV, steroid-induced diabetes, and acute rejections.
Conclusions: Overweight HT patients had better survival, but more rejections, CAV, and diabetes. Non-overweight HT patients had worse survival, plus more re-hospitalization time, lymphoma, and renal dysfunction.

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Introduction

The deleterious effects of higher pre-transplant patient weight on several clinical outcomes after heart transplantation (HT) have been documented by HT registry data from the International Society for Heart and Lung Transplantation (ISHLT),[1] as well as in studies by the research teams of Kilic,[2] Guisado,[3] Russo,[4] Almenar,[5] Lietz,[6] and Grady.[7,8] In addition, some researchers have investigated the negative impact of higher post-transplant patient weight on post-HT outcomes, but usually only one clinical outcome was reported in each study that related to the influence of heavier post-HT patient weight on outcomes.[9–19]

For example, analyses from the ISHLT[9] and UNOS[10] registries and research by Augustine et al[11] found worse survival in heavier HT recipients. Higher post-HT BMI was also related to the development of post-transplant cardiac allograft vasculopathy (CAV)[12–15] and steroid-induced diabetes,[16,17] as well as graft failure.[18] In addition, Grady et al[19] reported more episodes of acute rejection in heavier post-HT patients.

Therefore, this research compared 9 clinical outcomes in 2 weight groups of HT recipients (non-overweight vs overweight) during the first 3 years after HT surgery, and also identified risk factors for decreased survival.

Methods

Data source

The data for this report was derived from our 10-year prospective NIH study (1987–1997) that examined medical, physical,

Abbreviations: BMI, body mass index; CAD, coronary artery disease; CAV, cardiac allograft vasculopathy; CMV, cytomegalovirus; dl, deciliters; EENT, eye, ear, nose, and throat; GI, gastrointestinal; HT, heart transplant; HTN, hypertension; IABP, intra-aortic balloon pump; ISHLT, International Society for Heart and Lung Transplantation; IV, intravenous; kg, kilograms; MANCOVA, multivariate analysis of covariance; m, meters; mg, milligrams; MI, myocardial infarction; NIH, National Institutes of Health; PRA, panel-reactive antibody; PVR, pulmonary vascular resistance; SD, standard deviation; TAH, total artificial heart; UNOS, United Network for Organ Sharing; VAD, ventricular assist device.

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and psychosocial factors that can impact on multiple HT outcomes at various time points both pre-operatively and post-operatively. The study sample for this report consisted of 347 adult HT recipients (18 or older) from 2 hospitals in the midwestern and southern United States.

Data collection in parent study

In the parent study, patients were followed at standardized intervals pre-operatively while they were on the HT waiting list, and then post-operatively for up to 5 years after surgery (depending on how soon they were transplanted and how long they were in the study after surgery before funding ended).

At each of the pre-operative and post-operative time points in the parent study, comprehensive medical data was collected from patients' charts by nurses experienced in cardiac care. In addition, at each time point patients completed a study booklet of 9 questionnaires pre-operatively and 10 questionnaires post-operatively.

The booklet questionnaires included the following physical and psychosocial factors that can influence HT outcomes: symptom distress, functional ability, work status, satisfaction with the HT outcome, compliance with the HT regimen, perceived helpfulness of HT team interventions, HT-related stressors, coping behavior, social support resources, and quality of life.[20–36]

Before agreeing to participate in the study, patients were given the opportunity to review the pre-operative study booklet so they would know what was required of study participants. In addition, patients were paid $10 for each booklet they completed. Patients signed a consent form for study participation, and the study was approved by the Institutional Review Board at each site.

Data used for current report

The medical records data for the pre-operative period while patients were on the HT waiting list and for the first 3 years after HT were used in this analysis. Medical data was collected for the study every 3 months while patients were waiting for a heart donor, then 1, 3, 6, 9, and 12 months after surgery, and then every 6 months post-HT for years 2 and 3, and covered the entire study period.

Medical data included: baseline characteristics, pre-operative and post-operative medical and surgical history, post-HT complications, causes of death, lab test results, medications (immunosuppressant and other), hospitalizations (dates, duration, reason), and donor data. (Note: Data collection and data reliability verification procedures for this NIH study have been described in previous reports.[33–36])

Evolution of sample size

Figure 1 shows that, of the initial study sample of 347 patients transplanted at the 2 study sites, 72 patients died during the first 3 years after surgery (20.7%), with 72.2% of the deaths occurring in the first year after HT, 15.3% in the second year, and 12.5% in the third year. During the 3-year post-HT study period, only 5 patients dropped out of the study, stating that they were either too sick or too tired or too busy to fill out the study booklet.

By the time the 10-year study funding ended, 269 patients had reached 1 year after HT (269/347 = 77.5%), 215 patients had reached 2 years after HT (215/269 = 79.9%), and 145 patients had reached 3 years after HT (145/215 = 67.4%), and therefore had medical data available for each of those time periods.

The remainder of the patients had not yet reached either the 1-year or 2-year or 3-year post-HT time point by the time the study ended, due to waiting a long time before a compatible heart donor was found. Some patients waited as long as 4–5 years for their HT; mean waiting time was 276 days, with a maximum of 1838 days in this cohort.

BMI data and group classification

Post-HT outcomes were compared in 2 weight groups based on their mean post-transplant body mass index (BMI) for the entire length of time they were in the study after surgery for up to 3 years. Data on post-HT BMI was obtained from inpatient and outpatient medical records whenever patients came to the clinic for follow-up or came to the hospital for treatment of problems, and then a mean BMI was calculated from all the data available on a patient for the specific time period.

Body mass index is calculated as weight in kilograms divided by height in meters squared (kg/m^2), and is classified by NIH into 4 main groups: underweight (BMI <18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), and obese (BMI ≥30).[37]

In this cohort, 2.3% of the patients were in the underweight group, 28.8% were in the normal weight group, 45.8% were in the overweight group, and 23.1% were in the obese group. Because of the small proportion of patients in the underweight and obese categories, some groups were combined so only 2 groups were used for this analysis: (1) Group 1: non-overweight patients (underweight and normal weight BMI groups combined) and (2) Group 2: overweight patients (overweight and obese BMI groups combined).

The non-overweight Group 1 consisted of 108 patients (31.1%) with a mean post-transplant BMI less than 25 (range = 16–24, mean = 22, SD = 1.9). The overweight Group 2 consisted of 239 patients (68.9%) with a mean post-transplant BMI of 25 or higher (range = 25–40, mean = 29, SD = 3.2). Therefore, more than two-thirds of this cohort had a mean post-transplant BMI that was higher than clinically desired.

Outcomes

The 9 clinical outcomes examined in the 2 weight groups during the first 3 years after HT were as follows: *survival*: the number of days survived after HT surgery; *re-hospitalization*: the number of days re-hospitalized after the HT surgery discharge; and *7 post-transplant complications*: the number of treated acute rejection episodes, the number of IV-treated infections (infections treated with an IV antibiotic), and the incidence of the following post-HT complications: cardiac allograft vasculopathy (CAV, an accelerated form of post-HT coronary artery disease that is caused by both immunologic and non-immunologic factors, and is the leading cause of death during the first 3 years after HT[38]), new-onset steroid-induced diabetes, lymphoma, stroke, and severe renal dysfunction (which was defined as a serum creatinine >2.5 mg/dl or a diagnosis of renal failure or on dialysis, based on ISHLT registry data[9]). These outcomes were selected for analysis because reports from the international ISHLT registry consider them germane to HT patients' survival.[1,9,12,39–42]

Analysis

Data was analyzed with SPSS (V 13). Because of the multiple variables examined in this report, a more conservative probability level of .025 (instead of .05) was used to determine significant group differences in baseline characteristics, outcomes, and mortality risk factors. Baseline characteristics of the 2 weight groups were compared with chi square tests for categorical variables and *t*-tests for continuous variables.

Three different tests were used to analyze outcomes: logistic regression, multivariate analysis of covariance (MANCOVA), and Kaplan–Meier survival analysis. Logistic regression was used to

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