1129

Ideal Body Weight May Be A Better Comparative Variable than Actual Body Weight for Donor-Recipient Matching in Orthotopic Heart Transplantation

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Background

Appropriate donor and recipient matching in orthotopic heart transplantation (OHT) is instrumental in order to maximize graft function post-transplant. Within the past two decades, the influence of height mismatches, weight mismatches, and gender mismatches have shown varying results on morbidity and mortality in OHT recipients. It is assumed by convention that a small donor heart given to a large recipient will have poorer outcomes due to the poor inotropic characteristics of the donor heart relative to the recipient's cardiovascular and metabolic needs. Height mismatches, weight mismatches, and gender mismatches are all used as correlates for heart size mismatches.

The International Society of Heart and Lung Transplantation guidelines for adult heart transplantation recommend a donor to recipient actual body weight (ABW) ratio of greater than 0.8.[1]

A recent study[2] by Bergenfeldt et al. showed that donor weight <70% of recipient weight increase mortality in non-obese heart transplant recipients, but not in obese heart transplant recipients. They suggested that these obese heart transplant recipients had a lower incidence in mortality because they had a lower oxygen consumption, compared to non-obese patients. The obese patients had a lower minimum cardiac index that they needed to support their metabolic needs post-transplant, compared to non-obese patients. Therefore, a weight mismatch in the obese donor and recipient group did not yield poorer outcomes because there was a greater range of heart sizes that the recipients could support. In the same manner, a weight mismatch in the non-obese donor and recipient group yielded poorer outcomes because there was a smaller range of heart sizes that the recipients could support.

Hypothesis

We hypothesize that the lack of consensus on the effect of weight mismatch in OHT recipients might be that weight is a poor comparative variable and that obese patients – and their weight data – might be confounding the poor outcomes seen in a donor-recipient weight mismatch. Because heart size does not increase dramatically in the relative human weight ranges, we suggest that ideal body weight (IBW) might be a better comparative variable for estimating heart size mismatches between OHT donor and recipients.

Ideal Body Weight Calculation[3]

$$IBW_{men} = 50kg + \frac{2.3kg}{each\ in\ over\ 60in}$$

$$IBW_{women} = 45.5kg + \frac{2.3kg}{each\ in\ over\ 60in}$$

This IBW equation – from Devine et al. (1974) – is the most cited in the literature and was selected because other IBW equations, such as Robinson et al. (1983) and Miller et al. (1983), were all derived from similar height-weight tables. The differences in IBW between these equations are not significant.[4]

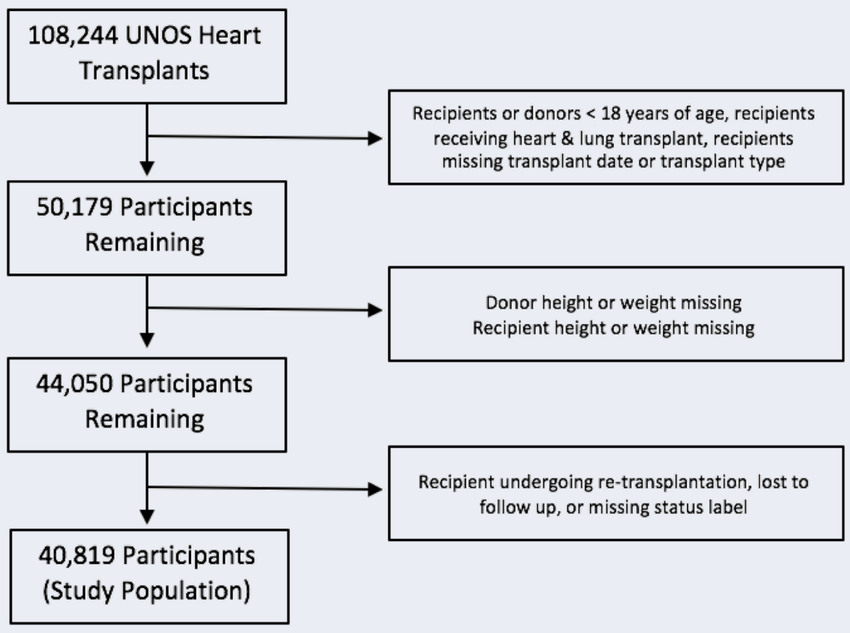
Disclosures

Y. Naka received consulting fees from Thoratec Corp.

The remaining authors have no conflicts of interest to disclose.

Methods

The United Network for Organ Sharing (UNOS) database was examined for adult heart transplants (HT) from 1987 to 2016.



IBW was calculated for each patient in the matched donor-recipient pair using a standard IBW equation. Weight ratios (WR) of donor-recipient pairs were then calculated using both IBW and ABW. Thirty-day mortality was studied with relation to both the IBW ratio and the ABW ratio.

Results

A total of 40,819 patients received a HT, with overall 30-day mortality of 5.9% (n=2,421). Of these 2421 patients, 424 (17.5%) died of primary graft failure, 338 (14.0%) died of multi-organ failure, and 173 (7.2%) died as a result of sepsis. Using ABW, 13.9% of donor-recipient pairs had a WR <0.8. Using IBW, 18.2% of donor-recipient pairs had a WR <0.8. Donor-recipient pairs with an IBW of <0.8 had a higher mortality (19.9%) than those with an ABW of < 0.8 (14.9%; p=0.014).

Univariate logistic regression analysis demonstrated that IBW ratio < 0.8 was a significant predictor for 30-day mortality (OR 1.11, 95% CI 1.00-1.23, p-value 0.044), whereas ABW ratio < 0.8 was not (OR 1.08, 95% CI 0.97-1.22, p-value 0.172).

Table 1. Events of common donor-recipient mismatches.

Characteristic	Number of Events (n)	% of Total Study Participants
Gender Mismatch	11154	27%
Female-donor to Male-recipient	7057	17%
Donor height + 15.24cm < recipient height	2340	6%
ABW Ratio < 0.8	5689	14%
IBW Ratio < 0.8	7451	18%
Recipient BMI < 18	690	2%
Recipient BMI 18 ≤ X < 30	30461	75%
Recipient BMI ≤ 30	9667	24%

Table 2. Comparison of average donor-recipient weight mismatches among 30-day mortality and cumulative mortality outcomes.

Outcome	Average ABW Ratio	Average IBW Ratio	Δ(IBW Ratio – ABW Ratio)
30-day mortality	1.0136	1.057	0.0434
Cumulative mortality	1.0105	1.0542	0.0437

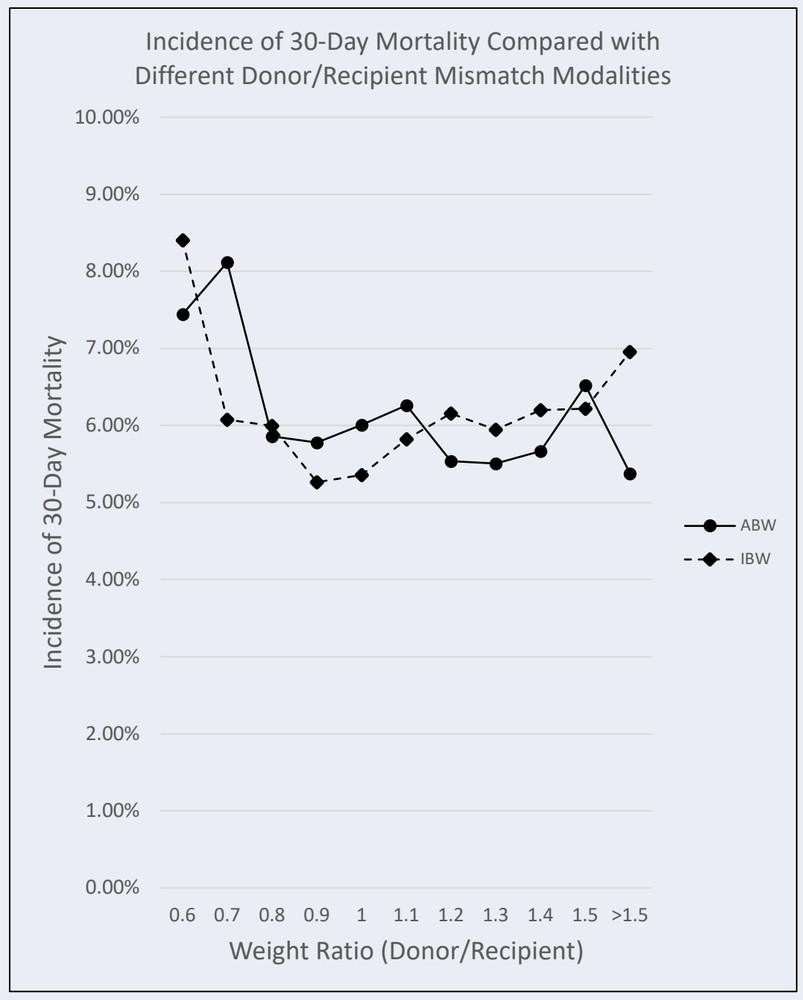


Figure 1. Comparison of 30-day mortality between donor-recipient actual body weight and ideal body weight mismatches.

Conclusions

Actual body weight may not be an ideal criterion for donor-recipient matching for OHT. Calculating WR using IBW may be better to predict outcomes after OHT than matching donor-recipient pairs based on ABW.

Future studies should investigate alternative methods of matching donor-recipient pairs based on weight ratios.

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