Impact of Deceased Organ Donor Demographics and Critical Care End Points on Liver Transplantation and Graft Survival Rates

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BACKGROUND: The criteria for organ acceptance remain inconsistent, which limits the ability to standardize critical care practices. We sought to examine predictors of liver graft use and survival to better guide the selection and management of potential organ donors.

STUDY DESIGN: A prospective observational study of all donors managed by the 8 organ procurement organizations in United Network for Organ Sharing Region 5 was conducted from July 2008 to March 2011. Critical care end points that reflect the normal hemodynamic, acid−base, respiratory, endocrine, and renal status of the donor were collected at 3 time points. Critical care and demographic data associated with liver transplantation and graft survival rates were first determined using univariate analyses, and then logistic regression was used to identify independent predictors of these two outcomes.

RESULTS: From 961 donors, 730 (76%) livers were transplanted and 694 (95%) were functioning after 74 ± 73 days of follow-up. After regression analysis, donor BMI (odds ratio [OR] = 0.94), male sex (OR = 1.89), glucose <150 mg/dL (OR = 1.97), lower dopamine dose (OR = 0.95), vasopressin use (OR = 1.95), and ejection fraction >50% (OR = 1.77) remained as independent predictors of liver use. Graft survival was associated with lower donor BMI (OR = 0.91) and sodium levels (OR = 0.95).

CONCLUSIONS: After controlling for donor age, sex, and BMI, both hemodynamic and endocrine critical care end points were associated with increased liver graft use. Both donor BMI and lower sodium levels during the course of donor management were independently predictive of improved graft survival. These results may help guide the management and selection of potential organ donors after neurologic determination of death. (J Am Coll Surg 2015;220:38−47. © 2015 by the American College of Surgeons)

As of April 2014, there were nearly 122,250 patients on the Organ Procurement and Transplantation Network/United Network for Organ Sharing (UNOS) waiting list. In the last annual report of 2011, however, only 28,535 organ transplantations were performed from 14,145 donors, and >6,600 patients died while waiting for an appropriate organ.[1] In an effort to address the profound shortage of organs available for transplantation, the US Health Resources and Services Administration has set goals for organ donation and transplantation through the Donation and Transplantation Community of Practice. As a part of its strategy to obtain higher conversion rates and a greater number of organs transplanted per donor, the Donation and Transplantation Community of Practice encourages the use of preset critical care end points to guide the management of donors after neurologic determination of death (DNDDs).[2]

Successfully meeting predefined critical care end points has demonstrated a positive effect on the number of organs transplanted per donor,[3-5] but analyses directed at

Disclosure Information: Nothing to disclose.

Presented at the 71st meeting of the American Association for the Surgery of Trauma, Kauai, HI, September 2012.

Received May 12, 2014; Revised July 29, 2014; Accepted September 8, 2014.

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http://dx.doi.org/10.1016/j.jamcollsurg.2014.09.020
ISSN 1072-7515/14

Abbreviations and Acronyms

DMG = donor management goal
DNDD = donors after neurologic determination of death
EF = ejection fraction
OPO = organ procurement organization
OR = odds ratio
UNOS = United Network for Organ Sharing

the use of specific organs are lacking. Because the reasons for organ acceptance for transplantation may be unrelated to donor management or graft quality, it is difficult to truly identify best practices by focusing merely upon organ use or transplantation rates. Consequently, analyses which include graft survival data can better identify targets for donor management optimization.

We sought to determine factors associated with liver graft outcomes to better guide donor management strategies by intensivists and organ procurement organization (OPO) staff, as well as organ acceptance by transplantation physicians. We hypothesized that meeting predefined critical care end points throughout the donation process is associated with a considerable increase in both liver transplantation and graft survival rates.

METHODS

Study design

A prospective observational study of all DNDDs managed by the 8 OPOs in UNOS Region 5 was conducted from July 2008 to March 2011. Region 5 represents the Southwest Region of the United States and includes California, Nevada, Arizona, New Mexico, and Utah. Both standard criteria donors (SCD) and extended criteria donors (ECD) were included, while donors after circulatory determination of death were excluded.

Extended criteria donors were declared legally dead by neurologic criteria and were aged either older than 59 years, or were aged 50 to 59 years with at least 2 of the following: chronic hypertension, stroke as the cause of death, or serum creatinine >1.5 mg/dL. Standard criteria donors were also declared dead by neurologic criteria and were aged either younger than 50 years, or were 50 to 59 years with <2 of the criteria mentioned.

Nine critical care end points that reflect the normal hemodynamic, acid–base, respiratory, endocrine, and renal status of the donor have previously been identified as donor management goals (DMGs) by all of the OPOs in Region 5 (see Table 1 for the specific end points currently being used). All DNDDs in the study were managed by their respective OPO based on their local donor management protocols. However, these individual practices are driven by the UNOS clinical pathway,[6] as well as the regional DMGs, and therefore contain similar guiding principles.

Data collection

The OPOs in UNOS Region 5 prospectively recorded the following critical care data on all DNDD: mean arterial pressure, central venous pressure, ejection fraction (EF),

Table 1. Proportion of Livers Transplanted When Categorical Variables Were Met or Not Met (n = 961)

	At authorization			12–18 Hours later			Before organ recovery		
Variable	**Met, %**	**Not met, %**	**p Value**	**Met, %**	**Not met, %**	**p Value**	**Met, %**	**Not met, %**	**p Value**
Male sex	79.8	70.1	0.001†	—	—	—	—	—	—
ECD status (SCD = not met)	64.0	79.6	<0.001†	—	—	—	—	—	—
Specific end points									
Mean arterial pressure 60–110 mmHg	75.9	76.5	0.899	75.8	77.9	0.675	75.6	80.6	0.372
Central venous pressure 4–12 mmHg	79.2	74.0	0.066*	79.3	68.6	<0.001†	79.6	67.5	<0.001†
Ejection fraction ≥50%	77.6	75.7	0.624	81.0	72.3	0.002†	82.7	69.2	<0.001†
Arterial blood gas pH 7.30–7.50	76.5	74.0	0.464	76.5	71.7	0.297	75.7	78.3	0.600
PaO_2/FiO_2 ≥300	82.2	72.0	<0.001†	82.4	70.9	<0.001†	80.8	71.7	0.001†
Serum sodium ≤155 mEq/L	75.9	76.2	0.910	76.5	74.0	0.467	76.2	74.8	0.733
Blood glucose ≤150 mg/dL	79.4	71.8	0.006†	77.3	75.0	0.408	78.4	73.4	0.070*
Urine output ≥0.5 ml/kg/h	77.1	71.6	0.116	77.1	70.8	0.079*	76.7	72.2	0.222
Vasopressors ≤1 and low dose‡	77.0	74.3	0.347	76.3	75.0	0.677	76.8	72.5	0.227
Thyroid hormone used	79.7	75.3	0.244	77.7	72.6	0.083*	75.9	76.1	0.948
Vasopressin used	77.1	75.6	0.658	80.2	73.9	0.033†	77.3	75.6	0.299

*$p < 0.1$.
†$p < 0.05$.
‡Low dose of vasopressors was defined as: dopamine ≤ 10 μg/kg/min, neosynephrine ≤ 60 μg/kg/min, and norepinephrine ≤10 μg/kg/min.
ECD, extended criteria donor; SCD, standard criteria donor.