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Arginine vasopressin significantly increases the rate of successful organ procurement in potential donors

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Abstract

BACKGROUND: Hormone replacement therapy increases the number and quality of grafts recovered from brain-dead organ donors. Arginine vasopressin (AVP) has also been shown to have beneficial effects. The aim of this study was to determine the effect of AVP on recovery rates.

METHODS: The Organ Procurement and Transplantation Network database was used. Donors treated with hormone replacement therapy and vasopressor agents who were successfully procured between January 1, 2009, and June 30, 2011, were studied. AVP-positive and AVP-negative donors were compared. The primary study end point was the rate of high-yield procurement (≥4 organs).

RESULTS: A total of 10,431 donors were included. AVP was infused in 7,873 (75.5%) and was associated with an increased rate of high-yield procurement (50.5% vs 35.6%, $P < .001$). There was less overall graft refusal due to poor function (38.9% vs 45.6%, $P < .001$). AVP independently predicted high yield procurement.

CONCLUSIONS: The use of AVP with hormone replacement therapy is independently associated with an increased rate of organ recovery. This strategy should be universally adopted in the management of donors progressing to neurologic death.

Transplant waiting lists are growing while graft availability is stable or decreasing.[1] Attempts to increase availability include donation after cardiac death,[2] expanded-criteria donors (ECDs),[3,4] living related donation, administrative measures,[5,6] and more aggressive management of catastrophic brain injury.[7,8] Donors who progress to neurologic death are a major source of quality grafts, and any improvement in this population would likely lead to more meaningful increases overall.

Hormone replacement therapy (HRT) is associated with significantly increased procurement,[8,9] particularly as it relates to cardiac and lung grafts.[10–12] HRT typically involves infusions of dextrose, insulin, methylprednisolone, and thyroxin in donors with hemodynamic instability.[7,8] Arginine vasopressin (AVP) has been shown to impart several favorable hemodynamic effects.[11,13–16] Despite an increasing adoption of AVP as the primary hemodynamic support agent in donors, published studies and recommendations variably include AVP as a component of HRT.[8,17,18] Although there are data on the effects of AVP as it relates to specific organs using small numbers of patients,[11,13] there are few data on overall organ procurement in a large pop-

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ulation. We hypothesized that HRT including AVP is associated with an overall increase in the number of successfully procured organs per donor.

Methods

The Organ Procurement and Transplantation Network (OPTN) donor database was used. Donors undergoing procurement between January 1, 2009, and June 30, 2011, who received HRT and vasopressors were identified. Donors who received AVP during resuscitation were compared with those who did not. HRT was defined as an infusion of dextrose, insulin, methylprednisolone, and thyroxin at any time during preoperative management. Because the OPTN data set does not provide specific doses for all infusions, all donors given HRT were presumed to have been administered the full standard protocol as defined by reporting centers. Successful procurement is defined as organ recovery with the intention of transplantation. High-yield procurement was defined as the successful recovery of ≥4 organs. Donors undergoing donation after cardiac death were excluded, but ECDs were included. ECD status is defined by age > 60 years or age 50 to 60 years with ≥2 of the following: (1) history of hypertension, (2) cerebrovascular cause of brain death, or (3) terminal serum creatinine > 1.5 mg/dL. A Centers for Disease Control and Prevention (CDC) high-risk donor is defined as having a history of intravenous drug use, hemophilia, high-risk sexual activity, human immunodeficiency virus exposure, and/or incarceration. The primary end point was the incidence of high-yield procurement, while the secondary end point was incidence of graft refusal because of poor function.

Results are expressed as mean ± SD, percentages, odds ratios with 95% confidence intervals, and *P* values or raw data as indicated. Analysis was performed using χ^2 tests, Fisher's exact tests, or *t* tests as applicable, and *P* values < .05 were considered statistically significant. Bivariate analysis was performed comparing the AVP-positive and AVP-negative groups to determine variables with significant differences. This was followed by logistic regression to determine independent associations with our primary end point. All variables with *P* values < .20 on bivariate analysis were entered into the regression model. Statistical analysis was performed using SPSS for Windows version 15 (SPSS, Inc, Chicago, IL).

Results

A total of 10,431 donors were studied. Most were male (n = 6,171 [59.2%]). Traumatic brain injury (TBI) (n = 3,926 [37.6%]) and cerebrovascular disease (n = 3,900 [37.4%]) were the most common causes of death. There were 2,394 ECDs (23.0%), 2,875 bacteremic or culture-positive donors (27.6%), and 875 CDC high-risk donors (8.4%). A total of 4,227 donors (40.5%) had ≥1 organ refused because of poor function (Table 1). AVP was infused in 7,873 donors (75.5%). A comparison of AVP-positive and AVP-negative donors is depicted in Table 2. Male donors and donors with TBI as the cause of death were more likely to be in the AVP-positive group, while the use of dopamine and norepinephrine was significantly less. AVP administration was associated with a significantly increased rate of high-yield procurement (n = 3,975 [50.5%] vs n = 911 [35.6%]; odds ratio, 1.157; 95% confidence interval, 1.132–1.183; *P* < .001). There were associated increases in recovery rates for all organs, but the contrast for heart procurement was most pronounced (n = 3,031 [38.5%] vs n = 695 [27.2%], *P* < .001). There was a moderate decrease in overall graft refusal because of poor organ function (n = 3,061 [38.9%] vs n = 1,166 [45.6%], *P* < .001). This difference was similar when each organ was analyzed separately. TBI (n = 2,516 [51.5%] vs n = 1,433 [25.8%], *P* < .001) was significantly associated with high-yield procurement, while the use of norepinephrine (n = 810 [16.6%] vs n = 1,436 [25.9%], *P* < .001) was not (Table 3). After adjusting for age, gender, cause of death, and other significant differences, AVP administration independently predicted high-yield procurement (odds ratio, 1.819; 95% confidence interval, 1.651–2.004; *P* < .001), as did male gender. However, norepinephrine infusion, ECD

Table 1 Donors receiving HRT

Variable	Value
Study patients	10,431 (100%)
Men	6,171 (59.20%)
Age (y)	40.58 ± 17.48
Race/ethnicity	
White	6,706 (64.30%)
Black	1,742 (16.70%)
Hispanic	1,577 (15.10%)
Other	406 (3.90%)
Cause of death	
Cerebral anoxia	2,307 (22.10%)
Cerebrovascular disease	3,900 (37.40%)
TBI	3,926 (37.60%)
Vasopressin	7,873 (75.50%)
Organs recovered	
Kidney (any)	9,624 (92.30%)
Liver	9,263 (88.80%)
Heart	3,729 (35.70%)
Lung (any)	2,662 (25.50%)
Pancreas	2,647 (25.40%)
Bowel	260 (2.50%)
Refusal because of poor function	
Kidney	514 (4.90%)
Liver	200 (1.90%)
Heart	1,972 (18.90%)
Lung	3,176 (30.40%)
Number of organs per donor	3.62 ± 1.4
High-yield procurements	4,886 (46.80%)

Data are expressed as number (percentage) or as mean ± SD.