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Name of Journal: *World Journal of Transplantation*

Manuscript NO: 82500

Manuscript Type: ORIGINAL ARTICLE

Observational Study

Haemodynamic management in brain death donors: influence of aetiologies of brain death

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Abstract

BACKGROUND

In brain death donors (BDD) donor management is the key in the complex donation process. Donor management goals, which ¹are standards of care or clinical parameters, have been considered an acceptable barometer of successful donor management.

AIM

We hypothesized that aetiology of brain death could influence hemodynamic management in BDDs.

METHODS

Hemodynamic data (blood pressure, heart rate, central venous pressure, lactate, urine output, vasoactive drugs) were recorded on ICU admission and during the 6-hour observation period (time 1 at the beginning; time 2 at the end).

RESULTS

The study population was divided according to aetiology of brain death: stroke (71 BDD donors), traumatic brain injury (48 donors) and post anoxic encephalopathy (19

BDD donors). On ICU admission, BDDs from post anoxic encephalopathy showed the lowest values of SBP and DBP associated with higher heart rate and lactate levels and a higher need of norepinephrine and other vasoactive drugs. At the beginning of the 6-hour period (Time 1), brain death donors from post anoxic encephalopathy showed higher values of heart rate, lactate and CVP together with a higher need of other vasoactive drugs. .

CONCLUSION

According to our data, hemodynamic donor management is affected by the aetiology of brain death. BDDs from post anoxic encephalopathy had higher requirements for norepinephrine and other vasoactive drugs.

INTRODUCTION

Management of potential organ donor is the key in the complex donation process, considering that hemodynamic instability may be responsible for the loss of organs of brain death donor (BDD) [1-8]. Changes in epidemiologic characteristics of BDDs, becoming older and with more comorbidities [9], do make hemodynamic management more challenging [10].

Donor management goals, which ¹are standards of care or clinical parameters, have been considered an acceptable barometer of successful donor management [9,10]. Meeting donor management goals has been associated with increased number of organ retrieval per donor [1,11-13] and, more recently, to reduced incidence of delayed graft function [14,15].

We hypothesized that aetiology of brain death could influence hemodynamic management in BDD donors. We tested this hypothesis in 138 BDD donors consecutively admitted to our Intensive Care Unit (ICU).

MATERIALS AND METHODS

In our single centre observational study, we enrolled 138 brain dead donors, consecutively admitted to our Intensive Care Unit from January 1 2018 to October 31 2022.

The study was approved by the Institutional Review Board of Regional Authority for Transplantation and are in accordance with Helsinki Declaration of 1975.

Study population

Diagnosis of death was confirmed by strict adherence to standardized clinical, neurologic, and electroencephalogram criteria in accordance with Italian law and related guidelines. According to the Italian law, death by neurologic criteria is certificated after a 6-hour observation period. Time 1 refers to the beginning of this period, time 2 to the end of this period.

Clinical data included age, risk factors (hypertension, diabetes mellitus, and known previous coronary artery disease).

Data were prospectively recorded and retrospectively analysed.

The study population was divided according to aetiology of brain death: stroke (71 BDD donors), traumatic brain injury (48 donors) and post anoxic encephalopathy (19 BDD donors).

Donor management

All potential donors were managed as previously described [8,10]. Management goals were as follows: mean arterial pressure > 70 mmHg, central venous pressure of 6 to 10 mmHg, urine output of 1.2 mL/kg/h, haemoglobin levels to ≥ 10 g/dL. Ventilatory management was aimed to target partial pressure of oxygen ≥ 90 mmHg [6,8,13]. Hemodynamic management also included replacement therapy with cortisone, thyroid hormone (T3). Antidiuretic hormone and intravenous insulin (target glucose values < 180 mg/dL) were considered case by case.

The following parameters were recorded on ICU admission and during the 6-hour observation period (time 1 at the beginning; time 2 at the end):

Systolic (SBP) and diastolic (DBP) blood pressures (mmHg), heart rate (bpm), central venous pressure (CVP cmH₂O), lactate (mg/dL) and urine output (ml/h).

Statistical analysis

Data were analysed with the use of SPSS 20 statistical software (SPSS Inc, Chicago, IL, USA). A two-tailed *P* value < .05 was considered statistically significant. Categorical variables are reported as frequencies and percentages, and continuous variables are reported as means \pm standard deviation or median (and 25th-75th interquartile range - IQR). For continuous variables, between-group comparisons were made using analysis of variance (followed by Bonferroni posttests if overall *P* value was significant) or by means of Kruskal-Wallis H test. Categorical variables were compared with chi-square tests.

RESULTS

The study population included 138 consecutive DB donors. Stroke was the most frequent aetiology (51%). Table 1 shows the comparisons between the three subgroups. Brain death donors with post anoxic encephalopathy were the youngest (aged 59 \pm 19 yrs). No differences were detectable among the three subgroups in risk factors and refusal rates. In BDD donors from post anoxic encephalopathy, the utilization rate showed a trend towards lower values, which did not reach statistical significance.

Hemodynamic data are depicted in Table 2, recorded at ICU admission and Time 1 and Time 2, respectively (that is at the beginning and at the end of the 6 h period).

On ICU admission, BDDs from post anoxic encephalopathy showed the lowest values of SBP and DBP (98 \pm 33 and 77 \pm 22 mmHg, respectively) associated with higher heart rate and lactate levels and a higher need of norepinephrine and other vasoactive drugs. Urine output and CVP were comparable among the three subgroups.

At the beginning of the 6-hour period (Time 1), systolic and diastolic blood pressures were comparable among the three subgroups, as well as urine output and norepinephrine use. Brain death donors from post anoxic encephalopathy showed

higher values of heart rate, lactate and CVP together with a higher need of other vasoactive drugs.

At the end of the 6-hour period (Time 2) no significant differences in hemodynamic data were detectable among the three subgroups except higher value of CVP in BDDs from post anoxic encephalopathy.

Other vasoactive drugs were vasopressin in all cases except dobutamine used in one BDD donor.

DISCUSSION

Our investigation, performed in 138 consecutive BDDs managed with the same donor manager protocol, documented that hemodynamic donor management is affected by the aetiology of brain death. BDDs from post anoxic encephalopathy require an aggressive treatment, that is a higher need of norepinephrine and other vasoactive drugs. Utilization rates did not differ among the BDDs from different aetiology, probably due to a strict hemodynamic monitoring and donor hemodynamic management.

Brain death has been reported to ² occur in about one-sixth of patients after successfully resuscitated cardiac arrest ^[16], thus creating opportunities for organ donation. In a recent review by Sandroni *et al* ^[17], kidneys, livers, hearts, and intestines retrieved from BDDs from post-anoxic encephalopathy showed survival rates comparable to that of organs transplanted from BDD donors from other aetiologies. No data are so far available on hemodynamic management in these donors.

In our investigation, we specifically addressed hemodynamic in BDDs from post anoxic encephalopathy at ICU admission and after brain death develops. Hemodynamic management in these donors is more challenging since norepinephrine administration is more frequently needed to reach and maintain donor management goals and, in about one third of cases, another vasoactive drug is required. This phenomenon may be attributed to post cardiac resuscitation syndrome. Higher values of heart rate can be related to reduced cardiac function (as a compensatory

mechanisms), as indicated by higher values of central venous pressure. Despite the achievement of donor management goals, lactate values are the highest in BDDs from post anoxic encephalopathy but urine output (an indirect index of systemic perfusion) is maintained.

The utilization rate in BDDs from post anoxic encephalopathy did not differ from that of BDDs from stroke and traumatic brain injury. This may be related to the strict hemodynamic monitoring and hemodynamic donor management, performed at our centre.

Our data underscore the utility of the relevant data on potential organ donors being reported to a national registry and how this can be used to drive practice improvement and eventually to develop consensus statements.

Limitation of the study: Since it is single-centre study, the number of enrolled BD donors is quite small. However, they have been managed with the same donor management protocol.

CONCLUSION

According to our data, hemodynamic donor management is affected by the aetiology of brain death. BDDs from post anoxic encephalopathy had higher requirements for norepinephrine and other vasoactive drugs.

ARTICLE HIGHLIGHTS

Research background

In brain death donors (BDD) donor management is the key in the complex donation process. Donor management goals, which ¹are standards of care or clinical parameters, have been considered an acceptable barometer of successful donor management.

Research motivation

Meeting donor management goals has been associated with increased number of organ retrieval per donor and, more recently, to reduced incidence of delayed graft function .

Research objectives

We hypothesized that aetiology of brain death could influence hemodynamic management in BDDs

Research methods

Hemodynamic data (blood pressure, heart rate, central venous pressure, lactate, urine output, vasoactive drugs) were recorded on ICU admission and during the 6-hour observation period (time 1 at the beginning; time 2 at the end).

Research results

The study population was divided according to aetiology of brain death: stroke (71 BDD donors), traumatic brain injury (48 donors) and post anoxic encephalopathy (19 BDD donors). On ICU admission, BDDs from post anoxic encephalopathy showed the lowest values of SBP and DBP associated with higher heart rate and lactate levels and a higher need of norepinephrine and other vasoactive drugs. At the beginning of the 6-hour period (Time 1), brain death donors from post anoxic encephalopathy showed higher values of heart rate, lactate and CVP together with a higher need of other vasoactive drugs

Research conclusions

According to our data, hemodynamic donor management is affected by the aetiology of brain death. BDDs from post anoxic encephalopathy had higher requirements for norepinephrine and other vasoactive drugs.

Research perspectives

Our data underscore the utility of the relevant data on potential organ donors being reported to a national registry and how this can be used to drive practice improvement and eventually to develop consensus statements.

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SIMILARITY INDEX

PRIMARY SOURCES

1

Quinn, L., W. McTague, and J.P. Orlowski. "Impact of Catastrophic Brain Injury Guidelines on Donor Management Goals at a Level I Trauma Center", Transplantation Proceedings, 2012.
Crossref

45 words — 3%

2

Sandroni, C.. "Are patients brain-dead after successful resuscitation from cardiac arrest suitable as organ donors? A systematic review", Resuscitation, 201012
Crossref

17 words — 1%