

THE PROFILE OF POTENTIAL ORGAN AND TISSUE DONORS

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This study aimed to characterize donors according to gender, age group, cause of brain death; quantify donors with hypernatremia, hyperpotassemia and hypopotassemia; and get to know which organs were the most used in transplantations. This quantitative, descriptive, exploratory and retrospective study was performed at the Organ Procurement Organization of the University of São Paulo Medical School Hospital das Clínicas. Data from the medical records of 187 potential donors were analyzed. Cerebrovascular accidents represented 53.48% of all brain death causes, sodium and potassium disorders occurred in 82.36% of cases and 45.46% of the potential donors were between 41 and 60 years old. The results evidenced that natural death causes exceeded traumatic deaths, and that most donors presented sodium and potassium alterations, likely associated to inappropriate maintenance.

DESCRIPTORS: organ transplantation; brain death; intensive care units

EL PERFIL DE PROBABLES DONADORES DE ÓRGANOS Y TEJIDOS

Se tuvo como objetivos determinar las características de los donadores según el sexo, el intervalo de edad, y, las causas por muerte encefálica; determinar el número donadores que presentaban hipernatremia, hiperpotasemia y hipopotasemia; conocer los órganos que fueron más utilizados para el trasplante. Es un estudio de tipo cuantitativo, descriptivo, exploratorio y retrospectivo. La investigación fue realizada en una Institución de donación de Órganos perteneciente al Hospital de las Clínicas de Sao Paulo. Fueron analizados los datos de 187 probables donadores. Entre las causas de muerte encefálica el 53,48% fueron por accidente cerebro vascular, en 82,36% de los casos se produjeron alteraciones en los valores de sodio y potasio y los donadores se encontraban entre 41 y 60 años de edad. Los resultados muestran que las causas naturales de muerte superaron a las muertes por traumatismo. La mayoría de los donadores tuvo alteraciones en los niveles de sodio y potasio, estando posiblemente relacionadas a medidas de conservación inadecuadas.

DESCRITORES: trasplante de órganos; muerte encefálica; unidades de terapia intensiva

O PERFIL DE POTENCIAIS DOADORES DE ÓRGÃOS E TECIDOS

Objetivou-se caracterizar os doadores, segundo o sexo, faixa etária, causa de morte encefálica, quantificar os doadores que apresentaram hipernatremia, hiperpotassemia e hipopotassemia e conhecer quais os órgãos mais utilizados para transplante. Trata-se de estudo de caráter quantitativo, descritivo, exploratório e retrospectivo. A pesquisa foi realizada na Organização de Procura de Órgãos do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo. Foram analisados os dados dos prontuários de 187 potenciais doadores. O acidente vascular cerebral representou 53,48% de todas as causas de morte encefálica, os distúrbios de sódio e potássio ocorreram em 82,36% dos casos e 45,46% dos potenciais doadores tinham de 41 a 60 anos. Os resultados obtidos evidenciaram que as causas naturais de morte superaram as mortes traumáticas e a maioria dos doadores apresentou alterações de sódio e potássio provavelmente relacionadas à manutenção inadequada.

DESCRITORES: transplante de órgãos; morte encefálica; unidades de terapia intensiva

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INTRODUCTION

Donation and transplantation is a complex process, which starts with the identification and maintenance of potential donors. Next, physicians inform the family about the patient's suspected brain death (BD), carry out tests to prove this diagnosis, notify the Organ Donation and Procurement Agency (CNCDO) about the potential donor. In São Paulo State, the CNCDO transmits this notification to the Organ Procurement Organization (OPO), responsible for the area of the hospital that issued the notification. The OPO professional assesses the potential donor's clinical conditions and the viability of organ and tissue extraction, and interviews the next of kin to request family consent with the donation. In case of refusal, the process is terminated. If the family authorizes the donation, the OPO forwards the donor information to the CNCDO, which distributes the organs and indicates the transplantation team responsible for withdrawal and implant⁽¹⁾.

After the notification, various actions are needed with a view to the donor's effective maintenance, permitting the organs' use for transplantation. Thus, knowledge about the process and the adequate performance of its steps make it possible to obtain high-quality organs and tissues safely. Besides guaranteeing organ quality, knowledge about the donation and transplantation process avoids inadequate procedures in any of the steps, which can arouse family inquiries or even lead to organ donations refusals⁽¹⁾.

One of the main potential donor maintenance problems is to maintain stable hemodynamic parameters, with a view to obtaining viable organs as, during the brain death process, a series of physiological changes occur that contribute to the donor's instability, such as: hypotension, *diabetes insipidus*, hypothermia, hypernatremia, metabolic acidosis, pulmonary edema and disseminated intravascular coagulation⁽²⁻³⁾. To maintain control of these functions as close to normal as possible, continuous recording and control of these parameters are needed.

Hence, care delivered to organ donors should not differ from care delivered to critical patients and should be performed at an Intensive Care Unit (ICU), as it requires constant surveillance by professionals who are trained for patient management in these cases.

Measures used for adequate organ maintenance with a view to transplantation include:

maintaining mean blood pressure at 70mmHg, diuresis of 0.5 - 3 ml/kg/hour, central venous pressure (CVP) between 8 and 12mmHg, heart frequency between 60 and 120 beats per minute and hemoglobin above 10g/dl. Moreover, the infusion of warmed crystalloids and/or colloids and vasopressors is extremely important⁽²⁾.

Fluid, electrolyte and metabolic alterations are common in donors. These disorders can be due to the patient's treatment, neurological damage or the effects of brain death. The most frequent alterations in donors are hypernatremia in 59% of cases, hyponatremia (38%), hypercalemia (39%), hypopotassemia (66%) and *diabetes insipidus* in between 9 and 87% of cases⁽⁴⁾.

Hypernatremia should be corrected, as sodium levels above 155mmol/L are related to liver dysfunction and loss of the implant in the receiver. Together with sodium correction, serum levels of calcium, phosphor, potassium and magnesium should also be normalized⁽⁴⁾.

This research aimed to characterize organ and tissue donors in terms of gender, age range, cause of brain death; quantify donors with hypernatremia, hyperpotassemia and hypopotassemia; and get to know which organs were the most used in transplantations.

METHOD

This is a quantitative, descriptive, exploratory and retrospective research. Data were described through absolute and relative frequency analysis⁽⁵⁾. The study sample consisted of the patient files of 187 potential donors who went through the donation process between January 2005 and December 2007, notified to the Organ Donation and Procurement Agency in São Paulo City (CNCDO-SP). The research was carried out at the Organ Procurement Organization of the University of São Paulo Medical School *Hospital das Clínicas* (OPO-HCFMUSP). A worksheet was used with data on the potential donors: gender, age range, cause of brain death, sodium and potassium levels, taken from the CNCDO-SP's multiple organ donor information cards. Reference levels used for sodium (135 to 145mEq/L) and potassium (3.5 to 5mEq/L) were those set by the laboratory of the Central Institute at HCFMUSP. After this phase, the collected data were transformed into graphs available in Word

software. Approval for this research was obtained from the Research Ethics Committee of the Clinical Board of Directors at the University of São Paulo Medical School *Hospital das Clínicas*.

RESULTS

Between January 2005 and December 2007, the Organ Procurement Organization at the University of São Paulo Medical School *Hospital das Clínicas* (OPO-HCFMUSP) made available 187 organ and tissue donors to the São Paulo State Transplantation System. Their profile was distinguished by means of the following figures.

Figure 1 shows the donors' gender distribution. Out of the 187 donors the OPO-HCFMUSP notified to the São Paulo Organ Donation and Procurement Agency (CNCDO-SP), 51.87% were women.

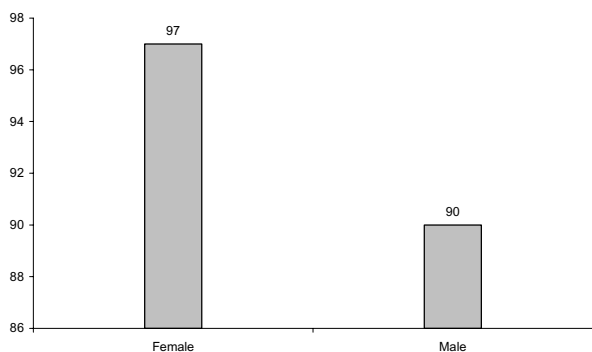


Figure 1 – Gender distribution of organ and tissue donors, OPO-HCFMUSP, 2005 - 2007

Figure 2 shows that 45.46% of the donors notified to the CNCDO-SP were between 41 and 60 years old.

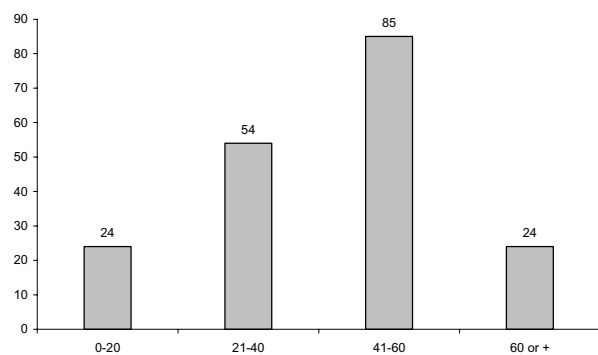


Figure 2 - Distribution of organ and tissue donors according to age range, OPO-HCFMUSP, 2005-2007

Figure 3 illustrates that cerebrovascular accidents (CVA) were responsible for more than half of all brain deaths (53.48%), followed by traumatic brain injury (TBI) with 32.09% and other causes (central nervous system tumor, firearm injury, encephalopathy after brain hypoxia, meningitis, convulsive crisis), corresponding to 14.43% of all donors.

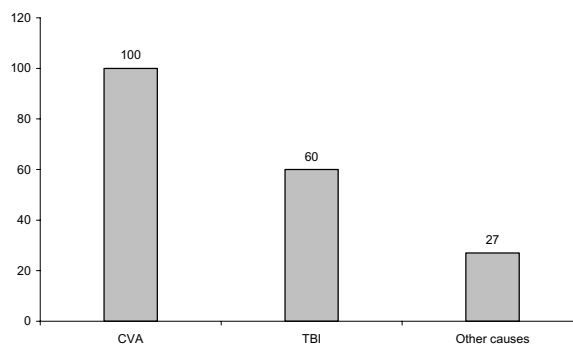


Figure 3 - Distribution of organ and tissue donors according to cause of brain death, OPO-HCFMUSP, 2005-2007

Figure 4 reveals that 54.01% of donors notified to the CNCDO-SP presented hypernatremia, 35.29% displayed sodium levels of 155mEq/L or higher (the highest level found was 200mEq/L), 17.65% hypotassemia and 10.70% hyperpotassemia.

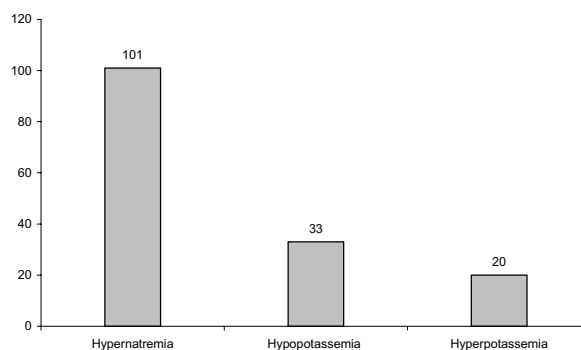


Figure 4 - Distribution of organ and tissue donors according to sodium and potassium alterations, OPO-HCFMUSP, 2005-2007

Out of 187 potential donors, 152 (81.28%) donated their kidneys for transplantation, liver 80.21%, corneas 61.50%, pancreas 29.25%, heart 18.72% and lungs, the latter with only 2.14% of usage, as shown in Figure 5.

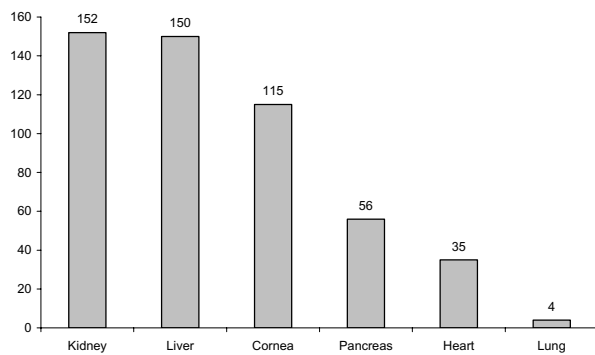


Figure 5 - Distribution of donors according to organ and tissue extraction, OPO-HCFMUSP, 2005-2007

DISCUSSION

The most frequent pathologies leading to a diagnosis of brain death (BD) are: hemorrhagic or ischemic cerebrovascular accident (CVA), traumatic brain injury (TBI), brain tumor, encephalopathy after hypoxia and others⁽⁶⁾. This study evidenced that CVA was responsible for more than half of all brain deaths. Most donors were women and the predominant age range was between 41 and 60 years old, as shown in Figures 1, 2 and 3. Two studies, one carried out in Costa Rica and another in Brazil, revealed that CVA represented more than half of all causes of BD, and that 50% of potential donors were between 40 and 59 years old, in line with the present research findings⁽⁷⁻⁸⁾.

The above mentioned data evidence a changing organ donor profile, with CVA instead of traumatic causes and increasing ages, possibly as a result of the aging process in the Brazilian population.

There are multiple causes for organ donations that do not take place. These are related to donors' hemodynamic and metabolic instability, non-recognition or delayed determination of brain death and refusal of family consent with organ and tissue donation for transplantation⁽⁹⁾. These causes may be directly related to the lack of organs for transplantation and, due to this scarcity, donor selection criteria have been more flexible. These donors, selected less strictly, are called marginal, borderline or with expanded criteria. The use of donors with expanded criteria, however, arouses an important ethical dilemma, because these organs can increase the chance of transplantation failure. The use of marginal organs increases mortality in liver transplantations, mainly when receivers are in a more severe state⁽¹⁰⁾.

Borderline organs are used because the number of donors in Brazil (six per million people per year – pmp/year) is insufficient to attend to receivers' demands in comparison with more developed countries, reaching levels of more than 22 effective donors pmp/year. The problem of organ capture, distribution and quality is partially due to health professionals themselves, who maintain potential organ and tissue donors under sometimes inadequate and ineffective clinical treatment to maintain the patient. Other causes are omission and non-notification of cases of brain death to Organ Procurement Organizations⁽¹¹⁾.

Hence, permanent education on the donation and transplantation process for health professionals may represent an alternative for the qualitative improvement of organs offered.

In this research, Figure 4 shows that most donors had some kind of sodium and potassium disorder, with more than half of the 187 donors suffering from hypernatremia. This fact revealed that the care and/or maintenance offered to these donors were probably accomplished inadequately.

It is important for the multiprofessional health team to value donor maintenance, as a study carried out at the University of Pittsburgh, USA, evidenced that hypernatremia in donors significantly increased levels of liver transplantation loss when compared with receivers who got a liver from donors with normal sodium levels. Differences in graft survival, however, improved by correcting donors' hypernatremia before the organ extraction and implant⁽¹²⁾.

Intensive care delivery to potential donors is essential, as it contributes to improve organ quality for transplantation⁽³⁻⁶⁾. On the other hand, inadequate care can represent an obstacle against donation, causing the donor's loss due to cardiac arrest. The same is true for hydroelectrolyte and metabolic disorders interfering in the quality of the transplanted organ.

Hypernatremia in organ donors is the most important risk factor that can provoke primary graft loss after liver transplantation⁽¹³⁾.

Besides hypernatremia, there are other factors related to the potential donor which affect the quality of organs for transplantations, such as: age, history of alcohol consumption, smoking, cause of brain death, time of cold ischemia (time the organ remains outside the donor's body in cooled conditions) more than 12 hours, time of warm ischemia (time

between the start of anastomosis of the vena cava and reperfusion of the vena porta in liver receivers) more than 45 minutes⁽¹⁴⁾.

In the present study, as shown in Figure 5, in a group of 187 potential donors, the kidneys were the most used when compared with other organs, such as liver, pancreas, heart and lungs. This fact is related to some advantages for kidney usage, such as: there is no age limit if laboratory creatinine levels are normal, extended duration of cold ischemia (the organ outside the body in cooled conditions can be used for transplantation during up to 36 hours) and the fact that kidneys can be removed from donors without heart beats⁽¹⁵⁾. The corneas were the most used tissues. It should be highlighted that Brazilian legislation requires family authorization for each organ and tissue donation.

CONCLUSION

In conclusion, this research showed that cerebrovascular accidents were responsible for more than half of all cases of brain death, that most donors were women. The predominant age range was between 41 and 60 years old, kidneys were the most used organs for transplantation in comparison with other organs like the liver, pancreas, heart and lungs. Corneas were the most used tissues and a large majority of donors presented sodium and potassium alterations, evidencing the probability of inappropriate maintenance. Inadequate organ donor maintenance is a determinant factor in sodium and potassium disorders, which can interfere in the quality of the organ for transplantation.

REFERENCES

1. Moraes EL, Massarollo MCKB. A recusa familiar para a doação de órgãos e tecidos para transplante. *Rev Latino-am Enfermagem* 2008; 16(3):458-64.
2. Mascia L, Mastromauro I, Viberti S, Vincenzi M, Zanella M. Management to optimize organ procurement in brain dead donors. *Minerva Anestesiol* 2008; 74:1-8.
3. Shah VR. Aggressive management of multiorgan donor. *Transplant Proc* 2008; 40:1087-90.
4. Shemie SD, Ross H, Pagliarello J, Baker AJ, Greig PD, Brand T, et al. Organ donor management in Canada: recommendation of the forum on medical management to optimize donor organ potential. *CMAJ* 2006; 174(6):13-30.
5. Gil AC. Como elaborar projeto de pesquisa. 4^a ed. São Paulo (SP): Atheneu; 2007.
6. DuBose J, Salim A. Aggressive organ donor management protocol. *J Intensive Care Med* 2008; 23(6):367-75.
7. Rodríguez AS, Arista JCR. Detección de donantes en muerte encefálica. *Acta Pediátr Costarric* 2002; 16(3):83-91.
8. Medina-Pestana JO, Sampaio EM, Santos THF, Aouqui CM, Ammirati AL, Caron D, et al. Deceased organ donation in Brazil: how can we improve? *Transplant Proc* 2007; 39(2):401-2.
9. Arbour R. Clinical management of the organ donor. *AACN Clin Issues* 2005; 16(4):551-80.
10. Bacchella T, Gavão FHF, Almeida JLJ, Figueira ER, Moraes A, Machado MC. Marginal grafts increase early mortality in liver transplantation. *São Paulo Med J* 2008; 126(3):161-5.
11. Galvão FHF, Caíres RA, Azevedo-Neto RS, Mory EK, Figueira ERR, Otsuki TS et al. Conhecimento e opinião de estudantes de medicina sobre doação e transplante de órgãos. *Rev Assoc Med Bras* 2007; 53(5):401-6.
12. Totsuka E, Dodson F, Urakami A, Moras N, Ishii T, Lee MC, et al. Influence of high donor serum sodium levels on early postoperative graft function in human liver transplantation: effect of correction of donor hypernatremia. *Liver Transpl Surg* 1999; 5(5):421-8.
13. Jawan B, Goto S, Lai CY, de Villa VH, Luk HN, Eng HL, et al. The effect of hypernatremia on liver allografts in rats. *Anesth Analg* 2002; 95(5):1169-72.
14. Totsuka E, Fung U, Hakamada K, Tanaka M, Takahashi K, Nakai M et al. Analysis of clinical variables of donors and recipients with respect to short-term graft outcome in human liver transplantation. *Transplant Proc* 2004; 36:2215-8.
15. Moraes EL, Silva LBB, Glezer M, Paixão NCS, Moraes TC. Trauma e doação de órgãos e tecidos para transplante. *J Bras Transpl* 2006; 9(3):561-5.