

Heart donations and transplants in the state of Paraná



Doações e transplantes cardíacos no estado do Paraná
Donaciones y trasplantes cardíacos en el estado del Paraná

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ABSTRACT

Objective: To analyze donations and heart transplants in the state of Paraná.

Method: A cross-sectional study with 3,931 reports of deaths from brain death and 8,416 transplants performed in the State of Paraná between 2011 and 2016. The donations and cardiac transplants were analyzed by descriptive, univariate and multivariate statistics.

Results: Of the 2,600 eligible donors, 128 (4.9%) donated the heart. The chance of cardiac donation effectiveness was higher among those who died and were younger than 40 years old (OR: 27,913) and males (OR: 1,559). In addition to hearts from other states, 165 (2.0%) cardiac transplants were performed, all of which were financed by the Unified Health System. There was a significant increase in donations and transplants over the years.

Conclusion: The number of donations and heart transplants were low in the analyzed period. It is important that managers devise actions to optimize the process and, consequently, decrease the waiting time for a heart.

Keywords: Heart transplantation. Tissue and organ procurement. Brain death. Health evaluation.

RESUMO

Objetivo: Analisar as doações e transplantes cardíacos realizados no estado do Paraná.

Método: Estudo transversal com 3.931 relatórios de óbitos por morte encefálica e 8.416 transplantes realizados no estado do Paraná, entre 2011 e 2016. As doações e transplantes cardíacos foram analisados de forma descritiva, univariada e múltipla.

Resultados: Dos 2.600 doadores elegíveis, 128 (4,9%) doaram o coração. A chance de efetivação da doação cardíaca foi maior entre os óbitos com idade menor que 40 anos (OR:27,913) e do sexo masculino (OR:1,559). Somado aos corações advindos de outros estados, realizaram-se 165 (2,0%) transplantes cardíacos, todos financiados pelo Sistema Único de Saúde. Houve um aumento significativo de doações e transplantes ao longo dos anos.

Conclusão: Os números de doações e transplantes cardíacos foram baixos no período analisado. Torna-se importante que os gestores elaborem ações para a otimização do processo e, consequentemente, a diminuição do tempo de espera por um coração.

Palavras-chave: Transplante de coração. Obtenção de tecidos e órgãos. Morte encefálica. Avaliação em saúde.

RESUMEN

Objetivo: Analizar las donaciones y trasplantes cardíacos en el estado de Paraná.

Métodos: Estudio transversal con 3.931 informes de muertes por muerte encefálica y 8.416 trasplantes realizados en el estado de Paraná entre 2011 y 2016. Se analizaron las donaciones y trasplantes cardíacos por estadística descriptiva, univariada y multivariada.

Resultados: De los 2.600 donantes elegibles, 128 (4,9%) donaron el corazón. La probabilidad de efectividad de la donación cardíaca fue mayor entre los fallecidos con edad menor de 40 años (OR: 27,913) y del sexo masculino (OR: 1,559). Sumado a los corazones venidos de otros estados, se realizaron 165 (2,0%) trasplantes cardíacos, todos provenientes del Sistema Único de Salud. Hubo un aumento significativo de donaciones y trasplantes a lo largo de los años.

Conclusión: El número de donaciones y trasplantes cardíacos fueron bajos en el período analizado. Se hace importante que los gestores elaboren acciones para optimizar el proceso y, consecuentemente, disminuir el tiempo de espera por un corazón.

Palabras clave: Trasplante de corazón. Obtención de tejidos y órganos. Muerte encefálica. Evaluación en salud.

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■ INTRODUCTION

The donation and the cardiac transplant are complementary processes, since the transplant is only possible through the donation of a deceased donor organ in brain death. The heart transplant is the best treatment for many chronic and disabling coronary diseases, especially the refractory heart failure, aiming to rehabilitate the patient and improve the quality of life, making the return to everyday activities carried out prior to the illness⁽¹⁻²⁾.

Brazil is recognized worldwide for having a 95% transplantation program financed with public resources through the Unified Health System (SUS - Sistema Único de Saúde), but also because it is the second country that most performs transplants in absolute numbers⁽³⁾. The National Transplant System manages the entire process in the Brazilian territory, including the national waiting list specific to each organ, whose order is also individualized. In the case of the heart, the distribution follows two criteria: the position on the waiting list of potential recipients, which is determined by blood compatibility, disease severity, age, donor-recipient weight ratio and single list entry time; and regionalization, which prioritizes recipients of the same donor's federative state, followed by the closest states, due to the time of ischemia of the heart (four hours) and logistical issues⁽⁴⁻⁵⁾.

In 2016, 357 heart transplants were performed; a rate of 1.7 transplants per million population (pmp), and the state of Paraná was ranked fifth with 2.4 pmp cardiac transplants. Despite these results, at the end of 2016, 282 people were on the waiting list for a heart transplant, 50 in Paraná⁽³⁾.

Thus, the number of heart transplants is halted, due to the inherent scarcity of the organ, which also occurs worldwide^(3,6). In the United States, over the past 15 years, between 2,000 and 2,700 heart transplants have been performed annually, however there were more than 4,000 patients on the waiting list,⁽⁶⁾ a number that grows every year because of the epidemic of heart failure that affects 1 to 2% of the population⁽⁷⁾.

Therefore, it is important to evaluate the donation and transplant processes, identifying their fragilities in order to provide substantial information to the management team and to the professionals involved in the development of interventions, improvement of public policies and the process itself, which increases the funding of the transplants and, thus, decrease the waiting list for a heart. Considering the above, the following questioning has arisen: What are the results obtained in the donation and cardiac transplant processes in the state of Paraná? To answer this question, the objective of this study was to analyze donations and heart transplants in the state of Paraná.

■ METHOD

This is a cross-sectional study conducted in the state of Paraná, located in the southern region of Brazil, which has four Organ Pursuit Organizations (OPOs) located in the macroregional East, West, North and Northwest health centers.

The study source of data were the 3,931 reports of deaths due to brain death and the 8,416 transplants issued by the Intra-Hospital Organ Donation and Transplant Tissue Commissions (IHODTTC) and Transplantation Centers to the State Transplant Center, in the period from 2011 to 2016.

The reports of deaths due to brain death of donors eligible for cardiac donation, that is, age >7 days of life, absence of clinical contraindication (HIV positive or Human T lymphotropic virus - HTLV, severe infection, neoplasia, tumor and dysfunction/organ failure) and notifications with concluded brain death protocol⁽⁴⁾. The reports of the transplants performed in the state were included, and those whose organs despite being collected in Paraná were sent to other Brazilian states were excluded.

The variables of this study related to donation were: year of notification (2011, 2012, 2013, 2014, 2015 and 2016), the notifying IHODTTC macroregional health (north, northwest, east and west), age of the eligible donor (≤ 40 and ≥ 41 years old), gender (female and male), cause of death, blood type (A, B, AB and O), causes of the ineligibility of donation, causes of the non-donation and effective heart donor (yes and no). The variables related to the transplantation were: outcome of the heart collection (discharge, transplantation into and out of state), heart transplant (yes and no), source paying (SUS, health insurance, private), year of transplantation (2011, 2012, 2013, 2014, 2015 and 2016) and macroregional where it was performed (north, northwest, east and west).

The data were analyzed by the Statistical Package for Social Sciences (SPSS), version 20.0 program, by univariate and multiple descriptive and inferential statistics. In order to analyze the heart donation, univariate analysis was conducted with all the independent variables related to the donation. Then, those that presented $p < 0.20$ in this analysis were inserted in the multiple model, obtained by binary logistic regression by the Forward Method, maintaining those with greater predictive power. The estimates were expressed by odds ratio and the statistical significance was obtained by the Wald's test. The variables related to cardiac transplants were analyzed by Pearson's Chi-Square association test. It was adopted as statistically significant $p < 0.05$.

The study was developed according to national and international standards of research ethics, and it was ap-

proved by the Research Ethics Committee of the State University of Londrina, according to the Opinion No. 1,395,408 of January 26, 2016 and CAAE: 51707215.8.0000.5231. For the use of the data, the Term of Secrecy and Confidentiality was provided to the State Transplant Center of Paraná.

RESULTS

The results of the donation and cardiac transplant processes are outlined in Figure 1. Of the 3,931 reports of brain death, 2,600 were eligible donors, of which 128 (4.9%) be-

came effective heart donors and 19 organs were sent to other states because there were no compatible recipients in Paraná on the waiting list. Of the 165 heart transplants performed, 56 organs came from other states, and all the hearts collected and received in Paraná were transplanted. Among the causes of ineligibility, it should be highlighted the brain death protocol that was not concluded in 759 (19.3%) of the cases reported to the State Transplant Center, and the 555 (14.1%) potential donors with clinical contraindications. Regarding the causes of non-donation, the family refusal predominated (999; 38.4%).

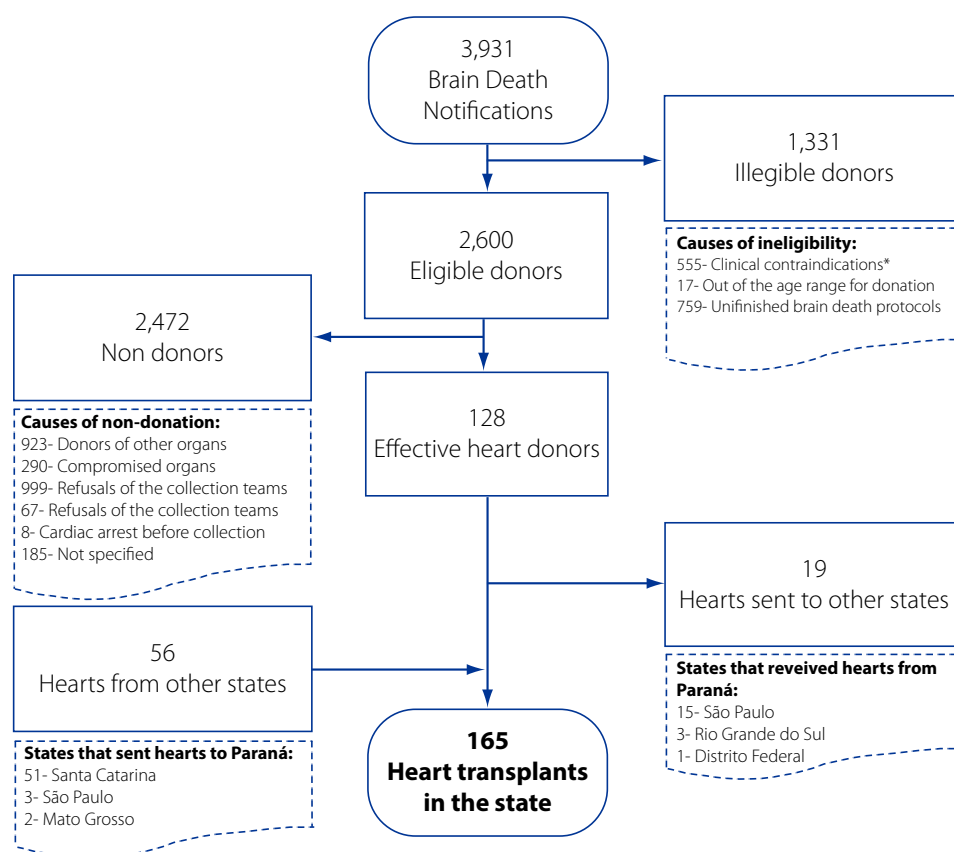


Figure 1 - Results of the donation and cardiac transplant processes. PR/Brazil

Source: Research data (2011-2016)

*131- positive serology (15- HIV; 3- HTLV; 113- not specified); 213- severe infection (172- sepsis; 41- others); 58- neoplasia; 45- tumor; 5- dysfunction of multiple organs; 12- cause of brain death unknown; 91- not specified clinical contraindication

In relation to the health macro-regional of Paraná, where the notifying center of the donation was located, 16.4% (n=21) were in the north, 16.4% (n=21) in the north-west, 43.0% (n=55) in the east and 24.2% (n=31) in the west. The median age of the eligible donors was 46 years old (interquartile range: 28 years), ranging from <1 to 88 years. Among the effective heart donors the median age

was 26 years old (interquartile range: 13 years), ranging from <1 to 56 years.

The chance of cardiac donation effectiveness was significantly higher among the deaths of individuals under 40 years old (OR: 27.913) and males (OR: 1.559). There was also a significant increase in effective heart donations as the years advanced, with the exception of 2016 (Table 1).

Table 1 - Variables associated with cardiac donations (n=2,600), PR/Brazil

Variables	Effective Donor		Value of p	Odds Ratio (Confidence Interval 95%)
	Yes	No		
	n (%)	n (%)		
Age of the eligible donor				
≤40 years old	121 (11.6)	918 (88.4)	<0.001	27.913 (12.893-60.431)
≥41 years old	7 (0.4)	1554 (99.6)		1
Gender of the eligible donor				
Female	30 (2.9)	1020 (97.1)	0.046	1
Male	98 (6.3)	1451 (93.7)		1.559 (1.007-2.412)
Year of the notification				
2011	15 (5.0)	284 (95.0)	0.001	1
2012	20 (5.4)	350 (94.6)	0.044	1.752 (1.015-3.025)
2013	23 (4.8)	453 (95.2)	0.003	2.238 (1.310-3.821)
2014	29 (6.9)	389 (93.1)	0.002	2.137 (1.322-3.457)
2015	33 (6.9)	445 (93.1)	0.044	1.566 (1.013-2.422)
2016	8 (1.4)	551 (98.6)	0.960	0.989 (0.652-1.501)

Source: Research data, 2011-2016.

Regarding the effective heart donors (n=128) the causes of death due to brain death were traumatic brain injury (59.4%; n=76), hemorrhagic stroke (13.3%; n=17), ischemic stroke (3.1%; n=4) and other not specified causes (24.2%; n=31). As for their ABO system, there was predominance of the type O (59.4%; n=76), followed by types A (32.8%; n=42), type B (7.0%; n=9) and type AB (0.8%; n=1).

In relation to the 8,416 transplants performed in the state, 165 (2.0%) were heart transplants (70.9%; n=117 in the male gender), all funded by the Unified Health System. Of the six transplantation centers accredited to the National Transplantation System, four belonged to the eastern macroregional and the other two to the west and north. With the exception of 2016, there was a significant increase in cardiac transplants performed in the state (Table 2).

Table 2 - Variables associated with heart transplants (n=8.146), PR/Brazil

Variables	Heart Transplant		Value of p
	Yes	No	
	n (%)	n (%)	
Year of the transplant			
2011	18 (1.2)	1430 (98.8)	0.037
2012	26 (1.8)	1385 (98.2)	
2013	23 (2.0)	1154 (98.0)	
2014	32 (2.6)	1178 (97.4)	
2015	38 (2.7)	1384 (97.3)	
2016	28 (1.6)	1720 (98.4)	

Paying source of the transplant

Unified Health System	165 (2.9)	5586 (97.1)	<0.001
Health Insurance	0 (0.0)	1961 (100.0)	
Private	0 (0.0)	704 (100.0)	

Health macroregional of the transplant

North	14 (1.4)	977 (98.6)	<0.001
Northwest	0 (0.0)	672 (100.0)	
East	138 (2.6)	5219 (97.4)	
West	13 (0.9)	1383 (99.1)	

Source: Research data, 2011-2016.

*Pearson's Chi-square

■ DISCUSSION

The findings of this study indicated that the unfinished protocols of brain death, the clinical contraindications, family refusal, and low heart withdrawal collection were the main barriers identified in the donation process. On the other hand, the number of donations and cardiac transplants grew annually and all the organs collected were transplanted using public resources.

The notification of brain death is performed after the first clinical examination that diagnosed absence of brain response and its determination (protocol conclusion) depends on a second clinical assessment, so that each one is attested by two different physicians, one of them must be a neurologist, neurosurgeon or neuropsychiatrist⁽⁵⁾. The brain death is confirmed among patients with Glasgow 3; absence of pupillary, corneal-eyelid, eye-cephalic, ocular-globe and cough reflexes; and apnea, respecting the time intervals between the two assessments according to the age group, and accompanied by at least one additional examination indicating the absence of electrical, metabolic or cerebral blood perfusion activity^(4-5,8). Thus, in 19.3% of the notifications, the second examination was not performed, mainly in notifying centers located in smaller cities, which usually do not have a neurologist to complete the protocol.

The second main reason for ineligibility was the clinical contraindication (14.1%), such as sepsis, positive serology, neoplasia and brain tumor, which were also indicated in another study⁽⁹⁾. The success of the heart transplant depends on the appropriate selection of the donor, who must be in ideal physiological conditions, but with the increasing need for transplants in addition to the change in the epidemiological profile of the patients on the waiting list, the use of donors with expanded and/or borderline criteria (the use of organs that may compromise graft func-

tion or transmit disease) is justified, especially when the risk of death is lower than that of the existing heart disease⁽⁸⁾.

In this sense, bacteremia and sepsis do not contraindicate the donation, however, in septic shock, it is not recommended^(1,10). A study carried out in the United States with 995 transplants from positive culture donors indicated that there was no influence on the survival of the transplant recipient, despite a higher morbidity⁽¹¹⁾. In these cases, the antibiotic therapy according to the microorganism is indicated to the recipient for at least seven days, as well as the donor should also receive antibiotics⁽⁸⁾. Thus, the State Transplant Center in conjunction with the transplantation team should evaluate the clinical and laboratory conditions of the potential donor in order to verify if the benefits outweigh the risks⁽⁵⁾.

Among the eligible donors, the predominant reason for the non-donation was the family refusal (38.4%). Although it is a high rate, it is among the lowest when compared to other Brazilian states, which varies from 36% to 81%⁽³⁾. However, in Spain, a world reference in donation and transplantation, the family refusal rate is 6%⁽¹²⁾.

According to investigations⁽¹³⁻¹⁴⁾, the lack of understanding of the organ transplantation and the diagnosis of brain death, in which relatives do not understand how a body with vital signs may be in a state of irreversibly dead; the religious interpretation of the family; the deceased person no having declared in life that they were a donor; the fear of mutilation of the body; the fear that the health team will make less effort to save the lives of potential donors and the insensitivity of the professionals responsible for the case and the execution of the interview were the main reasons reported by the families not to consent to the donation.

Different strategies are used to increase the donor consent. Some countries, such as the United States, developed

public policies that provided financial incentives, tax benefits, and even hospital bill coverage, but the number of heart transplants remained similar for two decades. Traditional awareness campaigns such as educational programs for donors, brochures and videos have also shown little impact⁽⁷⁾. In 2012, an organ donor initiative on Facebook® was launched in the United States, which contributed significantly to the increase in heart transplants from 9% (1990-2011) to 14% (2012-2014). The success of the campaign is probably due to the wide use of the social networking and "positive peer pressure" when "friends" in a network were informed of a new donor status⁽¹⁵⁾.

Of the 2,600 eligible donors of this study, 1051 were effective donors of organs, however, in only 128 (4.9%) the heart was collected. In Spain, in 2016, among the eligible donors due to brain death, 320 (21.0%) were cardiac donors and all were transplanted⁽¹²⁾. In the same year, 357 heart transplants were performed in Brazil, but the estimated need was 1,636, that is, it met only 21.8% of the demand, while in Paraná it reached only 30.3%⁽³⁾.

The low collection of the organ is related to two issues: the logistics and the clinical. In the first, the cardiac collection teams (the same ones that perform the transplantation) are consulted about the possibility of collection regarding the clinical conditions of the recipient and their location, considering whether there will be adequate time for collection and transplantation, since the organ ischemia time is up to four hours⁽⁵⁾. Regarding the clinical, the quality of the donor heart should be considered, especially the anatomical and physiological questions evaluated by laboratory tests, such as troponin, creatine kinase MB isoenzyme (CK-MB), electrocardiogram, echocardiography and cardiac catheterization⁽⁸⁾. In this sense, cardiovascular diseases are the main causes of death in Brazil and worldwide^(4,16), responsible for the pathological changes in the organ, which makes donation unfeasible.

The assertion about the clinical issue is confirmed by the fact that the chances of having a cardiac donation were higher in the deaths of men less than 40 years old and victims of cranioencephalic trauma, in which the comorbidities are few or nonexistent, characteristics corroborated among effective cardiac donors in Spain⁽¹²⁾. In addition, regarding the predominance of males among potential donors, it is inferred that they are more exposed to car accidents and physical violence, which predisposes the death of young people due to brain death⁽⁹⁾.

There is no maximum age limit for donation, however, the higher the donor's age, especially above 64 years old, the shorter the recipient's survival. When the donor is older than 40 years old, there is an exponential risk of mortality in

the first year after transplantation⁽¹⁷⁾. Thus, the decision on the maximum age of the donor is the responsibility of the transplant teams⁽⁸⁾.

As the years went by, there was an increase in the number of donations and heart transplants in the state, which also happened at the national level⁽³⁾. This favorable result is related to the Brazilian public policies, with attributions and autonomy for the states to make their own actions at the hospital level, which includes the qualification of the professionals to act in the processes of donations and transplants⁽⁴⁾.

Equally important is the insertion of thematic in the undergraduate pedagogical projects of the health area, because generally these processes are not approached in a satisfactory way, which lead to professionals who are unprepared for acting⁽¹⁸⁾.

It was verified that all the organs collected were transplanted, as well as in other Brazilian states, whose totality was financed by SUS. The heart transplant is among the ones that present the highest cost among all the types of transplants (R\$ 37,052.69)⁽¹⁹⁾, encouraging patients to seek public funding for the surgical procedure.

Most cardiac transplants were performed in the eastern macroregional, which was already expected, since it has four out of the six transplantation teams in the state. Transplants can only be performed by health facilities and specialized teams accredited to the National Transplant System, linked to the appropriate physical and organizational structure, and proven professional experience in the field of transplantation, whose authorization is renewed every two years⁽⁴⁻⁵⁾.

In order to overcome the weaknesses mentioned above, as well as to achieve success in the processes of donation and cardiac transplantation, it is mentioned the fundamental role of the nurse, since its performance goes through all the phases, and involves aspects of care and management.

Thus, in the hospital setting, the nurse must act proactively in the organization of the donation and transplant processes as coordinator or member of the IHODTTC⁽⁴⁾ and of the transplant programs⁽²⁰⁾; in identifying and maintaining the potential heart donor; in conducting the interviews for consent to the donation⁽⁴⁾; in the pre and post-transplant care to patients and their families⁽²⁰⁾. As an OPO manager, the nurse must develop public policies, promote training for professionals in hospital institutions and conduct an active search in intensive care units, in order to increase the number of cardiac donations.

■ CONCLUSION

The effectiveness of cardiac donation was 4.9% among eligible donors in brain death, being higher among deaths

under 40 years old and males, as well as increasing significantly between 2011 and 2016. In addition to the organs that came from other Brazilian states, 165 heart transplants were performed, all funded by the Unified Health System.

As limitations of the study, it is possible to mention the lack of information on the reasons for the non-collection of the heart among effective donors of other organs; and the anatomical, physiological, clinical and laboratory conditions of donated organs. It should also be considered that these are data from a single Brazilian state, which prevents the generalization of the results.

Despite this, this study advances knowledge by identifying the prevalence of cardiac transplantation, as well as related clinical and organizational factors. These results may support the development of strategies by nurses coordinating OPO, IHODTTC and transplant, as well as other managers to increase donation and, consequently, reduce the number of people waiting for a heart.

It is still relevant to invest in the continuing education of nursing workers and other professionals involved since graduation, making them aware of the important role they play in the donation process, especially in reducing the managerial weaknesses and supporting families in autonomous and knowledgeable decision about the organ donation.

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