Original Article

Lung donor profile in the state of São Paulo, Brazil in 2006*

Perfil do doador de pulmão disponibilizado no estado de São Paulo, Brasil, em 2006*

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Abstract

Objective: To analyze the rate at which lungs available for transplantation in the state of São Paulo in 2006 were utilized and to determine the lung donor profile in the same period. **Methods:** A retrospective study of 497 clinical charts of lung tissue donors from January to December of 2006. **Results:** According to the clinical charts, lungs were not offered for transplant in 149 cases (30%), which were therefore excluded from the study. Among the 348 lung donors eligible for inclusion in the study, the mean age was 37.4 ± 16.1 years, and 56.9% were males. The main causes of brain death among the donors were stroke (in 40.5%), skull-brain trauma (in 34.2%) and subarachnoid hemorrhage (in 10.9%). The great majority of these lung donors (90.5%) received vasoactive agents, and 13.5% presented cardiopulmonary arrest. The mean donor leukocyte count was 15,008 ± 6,467 cells/mm^3, 67.8% of the donors received anti-bacterial agents, and 26.1% presented lung infection. Nearly 40% of the lung donors presented chest X-ray abnormalities. Only 4.9% of the lung donors were accepted, representing 28 lungs (allograft utilization rate of 4%). The causes for donor exclusion were gas exchange alterations (in 30.1%), infection (in 23.7%) and distance (in 10.9%). **Conclusions:** The lung utilization rate in the state of São Paulo is low when compared to mean rates worldwide. In addition, more than half of the donor pool was excluded due to altered gas exchange or pulmonary infection. The combination of better care of the potential donor and more flexible selection criteria could increase allograft utilization.

Keywords: Lung transplantation; Donor selection; Tissue donors.

Resumo

Objetivo: Analisar a taxa de aproveitamento de pulmões disponibilizados em São Paulo no ano de 2006, bem como caracterizar o perfil dos doadores de pulmão deste período. **Métodos:** Estudo retrospectivo de 497 prontuários de doadores de pulmão, no período de janeiro a dezembro de 2006. **Resultados:** Não houve oferta de doação de pulmões para transplante em 149 (30%) dos prontuários analisados, sendo excluídos do estudo. A idade média dos 348 doadores eleitos para o estudo foi de 37,4 ± 16,1 anos, e 56,9% deles eram do sexo masculino. As principais causas da morte cerebral dos doadores foram: acidente vascular cerebral (40,5%); trauma cranioencefálico (34,2%); e hemorragia subaracnóidea (10,9%). A grande maioria dos doadores recebia drogas vasoativas (90,5%), sendo que 13,5% haviam apresentado parada cárdio-respiratória. Do ponto de vista infeccioso, o leucograma médio foi de 15.008 ± 6.467 células/mm^3, 67,8% recebiam antibioticoterapia e 26,1% apresentavam infecção pulmonar. Quase 40% dos doadores apresentavam alterações radiográficas. Apenas 4,9% dos doadores foram aceitos, representando 28 pulmões (taxa de aproveitamento de órgãos de 4%). Os motivos de recusa foram: alteração gasométrica (30,1%); infecção (23,7%); e distância (10,9%). **Conclusões:** A taxa de aproveitamento de pulmões em nosso meio é baixa quando comparada às taxas médias de aproveitamento mundial. Além disso, mais de 50% das recusas deveram-se à gasometria arterial inadequada e infecção pulmonar. Aliar melhor cuidado ao potencial doador à menor rigidez nos critérios de seleção poderia aumentar a utilização dos órgãos doados.

Descritores: Transplante de pulmão; Seleção do doador; Doadores de tecidos.

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Introduction

Since 1983, when the first successful lung transplant, carried out by the Toronto Lung Transplant Group, was reported, there have been ongoing improvements in terms of technical details, solutions for lung preservation and postoperative management. The first isolated lung transplant in Brazil was performed in 1990.[1]

Currently, more than 2,000 procedures are performed annually, and data from the International Society for Heart and Lung Transplantation show that 22,684 transplants were carried out by 2005,[2] suggesting that this is a widely used treatment for patients with severe lung disease.[3]

Nevertheless, the number of recipients on the waiting list has increased significantly in the past 15 years, surpassing the number of organs available.[4] Consequently, mortality among patients on waiting lists has also increased, reaching 50% in some patient populations.[5]

Various strategies have been proposed in order to increase the number of donors: xenotransplants; living donor transplants[6]; and using non-heart-beating donors. However, due to medical, technical and ethical criteria, these strategies did not have the expected impact on transplant rates.

Within this context, the selection criteria for organs accepted for transplant began to be analyzed. These criteria, created at the beginning of the era of lung transplants and based on individual opinions and experiences, without a high level of evidence of scientific rigor,[7] were aimed only at selecting the so-called "ideal" donors. However, numerous transplant groups have shown that, through better care of the potential donor and by expanding selection criteria (to include less-than-ideal donors and marginal donors), it is possible to safely and dramatically increase the use of donor organs.[8-10]

Despite these attempts to take better advantage of the donor lungs available, the rate at which such lungs are actually utilized remains far from ideal. Mean utilization rates of approximately 13.4% (6.1-27.1%) have been described for Brazil as a whole.[11] However, according to data from the Brazilian Transplant Registry,[12] this percentage is even lower in the state of São Paulo. Brazil has the largest public health care transplant program in the world. In 2003, although more than 8,500 transplants were carried out, there were nearly 60,000 people on the waiting list.[13]

With the objective of analyzing the reasons for the low utilization of donor lungs in the state of São Paulo, we attempted to characterize the lung donor profile in the state of São Paulo, correlating these data with the number of transplants performed and the reasons given for exclusion.

Methods

This was a retrospective study of 497 potential lung donors evaluated between January and December of 2006, using clinical charts on file at the transplant center of the São Paulo State Health Department. The study was evaluated and authorized by the ethics committee of the institution. Patients who were not lung donors, even if donors of other organs, were excluded (Chart 1). Therefore, 149 donors (30%) were excluded from the study. The following variables were analyzed in the remaining 348 donors (70%):

a) General characteristics: *gender* and *age*
b) Comorbidities: *diabetes* and *smoking*
c) Complications in the intensive care unit (ICU): *cardiopulmonary arrest*; *use of vasoactive agents*; *antibiotic therapy*; *infection* (presence and site); and *orotracheal intubation* (*OTI*, days)
d) Complementary tests: *ratio of arterial oxygen tension to the fraction of inspired oxygen* (PaO_2/FiO_2); *blood culture*; *leukocyte count*; *seropositivity* (for Chagas disease, hepatitis C, hepatitis B, HIV, human T-lymphotropic virus (HTLV) I/II, toxoplasmosis, cytomegalovirus or syphilis); and *chest X-ray abnormalities* (focal or diffuse)
e) *Cause of brain death*
f) Status of donor organ: *refused* (reason for refusal); or *accepted* (bilateral or unilateral)

In the data analysis, the absolute number of cases, mean ± standard deviation and variation (minimum and maximum) were calculated for all of the variables studied, as were the percentage values in relation to the whole.

Results

Of the 348 donors, 150 (43.1%) were female and 198 (56.9%) were male. The mean age was 37.5 ± 16.1 years (range, 16 days to 82 years). The

Chart 1 - Standard and extended donor criteria for lung transplant.

Selection criteria	Standard	Extended
ABO[a] compatibility	Identical	Compatible
Age	≤55 years	>55 years acceptable
Smoking	≤20 pack-years	>20 pack-years acceptable
Thoracic trauma	Absence	Absence of extensive trauma (localized trauma)
Intubation time	≤7 days	>7 days acceptable
Asthma	No	Yes acceptable
Cancer	No (except for skin cancer and neoplasia *in situ*)	Primary CNS tumor allowable
Secretion culture	Negative	Positive acceptable (with appropriate prophylaxis)
PaO_2/FiO_2 ratio[b]	≥300	<300 acceptable
Chest X-ray	Normal	Focal or unilateral abnormality acceptable
Bronchoscopy	Normal	Secretion in principal airways acceptable
Cardiothoracic surgery	Absent	Occasionally acceptable
Serological tests	Negative	Cytomegalovirus and toxoplasmosis tolerated

PaO_2/FiO_2: arterial oxygen tension/fraction of inspired oxygen; and CNS: central nervous system. [a]Blood groups. [b]Ideal FiO_2 for calculation equal to 100% and positive end-expiratory pressure equal to 5 cmH_2O.

variables analyzed and the results obtained are shown in Table 1.

For the variables *age*, *smoking*, *PaO_2/FiO_2 ratio*, *chest X-ray abnormalities* and *OTI time*, the values were analyzed independently in accordance with standard and extended criteria for lung transplants. There were 300 donors who were younger than 55 years of age (standard criterion) and 339 donors who were younger than 65 (extended criterion). Among the donors in whom PaO_2/FiO_2 ratio was calculated, the mean value was 244 ± 190 (range, 30-1,366), being equal to or greater than 300 (standard-criterion) in 85 and lower than 300 (extended criterion) in 245. On chest X-rays, 138 donors (39.7%) presented abnormalities. Of those 138, 35 (25.3%) presented bilateral abnormalities, 43 (31.1%) presented abnormalities on the right, and 16 (11.6%) presented abnormalities on the left. Infiltration, consolidation, darkening, opacity and atelectasis were considered pulmonary alterations. For the variable *OTI time*, we obtained a mean value of 5.2 ± 4.3 days (range, 12 h to 33 days), and 94 donors presented an OTI time < 2 days. As for the variable *smoking*, this information was omitted from 278 charts (79.9%). In addition, in the donors with a history of smoking, the information was not standardized and was expressed as year-packs, pack-days, pack-years or cigarette-days.

Regarding complications in the ICU, the variable *cardiopulmonary arrest* was present in 47 cases (13.5%), although the time in arrest was described in few cases. Most donors used vasoactive agents (90.5%) such as noradrenaline, dopamine and dobutamine, either in isolation or in combination.

Leukocyte counts were recorded on 327 (93.9%) of the clinical charts. Counts were within the normal range (5,000-10,000 cells/mm^3) in 72 cases (22%), leukopenia was identified in 8 cases (2.4%), and 247 cases (75.5%) presented leukocytosis. The results of the serological tests for hepatitis B were as follows: two donors were HBsAg positive, anti-HBs negative and anti-HBc positive; 23 were anti-HBs positive and anti-HBc positive; 35 were anti-HBs positive and anti-HBc negative; and 11 were anti-HBs negative and anti-HBc positive. There was only one case of acute cytomegalovirus infection (positive for immunoglobulin M) and none of the donors presented seropositivity for toxoplasmosis, the remaining donors who were seropositive for these agents testing positive for immunoglobulin G. Serological tests for HIV and HTLV I/II were negative. There were only two donors testing positive for syphilis. Three donors presented seropositivity for Chagas disease, and three others presented seropositivity for hepatitis C virus (Table 2).

Cerebrovascular accident was the leading cause of brain death, corresponding to 141 cases (40.5%), hemorrhagic in 113 (32.5%) and ischemic in 28 (8%). Traumatic lesions caused by gunshot wounds constituted the fourth leading cause of brain death, with 20 cases (5.7%). Among the other causes of brain death were arteriovenous malformation, cerebral

Table 1 - Profile of lung donors available in the state of São Paulo in the year 2006.

	Results	Evaluated
General characteristics		
Gender	Female: 150 (43.1%)	348 (100%)
	Male: 198 (56.9%)	
Age[a]	37.47 ± 16.16 years (16 days-82 years)	348 (100%)
Comorbidities		
Diabetes	Yes: 24 (6.9%)	339 (97.4%)
	No: 315 (90.5%)	
Smoking	Yes: 64 (18.4%)	70 (20.1%)
	No: 6 (1.7%)	
Complications in the ICU		
Cardiopulmonary arrest	Yes: 47 (13.5%)	322 (92.5%)
	No: 275 (79.0%)	
Use of vasoactive agents	Yes: 315 (90.5%)	348 (100%)
	No: 33 (9.5%)	
Antibiotic therapy	Yes: 236 (67.8%)	307 (88.2%)
	No: 71 (20.4%)	
Presence of infection	Yes: 100 (28.8%)	341 (97.9%)
	No: 241 (69.2%)	
Site of infection	Lung: 91 (26.1%)	97 (97%)
	CNS: 3 (0.9%)	
	Urinary tract: 3 (0.9%)	
Orotracheal intubation	5.18 ± 4.26 days (12 h-33 days)	345 (99.1%)
Complementary tests		
PaO_2/FiO_2 ratio[b]	244 ± 190 (30-1366)	330 (94.8%)
Blood culture	Positive: 7 (2.0%)	125 (35.9%)
	Negative: 118 (34.0%)	
Leukocyte count	15008 ± 6467 (3380 - 37600) cells/mm^3	327 (93.9%)
Chest X-ray[c]	Normal: 180 (51.7%)	318 (91.3%)
	Abnormal: 138 (39.6%)	
Cause of brain death	CVA: 141 (40.5%)	348 (100%)
	CCT: 119 (34.2%)	
	SAH: 38 (10.9%)	
	GSW: 20 (5.7%)	
	Hypoxia/Cerebral anoxia: 13 (3.7%)	
	Others: 11 (3.1%)	
	CNS tumor: 6 (1.7%)	
Status of donor	Accepted: 17 (4.9%)	348 (100%)
	Refused: 331 (95.1%)	

ICU: intensive care unit; CNS: central nervous system; CVA: cerebrovascular accident; CCT: craniocerebral trauma; SAH: subarachnoid hemorrhage; and GSW: gunshot wound. [a]300 donors < 55 years and 339 donors < 65 years. [b]Among the donors in whom the arterial oxygen tension/fraction of inspired oxygen (PaO_2/FiO_2) ratio was calculated, 85 donors presented a ≥ 300 ratio and 245 donors presented a < 300 ratio. [c]Among the donors with abnormalities on chest X-ray, 94 (68.1%) were analyzed as to the site of the abnormality: 35 bilateral abnormalities (25.3%), 43 abnormalities (31.1%) on the right and 16 abnormalities (11.6%) on the left.

edema and bacterial meningoencephalitis, although each accounted for only a small percentage of cases (Figure 1).

In the period analyzed (the year 2006), 17 lung transplants were carried out, 11 of which were bilateral and 6 of which unilateral (4 on the right and

Table 2 - Serological test results of available lung donors in the state of São Paulo in the year 2006.

	Positive	Negative	Total assessed
Serology for Chagas	3 (0.9%)	341 (98.0%)	344 (98.9%)
Serology for HIV	0	345 (99.1%)	245 (99.1%)
Serology for CMV[a]	182 (52.3%)	29 (8.3%)	211 (60.6%)
Serology for HTLV I/II	0	345 (99.1%)	345 (99.1%)
Serology for toxoplasmosis[b]	128 (36.8%)	82 (23.6%)	210 (60.4%)
Serology for syphilis (VDRL test)	2 (0.6%)	308 (88.5%)	310 (89.1%)
Serology for hepatitis C	3 (0.9%)	341 (98.0%)	344 (98.9%)
Serology for hepatitis B			
HBsAg	2 (0.6%)	343 (98.5%)	345 (99.1%)
Anti-HBs	60 (17.3%)	204 (58.6%)	264 (75.9%)
Anti-HBc[c]	38 (10.9%)	299 (85.9%)	337 (96.8%)

CMV: cytomegalovirus; and VDRL: venereal disease research laboratory test. [a]Among the cases with positive results, we had only one case of positive immunoglobulin M. The remaining cases were positive for immunoglobulin G. [b]Among the cases with positive results, they were all positive for immunoglobulin G, and there were no cases of positive immunoglobulin M. [c]There were three cases with inconclusive results, which were not considered.

2 on the left). Therefore, only 28 of the 696 potential donor lungs were utilized, and the rate of allograft use was 4%. The principal reasons for donor lung exclusion are shown in Figure 2. A single reason for exclusion was given in 289 cases, 2 reasons were given in 41 cases, and 4 reasons were given in one case. The three principal reasons for exclusion were as follows: abnormal arterial blood gas values, corresponding to a low PaO_2/FiO_2 ratio (30.1%); infection (23.7%); and distance from the transplant center, which would increase cold ischemia time (10.9%).

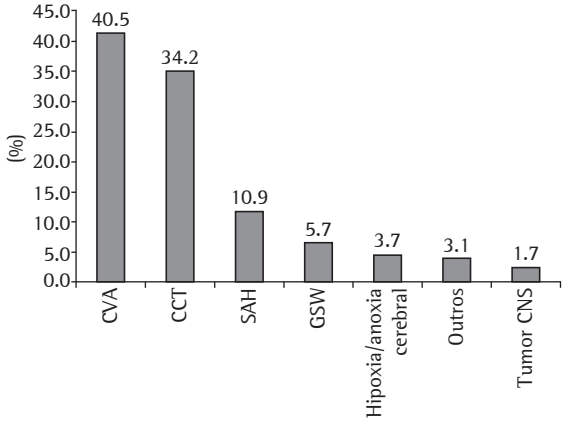

Figure 1 - Causes of brain death in potential lung donors available in the state of São Paulo in the year 2006. CVA: cerebrovascular accident; CCT: craniocerebral trauma; SAH: subarachnoid hemorrhage; GSW: gunshot wound; and CNS: central nervous system.

Discussion

The strict criteria used in the selection of feasible donors has been one of the major factors responsible for the restriction in the number of organs available for transplant.[14] Most of these criteria, however, were based on retrospective studies involving small samples and conducted when the lung transplant technique was still in the development phase.[7,15] In view of the high mortality rate among the patients on the waiting list, which increases every year, and of the increasing number of patients added to that list, it is urgent that the number of organs available for transplant be increased.[4] According to a study conducted in 1998,[5] the waiting period in the USA doubled within the space of 10 years, and, at some European centers, mortality rates on the waiting list increased by 50% over the same period. This situation has increased interest in expanding the acceptance criteria for organs, leading to the creation of a category designated "marginal donors", which includes those donors whose characteristics do not meet the current highly selective criteria of "ideal donors".

Our study showed that the rate at which donor lungs were utilized in the state of São Paulo in the year 2006 was low (4%) when compared to the mean worldwide national rate of 13.4% (range, 6.1-27.1%).[11] According to data from the United Network for Organ Sharing, in the year 2004, only 15% of all donor lungs available worldwide (970 out of 12,000) were used.[16]

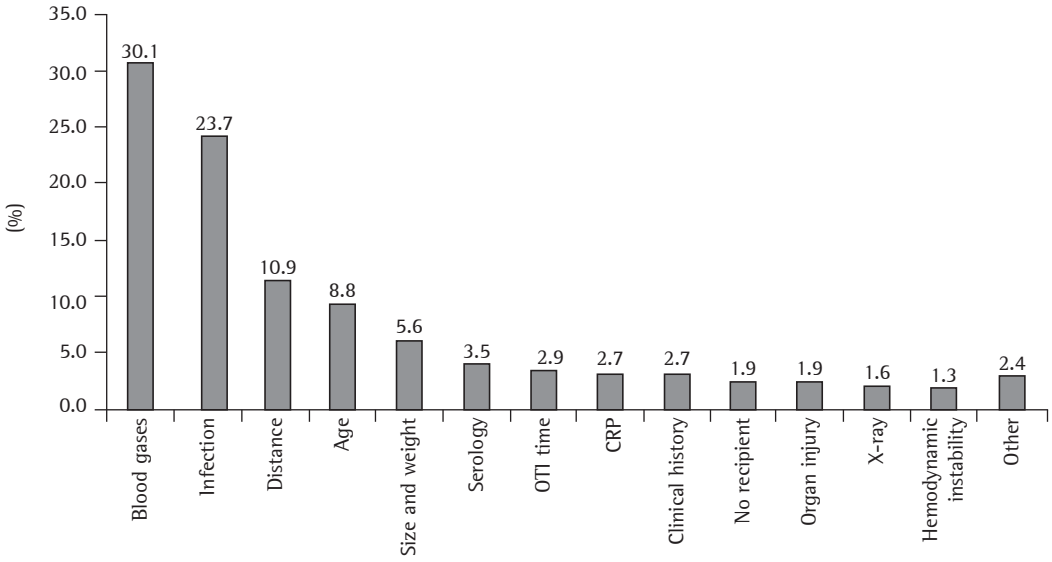

Figure 2 - Reasons for exclusion of lungs available in the state of São Paulo in the year 2006. OTI: orotracheal intubation; and CRP: C-reactive protein.

When these data are compared to those for kidney and liver transplants, this low utilization becomes even more evident. According to the São Paulo State Health Department, in the year 2006, 368 livers and 705 kidneys became available for transplant, and the utilization rates were 91.3% and 90.2%, respectively. It is quite true that, thanks to the particular characteristics of each organ, especially in terms of cold ischemia time and the susceptibility to deterioration after brain death, the utilization rate of donor lungs will never be as high as that of kidneys or liver. However, the comparison above is valid, since it underscores the fact that the lung utilization rate is undeniably low. In this sense, a study on the profile of donors and an analysis of the reasons for exclusion appears to be quite useful in order to determine new measures that aim to increase organ utilization rates.

Various transplant centers worldwide have carried out studies on the effects of lung transplants from marginal donors. One group of authors,[17] through a retrospective study of 29 pairs of lungs rejected for transplantation, showed that approximately 41% of such lungs could be safely used. At some centers, transplants using marginal donors are performed in emergencies. At such centers, there has been a 40% increase in the number of procedures performed.[8] In the state of California (USA), the proportion of usable donor lungs increased from 5% to 38% over a 10-year period. In 2002, this proportion reached 43% in Toronto, Canada and 57% in Victoria, Australia.[18] Alternatives aimed at expanding the pool of donor organs have been proposed. Such alternatives include ex vivo methods of reconditioning organs that were initially rejected for transplantation because they did not meet the selection criteria.[19]

Although there is a greater tendency toward bilateral transplants, the scarcity of available organs has led some centers to preferentially perform unilateral transplants. Studies have shown that the choice of the type of transplant performed (unilateral or bilateral) does not affect patient global survival rate. In 2005, one group of authors conducted a retrospective study in which 369 lung transplants conducted in the 1992-2003 period were analyzed.[20] The authors concluded that there was no significant difference between patients submitted to unilateral transplant and those submitted to bilateral transplant in terms of survival.

The reason most often given for exclusion was abnormal arterial blood gas values (113 lungs; 30.1%), followed by infection (89 lungs; 23.7%), distance from the transplant center (41 lungs; 10.9%) and age (33 lungs; 8.8%). According to the ideal donor criteria, appropriate arterial blood

gas values correspond to PaO_2/FiO_2 values greater than 300 mmHg, based on a FiO_2 of 100%. This allegedly ideal value was suggested based on a case report conducted in 1987,[15] in which the authors reported perioperative primary graft failure after utilization of a donor organ with a PaO_2/FiO_2 ratio lower than 250 mmHg. This occurrence illustrates one of the key arguments of the advocates of the extension of selection criteria: poor scientific evidence to support such selection criteria. In 1994, another group of authors performed 25 transplants using donors with PaO_2/FiO_2 ratio > 250.[21] They found that survival during the first 18 months of follow-up was not significantly different from that observed at other transplant centers. It is estimated that 30% of donor lungs can have their arterial blood gas levels improved through the optimization of ventilation maneuvers,[22] increasing the PaO_2/FiO_2 ratio to values greater than 300 mmHg and therefore upgrading the allegedly marginal donors to ideal donors. Therefore, arterial blood gas values measured in the ICU should not be an independent exclusion criterion of donors, since there can be a discrepancy between these values and those obtained at the time of organ removal. In our study, 6 (35.2%) of the 17 donors whose lungs were accepted for transplant could have been classified as marginal, since they presented a PaO_2/FiO_2 ratio lower than 300 mmHg. Although inappropriate arterial blood gas values are the leading cause of organ exclusion, it is typically in combination with another reason for exclusion. In the present study, inappropriate arterial blood gas values constituted an isolated reason for exclusion in only 39 cases (10.4%).

Infection, as well as the consequent clinical alterations, is typically confirmed by abnormalities on chest X-rays, in blood cultures or in leukocyte counts. In cases of purulent infection, bronchoscopy can also facilitate the diagnosis and treatment by identifying certain conditions (secretion plug, foreign bodies or incorrect positioning of the tracheal tube).[22] The confirmation of infection through traditional criteria prevents the utilization of the organ.[23] This is one of the principal reasons why the lungs of multiple-organ donors are often excluded, since certain infections are tolerated for the transplantation of other organs, such as kidneys and livers. The principal factors that favor the appearance of infections are the increased probability of aspiration, due to brain death, and the use of mechanical ventilation, which predisposes individuals to colonization of the tracheobronchial tree, since it eliminates the protection mechanisms of the upper airways.[24] Therefore, by traditional criteria, the ideal donor should have an OTI time of less than 2 days. However, since this measure would significantly reduce the numbers of lungs available for transplant, marginal donors with less than 14 days of OTI time are accepted. In our study, 94 potential donors (26.9%) presented an OTI time < 2 days. However, only 11 donors (3.2%) presented an OTI time > 14 days. Among the 17 donors used, only 5 (29.4%) presented an OTI time < 2 days, which suggests that the use of donors considered marginal on the basis of this criterion is common in the state of São Paulo. The mean OTI time for the donors evaluated was 3.6 days. In our patient sample, 8 potential donors (2.1%) were excluded due to prolonged OTI alone, and the mean intubation time among those patients was 16 days (range, 8-30 days).

According to ideal selection criteria, there should be no chest X-ray abnormalities. One study, conducted in 2002,[10] reported that unilateral pulmonary infiltrate is acceptable for transplants, whereas bilateral pulmonary infiltrate is not, especially when accompanied by atelectasis and purulent secretion. Numerous studies involving donors who presented chest X-ray abnormalities have been conducted. However, it should be noted that the classification of these tests as normal or not depends on highly subjective criteria.[25] Another study[26] demonstrated that, although 39 (60.9%) of the 64 marginal donors analyzed presented chest X-ray abnormalities, there was no impact on the survival rate of the recipients. Another group of authors,[27] in a retrospective study, did not observe any difference between donors with chest X-ray abnormalities and those without in terms of the recipient survival rate. In our sample, none of the organs were excluded due to chest X-ray abnormalities alone. In addition, in 2 of the lungs accepted, there were chest X-ray abnormalities consistent with unilateral infiltrate. Nevertheless, the overall number of abnormalities observed was high (138; 39.6%): 35 lungs (10%) presented bilateral abnormalities; 58 (16.6%) presented unilateral abnormalities; and which hemithorax was affected was not noted in the remaining cases. The affected hemithorax was

considered important when the description of the X-ray used the following terms: infiltrate; consolidation; darkening; opacity; or atelectasis. In the clinical charts of 30 donors (8.6%), data on the performance of chest X-rays were missing.

The third most often mentioned reason for exclusion of lungs for transplant was the distance between the place of death of the donor and the place where the transplant team was located, since it would increase cold ischemia time. This reason is rarely given in the international literature, most of the studies contained therein having been conducted in European countries, the USA and Canada. The small territorial dimensions of European countries certainly minimize this problem. In addition, such countries have efficient transportation systems and, above all, a quite homogenous distribution of transplant teams throughout their territory. In the state of São Paulo, distance is a pertinent cause, especially because the transplant teams are highly concentrated in the area surrounding and including the state capital. In the present study, 30 donor lungs (8.6%) were refused for this reason alone: 27 were in other states; and 3 were in the state but not in the vicinity of the state capital. Another 11 donor lungs were excluded for other reasons associated with distance. In this sense, it is necessary to establish transplant teams in the state at large and in other Brazilian states.

The fourth leading reason for exclusion in our study was the age of the donor. According to the ideal criteria, the maximum lung transplant donor age is 55 years. Lungs from older donors are more likely to present neoplasia and infections, as well as emphysematous processes, with reduced pulmonary function. One group of authors concluded that donor age < 10 years or > 50 years can be associated with increased post-transplant mortality.[28] However, age is not an isolated predictor of survival. Nevertheless, when inappropriate age is combined with a cold ischemia time > 6 h, the results are notably worse. Of the 331 potential donor lungs refused by the medical team in our sample, 33 (8.8%) were refused because they did not meet the age criterion. Of the lungs accepted for transplant, none were from donors > 55 years of age, and 2 were from donors ≤ 10 years of age. Expanding the criteria to include donors over the age of 55 would probably increase the number of acceptable donors, and age would be an exclusion factor only in cases in which the cold ischemia time was > 6 h.

We conclude that the lung utilization rate in the state of São Paulo is low when compared to the best selection models worldwide. Most of the exclusions were due to inappropriate arterial blood gas values and pulmonary infection. These factors reflect the low quality of ICU treatment that these donors received. The combination of better care of the potential donor and more flexible selection criteria could increase allograft utilization, leading to lower mortality rates and shorter waiting times among patients on lung transplant waiting list.

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