
SEROPREVALENCE OF ANTI-*Trypanosoma cruzi* AND ANTI-*Toxoplasma gondii* ANTIBODIES IN POSSIBLE AND POTENTIAL ORGAN DONORS IN THE SOUTH OF RIO GRANDE DO SUL STATE, BRAZIL

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ABSTRACT

Serological profiles are important in cases of solid organ donation where serological findings, such as antibodies against *Trypanosoma cruzi* and toxoplasmosis, may interfere in organ donation by increasing morbidity and mortality. This study aimed to outline seroprevalence of anti-*Trypanosoma cruzi* and anti-*Toxoplasma gondii* antibodies in possible and potential organ donors in the south of Rio Grande do Sul (RS) State, Brazil. A cross-sectional quantitative and retrospective epidemiological study was carried out, based on secondary data. Data on serology were extracted from medical records found in the *Sistema de Gestão Hospitalar* (SIGH), a hospital management system used by a university hospital in the south of RS, Brazil. Sociodemographic variables, such as age, sex and race, as well as clinical variables, such as titration of IgM and IgG anti-*T. cruzi* and anti-*T. gondii* antibodies, were analyzed. Medical records were found to be poorly filled in, since 67.6% (506 records) could not be used due to lack of information. Seroprevalence of *T. cruzi* was 6.8% (5 cases), mostly in white males. Regarding seroprevalence of *T. gondii*, 76.2% (64 donors) were serologically positive, 10.9% of which were IgM positive. This is the first study on anti-*T. cruzi* and anti-*T. gondii* antibodies in organ donors in RS, Brazil and should be furthered since there may be consequences regarding organ uptake and donation.

KEY WORDS: Epidemiological studies; *Trypanosoma cruzi*; *Toxoplasma gondii*; organ donation

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INTRODUCTION

Organ and tissue transplantation, which have been seen as advances in the medical field, result from the improvement in surgical procedures, technological advances in vital support, better organ conditioning and refinement of immunosuppressive drugs. All these factors have enabled better organ uptake, currently a more acceptable and safer therapeutic alternative for patients who undergo terminal failure of different organs (Tall & Brenner, 2008; Garcia, 2006; Westephal et al., 2016).

Organ and tissue transplantation have proved to be paths for the transmission of Neglected Tropical Diseases (NTDs) and others infectious and parasitic diseases. In Latin American countries, main infections are related to cytomegalovirus (CMV), acute Chagas disease (CD) and toxoplasmosis. Risks of re-activation of a latent infection are associated with the intensity of post-transplantation immunosuppression and with microorganism strains (Pierrotti et al., 2018; Rosário et al., 2017; Salvador et al., 2018).

Incidence of parasitic infections tends to increase in patients who undergo transplantation due to the transmission of infectious agents found in solid organs. However, in order to meet demands, the use of organs from donors whose condition is not ideal for donation, must be considered (Abouna, 2008; Clemente et al., 2018).

Concerning donors infected by *Trypanosoma cruzi*, the protozoan which causes CD, organ transplantation is often avoided due to risks of disease transmission and re-activation. Even so, organ transplantation has increasingly become an important factor in CD transmission. CD transmission rates in organ donors range from 10% to 20%, mainly in heart transplantation (Campos et al, 2016; Durães et al., 2015; Ferreira et al., 2018).

Immunosuppressed patients have had to face the protozoan *Toxoplasma gondii* lately. The most frequent forms of dissemination show multiple cysts of *T. gondii* in lungs, liver, myocardium, pancreas and, mainly, in the brain (Renoult et al., 1997).

Diagnosis of CD and *T. gondii* in prospective donors of solid organs and tissues must be performed due to high *T. cruzi* and *T. gondii* transmission rates. Therefore, to determine the prevalence of these parasitic agents in solid organ donors – and resulting complications –alterations in clinical practices are fundamental. Therefore, the purpose of this study was to investigate seroprevalence of *T. gondii* and *T. cruzi* and profiles of possible and potential organ donors in the south of Rio Grande do Sul (RS) State, Brazil.

METHODS

Study area

A cross-sectional quantitative and retrospective epidemiological study was carried out, based on secondary data. Data on organ donations were collected from March to October 2018 at the São Francisco de Paula University Hospital (HUSFP) – a reference hospital in organ uptake – located in Pelotas, in the south of RS, Brazil. Medical records were analyzed at the *Serviço de Arquivo Médico* (SAME).

Population and data collection

The population under investigation was composed of possible and potential organ donors following brain death (BD). It should be highlighted that possible organ donors are those presenting severe brain injury requiring mechanical ventilation (MV), while potential donors are patients who have begun donation procedures.

Data on serology were listed after medical records provided by the SIGH were analyzed. The investigation also comprised the following variables: age, sex, race, occupation, schooling; place of birth; cause of coma/death; organs (when these were donated); associated comorbidities and titration of IgG anti-*T. cruzi*, IgG anti-*T. gondii* and IgM anti-*T. gondii* antibodies. The technique used to detect the antibodies was Indirect Immunofluorescence Assay.

Selection of medical records was based on forms that notified BD from 2010 to 2018 in the Intra-hospital Committee of Organ and Tissue Donation for Transplantation (CIHDOTT) at the HUSFP. Exclusion criteria were incomplete or not found medical records, and those whose donors presented some form of ineligibility, such as Human Immunodeficiency Virus (HIV).

After exclusion criteria were applied, data were tabulated by the Microsoft Excel® program and seroprevalence (%) ratios were calculated by the formula: Seroprevalence ratio (%) = (positive numbers/total under evaluation) x 100.

The Fisher's Exact Test was carried out to calculate significance among variables and seroprevalence.

Ethical considerations

The project was presented to the CIHDOTT at the HUSFP. After acceptance, the project was submitted to, judged and approved by the Ethics Committee (registration n. 2.627749).

RESULTS

Medical records often proved to have been incorrectly handled, i. e., there were several irregularities related to lack of data that should have been filled in, such as sociodemographic data, room spreadsheets, surgical descriptions, death certificates and mandatory exams (Figure).

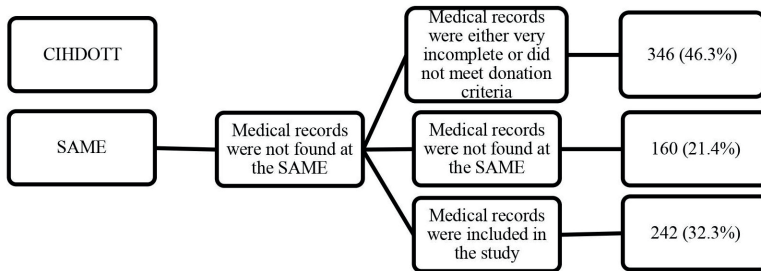


Figure. Categorization of difficulties found in the research with medical records.

In this study, 169 (70.1%) out of 241 participants were not tested for CD or their serology records were not included in the medical records. Three medical records, whose clinical history showed CD, did not carry confirmatory exams; as a result, these were discarded. Five (6.8%) out of 73 possible donors tested for anti-*T. cruzi* antibodies were classified positive. In this group, four became effective donors while the family of the remaining one did not consent to donation.

Table 1 shows sociodemographic and serological factors related to *T. cruzi* seropositive possible and potential donors. Data were not statistically significant ($p > 0.05$).

Table 2 shows the main causes of coma in possible and potential donors who were tested for *T. cruzi*.

Table 3 shows organs donated by *T. cruzi* positive possible and potential donors.

Regarding the protozoan *T. gondii*, 64 (76.2%) out of 84 possible and potential donors tested positive. Seven of these (10.9%) were IgM positive, which characterizes either recent infection or re-activation, while 57 (89.1%) reacted to IgG and showed chronic infection. Statistical significance was observed with $p < 0.05$ for the age variable, based on Pearson's chi-square test.

Table 1. Sociodemographic factors of possible and potential donors tested for anti-*Trypanosoma cruzi* in the south of Rio Grande do Sul, Brazil.

Variables	Negative n (%)	<i>T. cruzi</i> ⁺ n (%)	Total n (%)	p value
Age				
0-39	26 (92.9)	2 (7.1)	28 (100)	> 0.05
≥ 40	41 (93.9)	3 (6.8)	41 (100)	
Sex*				
Male	32 (100)	0 (0)	32 (100)	> 0.05
Female	34 (87.2)	5 (12.8)	39 (100)	
Schooling*				
Up to 8 years	24 (88.9)	3 (11.1)	27 (100)	> 0.05
≥9 years	14 (93.3)	1 (6.7)	15 (100)	
Place of Residence*				
Pelotas	47 (92.2)	4 (7.8)	51 (100)	> 0.05
Others	21 (95.5)	1 (4.5)	22 (100)	
Anti <i>T.gondii</i> positive				
IgM	70 (98.6)	1 (1.4)	71 (100)	> 0.05
IgG	66 (97.5)	2 (2.9)	68 (100)	
Anti CMV positive*				
IgG	63 (95.5)	3 (4.5)	66 (100)	> 0.05
IgM	61(100)	0 (0)	61 (100)	

* Data were missing in the medical records; **T. cruzi*: *Trypanosoma cruzi*; * *T. gondii*: *Toxoplasma gondii*; * IgG: Immunoglobulin G; *IgM: Immunoglobulin M; *CMV: Citomegalovirus.

Table 2. Main causes of coma in possible and potential donors tested for *Trypanosoma cruzi* in the south of Rio Grande do Sul, Brazil.

Variable	Total* n (%)	<i>T. cruzi</i> n (%)
AVC	23 (95.8)	1 (14.2)
TCE	12 (92.3)	1 (7.7)
Subarachnoid hemorrhage	14 (87.5)	2 (12.5)
Others	15 (93.7)	1 (6.3)

*09 medical records did not show cause of coma; * AVC: Stroke; *TCE: Traumatic Brain Injury.

Table 3. Main organs donated by *Trypanosoma cruzi* positive possible and potential donors in the South of Rio Grande do Sul, Brazil.

Donated Organ	Donor	%
Kidney	4	36.4
Liver	4	36.4
Corneas	3	27.2
Total	11	100

Table 4 shows sociodemographic factors of possible and potential donors with anti-*T. gondii* antibodies.

Table 4. Analysis of sociodemographic factors of possible and potential donors who tested positive for anti-*Toxoplasma gondii* antibodies in the south of Rio Grande do Sul, Brazil

Variable	Negatives n (%)	<i>T. gondii</i> + n (%)	Total n (%)	p value
Age*				
Upto 39 years	13 (39.4)	20 (60.6)	33 (100)	
≥40 years	7 (14)	43 (86)	50 (100)	< 0.05
Sex*				
Female	9 (10.8)	26 (31.3)	35 (42.1)	
Male	11 (13.2)	37 (44.6)	48 (57.8)	> 0.05
Race*				
White	18 (22.2)	53 (65.5)	71 (87.7)	
Non Whites	1 (1.2)	9 (11.1)	10 (12.3)	> 0.05
Schooling*				
Up the 8 years	3 (5.9)	26 (51)	29 (56.9)	> 0.05
9 or > years	9 (17.6)	13 (25.5)	22 (43.1)	
Place of residence*				
Pelotas	13 (19.1)	38 (55.9)	51 (75)	>0.05
Others	2 (2.9)	15 (22.1)	17 (25)	

* Data were missing in the medical records.

Table 5 shows the main causes of coma in possible and potential donors who were tested for *T. gondii*.

Table 5. Main causes of coma in possible and potential donors tested for *Toxoplasma gondii* in the South of Rio Grande do Sul, Brazil.

Variables	<i>T. gondii</i> n * (%)
AVC	22 (35.5)
TCE	13 (20.9)
Subarachnoid Hemorrhage	13 (20.9)
Others	14 (22.7)
Total	62 (100%)

*02 medical records did not show cause of coma; * AVC: Stroke; *TCE: Traumatic Brain Injury

DISCUSSION

A clinical study is an investigation where the object observed is the patient, therefore requiring integration with laboratory diagnosis and teaching (Zago, 2004). In regard to the lack of data in the medical records, it should be highlighted that recording information is the interdisciplinary team's daily task. A medical record is an extremely relevant document whose purpose is to record the patient's progress, besides providing guidelines for the best therapeutic or rehabilitation procedures (Cardoso et al., 2017). This study verified that more than 50% of the medical records under analysis could not be utilized, a fact that impaired the specific characterization of profiles of possible and potential organ donors, as well as other diseases under study. Regarding CD, three medical records that mentioned the donor had tested positive were discarded since there were no copies of confirmatory exams attached resulting in a relevant loss to the history of the disease in the region.

This study showed that 6.8% of possible and potential organ and tissue donors tested positive for CD. This prevalence may be considered high, even in comparison with one of the anti-*T. cruzi* antibodies found in the region by other evaluations, which was considered high in relation to data collected in other Brazilian cities. In the rural area in Pelotas 2.7%, RS (Araújo et al., 2015), 5% of patients with cancer (Rosenthal et al., 2016) and 5% of patients with HIV. The last percentage is 3.8-fold the one estimated by the Ministry of Health for *T. cruzi*/HIV co-infection in Brazil (Stauffert et al., 2017).

Regarding evaluations carried out in Brazil in relation with the prevalence of anti-*T. cruzi* antibodies in organ donors, the rate found in this study (6.8%) was even higher when compared to results of other investigations. Baumel et al.(2011) characterized the serological profile of potential donors in Santa Catarina (SC) State. High positivity is important when donors are involved, since organ transplantation presents an alternative route of CD transmission, facilitated by immunosuppressive therapy necessary in organ recipients, mainly heart and kidney cases (Clemente et al., 2018).

CD was more frequently found in donors over 40 years of age, a fact that may be related to the high number of intrahousehold vectors over the past decades, previous to the implementation of the Brazilian Program for the Control of Chagas Disease in 1975, even though this only covered the whole country in 1983 (Villela et al., 2005; Villela et al., 2009; Priotto et al., 2014). In younger patients, whose cases were found in two medical records, infection may be the result of oral transmission (not so common nowadays) and even congenital contamination. Silveira et al. (2009) corroborate that the younger population knows little about the vector and its relation with CD. This is due to the fact that young people do not see the disease as a problem and, since they were born after the implementation of the control program, they do not tend to participate in any entomological surveillance responsibly.

Concerning place of residence, most *T. cruzi* seropositive donors lived in Pelotas, RS, an important endemic region for CD in the south of Brazil (Baruffa & Alcantara Filho, 1985). Regarding schooling, 75% of seropositive patients attended school for eight years, at most, a fact that shows the importance of schooling to implement preventive measures related to CD (Villela et al, 2009).

With respect to *T. cruzi/T. gondii* co-infection, three donors were seropositive, while three patients were co-infected for *T. cruzi*/CMV; in this case, the three patients were IgM+ for CMV. Since the CD cases were in the life long chronic phase, the probability of infectious and non-infectious comorbidities increases (Almeida et al, 2010). It is noteworthy that the association of these comorbidities with immunosuppressive conditions – either acquired or induced – may have a negative impact on organ transplantation; meaning professionals must be aware of possible consequences (Rosenthal et al., 2016; Stauffert et al., 2017).

Despite the risk of infection, the Committee for Organ Donation and Transplantation at the Brazilian Intensive Care Society (AMIB) has stated that *T. cruzi* seropositive individuals may donate organs, such as kidneys, pancreas, liver and lungs (Westphal et al, 2016). In this study, donated organs were kidneys, liver and corneas.

Regarding the protozoan *T. gondii*, the 76.2% prevalence in the group under study was close to the highest rates found in Brazil by other researchers, who have reported that seroprevalence ranges from 50 to 80% in Brazil

(Dubey, 2000; Xavier et al., 2013). Same rates, close to those found in this study, were identified in other Brazilian regions, such as Eldorado, a city in Mato Grosso do Sul (MS) State (79.45%), Porto Alegre (RS) (88%) and in Sergipe (SE) State (69%) (Marques et al., 2008; Engroff et al., 2014; Inagaki et al., 2009). These may be related to environmental factors and habits, which may be the case of similarities found between individuals from Porto Alegre and those under study, since they live in areas that are geographically near each other. According to Dubey (2000), incidence of infection caused by *T. gondii* is widely spread and varies among different populations all over the world, since it depends on local eating habits, contact with animals that carry the protozoan, schooling, weather conditions and access to health care.

Most *T. gondii* seropositive patients were men. Xavier et al. (2013) studied patients who were co-infected with *T. gondii* and HIV in the south of RS and found that 81.7% of men were seropositive. The authors reported that carnivorousism is an important transmission route of this parasite, mainly the intake of raw or undercooked meat. Besides, soil manipulation and activities connected to animal husbandry increase exposure of male individuals to the parasite.

Concerning place of birth, there was no significant difference among participants in this study, a fact that may be explained by their socioeconomic and cultural characteristics. Pelotas, RS, is a city presenting Portuguese, Italian and German colonial origins, similar to other cities in the region, a fact that explains the uniformity and high prevalence rate (Salamoni et al., 2001). In terms of schooling, since 65.1% of the participants only received basic education, the low educational level may be related to the transmission of the disease, i. e., they were not aware of transmission routes and habits that help disseminate *T. gondii*. Besides, immunosuppression seems to be a relevant factor; 10.9% of possible and potential donors had an active infection. This percentage is higher than that found among pregnant women (from 0.42 to 2.4% for IgM) (Figueiró-Filho et al., 2005; Varela et al., 2003), for instance, and may lead to severe consequences to organ uptake and donation.

High rates of seroprevalence of anti-*Trypanosoma cruzi* and anti-*Toxoplasma gondii* antibodies were found among possible and potential organ and tissue donors in the south of RS.

The health softwares or applicatives, such as the Electronic Health Record (EHR), are considered efficient tools for hospital records and clinical management. These systems reliably assemble information, enable data collection for research, guarantee easy access, contribute to time optimization and avert the risk of incompleteness. A correctly filled in medical record enables improvement of medical practices and research (Brandão-Souza et al., 2019).

This study presented limitations. Inappropriate physical space to store, organize and preserve the records was identified as the major complicating factor. Other limitations were related to the scarcity of exams, organ harvesting records and disjointed chronology. Due to these conditions, the missing data percentage may have been overestimated when related to the study variables.

Seroprevalence of 6.8% for *T. cruzi* is higher than that detected by other investigations carried out in this region and in other parts of the country. In addition, this study is the first regarding seroprevalence of CD and toxoplasmosis among organ donors in RS. Even though it has some limitations, its results, which may contribute to further studies, highlight not only the importance of filling in medical records correctly and improving data storage but also the need to provide complete data to organ and tissue transplantation centers.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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