











## Infectious events in kidney transplant recipients from deceased expanded criteria donors: a prospective cohort

Eventos infecciosos em receptores de transplante renal de doador falecido com critério expandido: coorte prospectiva

Eventos infecciosos en receptores de trasplante renal de donante fallecido con criterios expandidos: cohorte prospectiva

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### ABSTRACT

**Objective:** Analyze risk factors for infection in kidney transplant recipients from deceased expanded criteria donors (DECD) in the first two years of follow-up. **Method:** This is a prospective cohort study with 466 patients from DECD who underwent kidney transplantation in 2015 and 2016 in Brazil. A total of 551 events were recorded. The largest incidence of infectious events occurred in the first month after kidney transplantation. Cytomegalovirus infection was the most common infectious episode. **Results:** The incidence rate of infections was 57.1%. Among bacterial infections, only 4% were due to multidrug-resistant microorganisms. The death rate was 3.3% (15) patients. The main cause of death was infectious (73.3%). Hospitalization until the first infection (aOR:1.61), Number of infections in 1 year (aOR:40.16), and Cytomegalovirus infection (aOR:13.84) was risk factors for infection by multidrug resistant microorganisms (MDR). **Conclusion:** Infection incidence with MDR bacteria was high among kidney transplant recipients from DECD, and the main cause of death was infection. Survival was high among patients with infection.

### DESCRIPTORS

Infections; Kidney Transplantation; Transplants; Mortality; Survival rate.

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## INTRODUCTION

Kidney transplant accounts for the largest share of all solid organ transplants in the world. Quality of life and survival rates in kidney transplantation have been improving mainly due to improvement in surgical techniques, immunosuppressive therapy and better clinical management of these patients<sup>(1)</sup>.

In Brazil, the rate of kidney transplantation between 2012 and 2018 remained unchanged (28.5 pmp), with a drop of 32.9% in the rate of transplants from live donors, from 7.3 pmp to 4.9 pmp and an increase in the rate of transplantation from deceased donors of only 10.3% (from 21.4 pmp to 23.6 pmp). In 2018 the rate of effective donors grew by only 2.4%, from 16.6 pmp in 2017 to 17.0 pmp in 2018, 5.5% below the expected rate (18.0 pmp). This increase was due to a 0.6% increase in the notification rate of potential donors and 2.2% increase in the donation effectiveness rate. However, the growth rate of organ transplantation with deceased donors was only 0.7%, from 41.0 pmp to 41.3 pmp, revealing an increase in the rate of non-use of deceased donor organs. In 2018, 4,905 transplants were performed with a deceased donor with a survival rate of 83% in the first year after transplantation<sup>(1-2)</sup>.

As a consequence of the imbalance between the number of transplants and the waiting list, the number of deaths and patients on the list grows, registering a lower quality of life, worse rehabilitation and increased costs after a transplant. To minimize this problem and increase the number of organs for kidney transplantation, it has been proposed to use borderline or expanded criteria donors. Deceased donors are considered donors who provide organs for transplantation that offer greater risk to recipients or risk of worse graft functioning in the long term<sup>(2-3)</sup>. Expanded criteria donors<sup>(3)</sup> are donors over 60 or between 50 and 59 years old (with at least 2 of the 3 criteria: being hypertensive, having creatinine level greater than 1.5 mg/dl, having stroke as the cause of death), kidney and diabetic donors, pediatric donors, borderline donors as to the potential for disease transmission and the presence of malignant abnormalities, donors with infection, donors with social/sexual behavior with inclusion in risk groups, and donors with kidneys with anatomical abnormalities.

For deceased donor recipients, selection is based on blood group compatibility (ABO), HLA and negative cross-testing. Studies that analyze survival, morbidity and mortality in kidney transplant recipients are important to also assess the cause of death in this group of patients. The leading cause of death during the first year of transplantation has an infectious etiology<sup>(4-6)</sup>.

Infectious events are often related to two conditions: patient immunosuppression and environmental exposures<sup>(2,5-7)</sup>. In kidney transplant patients, the rate of infectious events is 49%, and these complications add significant morbidity and mortality for patients, especially in the first year after transplantation<sup>(8)</sup>.

Infection remains the major cause of morbidity and the second most frequent cause of mortality, preceded only by cardiovascular events as the first cause of death for patients with CKD<sup>(9-12)</sup>.

Based on the risk of bacterial colonization and infection of kidney deceased expanded criteria donors (DECD) and on the need for additional epidemiological studies on morbidity and mortality of DECD, we conducted a study to analyze risk factors for infection in kidney transplant recipients from DECD in the first two years of follow-up.

## METHODS

### TYPE OF STUDY

This is a prospective cohort study<sup>(13)</sup> of kidney transplant DECD recipients who underwent transplantation at Oswaldo Ramos Foundation's Kidney and Hypertension Hospital in the city of São Paulo, Brazil.

The Kidney and Hypertension Hospital (HRIM – *Hospital do Rim e Hipertensão*) is a world reference in kidney transplantation, internationally recognized for the quality of care, teaching and research, with an average of 1,000 transplants per year.

### POPULATION; LOCAL; SELECTION CRITERIA

The study comprised the 466 patients from DECD who underwent kidney transplantation in 2015 and 2016. Patients with 18 years or older, of both sexes, who underwent transplantation from DECD and with completeness of data in the medical record were included.

### DATA COLLECTION

Data collection was performed by two research nurses, specialists in nephrology, using the patients' records. A double check was performed on the data entered in the spreadsheet as well as an audit to confirm data tabulation. The variables collected were sociodemographic, clinical, biochemical, type of immunosuppressants, need for post-transplant dialysis treatment, site and type of infection confirmed by culture, graft loss, cause of graft loss, death, and cause of death.

In relation to DECD, data was collected on age, weight and height (BMI), race, blood type, cause of death, initial and final creatinine value, use of vasoactive drugs, presence of cardiac arrest (CPR), presence of infection, etiologic agent, infection site, use of antibiotics, recipient serology, and presence of acute tubular necrosis (ATN).

The presence and type of infection, late infection (type of infection up to 24 months) after transplantation were verified. The identification of all types of infectious events (urinary tract infection, surgical site, pulmonary and bloodstream) was based on the description of signs and symptoms, medical diagnosis, and positive laboratory exams, as registered in the medical records.

Cytomegalovirus (CMV) infection was defined by signs and symptoms and, mainly, by the result of antigenemia described by a peripheral blood sample or in biopsies. The presence of *herpes zoster* infections was defined according to the description of the lesions and site. Pulmonary infections were defined according to signs and symptoms, description

of fever, cough, exams compatible with the diagnosis (radio-graphy, result of bronchial aspirate).

For each infection site, the medical record was assessed by a medical professional, with results of tests that confirmed the type of etiologic agent and bacterial multidrug resistance as well as the proposed treatment and outcome of the case. The delayed function of the graft was considered whenever renal replacement therapy in the first week after kidney transplantation with deceased donors took place.

Regarding the type of deceased donor, DECD (border-line) were classified as donors 60 years of age or older, with creatinine above 1.5 mg/dl, with brain death, hemorrhagic stroke, CRP documented, presence of infection or in the course of infection treatment.

## DATA ANALYSIS AND TREATMENT

In the descriptive analysis, data were presented using counts and frequencies, means, standard deviations, and minimum and maximum values, when appropriate. In order to identify possible risk factors for the onset of infections, the isolated influence of each variable was initially investigated.

Pearson's chi-square test or Fisher's exact test was used to compare the number of patients with and without infections for the different categorical variables. The Mann-Whitney or Student's t test was used for quantitative variables to compare the group with and without infection<sup>(14)</sup>. The same was done to ascertain the characteristics associated with infection by multidrug resistant (MDR) bacteria to some infection data.

Variables with  $p < 0.05$  in the univariate analysis were included in a multiple logistic regression model (multivariate approach). The results were presented as Odds Ratio, respective descriptive levels (p values) and 95% confidence intervals. The reduced model corresponds to the final model, with all significant covariables at 5%.

Weibull model of survival was used for variables whose survival curve was different for the different groups to ascertain the variables associated with the time until the first infection<sup>(14)</sup>. The level of significance adopted was 0.05. The statistical program used to perform the calculations was RStudio, version 1.2.1335 and R, version 3.4.4.

## ETHICAL ASPECTS

The research was analyzed and approved in 2016 by the Ethics Committee of the Federal University of São Paulo, with Opinion Number: 1,777,351; as required by Brazilian resolution 466/12. Since the research worked only with secondary data, there were no direct ethical implications for the participants.

## RESULTS

We analyzed the medical records of 466 recipients from DECD under follow-up, followed for two years at the transplant clinic. Table 1 presents the demographic characteristics of kidney recipients and DECD.

Table 2 shows kidney transplant characteristics of the 466 kidney transplant recipients from DECD and immunosuppression protocol.

**Table 1** – Characteristics prior to transplantation of kidney recipients and deceased expanded criteria donors – São Paulo, SP, Brazil.

Characteristics	Recipient	Donor
<b>Male</b>	294 (63.1%)	
<b>Female</b>	172 (36.9%)	
Age, mean (SD)	47.01 (12.1)	46.86 (14.0)
BMI, mean (SD)	24.40 (4.6)	26.25 (5.6)
<b>Blood type</b>		
A	193 (41.4%)	186 (39.9%)
B	58 (12.4%)	48 (10.3%)
O	183 (39.3%)	184 (39.5%)
AB	28 (6.0%)	27 (5.8%)
<b>Serology</b>		
Negative	51 (11.0%)	297 (63.7%)
CMV	370 (79.2%)	169 (36.3%)
Others	45 (9.6%)	
<b>Alcoholic</b>		
Yes	42 (9.0%)	
No	424 (91.0%)	
<b>Former smoker</b>		
Yes	140 (30.0%)	
No	326 (70.0%)	
<b>Hematocrit</b> mean (SD)	39.6 (18.9)	
<b>Hemoglobin</b> mean (SD)	13.0 (4.2)	
<b>Leukocytes</b> mean (SD)	7731.90 (6758.8)	
<b>Platelets</b> mean (SD)	205.59 (72876.9)	
<b>PTH*</b> mean (SD)	581.40 (524.9)	
<b>Diuresis in 24h</b> mean (SD)	583.30 (459.1)	

\*SD – Standard deviation; BMI – Body Mass Index; CMV – Cytomegalovirus; PTH – Parathyroid hormone.

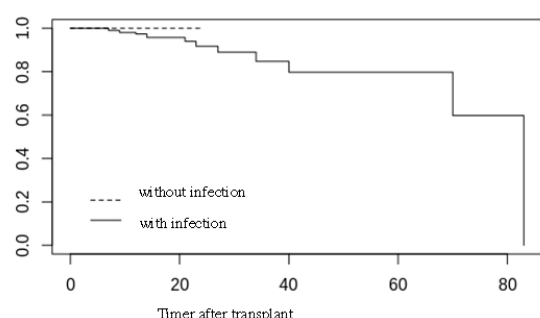
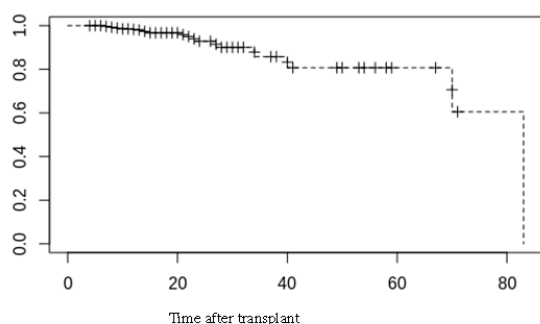
The average age of donors was 46.8 years. All donors had negative serology for hepatitis B, C and HIV. For CMV positive serology, a total of 169 (36.3%) were positive. The initial and final donor creatinine values ranged from 1.1 to 2.3 mg/dl. Regarding race, 49.1% of donors were registered as white race and 33.3% as mixed race. For blood type, 39.9% had blood type A and 39.5%, type O. Only 3.9% of the donors had PCR before the actual organ donation. At the time of identification of the donor, 13.1% had some type of infection under treatment. For the result of the donor kidney biopsy in relation to the presence of ATN, it was classified as mild for 21.1% of the biopsies, moderate for 35.8% and severe for 7.3%. The main cause of death of the donor was stroke (31.5%), followed by AVI (14.4%). The use of vasoactive drugs (norepinephrine) was present in 88.6%.

Regarding the survival analysis, it is noted that in the group without infection, the survival time to discharge is 1 and does not change over time, indicating that no one in this group died. In the group with infection, on the other hand, the survival time until discharge decreases over time, indicating that the number of survivors decreases over time (Part B). For part A of the figure, it is noted that the survival time until discharge decreases over time and that there are several censors over time, indicating that several of them did not suffer the event (Figure 1).

**Table 2** – Characteristics of kidney transplantation and immuno-suppression protocol – São Paulo, SP, Brazil.

Characteristics	n (%) / mean
Cold ischemia time (minutes) – mean (SD)	1,503 (400.1)
Vascular anastomosis time (minutes) – mean (SD)	30 (9.5)
<b>Type of urethral anastomosis</b>	
Gregoir	249 (53.4%)
Politano	144 (31%)
U-P	57 (12.2%)
Delay bladder catheter time (days) – mean (SD)	5.9 (1.7)
Total RRT after transplantation, mean (SD)	3.5 (2.6)
Discharge in days after transplantation, mean (SD)	13.3 (10.7)
FPM	220 (47.2%)
FP	46 (9.9%)
Everolimus	31 (6.6%)
Simulect	16 (3.4%)
<b>Thymoglobulin use</b>	
Once	186 (39.9%)
Twice	33 (7.1%)
Three times	23 (4.9%)
Four times	74 (15.9%)
Five times	41 (8.8%)
PRA C I	40.5 (42.3)
PRA C II	51.5 (26.1)

\*U-P: Pyeloureteral anastomosis; RRT – Renal Replacement Therapy; FPA – Tacrolimus (FK), Prednisone and Azathioprine; FPM – Tacrolimus, Prednisone and Mycophenolate Sodium; FP – Tacrolimus and Prednisone; PRA – Panel Reactive Antibody.

**Figure 1** – Survival curves among kidney transplant recipients with and without infectious episodes.

The largest incidence of infectious events occurred in the first month after kidney transplantation. A total of 551 events were recorded. CMV infection was the most common infectious episode. The incidence rate of infections

was 57.1%. Among bacterial infections, only 4% were due to multidrug-resistant microorganisms. CMV infections occurred mainly from the first to the third month (281/81%). Then, urinary tract infections (UTIs) were the most present. In the second year after transplantation, a total of 27 episodes of infectious (flu, tonsillitis, dengue, among others) were observed). The most frequent etiologic agents in the result of urine cultures from 123 UTI were *Escherichia coli* (31 urine cultures), *Klebsiella* (19 urine cultures) and *Klebsiella Pneumoniae Carbapenemase* (KPC). For other infections, 14 pneumonias, 10 bloodstream infections, 15 surgical site infections, nine herpes zoster, seven genital herpes and several others were observed. In the period from the thirteenth to the twenty-fourth month after transplantation, there were only 27 different infectious events.

Table 3 presents a comparison between kidney transplant recipients from DECD with and without infection. The death rate was 3.3% (15) patients. The main cause of death was infectious (73.3%), followed by cardiovascular (26.6%) and hemorrhagic shock (0.01%). All recipients who died had an infectious event after transplantation, with 80% having CMV infection.

The risk factors for infection of recipients in univariate analysis were time on dialysis in months, positive serology for CMV, type of urethral anastomosis UP, post-transplant RRT, use of the immunosuppressive protocol FPA, FPM,

**Table 3** – Presence of infection in kidney transplant recipients – São Paulo, SP, Brazil.

Total patients	With infection	Without infection	p value
<b>Recipient</b>	327 (70.2%)	139 (29.8%)	
Sex, n%			
Female	128 (39.1%)	44 (31.6%)	0.1253
Male	199 (60.9%)	95 (68.4%)	
<b>BMI</b>	24.6 (4.9)	23.77 (3.9)	0.0259
<b>Race</b>			
White	95 (29.1%)	38 (27.3%)	0.8894
Black	69 (21.1%)	29 (20.8%)	
Brown	144 (44.0%)	62 (44.6%)	
Yellow	10 (3.1%)	6 (4.3%)	
<b>CKD etiology*</b>			
Undetermined	142 (43.4%)	59 (42.4%)	0.8169
Diabetes	47 (14.4%)	17 (12.2%)	
Hypertension	47 (14.4%)	28 (20.1%)	
Diabetes and hypertension	9 (2.7%)	3 (2.2%)	
PKD*	24 (7.3%)	11 (7.9%)	
Glomerulopatias	30 (9.2%)	12 (8.6%)	
Others	28 (8.6%)	9 (6.4%)	
<b>Diuresis ml in 24h</b>	313.6 (449.5)	338.8 (443.8)	0.18
<b>Transfusion</b>			
No transfusion	141 (43.1%)	63 (45.3%)	0.8333
Received up to 5 bags	163 (49.8%)	68 (48.9%)	
Above 5 bags	23 (7.0%)	8 (5.7%)	

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Total patients	With infection	Without infection	p value
Pre-transplant tests			
PTH	576.4 (522.0)	593.4 (534.0)	0.3635
Hemoglobin	13.1 (4.8)	12.7 (1.9)	0.3611
Hematocrit	40.2 (22.2)	38.2 (6.2)	0.5784
Leukocytes	7,636 (5,400.9)	7,954 (9,195.2)	0.5067
Platelets	207,714 (76,755)	200,724 (63,029)	0.3455
Priority for transplant	313 (95.7)	134 (96.4)	
Post-transplant RRT	2.4 (2.9)	1.3 (1.7)	0.7104
Immunosuppression			
FPA (yes)	98 (29.9%)	78 (56.5%)	6.082 × 10-8
FPA (no)	230 (70.1%)	60 (43.5%)	
FPM (yes)	193 (58.8%)	42 (30.4%)	2.15 × 10-8
FPM (no)	135 (41.2%)	96 (69.6%)	
FP (yes)	34 (10.4%)	16 (11.6%)	0.6957
FP (no)	294 (89.6%)	122 (88.4%)	
Everolimus	22 (6.7%)	10 (7.2%)	0.7965
Simulect	11 (3.4%)	5 (3.7%)	
Thymoglobulin use			
No	58 (17.7%)	56 (40.3%)	
Once	124 (37.9%)	59 (42.4%)	
Twice	23 (7%)	7 (5%)	
Three times	22 (6.7%)	1 (0.7%)	
Four times	65 (19.8%)	9 (6.5%)	
Five times	35 (10.7%)	7 (5%)	
CMV infection	241 (73.7%)	2 (1.4%)	<0.001
No CMV infection	86 (26.3%)	137 (98.5%)	
Recipient death	15 (4.6%)	0 (0.0%)	0.0075

\*BMI – Body Mass Index; CKD – Chronic Kidney Disease; PKD – Polycystic Kidney Disease; FPA – Tacrolimus, Prednisone, Azathioprine; FPM – Tacrolimus, Prednisone, Mycophenolate; FP – Tacrolimus and Prednisone; CMV – Cytomegalovirus.

induction with thymoglobulin and presence of infection by CMV. The presence of CMV infection increases the chance by almost 14 times to have post-transplant infection.

Table 4 presents the multivariate analysis for risk factors of infection among kidney transplant recipients. The variables associated with post-transplant infection were length of hospitalization (average of 13.3 days and 10.7 SD) until the first infection, number of infections (average of 1.68 infections and 1.1 SD) in one year and CMV infection. Every increase of one unit in days until the first infection increases the chance of having an infection by 0.6%. The presence of CMV infection increases the chances of having post-transplant infection by almost 14 times. The risk factors for infection for the 327 (70.2%) recipients were the use of the immunosuppressive protocol FPA, FPM, induction with thymo and presence of CMV infection. The presence of CMV infection increases the chance of another infection 15.5 times.

The presence of infection by MDR microorganisms was observed in 20 (6.1%) of kidney transplant recipients from DECD. The risk factors for infection by MDR microorganisms were history of diabetes (7.2 [1.4; 30.6]). The most

**Table 4** – Multivariate analysis for risk factors for infection among kidney transplant recipients – São Paulo, SP, Brazil.

Variables	Odds ratio	95% CI	P value
Time on dialysis	0.98	[0.96; 1.01]	0.3271
Positive serology container – CMV	0.46	[0.03; 5.95]	0.5382
Type of urethral anastomosis U-P	17.78	[0.11; 19.16]	0.6588
RRT after transplant	0.85	[0.46; 1.56]	0.6170
RRT-DFG indication	33.25	[0.47; 31.56]	0.2711
FPA use	62.43	[0.31; 166.76]	0.2532
FPM use	29.18	[0.16; 63.08]	0.4728
Discharge on post-transplant days	10.20	[0.93; 1.21]	0.7414
CMV infection	16.26	[1.38; 317.52]	0.0403
Thymo 1 time	18.17	[0.29; 11.72]	0.5136
Thymo 2 times	15.65	[0.05; 35.12]	0.7825
Thymo 3 times	23.10	[0.02; 587.44]	0.7919
Thymo 4 times	57.12	[0.11; 253.01]	0.3745
Thymo 5 times	84.49	[0.15; 464.91]	0.3097
Recipient age	10.84	[1.12; 1.19]	0.0538
Donor age	10.22	[0.95; 1.09]	0.5174

#### Results – Multivariate analysis – model reduced

Hospitalization until the first infection	1.61	[1.16; 1.72]	0.0064
Number of infections in 1 year	40.16	[102.06; 27.84]	<0.001
CMV infection	13.84	[1.96; 127.17]	0.0106

common infection was UTI (70.0%), and the etiologic agent KPC was diagnosed in eleven urine cultures (78.5%). KPC pneumonia was present in four patients and in one due to surgical site infection (SSI). One patient had an UTI for *Escherichia coli* MDR, a SSI for VRE, and two had KPC and *Escherichia coli*. Three patients died, two due to infectious causes, only one during the 93-day period during hospitalization and being treated for infection. The other two deaths occurred after one year of transplantation. The patient with Vancomycin-resistant *Enterococcus* (VRE) infection in SSI had graft loss 26 days after transplantation. The two recipients who received transplants from donors with KPC and *Klebsiella* developed KPC infection.

## DISCUSSION

In this study, 466 kidney recipients from DECD who underwent transplantation from January 2015 to December 2016 were followed up for three years. DECD use has increased due to the disproportion between the waiting list and the accomplishment of transplantation annually<sup>(15)</sup> as well as due to the mortality of patients under renal replacement therapy (19.5%)<sup>(2)</sup>.

In this study, infection incidence was 70.2%, accounting for 551 episodes of infections. Infection incidence in kidney transplant recipients was more present in the first few months after transplantation. The most common infections are CMV and UTI. A systematic literature review with criteria for inclusion of articles, assessing the outcome of the presence of infection and type of donor, found that kidney

recipients from a deceased donor present a 20% higher risk of developing infections<sup>(16)</sup>.

Our study identified that CMV infection was the most prevalent infectious episode and occurred mainly from the first to the third month (281/81%). CMV infection is an important cause of morbidity and mortality in kidney transplantation. The donor's serological status was identified as an influential factor for CMV infection ( $p = 0.0320$ ). In this study, 52.1% of kidney transplant recipients had CMV infection. The episode was more frequent in the first 30 days after transplantation. Of the 20 recipients with MDR infection, 12 had CMV infection. All recipients had positive CMV serology. A different result regarding the time of occurrence of CMV infection was observed in a study with a cohort of 5,225 kidney transplant recipients who underwent the transplant from 1994 to 2014; the occurrence of CMV infection in the first 30 days was 0.2%. Antiviral therapy for CMV was introduced within 72 hours after kidney transplantation<sup>(17)</sup>.

The presence of diabetes in kidney transplant recipients was considered a risk factor for infection<sup>(18-20)</sup>. A retrospective case-control study was carried out to identify independent risk factors for *Escherichia coli* and *Klebsiella pneumoniae* producing extended-spectrum beta-lactamases (ESBL) in kidney transplant recipients in Portugal under outpatient follow-up<sup>(18)</sup>. Thus, 49 patients with UTI were compared by ESBL-producing bacteria as a group of cases and the same number of patients with UTI by negative ESBL as a control group. The presence of diabetes mellitus ( $p < 0.007$ ) represented a risk factor for infection by ESBL-producing bacteria. ESBL-producing bacteria exhibited greater resistance to fluoroquinolones ( $p = 0.002$ ), trimethoprim-sulfamethoxazole ( $p < 0.001$ ), and gentamicin ( $p < 0.001$ ). ESBL-producing UTI in ESBL recipients in kidney transplant recipients represents an important clinical challenge not only in hospitalized patients, but also in outpatients<sup>(21-22)</sup>.

Only one case of positive urine culture for *Escherichia coli* MDR was observed in our study. Of the total of 123 UTI, 31 (25%) had positive urine culture for *Escherichia coli*. The clinical history and immunocompromised status of kidney transplant recipients allows strains of *Escherichia coli* with low uropathogenic potential, but with greater resistance to antibiotics, to cause UTI<sup>(21-24)</sup>.

Immunosuppression use was predominant for FPA (37.8%) and FPM (50.4%) in our study. There was a six-fold increase in infection in recipients who used FPM and twice in recipients who used FPA. At the Kidney and Hypertension Hospital transplantation clinic, the available presentations for the immunosuppressive regimen are liquid cyclosporin and capsules, azathioprine tablets, tacrolimus capsules, mycophenolate mofetil tablets, MPS tablets, sirolimus in vials and tablets, everolimus tablets and prednisone tablet<sup>(25)</sup>. In our study, no patient used cyclosporine.

In this study, 3.3% of patients died. Infection was the main cause of mortality (73.3%). A Brazilian study with a cohort of 1,873 kidney transplant recipients described a total of 162 deaths (35 with DECD), with 53% of deaths due to infectious causes. The risk factors that were related to mortality were diabetes, time on dialysis, length of hospital stay, and others<sup>(6)</sup>. Another study with 944 kidney transplant recipients, who underwent transplantation from 2002 to 2015, aiming at identifying the cause of death of this group of patients reported that 10.2% (102) died, 35.5% due to infectious causes and 30.4% due to cardiovascular causes<sup>(26)</sup>.

This research has limitations that must be considered. Data collection of information about the donor and the presence or absence of infection was limited to reviewing the records in medical records. However, we know that these records can have flaws related to team activities. The donor's presence in the Intensive Care Unit can favor infections that may not be diagnosed during the donation process. Studies that assess the results of transplantation with expanded donors can contribute to the discussion of public policies that favor the entire transplant system, from donation to the actualization of the transplant.

## CONCLUSION

Risk factors for infection were length of stay, having CMV infection, use of FPM, FPA and induction with thymoglobulin. The risk factor for infection by MDR microorganism was a history of diabetes. Infection incidence with MDR bacteria was high among kidney transplant recipients from DECD, and the main cause of death among kidney transplant recipients with deceased donor was infection. Survival was high among patients with infection.

## RESUMO

**Objetivo:** Analisar fatores de risco para infecção em receptores de transplante renal de doador falecido com critério expandido (DFCE) nos primeiros dois anos de seguimento. **Método:** Trata-se de estudo de coorte prospectivo, com 466 pacientes do DFCE submetidos a transplante renal, em 2015 e 2016, no Brasil. Um total de 551 eventos foram registrados. A maior incidência de eventos infecciosos ocorreu no primeiro mês após o transplante renal. A infecção por citomegalovírus foi o episódio infeccioso mais comum. **Resultados:** A taxa de incidência de infecções foi de 57,1%. Entre as infecções bacterianas, apenas 4% foram devidas a microrganismos multirresistentes. A taxa de mortalidade foi de 3,3% (15) pacientes. A principal causa de morte foi infecciosa (73,3%). Hospitalização até a primeira infecção (ORA: 1,61), número de infecções em 1 ano (ORA: 40,16) e infecção por citomegalovírus (ORA: 13,84) foram fatores de risco para infecção por microrganismos multirresistentes (MR). **Conclusão:** A incidência de infecção por bactérias MR foi alta entre receptores de transplante renal de DFCE, e a principal causa de morte foi infecção. A sobrevivência foi alta entre os pacientes com infecção.

## DESCRIPTORES

Infecções; Transplante de rim; Transplantes; Mortalidade; Taxa de sobrevida.

## RESUMEN

**Objetivo:** Analizar los factores de riesgo de infección en receptores de trasplante renal de donante fallecido con criterios expandidos (DFCE) en los dos primeros años de seguimiento. **Método:** Estudio prospectivo de cohorte con 466 pacientes con DFCE sometidos a trasplante renal, en 2015 y 2016, en Brasil. Se registraron un total de 551 eventos. La mayor incidencia de eventos infecciosos ocurrió en el primer mes después del trasplante de riñón. La infección por citomegalovirus fue el episodio infeccioso más común. **Resultados:** La tasa de incidencia de infecciones fue del 57,1%. Entre las infecciones bacterianas, solo el 4% se debió a microorganismos multirresistentes. La tasa de mortalidad fue del 3,3% (15) pacientes. La principal causa de muerte fue infecciosa (73,3%). La hospitalización hasta la primera infección (ORA: 1,61), el número de infecciones en 1 año (ORA: 40,16) y la infección por citomegalovirus (ORA: 13,84) fueron factores de riesgo de infección por microorganismos multirresistentes (MR). **Conclusión:** La incidencia de infección bacteriana por MR fue alta entre los receptores de trasplante renal DFCE y la principal causa de muerte fue la infección. La supervivencia fue alta entre los pacientes con infección.

## DESCRIPTORES

Infecciones; Trasplante de Riñón; Trasplantes; Mortalidad; Tasa de Supervivencia.

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