Revista Brasileira de Enfermagem
REBEn

SUPPLEMENTARY EDITION 6
ADVANCED NURSING PRACTICES

ORIGINAL ARTICLE

Risk factors for colonization and infection by resistant microorganisms in kidney transplant recipients

Fatores de risco para colonização e infecção por microrganismos resistentes em transplantados renais

Factores de riesgo de colonización e infección por microorganismos resistentes en receptores de trasplante renal

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How to cite this article:
Taminato M, Morais RB, Fram DS, Pereira RRF, Esmanhoto CG, Pignatari AC, et al. Risk factors for colonization and infection by resistant microorganisms in kidney transplant recipientes. Rev Bras Enferm. 2021;74(Suppl 6):e20210219. https://doi.org/10.1590/0034-7167-2021-0219

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Submission: 03-28-2021 **Approval:** 05-13-2021

ABSTRACT

Objectives: to assess the prevalence of colonization and infection by multidrug-resistant bacteria in patients undergoing kidney transplantation and identify the rate of infection, morbidity and mortality and associated risk factors. **Methods:** a prospective cohort of 200 randomly included kidney transplant recipients. Epidemiological surveillance of the studied microorganisms was carried out in the first 24 hours and 7 days after transplantation. **Results:** ninety (45%) patients were considered colonized. Female sex, hypertension and diabetes (p<0.005), dialysis time (p<0.004), length of stay after transplantation, delayed renal function, and length of stay were identified as risk factors. The microorganisms were isolated from surgical site, bloodstream and urinary tract infections. **Conclusions:** colonization by resistant microorganisms in kidney transplant patients was frequent and risk factors associated with infection were identified. The results should guide the care team in order to minimize morbidity and mortality related to infectious causes in this population.
Descriptors: Infection; Infection Control; Kidney Transplantation; Bacteria; Nursing Care.

RESUMO

Objetivos: avaliar a prevalência de colonização e infecção por bactéria multirresistente em pacientes em transplante renal, identificar a taxa de infecção, morbimortalidade e os fatores de risco associados. **Métodos:** coorte prospectivo de 200 transplantados renais incluídos aleatoriamente. Realizou-se vigilância epidemiológica dos microrganismos em estudo nas primeiras 24 horas e 7 dias pós-transplante. **Resultados:** noventa (45%) pacientes foram considerados colonizados. Identificaram-se como fatores de risco: sexo feminino, hipertensão arterial e diabetes (p<0,005), tempo de diálise (p<0,004), tempo de internação pós-transplante, função renal retardada, tempo de internação. Os microrganismos foram isolados das infecções em sítio cirúrgico, corrente sanguínea e trato urinário. **Conclusões:** a colonização por microrganismos resistentes nos pacientes transplantados renais foi frequente e os fatores de riscos associados à infecção foram identificados. Os resultados devem direcionar a equipe assistencial, a fim de minimizar a morbimortalidade relacionada às causas infecciosas nesta população.
Descritores: Infecção; Controle de Infecções; Transplante Renal; Bactérias; Cuidados de Enfermagem.

RESUMEN

Objetivos: evaluar la prevalencia de colonización e infección por bacterias multirresistentes en pacientes sometidos a trasplante renal, identificar la tasa de infección, morbimortalidad y factores de riesgo asociados. **Métodos:** cohorte prospectiva de 200 receptores de trasplante renal incluidos aleatoriamente. La vigilancia epidemiológica de los microorganismos estudiados se realizó en las primeras 24 horas y 7 días posteriores al trasplante. **Resultados:** noventa (45%) pacientes fueron considerados colonizados. Se identificaron como factores de riesgo: sexo femenino, hipertensión y diabetes (p<0,005), tiempo en diálisis (p<0,004), tiempo de estancia después del trasplante, función renal retrasada, tiempo de estancia. Los microorganismos se aislaron de infecciones del sitio quirúrgico, del torrente sanguíneo y del tracto urinario. **Conclusiones:** la colonización por microorganismos resistentes en pacientes con trasplante renal fue frecuente y se identificaron factores de riesgo asociados a infección. Los resultados deben orientar al equipo asistencial para minimizar la morbimortalidad relacionada con causas infecciosas en esta población.
Descriptores: Infecciones; Control de Infecciones; Transplante de Riñón; Bacteria; Atención de Enfermería.

INTRODUCTION

Kidney transplantation is a high-cost procedure for the Unified Health System (SUS – *Sistema Único de Saúde*) and it brings considerable improvement in the quality of life of patients with chronic kidney disease. Comparisons of medical costs for the SUS show that the amounts spent on renal replacement therapies (RRT) are significantly higher than the costs of kidney transplantation, both for living and deceased donors. Thus, the financial investment with transplantation is compensated in a period of three years, generating savings in resources compared to RRT[1].

The leading cause of death during the first year after transplant has an infectious etiology[2]. Infectious events are often related to two conditions: patients' immunosuppression and environmental exposures. The use of immunosuppression favors greater susceptibility to infections, a situation in which morbidity and mortality are related to its intensity, infection type and occurrence of rejections[2-3].

Factors that can influence the incidence and severity of these infections have been recipients' age, the types and doses of immunosuppressive agents used, the institution of prophylaxis, patients' socioeconomic level, the presence of malnutrition, the housing conditions, transport and poor hygiene habits, as well as the search for early medical care[2-3].

This information about the profile of patients registered in the waiting list allows planning of care, in order to contribute to reduction in mortality and morbidity rates. These data are of paramount importance, not only for healthcare centers that perform kidney transplantation, but also for RRT institutions, enabling the determination of degree of impairment of chronic kidney disease (CKD) and the evolution in the post-transplant period[4].

Kidney transplant recipients are a group of patients at risk for Healthcare-Related Infections (HAI), due to clinical severity, invasive procedures, mechanical ventilation, immunosuppressants, antimicrobials and exposure to the hospital environment[5]. These factors are predictors of colonization and infection by multidrug-resistant bacteria (MDR)[6-7].

Transplant (TX) centers are considered to be at high risk for the development of infections due to individual and epidemiological exposures of transplant patients[6-7]. Among kidney transplant patients, a study showed that infections are one of the main causes of hospital readmissions and represent 51% of readmissions that occur within six months after TX, preceded only by surgical complications[8].

Another study evaluated the implementation of surveillance cultures for patients who would undergo kidney TX and demonstrated that patients colonized before TX had greater morbidity when compared to non-colonized[9].

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 TX[10].

There are few reports of infection and colonization in patients with CKD, as few countries carry out epidemiological surveillance of methicillin-resistant *S. aureus* (MRSA). Moreover, the dimension of colonization can only be obtained when there is an active search for carriers, as it is asymptomatic. In a study carried out in the Netherlands, incidence shows 13% of infection by the same MRSA strain among colonized patients. The authors suggest that failure to identify and isolate colonized patients contributes to increased rates of nosocomial MRSA infection[11].

Considering the complications that occurred due to infection in patients treated at the Nephrology Service of *Universidade Federal de São Paulo* (UNIFESP), Barbosa et al.[12-13] evaluated the prevalence of colonization by vancomycin-resistant *Enterococcus* (VRE) in 300 patients in dialysis program and 280 transplant patients treated in this service. There was a prevalence rate of 14.5% in dialysates and 14% in kidney transplant recipients, which is quite high compared to those documented in American services, which is around 7%[14].

Studies show that infections in kidney transplant patients are mostly related to Gram-negative bacteria producing extended-spectrum beta-lactamases (ESBL-E). Urinary tract infection is the main infectious complication and one of the main risk factors for graft loss and patient death. In the last decade, the incidence of MDR urinary infections, including ESBL-E, has increased and reaches over 50% in some TX centers[15].

We believe that the results of this study can bring important clinical contributions, with findings that can guide care actions in order to reduce morbidity and mortality related to the infection that affects this population of patients.

OBJECTIVES

To identify risk factors related to colonization and infection by multidrug-resistant bacteria in kidney transplant patients.

METHODS

Ethical aspects

This study was preceded by the approval of the Institutional Review Board of *Universidade Federal de São Paulo* (UNIFESP). Patients signed the Informed Consent Form.

Study design, site, and period

This is a prospective cohort, guided by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)[16], carried out from 2015 to 2018 at the *Hospital do Rim e Hipertensão* of UNIFESP (HRim - Kidney and Hypertension Hospital), institution considered of excellence in the national and international scenarios for assistance, teaching and research in kidney TX, which performs, on average, 1,000 to 1,200 TXs/year.

Sample; inclusion and exclusion criteria

The sample size was calculated considering an estimated prevalence of 15% of colonization by MDR, with a chance of error of 2.5%. The estimated minimum number was 200 patients, considering an alpha error of 5% and a beta of 20%. The estimated number of samples for the test to determine the minimum inhibitory concentration (MIC) and molecular typing was 60 samples of Carbapenemase-producing *Klebsiella pneumoniae* (KPC), which were randomly typed. In the first analysis, patients were classified as MDR bacteria non-colonized or colonized/carriers.

The study sample included 200 kidney TX patients, randomly included, who met were in the immediate postoperative period (IPO) - first 24 hours after TX and aged 18 years and over. TX performed at another institution, recent infectious event (less than 1 month before) or confirmed inflammatory status (systemic lupus, rheumatoid arthritis, among others, were excluded).

Study protocol

Data collection was performed at the HRim, from 2015 to 2018, on two occasions: in the first 24 hours after TX and 7 days after. To obtain the data, a form previously prepared by the researchers was used, in which identification, clinical and laboratory test data were recorded when patients entered the study.

The concept adopted by the Brazilian National Health Regulatory Agency (ANVISA - *Agência Nacional de Vigilância Sanitária*) was used as a criterion for defining colonization or infection, which relates the site of isolation of the microorganism to patients' clinical conditions. Therefore, considering colonization as the presence of a microorganism (identified by culture), without clinical manifestation or functional changes, whereas, in infection, the microorganism is identified and associated with clinical manifestations related to the infectious process, with organic changes or inflammatory response[17-18].

Included patients (colonized or not) were prospectively followed by the research team for a period of six months, according to the institutional follow-up protocol, from the IPO until the change in treatment, discharge or death. In cases of hospitalization during post-TX outpatient follow-up, location, cause, number and length of hospital stay, infection (site and isolated microorganism) and evolution (discharge, death and cause of death) were recorded).

For epidemiological surveillance of the microorganisms under study, the main researchers of the study (nurses) collected two swabs from each participant, following the institutional protocol. For surveillance of MRSA, a nasal swab was collected through the introduction of a cotton swab (Copan Diagnostics, Inc., Corona, CA) in the posterior nostril region with rotating movements. For surveillance of VRE and KPC, a rectal swab was collected, introducing the swab about 3 cm to 5 cm into the anal introitus, performing rotating movements. We use the nylon swab containing liquid transport medium (ESwab; Copan Diagnostics, Inc., Corona, CA).

Analysis of results, and statistics

The biological materials collected were sent to the Special Laboratory of Clinical Microbiology (LEMC - *Laboratório Especial de Microbiologia Clínica*) of the Infectious Diseases Course at UNIFESP, where all microbiological tests were performed in accordance with the recommendations of the Clinical and Laboratory Standards Institute (CLSI)[19], which include isolation, identification, culture, antimicrobial sensitivity tests and molecular analysis (Polymerase Chain Reaction Technique - PCR).

Descriptive analysis of patient groups was performed, considering demographic, clinical, laboratory variables and treatment-related parameters. Univariate analysis was performed comparing the groups (colonized or not). The association between multidrug-resistant bacteria and categorical variables was tested using the chi-square test or Fisher's exact test, and the association between continuous variables and multidrug-resistant bacteria was performed using Student's t-test or Mann-Whitney test, as appropriate. The tests used were two-tailed, and the significance level adopted was alpha <0.05. The statistical program used was the Statistical Package for the Social Sciences (SPSS), version 14.0 for Windows (Chicago, IL).

RESULTS

Ninety (45%) of the 200 patients included in the study were colonized. Table 1 shows the sociodemographic characteristics and the main risk factors for colonization: hypertension associated with diabetes mellitus (HP+DM) p<0.005 and dialysis time p<0.004.

Table 2 presents the clinical characteristics and variables of six-month post-TX follow-up for patients colonized with GES-type beta-lactamase-producing bacteria, Carbapenemase-producing *Klebsiella pneumoniae* (KPC) and *Pseudomonas aeruginosa*-producing Metallo-β-lactamases (SPM). The main findings for colonization by these microorganisms are as follows: immediate post-TX hospitalization time in days relative risk (RR): 5.61; need for post-TX dialysis (delayed renal function) RR: 2.85; post-TX hospitalization days RR: 2.01; surgical site infection RR: 18.43; and urinary tract infection (UTI) RR: 21.67.

Table 1 - Bivariate analysis between sociodemographic variables, comorbidities, dialysis type and laboratory tests according to colonization in kidney transplant recipients treated at the *Hospital do Rim e Hipertensão* of *Universidade Federal de São Paulo* from 2015 to 2018

Variables	Colonized N=90	Non-colonized N=110	*p* value
Age	47.20 ±12.11	46.12 ±12.31	0.325
Male	54 (62%)	77 (71%)	0.190
ESRD etiology* (%)			
Glomerulonephritis	6 (6%)	20 (19%)	0.100
Polycystic kidneys	12 (13%)	15 (14%)	0.102
Indefinite	75 (80%)	70 (64%)	0.038
Others	1 (1%)	5 (3%)	0.421
Comorbidities (%)			
Hypertension	77 (85%)	90 (90%)	0.110
DM+HP**	8 (9%)	2 (2%)	0.005
DM***	5 (6%)	18 (8%)	0.020
Dialysis type (%)			
Hemodialysis	41 (93%)	85 (94%)	0.953
Peritoneal dialysis	3 (6%)	3 (3%)	0.235
Conservative	1 (1%)	2 (3%)	0.378
Dialysis time (months)	65.02 ±43.23	45.06 ±43.11	0.004
Post-transplant hospitalization days	23.90 ±19.28	19.91± 18.32	0.117
Laboratory tests			
Urea (mg/dl)	133 ± 46	116± 43	0.221
Creatinine (mg/dl)	7.34± 3.72	6.61± 3.21	0.067
Leukocytes (/mm3)	7405± 7348	8831± 7776	0.085
Hemoglobin (g/%)	11.05± 1.75	11.51± 1.51	0.998
Hematocrit (%)	34.44± 5.86	36.96± 5.62	0.083

**ESRD - end-stage renal disease; **DM+HP - hypertension associated with diabetes mellitus; ***DM - diabetes mellitus.*

Table 2 – Association between clinical variables and the occurrence of complications in kidney transplant recipients in follow-up for 6 months treated at the *Hospital do Rim e Hipertensão* of *Universidade Federal de São Paulo* and the occurrence of colonization by GES-type beta-lactamase-producing bacteria, Carbapenemase-producing *Klebsiella pneumoniae* (KPC) and *Pseudomonas aeruginosa*-producing Metallo-β-lactamases (SPM) from 2015 to 2018

Variables	Colonized GES* + KPC** + SPM*** (22)	Non-colonized (110)	RR	95% CI
Deceased donor	21 (95%)	103 (93%)	0.988	0.28-1.71
Post-TX hospitalization days	51.31± 42.26	12.35±18.42	5.61	2.91-10.8
Post-TX dialysis**** (delayed renal function)	21 (95%)	88 (80%)	2.85	4.00-15.39
Induction with Thymoglobulin	81 (90%)	83 (85%)	0.89	1.14-7.91
Post-TX hospitalization days	31 ±25.80	19.91± 18.32	2.01	11.12-102.12
Dialysis time (months)	65.02 ±43.23	45.06 ±43.11	0.68	0.25-54.51
Infection				
Surgical site infection	2 (2%)	0%	18.43	7.64 – 44.47
Urinary tract infection	3 (3%)	0%	21.67	1.47 – 16.68
Cytomegalovirus infection	29%	14%	0.977	2.98-21.78
Death	0%	0%		

GES - betalactamase-producing bacteria; **KPC - Carbapenemase-producing Klebsiella pneumoniae; * SPM - Pseudomonas aeruginosa-producing Metallo-β-lactamases (SPM); ****TX - transplant; RR - relative risk.*

Table 3 – Association between clinical variables and the occurrence of complications in kidney transplant recipients in follow-up for 6 months treated at the *Hospital do Rim e Hipertensão* of *Universidade Federal de São Paulo* and the occurrence of colonization by vancomycin-resistant *Staphylococcus aureus* type VAN A (VAN A) from 2015 to 2018

Variables	Colonized VAN A* (3)	Non-colonized (110)	RR	95% CI
Deceased donor	3 (100%)	103 (93%)	0.988	0.28-1.71
Post-TX dialysis** (delayed renal function)	3 (100%)	88 (80%)	5.61	2.91-10.8
Induction with Thymoglobulin	2 (75%)	83 (85%)	0.88	1.12-15.67
Post-TX hospitalization days	22 ±25.80	19.91± 18.32	0.65	1.14-7.91
Dialysis time (months)	55.02 ±43.23	45.06 ±43.11	2.74	0.65-11.59
Concomitant colonization	100%			
Infection				
Surgical site infection	0%	0%		
Urinary tract infection	1 (33%)	0%	6.08	0.25-97.01
Death	0	0		

** VAN A - Vancomycin-resistant Staphylococcus aureus; **TX - transplant; RR - relative risk.*

Table 4 – Association between clinical variables and the occurrence of complications in kidney transplant recipients undergoing a 6-month follow-up at the *Hospital do Rim e Hipertensão* of *Universidade Federal de São Paulo* and the occurrence of colonization by methicillin-resistant *S. aureus* (MRSA) from 2015 to 2018

Variables	Colonized MRSA* (10)	Non-colonized (110)	RR	95% CI
Deceased donor	10 (100%)	103 (93%)	0.988	0.28-1.71
Female	7 (70%)	33 (33%)	7.08	0.65-11.59
Post-TX dialysis** (delayed renal function)	8 (80%)	88 (80%)	0.99	2.91-10.8
Induction with Thymoglobulin	8 (80%)	83 (85%)	0.88	1.12-15.67
Post-TX hospitalization days	11±22.30	19.91± 18.32	0.98	1.14 -7.91
Dialysis time (months)	54.02 ±43.23	45.06 ±43.11	4.67	0.65-18.98
Concomitant colonization	1 (10%)			
Infection				
Blood stream infection	1 (10%)	0%	14.19	0.65-11.59
Urinary tract infection	2 (20%)	0%	3.08	12.25-102.54
Death	0	0		

**MRSA - Methicillin-resistant Staphylococcus aureus. **TX - transplant; RR - relative risk.*

Tables 3 and 4 present the clinical characteristics of patients colonized by vancomycin-resistant *Staphylococcus aureus* type VAN A (VAN A) and methicillin-resistant *Staphylococcus aureus* (MRSA). We highlight the main outcomes in the 6-month follow-up: post-TX dialysis (delayed renal function) RR: 5.61; dialysis time in RR months: 2.74; and UTI RR: 6.08 for Van A. As the main risk factors for MRSA, the following stood out: female RR: 7.08; dialysis time (months) RR: 4.67; blood stream infection (BSI) RR: 14.19; and UTI RR: 3.08.

DISCUSSION

In the present study, 200 kidney transplant patients were included and colonization by GES, SPM, KPC, VAN A and MRSA bacteria was analyzed in this population.

The study brings contributions and evidence of colonization prior to the TX procedure, pointing out that colonization by multidrug-resistant microorganisms directly impacts on post-TX outcomes and prognoses. Colonization and previous risk factors influenced the success of solid organ TX, demonstrating the need to create screening and prognostic instruments using the clinical-demographic variables of our population[20].

In recent years, with the increasing disproportion between the waiting list for kidney TX and the completion of transplantation, the use of deceased donors has increased, especially those with expanded criteria[21].

A Brazilian study, which evaluated 1,046 kidney TX recipients, 658 from deceased donors, identified a progressive increase in the percentage of TX, with this type of donor, of 82.40% from 2015 to 2016 compared to the period from 1987 to 2000 (33 .10%) (p=0.001)[22].

A systematic literature review, which evaluated the outcome of presence of infection compared to the type of donor (living or deceased), concluded that kidney recipients from deceased donors are at increased risk (20%) for developing infections[23]. A retrospective cohort of 1,576 kidney transplant recipients (487 from deceased donors) identified an incidence of infectious episodes of 49% and the main risk factor for the occurrence of infection was performing TX with deceased donors (OR 3.29, CI 2.37n - 4.58)[10]. These records converge with the findings of our study, as the majority (97.14%) of kidney transplant recipients colonized by multidrug-resistant microorganisms received an organ from a deceased donor.

The most prevalent comorbidities found in the group of colonized patients were hypertension associated with diabetes,

corroborating a review study that indicates that the main determined causes of CKD were glomerulonephritis, followed by hypertension and other cardiovascular diseases and diabetes[23]. Furthermore, a case-control study, which sought to identify risk factors for ESBL-producing *Escherichia coli* and *Klebsiella pneumoniae* in kidney TX recipients in Portugal, also identified diabetes mellitus (p<0.007) as a risk factor for infection by these studied microorganisms[24].

Length of stay and the need for post-TX dialysis were higher in the colonized groups, except for those colonized by MRSA. In another Brazilian study with a cohort of 1,873 kidney TX recipients, a total of 162 deaths were identified, 53% of which were from infectious causes. Risk factors for mortality were related to diabetes, time on dialysis, length of hospital stay, among others[25].

A recent research investigated the use of prophylactic B-lactam and carbapenem antimicrobials in preventing infection in a cohort of 110 kidney TX recipients. The administration of a single dose of carbapenem reduced the incidence of infection by ESBL-producing bacteria and no case of KPC infection was identified in the studied sample[26].

A study that evaluated the epidemiology and risk factors for infections by Gram-negative microorganisms in kidney TX recipients (1,569) identified 81 (5.2%) patients with UTI, being *Eschirichia coli* (62.5%), *Klebsiella pneumoniae* (17%) *Acinetobacter baumanni* (10.2%), among others (10.3%), the main etiological agents identified. It is noteworthy that antimicrobial resistance was 86.6% and that all isolated microorganisms were resistant to the carbapenem Meropenen[27].

A recent study by our group described KPC infections in kidney transplant recipients and found that 62% of infections were observed in urine samples[23]. It is important to consider that UTI, especially in immunosuppressed patients, can progress to sepsis and is characterized as an important cause of morbidity, including loss of the transplanted organ. For this reason, bacterial resistance becomes an important challenge in clinical practice with this population.

A recent literature review on the global epidemiology of KPC showed that, in several studies, the mortality rate was similar to that found in the present study, ranging from 13 to 34% for groups that had early identification of bacteria and combined antimicrobial therapy[28]. It is noteworthy that, in Europe and the United States, the main cause of death of kidney TX recipients is related to cardiovascular events, while in Brazil, as in other developing countries, the main cause is infectious[29].

Therefore, it is necessary to elucidate the occurrence of infectious episodes in this population. in order to establish screening mechanisms for early diagnosis and intervention, minimizing morbidity and mortality related to infectious events in this population.

McNeil et al. evaluated the implementation of surveillance cultures for patients who were scheduled for kidney TX and demonstrated that patients colonized before TX had a higher morbidity when compared to non-colonized patients[9].

The routine surveillance culture protocol for prevalent bacteria for kidney transplant recipients is an important measure to improve the identification and isolation of carriers associated with other interventions with greater probability of success, including minimizing the use of invasive devices, shortening hospital stay, infectious surveillance, promoting antimicrobial administration, a standardized approach to active surveillance of at-risk populations, better compliance with hand hygiene, and protocols to discontinue carrier status[28,30-33].

Infections caused by multiple types of herpesviruses in patients with end-stage renal disease and transplant recipients have been constantly studied[34-35] and the impacts that cytomegalovirus infection can cause to patients undergoing kidney TX have already been established in the literature. These infections are related to a considerable occurrence of graft dysfunction and rejection[36-38], as observed in our study, suggesting also to consider this criterion for the stratification of infectious risk for this population.

Considering the high risk of infectious complications found in the patients in this study, previously colonized by multidrug-resistant microorganisms, and considering the fact that there are few reports of infection and colonization in this group of patients, as there are still few countries that carry out epidemiological surveillance, we warn of the need for more studies of this magnitude, since the dimension of colonization can only be obtained when there is an active search for carriers, as it is asymptomatic. Failure to identify and isolate colonized patients contributes to increased rates of nosocomial infection by MRSA and increased colonization by VRE and KPC.

These results, therefore, bring fundamental resources for health and nursing professionals in the better characterization of bacteria, transmission and resistance mechanisms and, mainly, instruments for the prevention and control of multidrug-resistant bacteria in patients colonized in conservative treatment before the beginning of highly complex procedures, such as dialysis and TX, in order to reduce morbidity and mortality, guiding the decision-making process of health teams and improving prevention and prognosis[23,29,32-34].

Study limitations

A limitation was the fact that it followed the participants for six months. This is justified because, after this period, most patients return to their health units and/or cities of origin to continue the outpatient follow-up, making follow-up in the study unfeasible. Another aspect to be highlighted is that, as this is information obtained from medical records, the records are not always clear and complete. For this reason, data collection, insertion and analysis were carried out and confirmed by two researchers, aiming at the reliability of results.

Contributions to nursing, health, and public health

This study significantly contributes to nursing, as it elucidates risk factors for infection by resistant microorganisms in kidney transplant recipients. These results can support the implementation of surveillance protocols for these microorganisms, in order to prevent the spread of these pathogens through compliance with HAI prevention measures, in addition to contributing to the implementation of care practices aimed at the risk factors raised, reducing morbidity and mortality related to infection in this population.

CONCLUSIONS

The results of this study showed colonization by resistant microorganisms in the sample of kidney transplant recipients studied and identified risk factors associated with such complication.

The main risk factors are systemic arterial hypertension associated with diabetes mellitus, dialysis time, post-TX hospitalization time, need for dialysis after the procedure (delayed renal function), post-TX hospitalization days, surgical site infection and UTI.

The importance of directing care and early intervention is emphasized, in order to minimize morbidity and mortality related to infectious causes in this population, especially for candidates for kidney TX who have the morbidity characteristics identified in this study.

FUNDING

We thank the Coordination for the Improvement of Higher Education Personnel (CAPES - *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*) and the São Paulo State Research Support Foundation (FAPESP - *Fundação de Amparo à Pesquisa do Estado de São Paulo)* for funding this study.

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