Revista Brasileira de Enfermagem
REBEn

Urinary tract infection in patients with chronic kidney disease under conservative treatment

Infecção do trato urinário em pacientes com doença renal crônica em tratamento conservador

Infección del tracto urinario en pacientes con enfermedad renal crónica en tratamiento conservador

Graciana Maria de Moraes Coutinho[I]
ORCID: 0000-0003-4022-2612

Emanuela Cardoso da Silva[I]
ORCID: 0000-0002-3246-1691

Cássia Regina Vancini Campanharo[I]
ORCID: 0000-0002-7688-2674

Angélica Gonçalves Silva Belasco[I]
ORCID: 0000-0002-0307-6225

Cassiane Dezoti da Fonseca[I]
ORCID: 0000-0002-2118-8562

Dulce Aparecida Barbosa[I]
ORCID: 0000-0002-9912-4446

[I]*Universidade Federal de São Paulo. São Paulo, São Paulo, Brazil.*

How to cite this article:
Coutinho GMM, Silva EC, Campanharo CRV, Belasco AGS, Fonseca CD, Barbosa DA. Urinary tract infection in patients with chronic kidney disease under conservative treatment. Rev Bras Enferm. 2022;75(3):e20210065. https://doi.org/10.1590/0034-7167-2021-0065

Corresponding author:
Graciana Maria de Moraes Coutinho
E-mail: graciana.maria@unifesp.br

Submission: 03-18-2021 **Approval:** 08-27-2021

ABSTRACT

Objectives: to assess the prevalence and associated risk factors for urinary tract infection in patients with chronic kidney disease under conservative treatment and identify the microorganisms isolated in the urine of these patients and the staging of chronic kidney disease. **Methods:** a cross-sectional, analytical study carried out at the Conservative Treatment Outpatient Clinic of a university hospital in the city of São Paulo. **Results:** the prevalence of urinary tract infection is 22%. The risk factors Diabetes Mellitus, hypertension, heart disease, neoplasms and thyroid and autoimmune diseases stand out in the infected group ($p < 0.001$). Most of the microorganisms found in urine cultures (87.9%) were Gram-negative, being Escherichia coli (50.70%), followed by Klebsiella pneumoniae (23.1%) and Enterococcus spp. (9.7%). **Conclusions:** the findings of this investigation reveal the intrinsic association between risk factors and microorganisms for the development of urinary tract infection.
Descriptors: Chronic Kidney Disease; Conservative Treatment; Urinary Tract; Bacteria; Urine.

RESUMO

Objetivos: avaliar a prevalência e os fatores de risco associados para infecção do trato urinário em pacientes com doença renal crônica em tratamento conservador e identificar os microrganismos isolados na urina desses pacientes e o estadiamento da doença renal crônica . **Métodos:** estudo transversal, analítico, realizado no Ambulatório de Tratamento Conservador de um hospital universitário da cidade de São Paulo. **Resultados:** a prevalência de infecção do trato urinário é de 22%. Destacam-se no grupo com infecção os fatores de risco *Diabetes Mellitus*, hipertensão arterial sistêmica, doença cardíaca, neoplasias e doenças da tireoide e autoimunes ($p<0,001$). Em sua maioria (87,9%), os microrganismos encontrados nas uroculturas foram Gram-negativos, sendo *Escherichia coli* (50,70%), seguida de *Klebsiella pneumoniae* (23,1%) e *Enterococcus* spp. (9,7%). **Conclusões:** os achados desta investigação revelam a intrínseca associação entre os fatores de risco e os microrganismos para o desenvolvimento da infecção do trato urinário.
Descritores: Doença Renal Crônica; Tratamento Conservador; Trato Urinário; Bactéria; Urina.

RESUMEN

Objetivos: evaluar la prevalencia y los factores de riesgo asociados de infección del tracto urinario en pacientes con enfermedad renal crónica en tratamiento conservador e identificar los microorganismos aislados en la orina de estos pacientes y la estadificación de la enfermedad renal crónica. **Métodos:** estudio transversal, analítico, realizado en el Ambulatorio de Tratamiento Conservador de un hospital universitario de la ciudad de São Paulo. **Resultados:** la prevalencia de infección del tracto urinario es del 22%. Los factores de riesgo de diabetes mellitus, hipertensión arterial sistémica, cardiopatías, neoplasias y enfermedades tiroideas y autoinmunes destacan en el grupo con infección ($p <0,001$). La mayoría de los microorganismos encontrados en los urocultivos (87,9%) fueron Gram negativos, siendo Escherichia coli (50,70%), seguida de Klebsiella pneumoniae (23,1%) y Enterococcus spp. (9,7%). **Conclusiones:** los hallazgos de esta investigación revelan la asociación intrínseca entre factores de riesgo y microorganismos para el desarrollo de infección del tracto urinario.
Descriptores: Lesión Renal; Tratamiento Conservador; Sistema Urinario; Bacterias; Orina.

INTRODUCTION

Nowadays, there is an increase in the life expectancy of the world population, with an increase in the prevalence and incidence of chronic diseases, such as hypertension (HP) and Diabetes Mellitus (DM), which are the main causes of chronic kidney disease (CKD), especially in the elderly[1].

Chronic non-communicable diseases are responsible for about 60% of the causes of death worldwide, affecting about 35 million people a year. Cardiovascular disease (CVD) has the greatest epidemiological impact, accounting for about 30% of all deaths worldwide. CVD has progressively increased, due to the accumulation of traditional risk factors, such as HP and DM, as well as aging and increased life expectancy, resulting from the demographic transition observed in recent decades. HP, DM and CVD are strongly related to the loss of kidney function, which can lead to end-stage renal disease[2-3].

CKD is defined as the presence of structural or functional abnormalities of the kidneys for more than three months, with health implications. According to the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines, CKD should be classified according to its cause and category of glomerular filtration rate (GFR) and albuminuria, which are factors that enable the identification of the risk of adverse outcomes, such as progressive CKD, end-stage renal disease, acute kidney injury, all-cause mortality and cardiovascular mortality.

The GFR can be estimated from the serum creatinine dosage, associated with other parameters such as age, sex, race and body size[4].

CKD treatment varies according to patients' underlying disease, the stage of the disease, the speed of decrease in the GFR, the complications and comorbidities, particularly cardiovascular ones. The progression of CKD can be delayed in the stages prior to the terminal phase. This pre- or non-dialysis treatment is known as conservative. With it, through nutritional intervention and strict control of blood pressure and blood glucose, when performed by a multidisciplinary team, there is improvement in clinical parameters and, consequently, renal replacement therapy (RRT) is postponed and the survival of chronic renal individuals is increased. However, when it progresses to more advanced stages, passing to terminal CKD, RRT is necessary, which replaces renal function through hemodialysis, peritoneal dialysis or renal transplantation[5].

Expressive loss of renal function can cause uremic syndrome, which affects practically all organs and systems. Uremia involves more than just a failure of renal excretion, compromising several metabolic and endocrine functions performed by the kidneys. Chronic renal patients, uremic or not, are considered immunocompromised, and the infection is an important cause of death in patients with CKD, in whom the cellular immune function is depressed[6]. Furthermore, CKD is a risk factor for the decrease in vitamin D levels, which also favors the appearance of infectious diseases[7].

CKD is an important risk factor for the development of healthcare-associated infections (HAI), which are associated with high rates of mortality and morbidity, with urinary tract infections (UTIs) and pneumonia being the ones with the highest incidence in patients with CKD. Worldwide, annually, UTIs affect 150 million people, accounting for 34,343 admissions to Intensive Care Units. In Brazil, UTIs are among the most common infections, accounting for a large part of care in primary care and emergency services[8-9].

Among the risk factors for the development of UTI are female gender, admission to intensive care, sexual activity, use of barrier contraceptives, vaginal infection, trauma and manipulation, DM, obesity, genetic susceptibility and anatomical abnormalities. UTIs are characterized by conditions ranging from the asymptomatic presence of bacteria in the urine to severe kidney infection, which can result in sepsis, and can be of hospital origin or acquired in the community[10].

Bacteria responsible for UTI can be Gram-positive or Gram-negative, the latter being the ones with the highest incidence. *Escherichia coli* is the microorganism causing most infections in all situations and age groups, accounting for 74.4% of UTIs in outpatients and 47% of infections in hospitalized patients. In addition to *E. coli*, they cause UTI, in variable frequency: Gram-negative *Klebsiella spp.*, *Pseudomonas aeruginosa*, *Proteus spp.*, *Streptococcus agalactiae* and *Staphylococcus saprophyticus*[11]. Considering that the progression of CKD may be directly related to recurrent infectious focus, studies that address UTIs and the identification of risk factors for impaired renal function are necessary for management and care of the population undergoing conservative treatment for CKD[12].

OBJECTIVES

To assess the prevalence and associated risk factors for UTI in patients with CKD under conservative treatment and identify the microorganisms isolated in the urine of these patients and the staging of CKD.

METHODS

Ethical aspects

This study was previously approved by the Institutional Review Board of the *Universidade Federal de São Paulo*, in compliance with standard 466 of the Brazilian National Health Council (*Conselho Nacional de Saúde*)[13].

Study design, period, and place

This is an epidemiological study, with a cross-sectional, analytical design, guided by the checklist of the STrengthening the Reporting of Observational Studies in Epidemiology (STROBE)[14]. It was carried out between February 2017 and March 2020.

This study was carried out at the Conservative Treatment Outpatient Clinic of the *Hospital do Rim e Hipertensão*, *Fundação Oswaldo Ramos*, São Paulo, Brazil. It is an institution that is a world reference in interprofessional care, teaching and research aimed at patients undergoing conservative and dialysis treatment and in the pre- and post-transplant periods. This study was carried out at the Conservative Treatment Outpatient Clinic, which predominantly assists adults and elderly (mostly aged 50 or over), male, whose main causes are CKD, HP and DM. Regarding the staging of CKD, most patients seen are in stages 3, 4 and 5 of CKD, and due to the high demand and demand for the service, patients in stages 1 and 2 are advised to seek the primary health network[7].

Patients referred for conservative outpatient treatment have tests that can make specialist assessment doubtful, who considers the results of tests performed within a period of up to three

months; for safety, new tests are requested to confirm or update these results, where patients waited a period of one week up to 36 months of waiting. Many of those who, in fact, should have already started treatment are still in the diagnostic confirmation phase[15].

Population and sample

To compose the sample of this study, the records of urine cultures collected from February 2010 to February 2018 were searched, totaling 1,555 exams, and, of these, 343 had a positive result for some microorganism. Considering a confidence level of 95%, margin of error of 5%, the first positive urine culture of each patient and excluding duplicate results, the infected group (GI) was composed of 134 individuals and the non-infected group (NIG) for 81, totaling 215 individuals.

The selected participants were submitted to the following inclusion criteria: medical records of patients treated at the Conservative Treatment Outpatient Clinic with prevalence of stages 3b, 4 and 5 of CKD and people aged ≥ 18 years who had a urine culture collected in the period from February 2010 to February 2018. Participants whose medical records were not found during data collection were excluded from the sample.

Study protocol

For data collection, we used a structured instrument composed of sociodemographic (age, sex, race, education and origin) and clinical variables (presence of DM, SAH, heart disease; patients with cancer, thyroid and autoimmune diseases; clearance of creatinine and CKD staging and classification), in cases of positive urine culture (type of microorganism and antibiogram), in addition to the infection outcome (stay in the Conservative Treatment Outpatient Clinic, death and dialysis). The outcome variable considered in both groups was the presence or absence of infection and risk factors[16].

The presence of microorganisms in the urine was considered an episode of urinary tract infection. Thus, UTI episodes were identified considering the current recommendations regarding HAIs used in Brazil. Confirmation of the infection episode was performed by recording physicians' clinical assessment and diagnosis in the medical record and the result of the first positive urine culture for any microorganism[17].

Analysis of results, and statistics

For statistical analysis, the chi-square test was performed to compare categorical variables between IG and NIG, and the Mann-Whitney test for continuous variables. To verify the risk factors between IG and NIG, the logistic regression model was used and, after this analysis, multiple regression was performed. Through the forward method, the factors that best explained the occurrence of infection were selected. For all analyses, a significance level of 5% was used (p-value ≤ 0.05).

RESULTS

A total of 215 participants were analyzed, 134 participants with positive urine culture and 81 with negative urine culture, being allocated to IG and NIG. The main risk factors in GI are DM, HP, heart disease, neoplasms and thyroid and autoimmune diseases (p< 0.001). Additionally, *E. coli* (50.7%), *Klebsiella pneumoniae* (23.1%) and *Enterococcus spp.* (9.7%) were observed as frequent microorganisms. The outcomes of patients who had UTI. Most of them (76.1%) remained in conservative outpatient treatment.

Regarding the IG's sociodemographic characteristics, the mean age was 72.4 (±14.2) years. The majority were female (69.4%), white (63.6%), with elementary education (82.4%) and from São Paulo (61.1%). In the NIG, the mean age was 53.3 (±16.3); most were male (45.2%), white (36.4%), with high school (70%) and from São Paulo (38.9%). Regarding comorbidities, in the IG, most patients had HP (67.6%), DM (71.4%) or other comorbidities (85.2%). The mean Body Mass Index (BMI) of 28.2 (±5.4) was also observed. In the GSI, most patients had HP (32.4%), with a mean BMI of 23.9 (3.85) (Table 1).

Table 2 presents multiple logistic regression analysis to verify which variables best explain the occurrence or not of UTI in people with CKD undergoing conservative treatment.

Table 3 shows the microorganisms found in urine culture of IG participants and the sensitivity profile. The most frequent were *E. coli* (50.7%), *K. pneumoniae* (23.1%) and *Enterococcus* spp. (9.7%), being *E. coli* and *K. pneumoniae*, mostly resistant.

Table 4 presents the occurrence of UTI according to staging/glomerular filtration rate in patients with CKD under conservative treatment. In this sample, UTI was more frequent in patients at stage 4 (37.4%), followed by CKD 5 (32%).

Table 1 - Sociodemographic data and comorbidities of groups with and without urinary tract infection in people with chronic kidney disease undergoing conservative treatment, São Paulo, São Paulo, Brazil, 2020

Variables	IG	NIG	Total	*p* value
Age	72.4 ± 14.2	53.3 ± 16.3	65.2 ± 17.6	**<0.0001***
Sex				
Male	57 (54.8)	47 (45.2)	104	0.0277†
Female	77 (69.4)	34 (30.6)	111	
Race				
White	96 (63.6)	55 (36.4)	151	0.5611
Non-white	38 (59.4)	26 (40.6)	64	
Education				
Without elementary school	13 (48.1)	14 (51.9)	27	**<0.0001**†
Elementary school	103 (82.4)	22 (17.6)	125	
High school	12 (30)	28 (70)	40	
Higher education	6 (26.1)	17 (73.9)	23	

To be continued

Table 1 (concluded)

Variables	IG	NIG	Total	*p* value
Patient's origin				
São Paulo	110 (61.1)	70 (38.9)	180	0.4046
Others	24 (68.6)	11 (31.4)	35	
Diabetes Mellitus				
Yes	65 (71.4)	26 (28.6)	91	0.0183*
No	69 (55.6)	55 (44.4)	124	
Hypertension				
Yes	123 (67.6)	59 (32.4)	182	0.0002*
No	11 (33.3)	22 (66.7)	33	
Heart disease				
Yes	36 (75)	12 (25)	48	0.0398*
No	98 (58.7)	69 (41.3)	167	
Neoplasms, thyroid and autoimmune diseases				
Yes	127 (85.2)	22 (14.8)	149	**<0.0001***
No	7 (10.6)	59 (89.4)	66	
Body Mass Index	28.2 ± 5.4	23.9 ± 3.8	26.6 ± 5.3	**<0.0001†**
Total patients	134	81	215	

*Results expressed as mean ± standard deviation or n (%); *Chi-square test; †Mann-Whitney test; IG - infected group; NIG - non-infected group; non-white - black and brown.*

Table 2 - Multiple logistic regression model for risk factors for presence or absence of urinary tract infection in people with chronic kidney disease undergoing conservative treatment, São Paulo, São Paulo, Brazil, 2020

Risk factors	Estimate	value *p*	OR	95%CI
Constant	2.71	0.2212		
Age	0.08	0.0063*	1.08	1.02-1.15
DM, yes versus no	0.69	0.0191*	1.99	1.12-3.55
HP, yes versus no	1.43	0.0004*	4.17	1.9-9.16
Heart disease, yes versus no	0.75	0.0425*	2.11	1.03-4.35
Neoplasms, thyroid and autoimmune diseases yes versus no	3.88	<0.0001*	48.66	19.69-120.26
Weight	0.02	0.0521	1.02	0.9998-1.04
BMI	0.20	<0.0001*	1.23	1.14-1.32

*OR - Odds Ratio; 95%CI - 95% confidence interval; DM - Diabetes Mellitus; HP - hypertension; BMI - Body Mass Index; *p<0.05.*

Table 3 - Microorganisms identified in urine culture performed in people with chronic kidney disease undergoing infection, São Paulo, São Paulo, Brazil, 2020

Microorganism	Total	Sensitivity profile MR	S
Gram-positive			
Staphylococcus aureus	2 (1.5)	-	2 (100)
Enterococcus spp.	13 (9.7)	4 (30.8)	9 (69.2)
Coagulase-negative *Staphylococcus*	1 (0.7)	-	1 (100)
Gram-negative			
Citrobacter spp.	1 (0.7)	1 (100)	-
Enterobacter spp.	6 (4.5)	6 (100)	-
Escherichia coli	68 (50.7)	36 (52.9)	32 (47.1)
Pseudomonas aeruginosa	6 (4.5)	2 (33.3)	4 (66.7)
Proteus mirabilis	3 (2.2)	2 (66.7)	1 (33.3)
Morganella morganii	2 (1.5)	2 (100)	-
Klebsiella pneumoniae	31 (23.1)	22 (70)	9 (30)
Klebsiella oxytoca	1 (0.7)	-	1 (100)

Results expressed as n (%); MR - antimicrobial-resistant microorganism; S- antimicrobial-sensitive microorganism..

Table 4 - Occurrence of urinary tract infection in patients with chronic kidney disease undergoing conservative treatment according to disease staging and glomerular filtration rate, São Paulo, São Paulo, Brazil, 2020

Stage	Glomerular filtration rate	Urinary tract infection
Stage 1	≥90 mL/minute	1 (0.75)
Stage 2	60-89 mL/minute	1 (0.75)
Stage 3a	45-59 mL/minute	8 (6)
Stage 3b	30-44 mL/minute	31 (23.1)
Stage 4	15-29 mL/minute	50 (37.4)
Stage 5	<15 mL/minute	43 (32)
Total		134 (100)

Results expressed as n (%).

DISCUSSION

Kidney disease is a global public health problem, affecting more than 750 million people worldwide. The impact of kidney disease varies substantially worldwide, as does its detection and treatment, due to limited or inconsistent data collection and surveillance practices[18]. UTIs are one of the main problems in patients with CKD, both in conservative treatment and in RRT, directly influencing morbidity and mortality rates[19].

Infection is a clinical condition caused by pathological microorganisms that, as a result of the pathophysiology of CKD, can have a negative impact on the health status of this population, contributing to the increase in morbidity and mortality[16].

CKD is prevalent in the general adult population. In the United States, it is estimated to be present in 13.1% of adults. In Brazil, data are uncertain, but population studies estimate that 3 to 6 million people have CKD[20-21].

The world population has been growing rapidly in recent years. In the next two decades, it is estimated that the number of elderly people will exceed 30 million people, which will correspond to 13% of the world population. The increase in the number of elderly people is accompanied by an increase in chronic diseases, including HP and DM, the main risk factors for CKD, which explains the age profile found in this study, corroborating the majority of the population of chronic kidney patients[22-23].

Women are often more susceptible to UTI because of their anatomy. The existence of a wetter environment also predisposes to the growth of microorganisms, as well as old age and local climacteric changes.

In this study, female patients were 1.87 times more likely to have UTI when compared to male patients, which can be explained by the presence of comorbidities and low immunity in this population[10,24].

In IG patients, elementary school was the most prevalent in relation to high school and higher education. For those who attended elementary school, 10.92 times more likely to have a UTI were shown, compared to those with secondary education, and 13.26 times more likely, when compared to those with higher education. This data highlights the negative impact that lower levels of education have on health[25].

In this investigation, it was observed that the main risk factors for UTI in chronic kidney patients under conservative treatment were HP, DM, heart disease, neoplasms and thyroid and autoimmune diseases. In this context, several studies have linked these comorbidities with decreased renal function. HP is considered the primary cause of the development of CKD, being characterized by structural changes in the renal parenchyma, with repercussions on renal hemodynamics. It is associated with a lifestyle based on a diet high in fat, salt and carbohydrates. Additionally, DM can be configured as an adjunct to HP, potentiating kidney damage and accelerating the progression of CKD. Diabetic nephropathy is therefore the clinical condition found in most chronic kidney patients. Some studies have revealed that chronic hyperglycemia is significant for the development of fibrosis in the glomerular basement membrane and, consequently, for the decrease in the glomerular filtration rate[2-3,5,26].

According to the US annual report of renal system data, older age, DM, HP, CVD and higher BMI are associated with CKD[27]. In developing countries, the prevalence and incidence rates are lower, a fact that can be explained by underreporting and the delay in diagnosis. Moreover, racial and environmental aspects can influence the number of cases[28].

A study carried out in Brazil in 2014, with the objective of verifying the prevalence of CKD and the factors associated with it in 1,016 elderly people, showed that age, DM, metabolic syndrome, inadequate self-assessment of health, HP and obesity were associated with CKD[29].

When the presence of UTI was associated with comorbidities, in this study, hypertensive individuals were 4.17 times more likely to have UTI than non-hypertensive individuals, diabetics, 1.99 times more likely compared to non-diabetics and those with disease heart disease, 2.11 times more likely than those without heart disease.

Patients with other antecedents, such as neoplasms and thyroid and autoimmune diseases, had 48.66 times more chances of UTI in this study compared to those without other antecedents.

The pathophysiology of HP, DM, heart disease, some neoplasms and autoimmune diseases may involve cellular mechanisms for the release of inflammatory and oxidative substances that contribute to immunomodulation imbalance, resulting in systemic susceptibility to infection. In this sense, chronic kidney patients under conservative treatment have these conditions exacerbated in favor of overlapping of these comorbidities[30]. Thus, the data presented in this investigation showed that the UTI was significant and that the microorganisms highlighted as the most opportunistic were prevalent and triggered unpleasant systemic repercussions.

Similar to the data demonstrated in this investigation, Beraldo-Massoli et al. revealed that the most common microorganisms found in UTI were enteric Gram-negative, especially *E. coli*, followed by *Klebsiella*, *Proteus* and *Pseudomonas*[31]. In a study carried out by D'Addazio and Moraes, the predominant bacteria were *Escherichia coli*, *Klebsiella*, *Proteus*, *Pseudomonas* and *Citrobacter*[32].

E. coli is predominant in urinary infections in patients with CKD, as it is associated with azotemia, urinary flow and decreased urinary concentration. It is prevalent in UTIs, in patients with CKD, affecting women over 65 years, with 41% resistance to ciprofloxacin and more severe in the presence of comorbidities[33].

Carbapenemase-producing *K. pneumoniae* (CPK) stands out as an important microorganism in HAI. It has great dissemination capacity and limited therapeutic options. The microorganisms found in this study are consistent with those mentioned in the literature, as they stand out as cause of infection in the community[34].

Outpatients have also shown resistance to antimicrobials, as evidenced in this study in outpatients under conservative treatment[11]. The resistance presented by microorganisms, both in the community and in the hospital environment, is a serious issue, which can lead the patient to sepsis and even death and, thus, cause irreparable damage to patients and their family[10].

In this study, most participants were classified in stages 3, 4 and 5 of CKD, i.e., with moderate to severe decline in renal function or end-stage CKD. The diagnosis was made through serum creatinine dosage and, after calculation of creatinine clearance by Cockcroft-Gault, patients were identified in the staging[30].

CKD has an important impact on the morbidity and mortality of patients, and conservative treatment is essential to delay the progression of renal dysfunction and reduce the occurrence of complications[35]. UTI can contribute to the progression of kidney disease and loss of function. In this study, patients remained in outpatient conservative treatment, need for RRT and death in IG. This scenario can impact patients' quality of life. CKD prevention, treatment and control is a challenge for the State and health institutions[36].

In the study carried out by Oliveira et al., it was identified that there is a compromise in the quality of life of patients with CKD, in the physical and emotional domains. Higher hospitalization rates lead to worse quality of life[37].

In summary, the present study glimpsed the main risk factors for UTI and the most frequent microorganisms as well as the staging of CKD in chronic renal patients undergoing conservative treatment.

Study limitations

This study had as limitations the fact that it was carried out in a single center, which may not reflect the reality of other locations. Data were obtained from medical records, often making it difficult to obtain the information. The sample of the non-infected group is small and may not reflect the characteristics of the entire population with CKD. However, the study was carried out in a world reference service for the care of patients with CKD under conservative treatment.

Contributions to nursing

The present study contributes to a multidisciplinary clinical practice, aiming to control modifiable risk factors causing HAI, propose the creation of CKD progression monitoring protocols, and institute educational hygiene actions in the elderly for UTI prevention as a role for nurses working in the Conservative Treatment Outpatient Clinic.

Given these findings, more research is needed in the outpatient setting, especially with patients under conservative treatment.

CONCLUSIONS

The present investigation demonstrated UTI in chronic kidney patients under conservative treatment associated with risk factors of advanced age, DM, HP, heart disease, BMI and the presence of other antecedents (neoplasms of different systems, thyroid diseases and autoimmune diseases). Most patients in this study population were in stages 3, 4 and 5 of CKD and UTI was more frequent in patients in stages 4 and 5, and the main microorganisms found in urine cultures were *E. coli* and *K. pneumoniae* with high resistance profile.

REFERENCES

1. Aguiar LK, Prado RR, Gazzinelli A, Malta DC. Factors associated with chronic kidney disease: epidemiological survey of the national health survey. Rev Bras Epidemiol. 2020;23:e200044. https://doi.org/10.1590/1980-549720200044
2. Ministério da Saúde (BR). Diretrizes clínicas para o cuidado ao paciente com doença renal crônica - DRC no Sistema Único de Saúde [Internet]. Brasília, DF: MS; 2014[cited 2021 Feb 8]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/diretrizes_clinicas_cuidado_paciente_renal.pdf
3. Bastos MG, Kirsztajn GM. Chronic kidney disease: importance of early diagnosis, immediate referral and structured interdisciplinary approach to improve outcomes in patients not yet on dialysis. J Bras Nefrol. 2011;33(1):93-8. https://doi.org/10.1590/S0101-28002011000100013
4. International Society of Nephrology. KDIGO 2012 Clinical practice guideline for the evaluation and. management of chronic kidney disease. Kidney Int Suppl [Internet]. 2013 [cited 2021 Feb 9];3:1-150. Available from: https://kdigo.org/wp-content/uploads/2017/02/KDIGO_2012_CKD_GL.pdf
5. National Institute for Health and Care Excellence. Chronic kidney disease in adults: assessment and management [Internet]. [London]: NICE; 2014[cited 2021 Feb 9]. Available from: https://www.nice.org.uk/guidance/cg182
6. Mendonça CM, Pereira WAGS, Lenzi RV. Influência econômica na qualidade de vida dos pacientes portadores de doença renal crônica no centro de hemodiálise de Cacoal. Rev Eletron FACIMEDIT [Internet]. 2017[cited 2021 Feb 9];6(1):53-64. Available from: https://pt.calameo.com/read/005900127b992e90ba94c
7. Silva EC, Taminato M, Fonseca CD, Moraes GM, Longo MC, Grothe CE, et al. Use of vitamin D and infection in patients with chronic kidney disease. Rev Bras Enferm. 2018;71(suppl 6):2957-64. http://doi.org/10.1590/0034-7167-2018-0640
8. Waller TA, Pantin SAL, Yenior AL, Pujalte GGA. Urinary tract infection antibiotic resistance in the United States. Prim Care. 2018;45(3):455-66. http://doi.org/10.1016/j.pop.2018.05.005
9. Guerra Júnior GES, Guerra KDOS, Crisóstomo CM, Veloso DA, D'Angelis CEM. Infecções do trato urinário: frequência e etiologia em pacientes não hospitalizados. Rev Unimontes Cient [Internet]. 2020[cited 2021 Feb 8];20(1):112-26. Available from: http://www.ruc.unimontes.br/index.php/unicientifica/article/view/725
10. Foxman B. Urinary tract infection syndromes: occurrence, recurrence, bacteriology, risk factors, and disease burden. Infect Dis Clin North Am. 2014;28(1):1-13. http://doi.org/10.1016/j.idc.2013.09.003
11. Dias IO, Coelho AD, Dorigon I. Infecção do trato urinário em pacientes ambulatoriais: prevalência e perfil de sensibilidade frente aos antimicrobianos no período de 2009 a 2012. Saúde (Santa Maria). 2015;41(1):209-18. http:// doi.org/10.5902/2236583415455
12. Luciano EP, Luconi PS, Sesso RC, Melaragno CS, Abreu PF, Reis SFS, et al. Prospective study of 2151 patients with chronic kidney disease under conservative treatment with multidisciplinary care in the Vale do Paraíba, SP. Braz J Nephrol. 2012;34(3):226-34. https://doi.org/10.5935/0101-2800.20120003
13. Ministério da Saúde (BR). Resolução nº 466, de 12 de dezembro de 2012 [Internet]. Brasília, DF: MS; 2012[cited 2021 Feb 8]. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/cns/2013/res0466_12_12_2012.html
14. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61(4):344-9. https://doi.org/10.1016/j.jclinepi.2007.11.008
15. Padovani CSS, Schor N, Laranja SMR. Assessment of epidemiological profile of patients and their difficulties for the first query in the screening ambulatory of nephrology UNIFESP-EPM. Braz J Nephrol. 2012;34(4):317-22. https://doi.org/10.5935/0101-2800.20120019
16. Draibe AS, organizador. Panorama da doença renal crônica no Brasil e no mundo [Internet]. São Luís (MA): UFMA; 2014[cited 2021 Feb 8]. Available from: https://ares.unasus.gov.br/acervo/handle/ARES/2028?show=full
17. Agência Nacional de Vigilância Sanitária. Indicadores nacionais de infecções relacionadas à assistência à saúde [Internet]. Brasília, DF: Anvisa; 2010[cited 2021 Feb 8]. Available from: http://www.cenapro.com.br/images/documentos/INDICADORESNACIONAISDEINFECONOVO.pdf
18. Bikbov B, Perico N, Remuzzi G. Disparities in chronic kidney disease prevalence among males and females in 195 countries: analysis of the global burden of disease 2016 study. Nephron. 2018;139(4):313-8. https://doi.org/10.1159/000489897
19. Roso CC, Beuter M, Bruinsma JL, Silva JH, Timm AM, Pauletto MR. Aspectos clínicos das pessoas com insuficiência renal crônica em tratamento conservador. Rev Rene [Internet]. 2013[cited 2021 Feb 8];14(6):1201-8. Available from: https://www.redalyc.org/pdf/3240/324029419017.pdf

20. Marinho AW, Penha AP, Silva MT, Galvão TF. Prevalência de doença renal crônica em adultos no Brasil: revisão sistemática da literatura. Cad Saude Colet. 2017;25(3):379-88. https://doi.org/10.1590/1414-462x201700030134

21. Bello AK, Levin A, Tonelli M, Okpechi IG, Feehally J, Harris D, et al. Assessment of global kidney health care status. JAMA. 2017;317(18):1864-81. https://doi.org/10.1001/jama.2017.4046

22. Sesso RC, Lopes AA, Thomé FS, Lugon JR, Martins CT. Brazilian chronic dialysis census 2014. Braz J Nephol. 2016;38(1):54-61. https://doi.org/10.5935/0101-2800.20160009

23. Negretti CD, Mesquita PGM, Baracho NCV. Perfil epidemiológico de pacientes renais crônicos em tratamento conservador em um hospital escola do sul de Minas. Rev Cienc Saude. 2014;4(4):49-60. https://doi.org/10.21876/rcsfmit.v4i4.268

24. Masajtis-Zagajewska A, Nowicki M. New markers of urinary tract infection. Clin Chim Acta. 2017;471:286-91. https://doi.org/10.1016/j.cca.2017.06.003

25. Oscalices MIL, Okuno MFP, Lopes MCBT, Batista REA, Campanharo CRV. Health literacy and adherence to treatment of patients with heart failure. Rev Esc Enferm USP. 2019;53:e03447. http://doi.org/10.1590/S1980-220X2017039803447

26. Kovesdy CP, Furth SL, Zoccali C. Obesity and kidney disease: hidden consequences of the epidemic [Editorial]. Braz J Nephrol. 2017;39(1):1-10. https://doi.org/10.5935/0101-2800.20170001

27. Collins AJ, Foley RN, Gilbertson DT, Chen S-C. United States renal data system public health surveillance of chronic kidney disease and end-stage renal disease. Kidney Int Suppl. 2015;5:2-7. https://doi.org/10.1038/kisup.2015.2

28. Sesso RC, Lopes AA, Thomé FS, Lugon JR, Martins CT. Brazilian chronic dialysis survey 2016. Braz J Nephrol. 2017;39(3):261-6. http://doi.org/10.5935/0101-2800.20170049

29. Amaral TLM, Amaral CA, Vasconcellos MTL, Monteiro GTR. Prevalence and factors associated to chronic kidney disease in older adults. Rev Saude Publica. 2019;53:44. https://doi.org/10.11606/S1518-8787.2019053000727

30. Malta DC, Machado ÍE, Pereira CA, Figueiredo AW, Aguiar LK, Almeida WS, et al. Evaluation of renal function in the Brazilian adult population, according to laboratory criteria from the national health survey. Rev Bras Epidemiol. 2019;22(suppl 2):E190010.SUPL.2. https://doi.org/10.1590/1980-549720190010.supl.2

31. Beraldo-Massoli MC, Nardi CPP, Makino LC, Schocken-Iturrino RP. Prevalência de infecções urinárias em pacientes atendidos pelo sistema único de saúde e sua suscetibilidade aos antimicrobianos. Medicina (Ribeirao Preto). 2012;45(3):318-21. https://doi.org/10.11606/issn.2176-7262.v45i3p318-321

32. D'Addazio LB, Moraes SR. Microrganismos isolados de infecção do trato urinário da comunidade. Rev Saude. 2015;6(1):11-3. https://doi.org/10.21727/rs.v6i1.42

33. Ionete OM, Avrămescu C, Bălăşoiu M, Popescu FD, Rosu L, Zlatian O. Susceptibility to ciprofloxacin of Escherichia colistrains isolated from patients with chronic kidney disease. BMC Infect Dis. 2014;14(suppl 7):P67. https://doi.org/10.1186/1471-2334-14-S7-P67

34. Munoz-Price LS, Hayden MK, Lolans K, Won S, Calvert K, Lin M, et al. Successful control of an outbreak of Klebsiella pneumoniae carbapenemase-producing K. pneumoniae at a long-term acute care hospital. Infect Control Hosp Epidemiol. 2010;31(4):341-7. https://doi.org/10.1086/651097

35. Rocha IA, Silva FVC, Campos TS, Marta CB, Lima RA. The caring costs for patients bearing chronic kidney disease (CKD), in a non-dialytic phase of a university hospital. Rev Pesqui Cuid Fundam. 2018;10(3):647-55. http://doi.org/10.9789/2175-5361.2018.v10i3.647-55

36. Castro MC. Conservative management for patients with chronic kidney disease refusing dialysis]. Braz J Nephrol. 2019;41(1):95-102. http://doi.org/10.1590/2175-8239-jbn-2018-0028

37. Oliveira APB, Schmidt DB, Amatneeks TM, Santos JC, Cavallet LHR, Michel RB. Quality of life in hemodialysis patients and the relationship with mortality, hospitalizations and poor treatment adherence. Braz J Nephrol. 2016;38(4):411-20. http://doi.org/10.5935/0101-2800.20160066