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Prevalence of uropathogens and antimicrobial susceptibility profile in outpatient from Jataí-GO

Prevalência de uropatógenos e perfil de sensibilidade aos antimicrobianos em pacientes ambulatoriais de Jataí-GO

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ABSTRACT

Introduction: Urinary tract infections (UTIs) affect people worldwide. *Escherichia coli* is the main agent of UTI, however the etiology may vary according to the age and sex of the patient. Regional variations in the prevalence and antimicrobial resistance should be considered for therapy choice. **Objectives:** This study aimed to conduct a survey on the main agents of UTI, and assess the resistance of these microorganisms, during the period of March 2010 to June 2012 in the city of Jataí-GO. **Method:** A retrospective cross-sectional study were performed, collecting data on the prevalence of uropathogens and their sensitivity profiles which were evaluated by disk diffusion method. **Results:** During this period, 2,181 urine cultures were evaluated, of which 510 (23.4%) were positive, predominantly female (81.4%) and aged between 21 and 64 years old (59.7%). The most frequently isolated microorganism was *E. coli* (61%), followed by *Staphylococcus saprophyticus* (9.4%), and *Proteus* (9.4%). The prevalence of these bacteria according to the patient sex has suffered a statistically significant change ($p < 0.05$). It was possible to detect high resistance rate of *E. coli* to some antibiotics of choice for UTI treatment, such as ampicillin (57.9 %), pipemidic acid (50.5 %), nalidixic acid (48.6 %), and trimethoprim-sulfamethoxazole (44.8%). **Conclusion:** These data demonstrate the need to know the reality of each region in order to establish an appropriate empirical therapy, when it is not possible to perform culture and antimicrobial susceptibility testing.

Key words: urinary tract infection; *Escherichia coli*; antimicrobial resistance.

INTRODUCTION

Urinary tract infection (UTI) ranks second in incidence of bacterial disease, second only to respiratory tract infections[12, 25]. UTI is defined as an invasion and multiplication of microorganisms in tissue within the urinary tract from the urethra to the kidney. Pathogens can reach the urinary tract in three pathways: ascending, hematogenous, or lymphatic[20]. These may results in bacteriuria, cystitis, pyelonephritis, or even acute urethral syndrome[21]. They affect individuals at any age, but the groups most affected are male newborns, preschoolers girls, sexually active young woman, men with prostatic obstruction, and elderly[5].

UTIs are, usually, caused by Gram-negative aerobic bacteria, present in the intestinal flora. In acute symptomatic urinary tract infections, *Escherichia coli* is prevalent, whereas a higher incidence of other enterobacteria with high prevalence of infections caused by *Klebsiella sp.*, *Proteus sp.*, *Pseudomonas sp.*, *Enterobacter sp.*, and Gram-positive from genera *Enterococcus sp.,* and *Staphylococcus sp.*, is observed in chronic infections, or acquired in hospital environment, or related to structural abnormalities of the urinary tract[10, 21, 23].

The occurrence of pathogens causing UTI varies geographically, and susceptibility profile requires monitoring in order to provide information for therapeutic orientation, especially

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regarding the empirical antimicrobial therapy. The increase in bacterial resistance to antimicrobial drugs is evident and brings difficulties in controlling urinary tract infections[8, 14, 24].

Most of studies on isolation and identification of multi-resistant bacterial strains is focused on hospitalized patients; however, it is believed that resistant microorganisms can be isolated from individuals in community, due to indiscriminate use of antimicrobials[24]. The empirical treatment of UTI is a routine that should be based on regional epidemiologic data, in order to be familiar with the main pathogens and their antimicrobial susceptibility profile. The Infectious Diseases Society of America recommends that therapeutic practice must be based on local epidemiologic data, as a way to periodically reevaluate the empirical therapies employed in that community, as well as to detect possible changes in the susceptibility profile[16, 28]. Thus, this study aims to help doctors in southwest Goiás, and also provide information that may contribute to the knowledge of UTIs in the country.

OBJECTIVES

This study aimed to describe the pathogens causing urinary tract infection in outpatients of clinical analysis laboratory at Jataí, in the state of Goiás, and analyze the antimicrobial susceptibility profile of the bacterial species.

METHOD

This is a retrospective cross-sectional study. The study was performed by collecting data in records of microbiological cultures and susceptibility tests on three clinical analysis laboratories, in Jataí, state of Goiás. Data on urine cultures performed from March 2010 to June 2012 were analyzed. Authorize access to records was warranted by technical experts of the laboratories, and the Project was approved by Research Ethics Committee-Universidade Federal de Goiás (UFG) (protocol 238/11).

Urine cultures were performed in dip slide, according to the laboratory routine, and bacterial identification was performed by conventional biochemical tests.

Susceptibility testing was performed according to antibiotic disk diffusion method. The antimicrobials tested differed among the laboratories participants in the study. Thus, the results for evaluating the susceptibility profile correspond to those antimicrobials tested in all laboratories. The results were expressed as simple percentages.

RESULTS

In this study, we analyzed the results of 2,181 urine cultures from outpatients in Jataí-GO; patients were 1,791 (82.1%) female, and 390 (17.9%) male. From the total urine cultures performed, 510 (23.4%) showed colony counts equal or greater than 10^5 UFC/ml of urine. Patients with positive urine culture were mostly female (81.4%). The age of the patients who underwent urine microbiological test varied from 0 to 97 years, and was prevalent in the age group 21-64 years (59.7%). Analyzing only patients whose urine culture was positive, there were also a prevalence of individuals in this age group (59.2%), as can be observed in **Table 1**.

TABLE 1 – Positivity of urine culture according to patient's sex

Age group (years)	Patients with positive urine culture		
	Female	Male	Total *n* (%)
< 1	27	20	47 (9.2%)
1-12	29	17	46 (9.0%)
13-20*	14	4	18 (3.6%)
21-64*	276	26	302 (59.2%)
> 64*	69	28	97 (19.0%)
Total	415	95	510 (100%)

*$p < 0.05$.

The UTIs frequency, according to patient's gender was not statistically significant in individuals under 12 years of age. Above this age, all age groups showed statistically significant difference between genders.

From 510 clinical samples with bacterial growth consistent to infection, *E. coli* was the most prevalent specie, representing 61% of bacteria strain. As shown in **Table 2**, *Proteus sp.* and *Staphylococcus saprophyticus* showed the second highest prevalence (9.4%). Analyzing the uropathogens prevalence, according to patient gender, it is possible to observe significant differences in the *E. coli*, *S. saprophyticus*, *Proteus sp.*, *Klebsiella sp.* e *Enterobacter sp.* results.

In relation to susceptibility profile, this study showed elevated resistance rate to the antimicrobials more commonly used in UTI treatment (**Table 3**). *E. coli* strains showed high resistance levels to ampicilin (57.9%), pipemidic acid (50.5%), nalidixic acid (48.6%), and trimethoprim-sulfamethoxazole (44.8%).

DISCUSSION

Urinary tract infection is a very common disorder that affects millions of people each year. It is one of the main reason that leads people to seek medical aid[2].

TABLE 2 – Frequency of microorganisms isolated at clinical analysis laboratories in Jataí, from March 2010 to June 2012

Bacterium	Sex				Total	
	Female		Male			
	n	%	*n*	%	*n*	%
*E. coli**	256	61.7	55	57.9	311	61.0
*S. saprophyticus**	48	11.6	0	0.0	48	9.4
*Proteus sp.**	38	9.2	10	10.5	48	9.4
*Klebsiella sp.**	22	5.3	10	10.5	32	6.3
Enterococcus sp.	10	2.4	8	8.4	18	3.5
*Enterobacter sp.**	13	3.1	4	4.2	17	3.3
S. aureus	7	1.7	6	6.3	13	2.5
Citrobacter sp.	5	1.2	2	2.1	7	1.4
Streptococcus beta-hemolytic	5	1.2	0	0.0	5	1.0
Providencia sp.	5	1.2	0	0.0	5	1.0
Pseudomonas sp.	4	1.0	0	0.0	4	0.8
Edwardsiella sp.	2	0.5	0	0.0	2	0.4
Total	415	100	95	100	510	100

*p < *0.05.*

TABLE 3 – Resistance profile of major uropathogens isolated in outpatients samples in Jataí, from March 2010 to June 2012

Antibiotic	Isolated species		
	E. coli (311) *n* (%)	*Staphylococcus sp.* (61) *n* (%)	*Proteus sp.* (48) *n* (%)
Nalidixic acid	151 (48.6)	NT	26 (54.2)
Pipemidic acid	157 (50.5)	NT	22 (45.8)
Amicacin	63 (20.2)	NT	4 (8.3)
Ampicilin	180 (57.9)	NT	18 (37.5)
Cafalexin	134 (43.1)	NT	22 (45.8)
Cefotaxime	29 (9.3)	NT	4 (8.3)
Cefoxitin	37 (14.3)	7 (11.5)	11(22.9)
Ceftriaxone	39 (12.5)	NT	7 (14.6)
Cefazolin	99 (31.8)	NT	22 (45.8)
Cefuroxime	60 (19.2)	NT	18 (37.5)
Ciprofloxacin	94 (30.2)	9 (14.7)	11 (22.9)
Clindamicin	NT	15 (24.6)	NT
Eritromicin	NT	15 (24.6)	NT
Gentamicin	45 (14.5)	6 (9.8)	11 (22.9)
Nitrofurantoin	81 (26.0)	3 (4.9)	26 (54.2)
Norfloxacin	109 (25.0)	10 (16.4)	7 (14.6)
Oxacillin	NT	4 (6.6)	NT
Penicillin	NT	30 (49.2)	NT
Rifampicin	NT	19 (31.1)	NT
Trimethoprim-sulfamethoxazole	139 (44.8)	22 (36.1)	29 (60.4)
Tetraciclin	131 (42.1)	6 (9.8)	18 (37.5)
Ticarcillin + clavulanato	7 (2.2)	1 (6.6)	3 (6.2)

NT: not tested.

According to the literature, UTIs affect mainly women[2]; this study also meet this result. The high prevalence in female is justified due to hormonal effects, behavioral factors, and woman anatomic characteristics, since their urethra is short and the anus is near to the vaginal vestibule, which favor urinary tract infections[13, 20, 21].

Escherichia coli is a microorganism belonging to normal human intestinal flora, and may cause extra intestinal infections[9]. The higher prevalence of *E. coli* as community urinary tract infection agent is expected and reported in epidemiologic studies worldwide. This microorganism was reported in 65.9%[6] and 75%[4] studies carried out in the State of São Paulo. In Santa Catarina and Minas Gerais, the prevalence found was 79.9%[23] and 72%[25], respectively. The increased *E. coli* prevalence found as an UTI agent is used to orientate/guide the empiric treatment, in which the recommendation is especially based on the susceptibility profile of Gram-negative bacteria, mainly *E. coli*[19]. However, despite the higher prevalence of this microorganism, rates can change dramatically; consequently, they will interfere in the therapeutic used. A study published in 2010, performed in Campina Grande - PB, a significant lower percentage of *E. coli* (48,2%) was found[9].

In other countries this variation in the major uropathogens prevalence can also be observed. An Indian study[26] showed *E. coli* prevalence of 48.3%; other studies showed prevalence of 71.3% in Turkey[1] and 77.5% in Belgium[3].

In the literature, data on other pathogens prevalence show large variation, while in this study, the most prevalent uropathogens, excepting *E. coli,* were *S. saprophyticus* (9.4%) and *Proteus sp.* (9.4%); other studies suggest *Klebsiella sp.* as the second most prevalent[7, 27]. Otherwise, Beraldo-Massoli *et al*.[4] found prevalence of 11% to *Enterobacter sp.*, while Queiroz and Felício[25] found similar results to those here observed.

In addition to data regarding the causative agent to UTI, for establishing an efficient empiric therapy, it is important to consider patient the age and sex, as regards to antimicrobials pharmacological properties and patient clinical history, but also to the prevalence differences of microbial agents in each region. In a study conducted by den Heijer *et al*., *E. coli* prevalence as UTI causative agent was significantly different between men (51%) and women (72%)[11]. Otherwise, these authors found

significant differences in susceptibility profile of isolated strains between male and female patients, demonstrating that empirical treatment should consider this aspect. Another study demonstrates significant differences in UTI etiology, according to patient sex and age. Thus, *Proteus sp.* showed significant higher prevalence among men, and *E. coli* prevalence among infants was significantly lower[18].

These last two antimicrobials are extensively used in UTI empirical treatment, but data demonstrated that significant number of *E. coli* are resistant. These data should be used to discourage the administration of these drugs for empirical treatment.

Naber suggest that in regions which the rate of resistance to a given antimicrobial is greater than 10% to 20%, this drug should not be used empirically[22]. Quinolones are widely used drugs in UTI treatment, and its administration is indicated for treatment when ther is a high resistant rate to trimethoprim-sulfamethoxazole[16, 28], but data here obtained, also reveal high resistance rate to this antimicrobial group: 48.6% to nalidixic acid, and 30.2% to ciprofloxacin. This finding indicates that the use of these drugs should be careful, and the empirical use should be discouraged, since its use easily select resistant strains[17].

Resistance to fluoroquinolones has been reported in several regions, this is due to its extensive use. Aypak *et al*. found prevalence of 41.1% to fluoroquinolones strains resistant, in a study carried out in Turkey[1]. Guajardo-Lara *et al*., in a study performed in Mexico, found 24.7% of resistance to ciprofloxacin[15]. Similar resistance percentage (23.5%) was also reported in India[26].

In Brazil, this situation is not different. Silveira *et al.*, in a study performed in Uberaba-MG, found trimethoprim-sulfamethoxazole (48%) and ciprofloxacin (25%) resistance rates similar to those here observed[27]. Otherwise, in other regions of the country, fluoroquinolones resistance does not reach such high rates. In a study carried out in Campina Grande-PB[9], trimethoprim-sulfamethoxazole resistance rate (41.9%) was similar to that found here, but the *E. coli* isolated strains showed low resistance to ciprofloxacin and norfloxacin (8.2% for both). Thus, these drugs represent an excellent therapeutic choice in that region.

CONCLUSION

Due to high levels of resistance found to first choice drugs, empirical therapy became a difficult clinical decision. Therefore, it is important to know the epidemiologic and resistance aspects of main pathogens in each region, in order to help in use of appropriate therapy to regional circumstances.

RESUMO

Introdução: *Infecções do trato urinário (ITU) afetam pessoas em todo o mundo.* Escherichia coli *é o principal agente de ITU, no entanto a etiologia pode variar de acordo com o sexo e a idade do paciente. Variações regionais quanto à prevalência e à resistência aos antimicrobianos devem ser consideradas para a escolha terapêutica.* ***Objetivos:*** *Este trabalho teve por objetivo realizar um levantamento sobre os principais agentes de ITU e avaliar o perfil de resistência desses microrganismos no período de março de 2010 a junho de 2012, na cidade de Jataí-GO.* ***Método:*** *Estudo retrospectivo de corte transversal realizado por meio de coleta de dados sobre a prevalência de uropatógenos e seus perfis de sensibilidade avaliados pelo método da difusão.* ***Resultados:*** *Neste período, foram realizadas 2.181 uroculturas, das quais 510 (23,4%) apresentaram resultado positivo, sendo predominantemente do sexo feminino (81,4%) e com idade entre 21 e 64 anos de idade (59,7%). O microrganismo mais frequentemente isolado foi* E. coli *(61%), seguido de* Staphylococcus saprophyticus *(9,4%) e* Proteus *(9,4%). A prevalência dessas bactérias, de acordo com o sexo do paciente, sofreu variação estatisticamente significativa (*$p < 0,05$*). Foi possível constatar elevada taxa de resistência de* E. coli *para alguns antimicrobianos de primeira escolha para tratamento de ITU, como ampicilina (57,9%), ácido pipemídico (50,5%), ácido nalidíxico (48,6%) e sulfazotrim (44,8%).* ***Conclusão:*** *Esses dados demonstram a necessidade de se conhecer a realidade de cada região a fim de se estabelecer uma terapia empírica adequada, quando não for possível a realização da cultura e do antibiograma.*

Unitermos: *infecção urinária;* Escherichia coli*; resistência aos antimicrobianos.*

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