Microorganisms prevalent in urinary tract infections and antimicrobial sensitivity profile: analysis of patients attended at the Military Police Hospital of the State of Goiás, Brazil, in the period from 1998 to 2008

Microrganismos prevalentes em infecções do trato urinário e perfil de sensibilidade antimicrobiana: análise dos pacientes atendidos no Hospital do Policial Militar do Estado de Goiás, Brasil, no período de 1998 a 2008

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Abstract

Objective – To evaluate the frequency of the bacterial agents responsible for urinary tract infections and the antimicrobial sensitivity profile of the uropathogens involved in these infectious processes. **Methods** – A survey was conducted of the data with reference to uroculture exams of patients attended at the Military Police Hospital of the State of Goias, Brazil, in the period from January, 1998 to December, 2008, in which it was verified that of the 10,162 urine samples, 1,506 (14.82%) were positives, while 8,656 (85.18%) presented no growth of microorganisms. **Results** – According to the results, it was verified that the female sex was the most affected (79.4%). The most frequent Gram-negative bacteria were *Escherichia coli* (63.08%) and *Enterobacter* sp. (6.31%) and the Gram-positive bacteria were *Staphylococcus saprophyticus* (4.52%) and *Staphylococcus aureus* (3.19%). **Conclusion** – With regard to bacterial susceptibility to antimicrobial agents, it was noted that *Escherichia coli* and *Enterobacter* sp. presented a higher sensitivity index in decreasing order to Ciprofloxacin, Norfloxacin and Ceftriaxon.

Descriptors: Urinary tract infections; *Escherichia coli*, Microbial sensitivity tests; Urine/microbiology

Resumo

Objetivo – Avaliar a frequência dos agentes bacterianos responsáveis por infecções do trato urinário e o perfil de sensibilidade antimicrobiana dos uropatógenos envolvidos nestes processos infecciosos. **Métodos** – Foi realizado levantamento dos dados referentes aos exames de uroculturas de pacientes atendidos no Hospital do Policial Militar do Estado de Goiás, Brasil, no período de janeiro/1998 a dezembro/2008, onde verificou-se que das 10.162 amostras de urina, 1.506 (14,82%) foram positivas, enquanto 8.656 (85,18%) não apresentaram crescimento de microrganismos. **Resultados** – De acordo com os resultados verificou-se que o sexo feminino foi o mais acometido (79,4%). As bactérias Gram-negativas mais frequentes foram *Escherichia coli* (63,08%) e *Enterobacter* sp. (6,31%) e as Gram-positivas foram *Sthaphylococcus saprophyticus* (4,52%) e *Sthaphylococcus aureus* (3,19%). **Conclusão** – Com relação à susceptibilidade bacteriana aos antimicrobianos notou-se que a *Escherichia coli* e *Enterobacter* sp. apresentaram maior índice de sensibilidade de forma decrescente à Ciprofloxacina, Norfloxacina e Ceftriaxona.

Descritores: Infecções urinárias; *Escherichia coli*; Testes de sensibilidade microbiana; Urina/microbiologia

Introduction and Literature review

Urinary tract infection (UTI) consists of microbial invasion and multiplication in any of the structures of the urinary system. The severity of infection ranges from asymptomatic colonization, or that is, without tissue degeneration through to symptomatic invasion of the tissues of any of the structures of the urinary system[1-2].

World-wide, a minimum occurrence of 150 million symptomatic cases of UTIs are observed every year, however, the real incidence is underestimated because a large portion of urinary infections are cured without medical follow-up[3].

The etiology of UT infections is related to the great diversity of microbial invaders, such as: bacteria, viruses and fungi. The etiologic agents most commonly isolated in UTIs are: *Enterobacteriaceae* family of gram-negative bacilli, its main representative being Escherichia coli, with a mean frequency of 40% to 85% among the nosocomial and ambulatorial cases, respectively[4]. Others genuses of this family are involved, however, having a lower incidence, such as: *Enterobacter* sp., *Citrobacter* sp., *Proteus* sp., *Klebsiella* SP[1,3,5-7].

In the United States, the non complicated UT infections constitute the main cause of morbidity among women, which results in around eight million consultations per annum. This is no different in Brazil. In ambulatorial clinical practice, UTIs are responsible for 80% of the medical attendances, and they are considered one of the most common bacterial affections, particularly in children, sexually active young adults and women, ranked lower in frequency only to respiratory infections[2,8].

The diagnosis of UTI is based on clinical and laboratorial findings. The finding of bacteria in the urine is a strong indication of urinary infection, mainly when the collection, transport and storage of the urine sample met the criteria recommended for these procedures[1,9]. Undoubtedly, the method considered the gold standard for the diagnosis of UTI is uroculture, as it allows the colony forming units per mL of urine (CFU/mL) to be counted, and at the same time allows the bacteria to be isolated in selective culture mediums that favor the biochemical assays for microbial identification and the antimicrobial sensitivity test (AST) to be performed[9-10].

Bacterial resistance to various antimicrobial agents used in the therapy in patients with UTI has been described all over the world. In view of the alarming number of antimicrobial resistance rates that have been notified in different areas of health, it is imperative to know the antimicrobial susceptibility profile against the etiologic agents of UTIs, since this type of infection is a frequent comorbidity between communities and treatment environments. The indiscriminate use of medications in the treatment of UTIs, particularly those

that originate in the hospital environment, may cause the induction and appearance of resistant bacterial strains, in addition to the aggravation of the infectious condition[7,11-12]. A great reduction in the sensitivity of UTI-causing bacteria against the antimicrobial agents most used in conventional therapy has been observed world-wide, thus motivating the continuous evaluation of the susceptibility of microorganisms isolated in urine samples.

Methods

Analysis was performed of 10,162 urine samples from ambulatorial patients attended at the Military Police Hospital of the State of Goiás – "Fundação Tiradentes", Brazil, in the period from January, 1998 to December, 2008. Uroculture was performed in all the samples for colony counts and antibiograms. The analyses were performed in the microbiology section of the Clinical Analysis Laboratory at above-mentioned institution.

Initially urocultures – colony counts and antibiograms were performed on the urine samples sent to the laboratory. All the biologic material was processed and analyzed during the period of twelve years, comprising the period from January, 1996 to December. 2007.

The samples were obtained by collection of the first urine of the morning, in sterile receptacles, using the middle jet of spontaneous miction. The material registered and identified by the reception personnel of the laboratory was sent to the microbiology section to be processed as quickly as possible, in order to favor minimum microbial proliferation[2,13].

The urines were seeded on Petri plates containing cystine-lactose electrolyte-deficient (CLED) medium, using the streak plate procedure, which provides the CFU/mL count. The sample was also seeded in 5% sheep blood Agar. For platinum plate seeding, a calibrated quantity of 1µl (0.001mL) was used, which enabled the microbiologist to perform the CFU count, multiplying each colony formed by 1000, allowing the the bacterial structures per mL of urine to be quantified. The plates were taken for incubation in a bacteriological oven at 36.5± 1º C, for 24 hours[8,10]. After seeding, with the aid of a loop, a smear of the fresh sample without centrifugation was made over a glass slide, in order to perform staining according to the Gram method[8].

After this the sample was sent for chemical and physical analysis of the material. The chemical exam was performed with the use of reagent strips. The tests for nitrite and leukocyte sterase were considered positive when the reagent area of the strip presented a pink color and 1+ or 2+, respectively. Physical analysis of the sample was performed after centrifugation of 10 mL of urine at 1,500 rpm for 5 minutes, and then 9 mL of the supernatant was discarded, according to the so called modified ADDIS technique. From the urine sediment the counts of cells, pyocytes, erythrocytes were determined, and other elements found, such as filaments of mucous, cylinders, crystals, microbiota, etc., could be demonstrated[9,14-15].

After the colony counts and microscopic analysis of the bacterioscopy, the microorganisms were seeded in selective mediums according to the type of staining. For the Gram-negative bacteria, Mac Conkey Agar was used and for the Gram-positives, Manitol Agar, which contain inhibitory substances in their formulations, such as bile salts and a high NaCl (6,5%) content, respectively. The interest in the procedure was to obtain colonies as pure and as isolated as possible, in order to perform biochemical identification assays and antibiograms[8-9].

Conventional seedings were used, as well as seeding in automated appliances, of the DIRAMIC 10 brand, with Cuban technology, which allowed bacterial growth in 4 hours and TSA in 2 hours to be determined[16]. The TSAs performed by conventional methodology were prepared on Müeller Hinton Agar, with inoculum calibrated according to 0.5 on the McFarland scale, with which, the bacterial concentration was adjusted to approximately 108 organisms/mL by turbidity. The optical density value obtained by the scale was determined by means of the DIRAMIC 10 program. The bacterial suspension was distributed over the entire Agar surface with the aid of a sterile swab, which was then applied to the selected antimicrobial discs according to the biochemical identification of the different morphotypes of the suspected microorganisms. This technique is known as the disc diffusion or Kirby-Bauer method[8,11,17].

Microbial identification was performed by various methodologies, considering the macroscopic and microscopic aspects of the pathogenic agents when making the choice. The API 20E, API Staphy and API Strep (bio Meièux) systems, Bactray I and II systems for used for identifying the strains. The lactose positive colonies observed in the Mac Conkey method, and those that had the characteristics of *Escherichia coli*, were identified by the conventional method known as the modified Rugai/ IAL method. The cultures that had colony counts higher than 105 CFU of a single microorganism per milliliter of urine were considered[18].

The data were digitized in an electronic spreadsheet (EXCEL® 9.0/2000, Microsoft, USA). According to the type of variables, objective of each of the studies of suppositions, the results were analyzed using the SPSS version 15.0 statistical program, by means of the t-test and Chi-square without correction, Wilcoxon, Kruskal-Wallis or exact Fischer (bicaudal) tests, as calculated by the above-mentioned program or by EPI-INFO 6.04b (CDC, USA). According to the program, the regression and development of the occurrence of microorganisms over the course of time was considered for preparation of the tables and graphs. In b = angular coefficient, when negative, indicated a decrease in the incidence and p expresses the manner of occurrence (increasing/decreasing) where, accentuated ($p < 0.05$) and slow reduction ($p > 0.05$).

The study was submitted to the Ethics Committee of IES-"Leide das Neves Fundation", Goiânia-Goiás for approval and received a favorable report.

Results

In the survey of the data with reference to the uroculture exams it was verified that of the 10,162 urine samples, 1,506 (14.82%) were positive, while 8,656 (85.18%) according to the inclusion criteria established in the study, presented no growth of microorganisms.

Among the various genuses and bacterial species isolated, according to the biochemical identification of the different morphotypes, 1,297 (86.12%) were Gram-negative bacillus/coccobacillus (B/CGN), with glucose-fermenters and non-fermenters and 209 (13.88%) Gram-positive cocci (CGP) in bunches, groups, chains, hemolytic and non-hemolytic being included.

Of the 1,506 positive samples, predominance of the Enterobacteriaceae family of microorganisms was observed. Of these, *Escherichia coli* (63.08%) was identified in 950 samples as the most frequent agent in the samples of positive cases. As the second most frequent agent *Enterobacter* sp. (6.31%) is outstanding, with 95 cases, remembering that this quantity does not include identified species of the same genus. In a diversified manner, other Gram-negative organisms represented 16.71% of the total, as described in Table 1.

Among the Gram-positive agents, microorganisms of the *Micrococaceae* and *Streptoccocaceae* families showed a total frequency of (13.90%), *Staphylococcus saprophyticus* being the largest representative (4.52%), followed by *Staphylococcus aureus* (3,19%). Other genuses/species of Gram-positive bacteria represented (6.19%) of those isolated (Table 2).

The female sex was the most affected, representing 1,189 (79.40%) of the cases, while only 309 (20.60%) were of the male sex. Nevertheless, in eight cases of positive urocultures, information as regards the patients' sex was omitted. Among the uropathogens isolated, it was observed that proportionally, *Proteus mirabilis* was responsible for a significant percentage (46.70%) in the male sex, according to Table 3

According to the above-mentioned results it was observed that the most frequent Gram-negative bacteria were *Escherichia coli* (63.08%) and *Enterobacter* sp. (6.31%) and the Gram-positive bacteria were *Staphylococcus saprophyticus* (4.52%) and *Staphylococcus aureus* (3.19%). Based on this fact, these bacteria were analyzed in an isolated manner with regard to the year in which they presented higher and lower incidence in the analyzed samples. *Escherichia* coli presented the lowest occurrence in the year 1999, when it was isolated in (57.89%) of the cases; and the highest 2003, representing (72.30%) of the occurrences. In 1999, *Enterobacter* sp. presented the lowest occurrence (0.58%) among the cases of positive urocultures,

Table 1. Type and quantity of Gram-negative bacteria isolated in samples from patient attended between 1998 and 2008

Microorganisms	n	%
Acinetobacter sp.	1	0.07
Aeromonas salmonicida	1	0.07
Aeromonas sp.	1	0.07
Citrobacter freundii	9	0.60
Citrobacter sp.	10	0.66
Edwardisiella tarda	1	0.07
Enterobacter agglomerans	13	0.86
Enterobacter gergoviae	1	0.07
Enterobacter sakazakii	6	0.40
Enterobacter sp.	95	6.31
Escherichia coli	950	63.08
Genella sp.	1	0.07
Klebsiella freundii	1	0.07
Klebsiella ornithinolitica	5	0.33
Klebsiella oxytoca	5	0.33
Klebsiella ozaenae	4	0.27
Klebsiella pneumoniae	27	1.79
Klebsiella pneumoniae pneumoniae	3	0.20
Klebsiella sp.	22	1.46
Kluyvera sp.	7	0.46
Listeria sp	1	0.07
Morganella morganii	5	0.33
Proteus mirabilis	61	4.05
Proteus penneri	2	0.13
Proteus sp.	4	0.27
Proteus vulgaris	9	0.60
Providencia rettgeri	3	0.20
Providencia sp.	1	0.07
Providencia stuartii	1	0.07
Pseudomonas aeruginosa	10	0.66
Pseudomonas cepacia	1	0.07
Pseudomonas fluorecences	4	0.27
Pseudomonas pseudomallei	1	0.07
Pseudomonas putida	1	0.07
Pseudomonas sp.	13	0.86
Salmonella sp.	1	0.07
Serratia liquefaciens	1	0.07
Serratia odorifera	3	0.20
Serratia sp.	10	0.66
Stenotrophomonas maltophilia	1	0.07
Xanthomonas maltophilia	1	0.07

Table 2. Type and quantity of Gram-positive bacteria isolated in samples from patient attended between 1998 and 2008

Microorganisms	n	%
Streptococcus sp	20	1.33
Streptococcus hemolyticus	1	0.07
Streptococcus agalactiae	6	0.40
Staphylococcus xylosus	17	1.13
Staphylococcus sp.	20	1.33
Staphylococcus scuri	2	0.13
Staphylococcus saprophyticus	68	4.52
Staphylococcus lentus	1	0.07
Staphylococcus haemolyticcus	2	0.13
Staphylococcus epidermides	1	0.07
Staphylococcus cohnii	3	0.20
Staphylococcus chromogenes	1	0.07
Staphylococcus aureus	48	3.19
Micrococcus sp.	11	0.73
Enterococcus faecalis	8	0.53

being identified with high occurrence (13.63%) in 2005. *Staphylococcus saprophyticus* was identified with the lowest frequency (0.76%) in 2003. Whereas, its highest occurrence was in 2000 (12.34%). *Staphylococcus aureus* had the lowest number of isolates

Table 3. Occurrence of microorganisms according to the sex of patients attended between 1998 and 2008

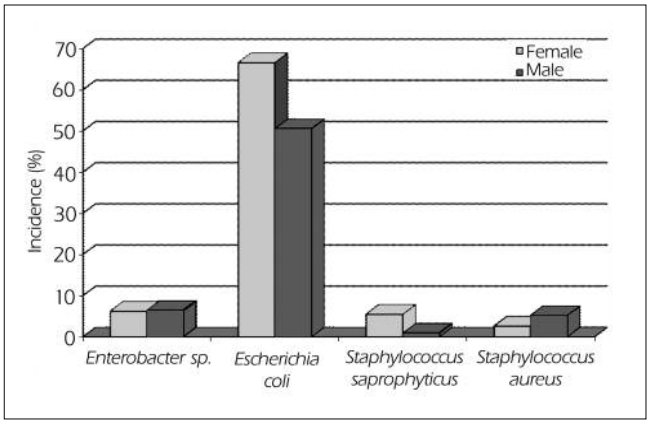
Microorganisms	Female		Male	
	n	%	n	%
Acinetobacter sp.	0	0.0	1	100.0
Aeromonas salmonicida	0	0.0	1	100.0
Aeromonas sp.	0	0.0	1	100.0
Citrobacter freundii	5	55.6	4	44.4
Citrobacter sp.	9	90.0	1	10.0
Edwardisiella tarda	1	100.0	0	0.0
Enterobacter agglomerans	11	84.6	2	15.4
Enterobacter gergoviae	0	0.0	1	100.0
Enterobacter sakazakii	5	83.3	1	16.7
Enterobacter sp.	74	78.7	20	21.3
Escherichia coli	791	83.5	156	16.5
Genella sp.	1	100.0	0	0.0
Klebsiella freundii	1	100.0	0	0.0
Klebsiella ornithinolitica	5	100.0	0	0.0
Klebsiella oxytoca	3	60.0	2	40.0
Klebsiella ozaenae	3	75.0	1	25.0
Klebsiella pneumoniae	19	70.4	8	29.6
Klebsiella pneumoniae pneumoniae	3	100.0	0	0.0
Klebsiella sp.	19	90.5	2	9.5
Kluyvera sp.	7	100.0	0	0.0
Listeria sp.	1	100.0	0	0.0
Morganella morganii	2	40.0	3	60.0
Proteus mirabilis	32	53.3	28	46.7
Proteus penneri	2	100.0	0	0.0
Proteus sp.	3	75.0	1	25.0
Proteus vulgaris	4	44.4	5	55.6
Providencia rettgeri	0	0.0	3	100.0
Providencia sp.	1	100.0	0	0.0
Providencia stuartii	0	0.0	1	100.0
Pseudomonas aeruginosa	2	20.0	8	80.0
Pseudomonas cepacia	1	100.0	0	0.0
Pseudomonas fluorecences	1	25.0	3	75.0
Pseudomonas pseudomallei	0	0.0	1	100.0
Pseudomonas putida	0	0.0	1	100.0
Pseudomonas sp.	3	25.0	9	75.0
Salmonella sp.	1	100.0	0	0.0
Serratia liquefaciens	1	100.0	0	0.0
Serratia odorifera	3	100.0	0	0.0
Serratia sp.	7	70.0	3	30.0
Stenotrophomonas maltophilia	0	0.0	1	100.0
Xanthomonas maltophilia	1	100.0	0	0.0
Streptococcus sp.	18	90.0	2	10.0
Streptococcus hemolyticus	0	0.0	1	100.0
Streptococcus agalactiae	6	100.0	0	0.0
Staphylococcus xylosus	12	70.6	5	29.4
Staphylococcus sp.	17	85.0	3	15.0
Staphylococcus scuri	1	50.0	1	50.0
Staphylococcus saprophyticus	65	95.6	3	4.4
Staphylococcus lentus	1	100.0	0	0.0
Staphylococcus haemolyticcus	1	50.0	1	50.0
Staphylococcus epidermides	0	0.0	1	100.0
Staphylococcus cohnii	3	100.0	0	0.0
Staphylococcus chromogenes	0	0.0	1	100.0
Staphylococcus aureus	31	66.0	16	34.0
Micrococcus sp.	6	54.5	5	45.5
Enterococcus faecalis	6	75.0	2	25.0
Total	1189	79.4	309	20.6

in 2006 (0.91%). However, the year in which this microorganism had the highest frequency was 2008 (5.12%).

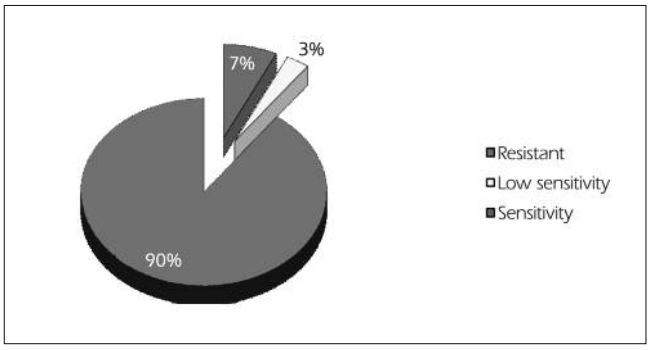
The four bacteria were also analyzed according the rate of incidence at which the two sexes were affected by the four most frequent microorganisms of the study. *Enterobacter* sp. presented a similar incidence in the two sexes. *Escherichia* coli and *Staphylococcus sa-*

prophyticus were the most frequent in the female sex, while *Staphylococcus aureus* was isolated more often in the male sex (Graph 1).

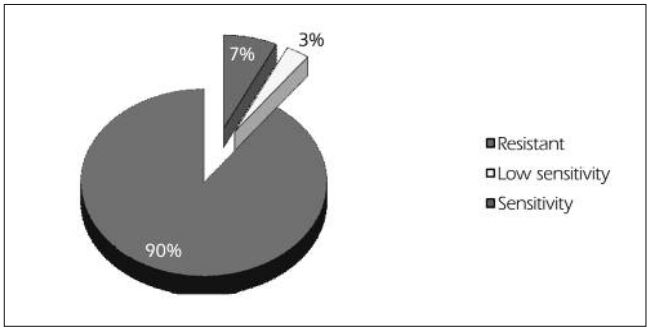
As regards the sensitivity profile of three antimicrobial agents, Ciprofloxacin (CIP), Norfloxacin (NOR) and Ceftriaxon (CRO), *Escherichia coli* showed most sensitivity to CIP, as shown in Graphs 2, 3, and 4.



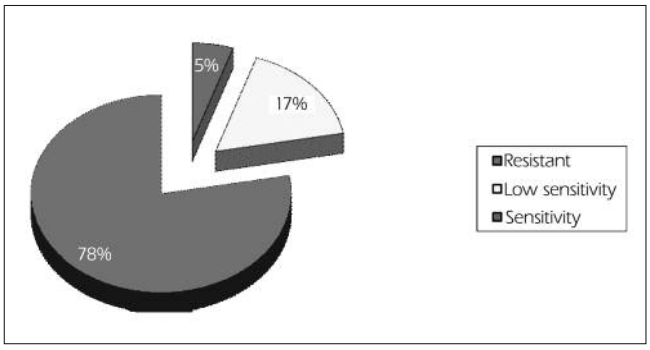
Graph 1. Incidence of bacteria more prevalent in gender



Graph 2. Distribution of bacterial susceptibility profile of *E. coli* in relation to CIP



Graph 3. Distribution of bacterial susceptibility profile of *E. coli* in relation to NOR



Graph 4. Distribution of bacterial susceptibility profile of *E. coli* in relation to CRO

The percentage of sensitivity of the Gram-negative bacteria (*Escherichia coli* and *Enterobacter* sp.) was analyzed during the course of eleven years in relation to the groups of antibiotics suggested by the FDA Commitee on Standardization and Approval – USA to be used in disc-diffusion tests. Thus, it was observed that *Escherichia coli* and *Enterobacter* sp., showed higher sensitivity indexes, on a decreasing scale, than Ciprofloxacin, Norfloxacin and Ceftriaxon. Whereas, the least effective antimicrobial agents were: Ampicilin, Cephalothin and Amoxicillin with Clavulanic Acid.

The number of occurrences in which the maximum percentage of sensitivity appeared during the course of the years determined the expression of the effectiveness of the drugs against the uropathogens. Thus, it was observed that for *Staphylococcus saprophyticus*, the antimicrobial agent: Vancomycin, Gentamycin, Ciprofloxacin, Chloranfenicol, Clindamycin and Tetracycline, in descending order, were the most effective. Whereas, for *Staphylococcus aureus* they were: Vancomycin, Ciprofloxacin, Chloranfenicol, Gentamycin, Clindamycin and Tetracycline. For Vancomycin there was no sample with sensitivity differing from 100% for the referenced microorganisms.

Discussion

Urinary infections have caused a great impact on clinical medicine because it is a pathology that affects millions of persons every year. The percentages of positive urocultures observed in various studies range from 28.7% to 75.0%, depending on the characteristics of the analyzed populations. The incidence of UTI may fluctuate according to socio-economic conditions , presence of *Diabetes mellitus*, self-medication and anatomic alterations of the urinary system, among other factors. However, of the total number of samples received for performing urocultures, a mean of 20.0% positivity is normally expected[2,10,19]. In this study the incidence was a little below the expected mean, as l4.82% positive cases were presented, nevertheless, the results were similar to those found by Poletto and Reis[8] (2005).

The world literature is unanimous in affirming that UTI occurs predominantly in patients of the female sex. The main reason is determined by the external genital anatomy that makes the ascension and colonization of microorganisms possible. In this study the female sex was also observed to be the most affected by urinary tract infection, representing 79.4% of the samples[2,10,17].

In the period from 1998 to 2008, 10.162 urine samples were received. Of these, 1506 (14.82%) were positive. Considering the microscopic/morphotypical aspect of the microorganisms identified in the positive samples, it was seen that (86.1%) were represented by Gram-negative and (13.9%) Gram-positive bacteria. In various studies it has been verified that *Escherichia coli* and *Klebsiella* sp., are outstanding among the Gram-negative, and *Staphylococcus saprophyticus* and *Enterococcus faecalis* the most prevalent among the Gram-positive bacteria[20]. In this study, *E. coli* (63.08%) and *Enterobacter* sp. (6.31%) were the most frequent Gram-negative bacteria and the most frequently isolated Gram-positive bacteria were *Staphylococcus saprophyticus* (4.52%) and *Staphylococcus aureus* (3.19%). When observing other studies, it was perceived in their findings that as regards the Gram-negative bacteria, members of the Enterobacteriaceae family were also represented as being predominant. As regards the genuses/species identified, *Escherichia* coli was always present, thus, maintaining its outstanding position in UTIs. In the literature it is evident that the large presence of *E. coli* in infectious processes could be due to the pathogenic phenotype of this strain. A remarkable characteristic is its ease of adherence to and invasion of epithelial cells. They are commonly present in various types of diseases that comprise all the human organ tissues and systems, making it a relevant microorganism in clinical laboratories[18].

When comparing the frequencies of GP bacteria reported in the literature, some agreement was found with reference to genuses /species isolated. An example was the predominance of *Staphylococcus saprophyticus*, member of the *Micrococcaceae* famíly. In various reports and in this study, it was observed that in UTIs, the fe-

male sex was most affected by this agent. One understands that there are several reasons that contribute to the expression of this frequency. Since this microorganism is present in the male autochthonous microbiota, sexually active women are normally contaminated by their partners during the sexual act. Thus, in the face of situations tht favor colonization, such as a fall in immunity, this microorganism becomes a pathogen in women, since it is not resident in their normal microbiota.

GP agents belonging to the *Streptoccocaceae* family have been reported in other studies as the second most isolated microorganism in UTIs. In this study the second place in prevalence among the GP bacteria was represented by a member of the *Micrococcaceae* family, *Staphylococcus aureus*.

Including all the urinary bacterial findings, various studies have shown *Escherichia coli* to be the microorganism with the highest occurrence in positive urocultures, followed by *Klebsiella* sp., *Enterobacter* sp., *Staphylococcus saprophyticus*, *Proteus mirabilis*, among others[20]. In the analyses of the present study, E. coli was also predominant, comprising 63.08% of the cases. Among other genuses/species identified in the present research, in decreasing order, the following frequency was verified: *Enterobacter* sp. (6.31%), *Staphylococcus saprophyticus* (4.72%), *Proteus mirabilis* (4.05%), *Staphylococcus aureus* (3.19%), *Klebsiella pneumoniae* (1.79%), Klebsiella sp. (1.46%), *Streptococcus* sp and *Staphylococcus* sp. (1.33%), *Staphylococcus xylosus* (1.13%) and others at lower percentages.

When exploring other statistical data pertinent to the incidence of the two Gram-negative and two Gram-positive bacteria most isolated over the course of eleven years of study, it was understood that there was growing and accentuated incidence of *Enterobacter* sp. Whereas *Escherichia* coli, *Staphylococcus saprophyticus* and *Staphylococcus aureus* presented a slow reduction in the number of times they were identified.

It is of great value to know which microbial agent is involved in an infectious process, but it is also very important to know its antimicrobial sensitivity profile. The antimicrobial sensitivity test is fundamental because it provides relevant help in the therapeutic procedure.

After a decade of treatment with fluoroquinolones (Ciprofloxacin and Norfloxacin) in urinary infections in cases that involved Escherichia coli and other microorganisms seen in the etiology of UTIs, it was observed that good effectiveness of these antimicrobial agents has been maintained. However, the highest sensitivity indexes reported and analyzed in the present research were for CIP, NOR and CRO, which may be confirmed according to data in the literature. The efficacy of other antibiotics used to combat various types of infections: Ampicillin, 1st generation Cephalosporins and Cotrimoxazol, has fallen to a large extent[7]. In this study it was confirmed that the two outstanding GN bacteria, *E. coli* and *Enterobacter* sp. presented extremely low rates of sensitivity to AMP and CFL. It was observed that *Staphylococcus saprophyticus* showed greater sensitivity to Vancomycin, Gentamycin and Ciprophloxacin and *Staphylococcus aureus* was more sensitive to Vancomycin, Ciprophloxacin and Chloranfenicol.

Conclusion

Although this study has been conducted over a long period (11 years) it should be remembered that microorganisms undergo mutations, individuals go through organic changes, antimicrobial agents respond differently after certain periods of use, and the site where a study is processed will determine its own characteristics. Finally, the authors suggest that further studies should be conducted and encourage this. Many of the findings in this research were in agreement with those that have been described in the literature. Nevertheless, it is suggested that other parameters should be analyzed, such as, for example, the resistance mechanisms of uropathogens, predominant bacteria in UT carriers of the Extended spectrum β-lactamase enzyme (ESBL), multiresistances, glucose non-fermenters, so that safer results, applicable in the treatment and prevention of UTIs may be reached.

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