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**RESUMO – Introdução:** Devido a frequência a infecção do trato urinário (ITU) responde por consumo elevado de antibióticos e tem impacto sócio-econômico elevado. Como a escolha do antimicrobiano no início do tratamento ou para o tratamento completo é geralmente empírica, o conhecimento da prevalência bacteriana e sua sensibilidade, que podem variar no tempo, é mandatória. **Objetivo:** O objetivo do trabalho é relatar a frequência das cepas bacterianas diagnosticadas em nossa instituição, bem como a sensibilidade aos antimicrobianos, e prover dados nacionais. **Métodos:** Foram analisados retrospectivamente os resultados de cultura de urina de 402 pacientes com ITU adquirida na comunidade e tratados em nossa instituição. **Resultados:** A idade média dos pacientes foi de 45,3±23,5 anos, 242 (60,2%) dos quais eram mulheres e 160 (39,8%) eram homens. A bactéria mais frequente foi a *E. coli* (58%) seguida de *Klebsiella sp.* (8,4%) e *Enterococcus sp.* (7,9%). Das bactérias isoladas somente 37% apresentavam sensibilidade à ampicilina, 51% à cefalotina e 52% ao trimaxazol. As maiores taxas de sensibilidade ocorreram para o imipenem (96%), ceftriaxone (90%), amicacina (90%), gentamicina (88%), levofloxacina (86%), ciprofloxacina (73%), nitrofurantoina (77%) e norfloxacina (75%). **Conclusão:** As bactérias Gram-negativas são a causa mais comum de ITU comunitária. Os antimicrobianos de escolha para tratamento oral são as fluoroquinolonas, nitrofurantoina, cefalosporinas de segunda e terceira geração. Para quadros graves que requerem antibiótico parenteral a escolha recai sobre os aminoglicosídeos, cefalosporinas de terceira geração e imipenem.

**DESCRIPTORES:** Trato urinário. Comunidade, infecção. Bactéria. Antibiótico, sensibilidade.

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#### Correspondence:

Antonio Carlos Pereira Martins  
Hospital das Clínicas – Departamento de Cirurgia  
Av. Bandeirantes, 3.900, 9º Andar  
Ribeirão Preto, SP, CEP: 14048-900

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13 – ARTIGO ORIGINAL

## Prevalence and bacterial susceptibility of hospital acquired urinary tract infection<sup>1</sup>

José Anastácio Dias Neto<sup>2</sup>, Leonardo Dias Magalhães da Silva<sup>2</sup>, Antonio Carlos Pereira Martins<sup>3</sup>, Ricardo Brianezi Tiraboschi<sup>2</sup>, André Luis Alonso Domingos<sup>2</sup>, Haylton Jorge Suaid<sup>3</sup>, Silvio Tucci Jr<sup>3</sup>, Aduino José Cologna<sup>3</sup>

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Dias Neto JA, Silva LDM, Martins ACP, Tiraboschi RB, Domingos ALA, Suaid HJ, Tucci Jr S, Cologna AJ. Prevalence and bacterial susceptibility of hospital acquired urinary tract infection. Acta Cir Bras [serial online] 2003 vol 18 suppl 4. Available in www.scielo.org.br/acb

**ABSTRACT – Purpose:** Urinary tract infection is the most common nosocomially acquired infection. It is important to know the etiology and antibiotic susceptibility infectious agents to guide the initial empirical treatment. **Objective:** To determine the prevalence of bacterial strains and their antibiotic susceptibility in nosocomially acquired urinary tract infection in a university hospital between January and June 2003. **Methods:** We analyzed the data of 188 patients with positive urine culture (= 10<sup>5</sup> colony-forming units/mL) following a period of 48 hours after admission. **Results:** Half of patients were male. Mean age was 50.26 ± 22.7 (SD), range 3 months to 88 years. Gram-negative bacteria were the agent in approximately 80% of cases. The most common pathogens were *E. coli* (26%), *Klebsiella sp.* (15%), *P. aeruginosa* (15%) and *Enterococcus sp.* (11%). The overall bacteria susceptibility showed that the pathogens were more sensible to imipenem (83%), second or third generation cephalosporin and aminoglycosides; and were highly resistant to ampicillin (27%) and cefalothin (30%). It is important to note the low susceptibility to ciprofloxacin (42%) and norfloxacin (43%). **Conclusion:** This study suggests that if one can not wait the results of urine culture, the best choices to begin empiric treatment are imipenem, second or third generation cephalosporin and aminoglycosides. Cefalothin and ampicillin are quite ineffective to treat these infections.

**KEY WORDS:** Urinary tract infection. Etiology, susceptibility. Nosocomial infection. Microbiology.

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#### INTRODUCTION

Hospitalized patients are predisposed to a variety of nosocomial infections, especially with multidrug-resistant organisms<sup>1</sup>. Urinary tract infection (UTI) is the most frequent nosocomial infection and has been suffering a shift in the etiology and antimicrobial susceptibility, as common as other infections detected in the last

decade<sup>2-5</sup>. Since most of treatments began empirically, prior knowledge of the bacterial prevalence as well as the resistance patterns in a particular setting is essential.

Information on the etiology and bacterial susceptibility of nosocomially acquired UTI in Brazil are scarce which makes the decisions on antibiotic choice almost entirely dependent of international data<sup>6</sup>. As both geographic and

temporal factors can influence these data, they need to be constantly and locally re-evaluated.

The aim of this study was to determine the local prevalence of bacterial strains and the antibiotic susceptibility of the nosocomially acquired UTI in our institution to guide antibiotic choice and to achieve a maximal clinical response in empiric treatment while the antibiotic susceptibility of the pathogen is still unknown.

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1. This research was developed at Hospital das Clínicas – FMRP-USP
  2. Medical resident of Hospital das Clínicas – FMRP-USP
  3. Professor and Assistants of FMRP-USP

## METHODS

All urinary specimens with significant bacteriuria, defined by Kass<sup>8</sup> as being urine culture with more than 10<sup>5</sup> colony forming units/mL, processed in the laboratory of the Hospital das Clínicas of the School of Medicine of Ribeirão Preto—University of São Paulo, between January and June of 2003, were included in this study. Nosocomial episode was defined as any UTI beginning 48 hours after admission.

We analyzed patient data and bacterial etiology as well as antimicrobial susceptibility to commonly used antibiotics.

## RESULTS

We obtained clinical information of 188 patients that had nosocomially acquired UTI. Half of them were male (99 patients). Mean age was 50.26 ± 22.7 (SD) (range 3 months to 88 years).

The prevalence increased after the 5<sup>th</sup> decade in males and 4<sup>th</sup> decade in the females (Table 1).

There were a great variety of isolated pathogens and their frequency is listed on Table 2. *E. coli* was the most frequent bacteria (26%), followed by *Klebsiella sp.* (15%), *Pseudomonas aeruginosa* (15%), and *Enterococcus sp* (11%).

Table 3 shows the antibiotic susceptibility of the four most frequent pathogens and the overall sensibility to antibiotics.

*E. coli* was very susceptible to imipenem, second or third generation cephalosporin, aminoglycosides, ciprofloxacin and nitrofurantoin, and showed a great resistance to ampicillin, trimethoprim-sulfamethoxazole (TMP-SMX) and norfloxacin.

*Klebsiella sp* were sensible to imipenem, second or third generation cephalosporin and fluoroquinolones, and highly resistant to ampicillin. *P. aeruginosa* had high levels of resistance, and was more sensible to ceftazidime, imipenem and specially to cefepime (100%), a fourth generation cephalosporin that is not commonly tested, only in special situations of multidrug-resistant organism.

*Enterococcus sp.* was the only Gram-positive bacteria with a high incidence and was very sensible to ampicillin (89%) different from the Gram-negative organisms described above. It was more sensible to specific antibiotics not presented in Table 3, like penicillin G (83%) and vancomycin (100%).

The overall antibiotic susceptibility is highly influenced by the Gram-negative bacteria, which were involved in approximately 80% of nosocomially acquired urinary tract infections. The pathogens were more sensible to imipenem, second or third generation cephalosporin and aminoglycosides; and were highly resistant to ampicillin and cefalothin. It is important to note the low susceptibility to ciprofloxacin and norfloxacin.

**TABLE 1.** Prevalence of nosocomially acquired urinary tract infections according to gender and age.

Age (years)	Male (n=99)	Female (n=99)
0-10	6 (6.06%)	7 (7.07%)
11-20	3 (3.03%)	5 (5.05%)
21-30	8 (8.08%)	14 (14.14%)
31-40	7 (7.07%)	8 (8.08%)
41-50	6 (6.06%)	21 (21.21%)
51-60	15 (15.15%)	16 (16.16%)
>60	43 (43.43%)	27 (27.27%)

**TABLE 2.** Micro-organisms isolated in urine

Number	%
<i>E.coli</i>	49 26.06
<i>Klebsiella sp.</i>	29 15.42
<i>P. aeruginosa</i>	29 15.42
<i>Enterococcus sp.</i>	21 11.17
<i>Enterobacter sp.</i>	11 5.85
<i>S. aureus</i>	9 4.78
<i>Acinetobacter sp.</i>	9 4.78
<i>Streptococcus sp.</i>	8 4.25
<i>Morganella sp.</i>	7 3.72
<i>Proteus sp.</i>	7 3.72
<i>Providencia sp.</i>	3 1.59
<i>Citrobacter sp.</i>	2 1.06
<i>Serratia sp.</i>	1 0.53

**TABLE 3.** Antibiotic susceptibility of uropathogens.

	<i>E. coli</i> (%)	<i>Klebsiella sp</i> (%)	<i>P.aeruginosa</i> (%)	<i>Enterococcus sp</i> (%)	Total (%)
ampicillin	20	0	–	89	27
amikacin	86	57	41	40	65
cefalothin	38	39	–	–	30
cefotaxima	92	54	20	–	51
cefoxitina	71	79	–	–	61
ceftriaxone	93	69	11	–	65
ceftazidime	93	70	61	–	70
ciprofloxacina	78	61	3	26	42
imipenem	98	100	55	–	83
gentamicin	83	53	40	43	63
levofloxacina	70	60	40	50	60
nitrofurantoin	78	53	0	90	59
norfloxacin	42	67	23	24	43
TMP-SMX	38	45	–	67	50
tetracycline	62	60	–	37	41
tobramycin	78	59	50	–	63

## DISCUSSION

The high mean age of our patients reflect the hospital population. The increase of prevalence of nosocomially acquired UTI in the male group after fifty years might be caused by the higher incidence of urinary tract pathologies like prostate diseases. The female group has a more uniform distribution, and the elevated incidence in the twenties and forties might be caused by the obstetric and gynecologic causes, respectively.

We found that *E. coli* is the predominant bacterium in urine samples, followed by *P. aeruginosa* and *Klebsiella sp.*, reflecting the predominance of Gram-negative bacteria. This is in accordance to previous studies in other countries<sup>9-11</sup>. There is a high prevalence of Gram-positive bacteria, corresponding to 22% of total, mainly due to *Enterococci* and *Staphylococci*, which correlates with previous data from other studies that report an increase in the number of Gram-positive bacteria and yeasts as nosocomial UTI pathogens<sup>4,9</sup>.

In this study, *E. coli* and *Klebsiella sp.* showed a higher resistance to ampicillin, TMP-SMX and cephalothin than described in the literature<sup>11,12</sup>. Nevertheless, the susceptibility to aminoglycosides, fluoroquinolones, second and third generation cephalosporins, nitrofurantoin and imipenem were equivalent to previous reports that have been showing an increasing resistance to antibiotics<sup>13-15</sup>.

*P. aeruginosa* showed resistance rates of over 50% for quinolones, aminoglycosides and some third generation cephalosporin, thereby posing a major problem in the management of

nosocomial UTI. The same pattern was described in several European hospitals<sup>12</sup>.

## CONCLUSION

This study suggests that if one could not wait the results of urine culture, the best choices to begin empiric treatment of nosocomial UTI are imipenem, second or third generation cephalosporin and aminoglycosides. Cefalothin and ampicilin are quite ineffective to treat these infections.

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Dias Neto JA, Silva LDM, Martins ACP, Tiraboschi RB, Domingos ALA, Suaid HJ, Tucci Jr S, Cologna AJ. Prevalência e susceptibilidade bacteriana da infecção urinária hospitalar. *Acta Cir Bras [serial online]* 2003 vol 18 suppl 4. Disponível em in [www.scielo.org.br/acb](http://www.scielo.org.br/acb)

**RESUMO – Introdução:** A infecção urinária é a mais comum das infecções hospitalares. O conhecimento da prevalência das cepas bacterianas e do antibiograma é importante para orientar a escolha inicial do antibiótico. **Objetivo:** Determinar a prevalência bacteriana e a sensibilidade aos antibióticos na infecção urinária hospitalar, em um hospital universitário, período janeiro-junho de 2003. **Métodos:** Foram analisados os prontuários de 188 pacientes com urocultura positiva ( $\geq 10^5$  colônias/ml), depois de decorrido um período de pelo menos 48h da internação. **Resultados:** Metade dos pacientes era homens. A idade média da amostra foi  $50,2 \pm 22,7$  anos com variação de 3 meses a 88 anos. Em 80% dos casos a bactéria identificada era Gram-negativa. Os micróbios mais comuns foram *E. coli* (26%), *Klebsiella sp* (15%), *P. aeruginosa* (15%) e *Enterococcus sp* (11%). O antibiograma mostrou maior sensibilidade bacteriana ao imipenem (83%), cefalosporinas de segunda e terceira geração e aminoglicosídeos e grande resistência à ampicilina e cefalotina. A sensibilidade foi baixa também para ciprofloxacina (42%) e norfloxacina (43%). **Conclusão:** Este estudo sugere que se não for possível aguardar os resultados da cultura e antibiograma a melhor escolha para início do tratamento seria o imipenem, cefalosporinas de segunda e terceira geração e aminoglicosídeos. A cefalotina e a ampicilina não constituem boa opção para o tratamento empírico inicial.

**DESCRIPTORES:** Infecção urinária. Etiologia, antibiograma. Infecção hospitalar. Microbiologia, sensibilidade.

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## Correspondence address:

Antonio Carlos Pereira Martins  
Hospital das Clínicas – Departamento de Cirurgia  
Av. Bandeirantes, 3.900, 9º Andar  
Ribeirão Preto, SP, CEP: 14048-900

14 – ARTIGO ORIGINAL

## Behavior of cholinesterase and liver mitochondrial function in dogs submitted to normothermic ischemia and reperfusion.<sup>1</sup>

Luis Pinto Fernandes<sup>2</sup>, Ajith Kumar Sankarankutty<sup>3</sup>, Eduardo Garcia Pacheco<sup>3</sup>, Sérgio Centurion<sup>3</sup>  
Maria Cecília Jordani<sup>3</sup>, Orlando de Castro e Silva Jr<sup>4</sup>

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1. Estudo realizado no Laboratório de Bioquímica e Transplante Hepático do Departamento de Cirurgia e Anatomia da Faculdade de Medicina de Ribeirão Preto-Universidade de São Paulo (FMRP-USP)
  2. Professor Doutor da Universidade do Distrito Federal, Brasília.
  3. Pós Graduandos do Programa de Pós Graduação em Clínica Cirúrgica do Departamento de Cirurgia e Anatomia da FMRP-USP
  4. Professor Associado do Departamento de Cirurgia e Anatomia