CHAPTER 22

Resistance profile of the most prevalent microorganisms in urine cultures at the Laboratório de Análises Clínicas Adolfo Lutz

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Rodrigo Lobo Leite
Master in Food Microbiology – UFLA
Fundação de Ensino de Contagem (Contagem Educational Foundation) – Unidade CENTEC (CENTEC Unity)
E-mail: rodrigo.leite@edu.contagem.mg.gov.br

Joelma Marins Silva
Clinical Analysis Technician
Fundação de Ensino de Contagem (Contagem Educational Foundation) – Unidade CENTEC (CENTEC Unity)
E-mail: joelma.marins28@gmail.com

Silvana Maria Cardoso
Technical Education in Pharmacy
Fundação de Ensino de Contagem (Contagem Educational Foundation) – Unidade CENTEC (CENTEC Unity)
E-mail: silvanamariacardoso6@gmail.com

Jefferson Rodrigues
Bachelor - Biological Sciences – Isabela Hendrix
Specialization - Clinical Analysis - UNA and Microbiology and Immunology - Faculdade Única (Única College); Hematology - Faculdade Única (Única College).
Fundação de Ensino de Contagem (Contagem Educational Foundation) – Unidade CENTEC (CENTEC Unity)
E-mail: jeffersonr2004@gmail.com

Walessa Martins de Castro
Master in Applied Health Biotechnology - UFSJ (São João del-Rei Federal University)
Fundação de Ensino de Contagem (Contagem Educational Foundation) - Unidade: CENTEC (CENTEC Unity)
E-mail: walessacastro10@gmail.com

Laura Lima de Oliveira Vargas
Technical Education in Clinical Analysis
Higher Education in Psychology IN PROGRESS / 5th period
Centro Universitário Una (Uma Universitary Center) - Campus Contagem
E-mail: lauralima458@gmail.com

Beatriz Almeida Silva de Lima
Higher academic education: Integrated High School with Clinical Analysis
Current acting institution: - Colégio Técnico da UFMG (UFMG Technical High School)
Rua José Américo de Almeida (José Américo de Almeida Street) 328, Camargos
E-mail: beatrizalmeidalima21@gmail.com

ABSTRACT
Urinary tract infection (UTI) is defined as microbial colonization and tissue invasion of some site of the genitourinary tract (GUT), capable of overcoming the defensive capacity of the host and causing injury. (Menin and Grazziotin, 2010). The main objective was to study the resistance profile of the most prevalent microorganisms in Urocultures at the Laboratory of Clinical Analysis Adolfo Lutz - FUNEC/CENTEC in order to have an overview of the resistance pattern of these microorganisms against the antibiotics used for the treatment of infections. During the study period, 316 urine cultures with antibiogram were performed in the clinical analysis laboratory Adolfo Lutz, FUNEC, UNIDADE CENTEC in Contagem/MG. Among these, 20.89% (66) presented a positive result, that is, microbial growth equal to or greater than 100,000 cfu/mL, with females being the most affected (83.34%). Escherichia coli was the microorganism with the highest incidence, followed by Staphylococcus aures and Klebsiela pneumoniae and in relation to the resistance profile of the isolated strains of Escherichia coli. A high level of resistance was observed for Ampicillin, Amoxicillin/Clavulinic Acid, Sulfametaxazole-Trimetropin, Nalidixic Acid, Cafazoline and Tetracycline respectively.

Keywords: Antibacterial agents, Bacteriuria, Prevalence, Antibiotics.

1 INTRODUCTION

Urinary tract infection (UTI) is defined as microbial colonization and tissue invasion of some site of the genitourinary tract (GUT), being able to overcome the host's defensive capacity and cause injury (MENIN and GRAZZIOTIN, 2010). According to Junior (2013) evaluating the microbial prevalence in urine cultures, describing patient characteristics in addition to the antimicrobial sensitivity profile of

positive samples at HUAC Hospital Universitário Alcides Carneiro (Alcides Carneiro Universitary Hospital), in Campina Grande-PB, realized that of the 554 urine cultures performed, 124 (22.4%) were positive for microbial growth. In the outpatient clinic Escherichia coli showed the highest prevalence (61.8%), followed by Klebsiella pneumoniae (8.8%). In the hospital, the most prevalent was Klebsiella pneumoniae (27.8%) followed by Escherichia coli (26.7%). Ampicillin showed the highest percentage of resistance in the outpatient and inpatients, against antibiotics such as nalidixic acid, sulfamethoxazole/trimethoprim, fluoroquinolones, cephalosporins, sulfamethoxazole/trimethoprim, quinolones, monobactans, ampicillin/sulbactam, cephalosporins, carbapenens, and aminoglycosides. According to Dias and Monteiro (2010), the belief that the problem of bacterial resistance will be overcome with the discovery of new drugs is for many, more practical than the design of interventions to contain its evolution. The rational use of antibiotics is fundamental to avoid microbial resistance. Based on the above, it is of utmost importance to develop a project with the general objective of studying the resistance profile of the most prevalent microorganisms in urine cultures in the Laboratory of Clinical Analysis Adolfo Lutz - FUNEC/CENTEC, in order to have an overview of the resistance pattern of these microorganisms against the antibiotics used for the treatment of infections.

2 THEORETICAL FRAMEWORK

Urinary tract infection (UTI) is defined as microbial colonization and tissue invasion of some site of the genitourinary tract (GUT), being able to overcome the host's defense capacity and cause injury. (Menin and Grazziotin, 2010).

The species of intestinal flora most frequently associated with urinary tract infections is Escherichia coli. In fact, this species is responsible for 80 to 90% of community-acquired urinary tract infections. Urinary tract infections usually occur via the ascending route, i.e. the E. coli from the intestines reaches the urethra, then passes into the bladder, and eventually the upper urinary tract. Because of the short distance between the anus and the female urethra, urinary infections are more frequent in women. The E. coli includes a large number of strains, but only a few are pathogenic for the urinary tract. These are characterized by the presence of adhesion fimbriae and the production of hemolysins. Urinary flow, anatomical or even functional changes are important factors in the genesis of urinary tract infections (TRABULSI and LTERTHUM, 2004).

According to Lopes et al. (1998) evaluating the changes over more than a decade (1983-1994) in the frequency of resistance to norfloxacin and ciprofloxacin in bacteria isolated from urine cultures, data show a gradual increase in the frequency of this resistance among the most common bacteria isolated in urine culture tests.

Santana et al (2012) studying the resistance profile of Escherichia coli and Klebsiella spp isolated from urine cultures from a community in the city of São Luis-MA in the period 2005-2008, concluded that in relation to the susceptibility to antimicrobials, E.coli and Klebsiella spp showed a high resistance rate

(75.6%) to amoxicillin/clavulanic acid and nalidixic acid (82.5%), suggesting the non-use of these antibacterials in the treatment of urinary tract infections.

According to Magalhaes et al (2010), the profile of bacterial resistance to the two quinolones tested, ciprofloxacin and norfloxacin, was similar in the studied urine cultures, with E. coli showing significant resistance to these two antimicrobials (20,85%).

Oliveira and Lacerda (2017), studying the resistance profile of the most prevalent microorganisms in urine cultures at the Laboratório de Análises Clínicas Laboranálise (Clinical Analysis Laboranalysis Laboratory) -in Sete Lagoas, Minas Gerais in the period from August 2015 to July 2016, noticed that in this period, the microorganism most frequently isolated was Escherichia coli (58.8%). The most affected gender was female (85.6%) and the age group with the highest occurrence was 18 to 30 years (24.9%). The enterobacteria were more resistant to the antibiotic Ampicillin followed by fluoroquinolones of first and second generation, while the carbapenems were the class with the lowest incidence of resistance. The pattern of resistance found in this study confirms the importance of developing regional studies to contain the main agents that cause UTIs and their pattern of resistance.

When analyzing 2,433 positive urine cultures performed in the microbiology laboratory of the Universitary Hospital of Brasília, Pires et al. (2017) noticed that Escherichia coli was the most isolated bacteria (62.4%), followed by Klebsiella pneumoniae (6.8%) and Proteus mirabillis (4.7%). Escherichia coli showed higher sensitivity to amikacin (98.6%), gentamicin (96.2%), nitrofurantoin (96.3%), and the quinolones ciprofloxacin (90.9%) and norfloxacin (89.8%), with low sensitivity to sulfamethoxazole-trimethoprim (50.6%). The other bacteria showed similar sensitivity pattern, concluding that Escherichia coli was the most isolated bacteria, being highly sensitive to aminosides, nitrofurantoin and quinolones.

From the 616 medical records, Salton and Maciel (2017) identified 55 (9%) of cases as significant bacteriuria in urine cultures from patients in a city in the interior of Rio Grande do Sul. The main pathogen present in the urine cultures was Escherichia coli with 70% (38), followed by Staphylococcus aureus with 21% (12) and Enterobacter spp. with 9% (5). Female patients were the most affected, representing 87% (48) of the cases. Regarding the age range, there was a higher prevalence of significant bacteriuria among individuals between 61 and 80 years of age, 40% (22). Regarding resistance profiles, 29% of E. coli showed resistance to sulfamethoxazole-trimethoprim, 17% of S. aureus showed resistance to the antimicrobials nitrofurantoin and sulfamethoxazole-trimethoprim, and 40% of Enterobacter spp. showed resistance to clindamycin. The data allowed us to conclude that in this study there was a high prevalence of significant bacteriuria in women, as well as in an age range of 61 to 80 years. The main pathogen found was E. coli, followed by S. aureus and Enterobacter spp. Regarding antibiotics, a high index of resistance of Enterobacter spp. was observed, followed by E. coli and S. aureus.

In a study on the antimicrobial resistance profile of urinary tract infections in women treated at a tertiary hospital in Vitória, ES, Filho et al. (2013) concluded that the antibiotic with the highest resistance

rate, both for E. Coli (44%), as well as for the other microorganisms (16.6%), was ampicillin, also observing a significant trend of resistance of E. Coli to ciprofloxacin throughout the months studied.

According to Dias and Monteiro (2010), the belief that the problem of bacterial resistance will be overcome with the discovery of new drugs is, for many, more practical than designing interventions to contain its evolution. The appropriate use of antibiotics is of crucial importance for the maintenance of population health and for an efficient use of resources in health care provider systems. The rational use of antibiotics is relevant for patients, healthcare professionals, policy decisions, as well as the pharmaceutical industry.

Based on the above, it is of utmost importance to develop a project with the general objective of studying the resistance profile of the most prevalent microorganisms in urine cultures in the Clinical Analysis Laboratory Adolfo Lutz - FUNEC/CENTEC.

3 METHODOLOGY

The study will be descriptive, retrospective and documental, based on information from data extracted from the GLAB, SISLAB and SILAC (HB) programs made available by the Adolfo Lutz Clinical Analyses Laboratory of FUNEC/CENTEC in the period from 04/01/2003 to 05/10/2021.

The target population of the study will consist of patients confirmed by urine culture tests at the Adolfo Lutz Clinical Analysis Laboratory of FUNEC/CENTEC. The data collected will be statistically analyzed in simple tables and graphs, with absolute and percentage frequency.

The project will be developed by analyzing the following parameters:

Number of positive urine cultures

Quantity by gender and age group

Main microorganisms isolated

Main antimicrobials tested

Resistance or Sensitivity to the antimicrobials tested

4 RESULTS AND DISCUSSION

During the period studied, 316 urine cultures with antibiogram were performed in the Adolfo Lutz Clinical Analyses Laboratory of FUNEC, CENTEC UNITY in Contagem, MG. Among those, 20.89% (66) were positive, i.e., microbial growth equal to or higher than 100,000 CFU/mL (Table 1), and females were the most affected (83.34%), as shown on table 2.

Table 1 - Total of urine cultures performed

Total Urine culture	316	100%
Negative Cultures	250	79,11%
Positive Cultures	66	20,89%

Tabela 2 – Total urocultures performed per gender

Gender	Quantity	Percentage
Female	55	83,33
Male	11	16,67
Total	66	100

According to FILHO et al. (2013) women are more susceptible due to several factors, such as anatomical proximity between the anus and vagina, which facilitates upward contamination, anatomical and functional changes of the bladder and active sexual activity.

Table 3 shows the frequency of microorganisms isolated in this study, where Escherichia coli was the microorganism with the highest frequency, followed by Staphylococcus aures and Klebsiela pneumoniae.

Filho at. (2013) conducting a study on the antimicrobial resistance profile of urinary tract infections in women assisted in a tertiary hospital, isolated from the 585 positive samples E. coli (69.9%), Klebsiela pneumoniae (6%), Staphylococcus saprophyticus (5.1%) and Proteus mirabilis (3.1%), a result similar to that in this research

Regarding the resistance profile in this study, the main focus was on Escherichia coli, Stapylococcuys aureus and Klebsiella pneumoniae being the main bacteria isolated in the positive urine cultures.

Table 4 demonstrates the resistance profile of the isolated Escherichia coli strains, noting a high level of resistance to Ampicillin, Amoxillin/Clavulinic Acid, Sulfametaxazole-Trimethropin, Nalidixic Acid, Cafazolin, and Tetracycline, respectively.

Tabela 3 – Frequency of isolated microorganisms

Isolated Bacteria	
Escherichia coli	66,70%
Staphylococcus aureus	6,10%
Klebsiella pneumoniae	6,10%
Enterococcus sp.	4,55%
Staphylococcus sp. (Coagulase negative)	4,55%
BGN - UNIDENTIFIED	3,00%
Streptococcus agalactiae (B group)	1,50%
Staphylococcus saprophyticus	1,50%
Klebsiella sp.	1,50%
Corineforme	1,50%
Citrobacter freundii	1,50%
Klebsiella oxytoca (sucrose +)	1,50%

Table 4: Resistance profile of strains isolated from Escherichia coli

Escherichia coli	
Ampicillin	61,36%
Amoxillin/Clavulinic Acid	40,90%
Sulfametaxazole- Trimethoprim	34,10%
Nalidixic Acid	31,81%
Cafazoline	31,81%
Tetraciclina	29,54%
Ciprofloxacina	27,27%
Norfoloxacin	20,45%
Lomefloxacina	11,36%
Gentamicin	11,36%
Cefepime	11,36%
Nitrofurantoin	9,10%
Ceftriaxone	9,10%
Ofloxacina	6,81%
Amikacin	4,54%
Tobramycin	4,54%
Chloramphenicol	2,27%
Cefuroxime	2,27%
Levofloxacina	2,27%

Table 5 demonstrates the resistance profile of the isolated strains of Stapylococcus aureus, observing a high level of resistance for Amoxaxillin/Clavulanic Acid, Ampicillin, Nalidixic Acid, Amikacin and Cefepime respectively.

Table 5: Resistance profile of strains isolated from Stapylococcus aureus

Stapylococcus aureus	
Nalidixic Acid	75%
Amikacin	75%
Amoxicillin/Clavulanic Acid	100%
Ampicillin	100%
Cefepime	75%
Ceftriaxone	50%
Gentamicin	50%
Meropenem	25%
Nitrofurantoin	25%
Tetracycline	50%

Table 6 demonstrates the resistance profile of the isolated strains of Klebsiella pneumoniae, noting a high level of resistance for Ampicillin, and Sulfametaxazole Trimethropin respectively.

Table 6: Resistance profile of isolated strains of Klebsiella pneumoniae

Klebsiella pneumoniae	
Nalidixic Acid	50%
Amoxicillin/Clavulanic Acid	50%
Ampicillin	100%
Cefazolin	25%
Ciproflxacin	50%
Levofloxacin	25%
Lomofloxacin	50%
Nitrofurantoin	25%
Norfloxacin	50%
Tetracycline	50%
Sulfamethoxazole Trimethropin	75%

5 CONCLUSION

According to the results obtained, the importance of new studies about the arguments presented by the main microorganisms present in positive urine culture exams can be noticed, besides expanding the knowledge about the behavior against the antimicrobials tested.

For all the aspects presented, that the study developed may help new researches and, mainly, avoid self-medication that weakens the organism, besides creating bacterial resistance to the drugs available in the market.

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