

**PATTERNS OF BACTERIAL RESISTANCE AND SENSITIVITY TO ANTIBIOTICS IN
PATIENTS WITH URINARY TRACT INFECTION AT “X” REGIONAL HOSPITAL IN
2024**

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Abstract

Urinary tract infection (UTI) is a condition caused by the presence of microorganisms in very large numbers in the urine and causes infections in the urinary tract. Bacterial resistance to antibiotics reduces the effectiveness of therapy. Bacterial sensitivity aims to determine whether the bacteria are resistant to various antibiotic preparations. The purpose of this study was to determine bacterial resistance and sensitivity in determining the effectiveness of antibiotics in UTI patients. This study research design used being descriptive observational through a design approach retrospective, to see the suitability of antibiotic use and bacterial sensitivity presentation data. Sampling using purposive sampling technique many as 40 samples based on information from medical records of UTI patients at “X” Regional Hospital then analyzed using SPSS and Microsoft Excel.

The results of this study found UTI as the main diagnosis of 60% and 40% as a secondary diagnosis. The bacteria that cause UTI in this study were found to be 3 types of bacteria, the most dominant of which are *Escherichia coli*'s many as 20 patients (50%), *Streptococcus* sp many as 12 patients (30%) and *Acinetobacter baumannii*s many as 8 patients (20%). *Escherichia coli* resistant to the antibiotic cefixime (100%) and most sensitive to the antibiotic ciprofloxacin (100%). *Streptococcus* sp resistant to the antibiotic cefixime (83%) and most sensitive to the antibiotic's gentamicin and meropenem (92%). *Acinetobacter baumannii* resistant to the antibiotic cefixime as many as 5 people (62.5%) and most sensitive to the antibiotic trimethoprim-sulfamethoxazole as many as 7 people (87.5%).

Keywords: antibiotics, bacteria, UTI, resistance, sensitivity

INTRODUCTION

Urinary tract infection (UTI) is a condition caused by the presence of microorganisms in large numbers in the urine and causes urinary tract infections (Dipiro et al., 2018). UTI is usually caused by microorganisms in the urinary tract, including the bladder, urethra, kidneys, ureters. The bacteria that cause UTI are *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterococcus faecalis* and *Staphylococcus saprophyticus* (Ana et al., 2015).

The use of antibiotics in Indonesia is still the main choice for treating UTI. Antibiotics used in UTI therapy are penicillin, cephalosporin, fluoroquinolone, sulfonamide, aminoglycoside, and carbapenem (Dipiro et al., 2018).

Antibiotic resistance is a consequence of the wrong use of antibiotics and the development of the microorganisms that cause them, this condition is also due to mutations or acquired gene resistance resulting in resistance to antibiotics (Syah Putra et al., 2020).

The mechanism of antibiotic resistance is that microbes can change the cell surface so that antibiotics cannot enter and microbes that produce enzymes damage the structure of antibiotics and reduce their effectiveness so that antibiotics cannot bind effectively to cells. In the final stage, microbes can pump out antibiotics from the cell so that the effectiveness of antibiotics will remain low in concentration (Tortora et al., 2010).

Bacterial resistance to antibiotics causes reduced therapeutic effectiveness, lack of antibiotic sensitivity to a bacterium which makes the bacterium increasingly immune and has an impact on increased morbidity and mortality and excessive health care expenditures (Rukmini et al., 2019).

Syafada's research (2013) the author conducted an evaluation of bacterial strains and their sensitivity to bacterial patterns that cause UTIs at Hospital X in Yogyakarta. The results of the study showed that the most common bacterial group causing UTIs was gram-negative, namely *Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae* bacteria. The most

common gram-positive bacteria were coagulase-negative Staphylococci. Antimicrobials that are still sensitive to gram-negative bacteria are amikacin, imipenem, netilmicin, and fosfomycin. Antimicrobials that are still sensitive to gram-positive bacteria are nitrofurantoin, vancomycin, imipenem, and cefuroxime. Based on the background that has been described, this study aims to determine the resistance and sensitivity of bacteria in determining the effectiveness of antibiotics in UTI patients.

METHOD

This study is a non-experimental study with a descriptive observational research design through a retrospective design approach, to see the suitability of antibiotic use and bacterial sensitivity percentage data in UTI patients at RSUD X in 2024. In this study, researchers want to know the resistance and sensitivity of bacteria to antibiotics in UTI patients at RSUD X in 2024. The population used in this study were all inpatients with UTI at RSUD "X" in 2024. The sample in this study was patients with UTI in the inpatient room at RSUD "X". Sampling in this study was carried out using a purposive sampling technique, namely a sampling technique by taking samples among the population according to the researcher's considerations, namely where the samples taken were considered good and suitable to be used as researcher samples (Firdaus, 2021). The sampling technique in this study was total sampling obtained from medical record data of UTI cases at RSUD "X" in January-December 2024. In this study, sampling was based on a specific consideration made by the researcher in the form of inclusion and exclusion criteria.

Data collection was obtained by using retrospective data from medical records of UTI antibiotic resistance patients at RSUD "X" in 2024. The instruments used in this study were carried out using patient medical records, UTI microbiology test results data, and bacterial sensitivity results data.

The percentage of resistance and sensitivity to bacteria was carried out using the SPSS version 25 program by collecting medical record data that included patient information and UTI microbiology test results data. The data that had been processed in the form of a table was then described to see the characteristics of UTI patients, UTI diagnosis classification, UTI-causing bacteria and the results of resistance and sensitivity tests of UTI-causing bacteria to antibiotics.

RESULT AND DISCUSSION

In the study of resistance patterns and sensitivity of bacteria to antibiotics for UTI disease at RSUD "X" Pekalongan, 40 samples were obtained. Primary data collection in the form of characteristic data and research variables was carried out based on information from medical records of in patients at RSUD "X" in 2024.

A. Characteristics of UTI Patients at RSUD X.

Table 1 Distribution of Patient Characteristics

No	Karakteristik	Jumlah	%
1	Usia		
	17-25	2	5.0
	26-35	3	7.5
	36-45	5	12.5
	46-55	8	20.0
	56-65	11	27.5
	>65	11	27.5
2	Jenis Kelamin		
	Laki-laki	11	27.5
	Perempuan	29	72.5
3	Pendidikan		
	Tidak Tamat SD	6	15.0
	SD	20	50.0
	SMP	2	5.0
	SMA	9	22.5
	S1	3	7.5
4	Pekerjaan		
	IRT	18	45.0

Buruh	7	17.5
Petani	2	5.0
Nelayan	1	2.5
Pedagang	4	10.0
Tidak Bekerja	2	5.0
Wirawasta	3	7.5
Karyawan Swasta	1	2.5
Pensiunan PNS	2	5.0

The results of this study are in line with the theory of Smeltzer et al. (2018), in old age there are significant changes, namely weakness of the urethral sphincter and reduced bladder volume which can cause urinary tract infections. At the age of over 50 years there is a decrease in immunity, this is caused by decreased thymus atrophy function. Involution of thymus cells causes the number of cells and the quality of T cell responses to decrease. The number of memory T cells increases but is increasingly difficult to develop, especially cytotoxic T cells (CD8 +) and Th1 cells (CD4) due to apoptosis. Cytotoxic T cells (CD8 +) play a role in the immune response to antigens in infected cells by killing infected cells to prevent the spread of infection, while Th1 cells (CD4) play a role in helping B cells to produce antibodies. In old age there are significant changes, namely weakness of the urethral sphincter and reduced bladder volume which can cause urinary tract infections in old age (Hariati, 2019). In the study of UTI patients at RSUD "X" Pekalongan, the highest frequency of gender was female, namely 29 people (72.5%) compared to male gender as many as 11 people (27.5%). The results of this study are in line with research conducted by Inggaini et al. (2022) most UTI patients were female, namely (68%) while those who were male were (32%).

In this study, the highest frequency of education level was elementary school as many as 20 people (50%) and the lowest frequency of education level was S1 as many as 3 people (7.5%). The results of this study are in line with research conducted by Putra (2017) at RSU Muhammadiyah Palembang which found that the highest proportion of UTI incidence was the group with basic education level, namely 22 patients (66.7%), compared to patients with secondary and higher education levels, namely 10 patients (33.3%) (Putra, 2017).

In the occupational category, the majority of UTI patients in this study were housewives, as many as 18 people (45%), this is in accordance with the findings in the gender category which is dominated by women. Women are more susceptible to UTI because women have a shorter urethra so that pathogens that cause UTI will be transmitted to the urinary tract more easily and quickly than men (Annisah et al., 2024).

B. Analysis of Bacterial Resistance and Sensitivity Patterns to Antibiotics in Urinary Tract Infection Patients at RSUD X in 2024

1. Frequency Distribution of UTI Patients Based on Patient Classification

Table 2 Distribution of UTI Patients Based on Clinical Classification

No	Klasifikasi	Jumlah	%
1	Diagnosa Utama	24	60
2	Diagnosa Sekunder	16	40

Based on the results of the study in table 2, the clinical classification of UTI patients as the primary diagnosis was 24 patients (60%) and UTI as a secondary diagnosis was 16 patients (40%). In addition to the causes of UTI from various types of microbes, there are many risk factors that cause an increase in the incidence of UTI. Other risk factors that are most often identified are previous antibiotic use and the use of catheterization (Tenney et al., 2018). In addition, it can be seen in table .3 of patients who experienced UTI as a secondary diagnosis.

Table 3 Frequency Distribution of Patients with Secondary Diagnosis of UTI

No	Diagnosis	Jumlah	%
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1	Diabetes Mellitus	12	75
2	Vertigo	1	6.3
3	Hipokalemia	1	6.3
4	Cerebral Infraction	1	6.3
5	Malignant Neoplasm of Bone	1	6.3

In this study, the secondary diagnosis of patients with UTI was mostly dominated by patients with diabetes mellitus as many as 12 people (75%). Lack of blood glucose control can cause chronic hyperglycemia which provides the opportunity for various complications including urinary tract infections Black, J. M & Hawks (2014). In patients with DM and uncontrolled blood glucose levels are also one of the causes of UTI. In patients with vertigo, hypokalemia, cerebral infarction and malignant neoplasm of bone, UTI can be caused by the use of catheters during hospitalization. The use of catheters often causes microorganisms to enter the bladder due to the lack of hygiene of the equipment or health workers who insert the catheter (Kurniasari et al., 2020). The prevalence of UTI is high in patients who use catheters, namely 80% and 10% -30% of these patients will experience bacteriuria (Semarandana, 2014).

2. Frequency Distribution of Bacteria Causing UTI in Patients at RSUD "X"

Table 4 Frequency Distribution of Bacteria Causing UTI in Patients at RSUD

No	Jenis Bakteri	Jumlah	%
1	Acinobacter Baumanii	8	20
2	Escherichia coli	20	50
3	Streptococcus sp	12	30

Based on the findings of bacteria in microbiology tests on UTI patients at RSUD "X", the most commonly found bacteria were Escherichia coli, namely 20 patients (50%). E. coli is an opportunistic normal flora in the digestive tract, namely if the number is within normal limits, the bacteria can be beneficial, but if there is an increase in the number from the normal number, the bacteria will become pathogenic. E. coli has a virulence factor that can increase colonization and invasion of bacteria into the urinary tract to cause infection. Its adhesive properties are facilitated by fimbriae (Harvey, 2007).

Based on research data on bacterial patterns from urine isolates in 3 different places in Indonesia, namely Jakarta (microbiology department and pathology department of the FKUI-RSCM Clinic), Bandung (clinical pathology department, sub-microbiology department of Hasan Sadikin), and Surabaya (Microbiology department of Soetomo Hospital) the results showed that the most common bacteria causing UTI were E. coli at 38.85% followed by Klebsiella at 16.63%, and Streptococcus at 14.95% (Firizki, 2013).

3. Bacterial Resistance and Sensitivity Test to Antibiotics

One of the factors that can cause antibiotic therapy failure is antibiotic resistance. Organisms that are resistant to antibiotics are increasingly emerging, especially due to inappropriate use of antibiotics, inadequate doses, and stopping taking antibiotics Mortazavi-Tabatabaei et al. (2019), to avoid therapy failure due to inappropriate use of antibiotics, bacterial sensitivity tests are carried out.

Sensitivity tests measure how effectively antibiotics or chemical drugs kill or stop the growth of bacteria in order to determine whether the bacteria are resistant to various antibiotic preparations (Vineetha, 2015). The content of antibiotics is a chemical compound produced by microorganisms or produced synthetically which is toxic. The compounds formed can kill or inhibit the development of bacteria and other organisms that come into contact with the bacteria (Nur et al., 2013).

The results of the resistance and sensitivity tests of bacteria to antibiotics in UTI patients at the "X" Regional Hospital can be seen in the following table.

Table 5 Results of the Resistance and Sensitivity Test of *Acinobacter baumannii* Bacteria to Antibiotics in Patients at the "X" Regional Hospital

No	Jenis Antibiotik	R	%	S	%
1	Amikacin	2	25	6	75
2	Amoxicillin-clavulanate	4	50	4	60
3	Ampicillin	3	37.5	5	62.5
4	Ampicillin-sulbactam	4	50	4	50
5	Ceftriaxone	2	25	6	75
6	Cefixime	5	62.5	3	37.5
7	Ciprofloxacin	2	25	6	75
8	Gentamicin	2	25	6	75
9	Imipenem	4	50	4	50
10	Levofloxacin	3	37.5	5	62.5
11	Meropenem	2	25	6	75
12	Mufifloxacin	3	37.5	5	62.5
13	Piperacillin-tazobactam	2	25	6	75
14	Tetracycline	3	37.5	5	62.5
15	Trimetprim-sulfamethoxazole	1	12.5	7	87.5
Total Pasien 8 orang					

Based on table 5, antibiotic resistance and sensitivity tests in UTI patients with the most common bacteria found were cefixime antibiotic resistance in 5 people (62.5%) and the most sensitive to trimethoprim-sulfamethoxazole antibiotic in 7 people (87.5). The results of this study are in line with research conducted by Kandardini et al. (2020) which stated the high value of cefixime antibiotic resistance to *Acinetobacter baumannii* microorganisms with a resistance value of (100%) from 17 samples tested and the most sensitive to trimethoprim/sulfamethoxazole antibiotics with a sensitivity value of (81.8%) from 22 samples tested. Another study conducted by Almani et al. (2017) stated the high value of cefixime antibiotic resistance to *Acinetobacter baumannii* microorganisms with a resistance value of (90%).

According to MK (2018), the microorganism *Acinetobacter baumannii* is most sensitive to trimethoprim/sulfamethoxazole antibiotics tested on 94 samples with a sensitivity value of (44.6%).

Table 6 Results of Resistance and Sensitivity Tests of *Escherichia coli* Bacteria to Antibiotics in Patients at RSUD "X"

No	Jenis Antibiotik	R	%	S	%
1	Amikacin	4	20	16	80
2	Amoxicillin-clavulanate	8	40	12	60
3	Ampicillin	18	90	2	10
4	Ampicillin-sulbactam	16	80	3	20
5	Ceftriaxone	4	20	5	25
6	Cefixime	20	100	0	0
7	Ciprofloxacin	0	0	20	100
8	Gentamicin	1	5	19	95

9	Imipenem	10	50	10	50
10	Levofloxacin	9	45	11	55
11	Meropenem	7	35	13	65
12	Mufifloxacin	8	40	12	60
13	Piperacillin-tazobactam	5	25	15	75
14	Tetracycline	7	35	13	65
15	Trimetprim-sulfamethoxazole	6	30	14	70
Total Pasien 20 orang					

Based on table 6, antibiotic resistance and sensitivity tests in UTI patients with the most common *Escherichia coli*-causing bacteria were found to be resistant to the antibiotic cefixime as many as 20 people (100%) and the most sensitive to the antibiotic ciprofloxacin as many as 20 people (100%) and gentamicin as many as 19 people (95%). The results of this study are in line with research conducted by Arivo & Dwiningtyas (2019) which showed that antibiotics that are sensitive to *E. coli* are gentamicin at 100%, and ciprofloxacin at 60%. In line with this study, the results of another study conducted in Saudi Arabia on 101 patients suffering from urinary tract infections showed that the antibiotic that is most sensitive to the microorganism *E. coli* is nitrofurantoin, followed by ciprofloxacin and cefazolin with a sensitivity value of 22.77%. This study also showed a high resistance rate of *E. coli* microorganisms to the antibiotic ampicillin at 82.76% (Alanazi M, Alqahtani F, 2019).

Table 7 Results of Resistance and Sensitivity Tests of *Streptococcus sp* Bacteria to Antibiotics in Patients at "X" Regional Hospital

No	Jenis Antibiotik	R	%	S	%
1	Amikacin	4	33	8	67
2	Amoxicillin-clavulanate	9	75	3	25
3	Ampicillin	5	42	7	58
4	Ampicillin-sulbactam	3	25	9	75
5	Ceftriaxone	6	50	6	50
6	Cefixime	10	83	2	17
7	Ciprofloxacin	9	75	3	25
8	Gentamicin	1	8	11	92
9	Imipenem	5	42	7	58
10	Levofloxacin	4	33	8	67
11	Meropenem	1	8	11	92
12	Mufifloxacin	6	50	6	50
13	Piperacillin-tazobactam	4	33	8	67
14	Tetracycline	3	25	9	75
15	Trimetprim-sulfamethoxazole	4	33	8	67
Total Pasien 12 orang					

Based on table 7, the resistance and sensitivity tests to antibiotics in UTI patients with the most common *streptococcus sp* bacteria found were resistant to cefixime antibiotics as many as 10 people (83%) and the most sensitive to gentamicin and meropenem antibiotics as many as 11 people (92%). The results of this study are in line with the study conducted by Fergiawan Indra Prabowo & Inayati (2012) on the identification of sensitivity patterns and types of bacteria in

UTI patients at the PKU Muhammadiyah Hospital in Yogyakarta, where the results showed that gram-positive streptococcus sp bacteria were sensitive to meropenem antibiotics (66.67%) and gentamicin (66.67%), but resistant to other antibiotics, namely amoxicillin (66.67%), cefixime (66.67%), ciprofloxacin (67%).

4. Overview of UTI treatment at RSUD X

The results of antibiotic resistance and sensitivity tests in UTI patients with the most common acinobacter baumannii bacteria were found to be resistant to cefixime antibiotics in 5 people (62.5%) and most sensitive to trimethoprim-sulfamethoxazole antibiotics in 7 people (87.5%). The therapy given at RSUD "X" in cases of UTI caused by acinobacter baumannii bacteria was given trimethoprim-sulfamethoxazole antibiotics. The therapy given was in accordance with the management of antibiotic administration. First-line therapy for non-complicated UTI is trimethoprim-sulfamethoxazole with a dose of 160 mg/800 mg given orally twice a day for 3 days (Dipiro et al., 2018).

The results of antibiotic resistance and sensitivity tests in UTI patients with Escherichia coli bacteria were most commonly found to be resistant to cefixime antibiotics in 20 people (100%) and most sensitive to ciprofloxacin antibiotics in 20 people (100%) and gentamicin in 19 people (95%). The therapy given at "X" Hospital in cases of UTI caused by Escherichia coli bacteria was given ciprofloxacin and gentamicin antibiotics. The results of antibiotic resistance and sensitivity tests in UTI patients with Streptococcus sp bacteria were most commonly found to be resistant to cefixime antibiotics in 10 people (83%) and most sensitive to gentamicin and meropenem antibiotics in 11 people (92%). The therapy given at "X" Hospital in cases of UTI caused by Streptococcus sp bacteria was given gentamicin antibiotics. Gentamicin is a broad-spectrum antibiotic from the aminoglycoside group. Most streptococcus bacteria are resistant to gentamicin due to the failure of this drug to reach the ribosomes in the germ cells (Katzung, 2015).

This study also found that most bacteria that cause UTI are resistant to cefixime. The high rate of resistance to the beta lactam group is due to the ability of bacteria to form beta lactamase enzymes. To overcome this problem of germ resistance, two types of compounds have been synthesized, namely derivatives that are resistant to beta lactamase and those that block beta lactamase (Hemansyah, 2016).

CONCLUSION

The pattern of antibiotic resistance in UTI patients at RSUD "X" in 2024, namely the bacteria that cause acinobacter baumannii are most commonly found, namely resistant to the antibiotic cefixime as many as 5 people (62.5%). The bacteria that cause escherichia coli are most commonly found, namely resistant to the antibiotic cefixime as many as 20 people (100%). with the bacteria that cause streptococcus sp being most commonly found, namely resistant to the antibiotic cefixime as many as 10 people (83%).

The pattern of antibiotic sensitivity in UTI patients at RSUD "X" in 2024, namely the bacteria that cause acinobacter baumannii are sensitive to the antibiotic trimethoprim-sulfamethoxazole as many as 7 people (87.5%). The bacteria that cause escherichia coli are sensitive to the antibiotics gentamicin and meropenem as many as 11 people (92%). The bacteria that cause streptococcus sp are most sensitive to the antibiotics gentamicin and meropenem as many as 11 people (92%).

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