

ORIGINAL ARTICLE

Study of the Bacterial Sensitivity to different Antibiotics which are isolated from patients with UTI using Kirby-Bauer Method

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Received: June 15, 2022,

Revised: July 01, 2022,

Accepted: August 01, 2022,

DOI: 10.57238/jbb.2022.19387



Abstract

Background: The Aim of the study was to determine the sensitivity of different types of bacteria to 30 different types of antibiotics by using Kirby-Bauer Method.

Methods: The study was conducted in December 2021 and January 2022, in Al-Samawah city. Where the study was conducted on 33 patients from both genders suffering from urinary tract infection, urine samples were collected using (First morning specimen), Where the chemical tests were carried out before the process of urine culturing by using petri dishes than bacterial species were isolated and their sensitivity to different antibiotics was determined.

Result: *Staphylococcus aureus* showed sensitivity to different antibiotics where the most effective antibiotic were Imipenem (100%). *E. coli* showed sensitivity to Amikacin, Imipenem and Meropenem by (100%). For *Proteus mirabilis* the most effective antibiotics were Amikacin, Cefotaxime, Ceftriaxone, Imipenem and Meropenem by (100%). For *Streptococcus pyogenes* the most effective antibiotics were Amikacin, Ciprofloxacin, Doxycycline, Imipenem, Meropenem, Norfloxacin, Rifampicin, Levofloxacin and Tetracycline (100%) and for *Staphylococcus epidermidis* were Cefepime, Norfloxacin, Nitrofurantoin, Piperacillin, Rifampicin, Gentamycin, Trimethoprim, Tobramycin and Levofloxacin (100%) and for *Enterococcus faecalis* were Cefotaxime, Ceftriaxone, Imipenem, Rifampicin and Meropenem (100%).

Conclusions: The current study shows *Staphylococcus aureus* and *E. coli* to be the most common pathogens in our study, with very high antibiotic sensitivities to Amikacin, Cefotaxime, Ceftriaxone, Imipenem and Meropenem and according to the C&S results.

Keywords: Antibiotics, Culturing, Sensitivity (C&S), Urinary tract infection (UTI)

1 Introduction

The most significant infection in the renal system, namely a bacterial variety, is a urinary tract in-

fection (UTI) [1]. Due to anatomical variations, women are much more likely to develop UTI than men. Uropathogens can thrive in women's vagina and moist peri-urethral regions, and the close prox-

imity of the urethral opening to the anal opening and bladder increases the risk of infection from ascending uropathogens. By the time they reach their late 20s, over half of all women have experienced a UTI [2, 3]. The Enterobacteriaceae family of (gram-negative) facultative anaerobic bacilli, which is typically present in the large intestine, is the one that most frequently causes UTIs. *Escherichia coli* is the most prevalent of these bacteria and is responsible for roughly 90% of all UTIs in ambulatory people [4]. Other Enterobacteriaceae, including *Klebsiella* and *Proteus*, as well as members of the *Pseudomonas* family also cause UTIs, especially among women with complicated infections [5]. *Staphylococci* may cause 5 to 10 percent of urinary tract infections in many populations [6]. Chronic renal illness and hypertension can be brought on by recurrent UTIs [7, 8].

2 Methods and Materials

The study was Case-control study, conducted in the period between the beginning of December 2021 and end of January 2022, in Al-Samawah city, where the study was conducted on (33) patients both males and females and with different age groups suffering from urinary tract infection.

3 Method of sample collection

Urine samples were collected using (First morning specimen): This sample is also termed as a first voided specimen [9]. This sample is taken when the patient urinates for the first time in the morning. The first voided specimen is the most concentrated, making it ideal for pregnancy tests, bacterial cultures, and other tests. Confirmation on the patient not to take any kind of antibiotics or chemical treatments for a period of not less than 48 hours from the time of taking the sample in the laboratory, with giving detailed instructions to the patient on how to fill and put the sample in the container, where the collection should be from the middle of the urethra to avoid external contamination in the sample. The samples were placed in sterile containers designated for collecting urine samples with a capacity of 30 ml and the time of bringing samples to the laboratory was direct and standard at a rate of 5 minutes to start working on them in the laboratory, taking into account the preservation of the sample from contamination due to external factors, and biochemical tests were carried out on the samples The rapid test strip method is from the Korean company cybow.

4 Method of Culturing

For the purpose of isolating the bacteria present in the urine, 1 ml of urine samples were cultured on a nutrient agar by using a glass spreader and incubated at a temperature of 37 °C for 24 hours for the purpose of activating the bacteria and obtaining the most species present in the sample. Then the second bacterial culture was carried out by Continuous streaking method and incubated at a temperature of 37 °C for 24 hours in order to differentiate and select for the developing bacteria by using petri dishes for the medium of blood agar and MacConkey agar for the isolation and diagnosis of the bacteria according to the culture, morphological and microscopic characteristics of bacteria, As the medium is selective because it hinders the growth of gram- negative bacteria and prevents the growth of gram-positive bacteria because it contains crystal violet and Bile salts [10].

Therefore, any bacterial type that shows growth on the medium of the MacConkey is a gram-negative bacterium and is also one of the differential media because it contains lactose Therefore, by culturing on the medium of the MacConkey, it is possible to differentiate between fermented lactose gram-negative bacteria and the other type of non-fermented lactose gram- negative bacteria. When it comes to blood agar, alpha, beta, or gamma hemolysis cause it to be a differentially rich medium between hemolytic species [11].

5 Bacterial Diagnosis

The bacteria growing on the differential media were diagnosed visually by the shape and phenotypic characteristics of the bacterial colonies such as color, size, hemolysis and the dimensions of the growing colonies in addition to the microscopic diagnosis by making slides stained with gram stains to confirm the bacterial type isolated according to cellular shape, type of bacterial assembly and type of dye in addition to biochemical tests In order to confirm the diagnosis and distinguish between the isolated bacterial species.

6 Method of Sensitivity Test

The sensitivity of the isolated bacteria to antibiotics was done by a method of Kirby-Bauer (Disk Diffusion Method) Whereas Miller Hinton medium has been used as a rich nutrient medium for the growth of bacteria, in addition to 30 different types of uni disc antibiotics. 6 different types of antibiotic tablets were placed in each culture dish, which became 5 petri dishes for each sample. Cultivation was carried out on Miller Hinton medium using continuous streaking method and incubated at 37°C for 18 - 24 hours.

6.1 Result

The Age of patients ranged between (17 – 70) years old, the higher percentage of the UTIs in this study was for patients over 50 years old (48 %), And it was (66.6%) females and (33.3%) males.

The results showed in diagnostic bacterial culture, microscopically and biochemical diagnostic, there are different bacterial species in the samples that collected from patients with symptoms of UTI. These bacterial species found among the patients, specimens were in different proportions, as the following: Staphylococcus aureus was present in most of the samples in a proportion of (17:33) followed by E. coli (9:33), Proteus mirabilis (2:33) Streptococcus pyogenes (2:33) Enterococcus faecalis (2:33) and Staphylococcus epidermoid (1:33) and the percentages out of total samples are present in Table 1.

Species	Percentage from total samples
Staphylococcus aureus	51.51%
E. coli	27.27%
Proteus mirabilis	6.06%
Streptococcus pyogenes	6.06%
Staphylococcus epidermidi	3.03%
Enterococcus faecalis	6.06%

Table 1: percentage of bacterial species from total samples.

And for the results of the sensitivity and resistance of bacteria to 30 different antibiotics Table 2 shows that Staphylococcus aureus showed sensitivity to different antibiotics (21:30) where the three most effective antibiotics were Imipenem (100%), Meropenem and Nitrofurantoin (82.35%), Amikacin and Doxycycline (76.47%). The study showed a large discrepancy between the antibiotic resistance of different bacterial genera. The maximum effectiveness was 100% and the minimum effectiveness was 17.64% Table 2.

7 Discussion

Urinary tract infections due to bacterial infection have become one of the most common diseases in both genders, and the reason for this is due to the misuse of antibiotics and the failure of patients to adhere to the treatment plan set by the specialist doctor, as this led to the development of new strains of bacteria that are resistant to a large number of antibiotics, which leads to exacerbation when there is a need to use antibiotics to treat Urinary tract infections due to bacterial causes [12, 13]. Urinary tract infections are more common in women than men because of the anatomical structure of the genitourinary system and its close proximity to the anus. If the infections are frequent or severe, urinary tract infections are likely to cause serious complications if they are

treated early and use an appropriate antibiotic. All younger children with UTIs should have their urine tested, and both older children and adults should be evaluated alike [14]. A good criterion for the diagnosis of the microscopic cause of a UTI is urine culture. Prompt and appropriate treatment with antibiotics can prevent long-term complications [15]. The Age of patients ranged between (17 – 70) years old, the higher percentage of the UTIs in this study was for patients over 50 years old (48 %), and for gender it was (66.6%) females and (33.3%) males, so from this percentage, it will be concluded that the incidence of urinary tract infection is more in females than males and also conclude from this that people over (50) years of age are more likely to have a urinary tract infection, especially females. The study was conducted on 30 patients, and different 6 types of bacteria were diagnosed, distributed among patients suffering from urinary tract infection in the following proportions: Staphylococcus aureus 51.51%, E. coli 27.27%, Proteus mirabilis 6.06%, Streptococcus pyogenes 6.06% Staphylococcus epidermidi 3.03% Enterococcus faecalis 6.06% Table 1. Use 30 different antibiotics with different mechanisms of action ranging from attacking the wall or coating the surrounding bacteria, interfering with the bacteria multiplication process and stopping the protein production in the bacteria inside the body [16]. E. coli also showed sensitivity to different antibiotics (21:30) where the three most effective antibiotics were Amikacin, Imipenem and Meropenem (100%) and it was (55%) for Ciprofloxacin, Norfloxacin and Levofloxacin and (44.44%) for Trimethoprim and Doxycycline respectively. Proteus mirabilis showed sensitivity to different antibiotics (15:30) where the most effective antibiotics were Amikacin, Cefotaxime, Ceftriaxone, Imipenem and Meropenem (100%). Streptococcus pyogenes showed sensitivity to different antibiotics (14:30) where the most effective antibiotics were Amikacin, Ciprofloxacin, Doxycycline, Imipenem, Meropenem, Norfloxacin, Rifampicin and Levofloxacin Tetracycline (100%). Staphylococcus epidermidi showed sensitivity to different antibiotics (9:30) where the most effective antibiotics were Cefepime, Norfloxacin, Nitrofurantoin, Piperacillin, Rifampicin, Gentamycin, Trimethoprim, Tobramycin and Levofloxacin (100%). Enterococcus faecalis showed sensitivity to different antibiotics (15:30) where the most effective antibiotics were Cefotaxime, Ceftriaxone, Imipenem, Rifampicin and Meropenem (100%). Amoxicillin, Augmentin, Erythromycin, Aztreonam, Nalidixic acid and Neomycin were not sensitive to the cultured bacteria Table 2.

Table 2: percentage of bacterial species from total samples.

	Staphylococcus aureus		E. coli		Proteus mirabilis		Streptococcus pyogenes		Streptococcus epidermidis		Enterococcus faecalis	
	Result	%	Result	%	Result	%	Result	%	Result	%	Result	%
Amoxicillin	-	-	-	-	-	-	-	-	-	-	-	-
Augmentin	-	-	-	-	-	-	-	-	-	-	-	-
Amikacin	S	76.47%	S	100%	S	100%	S	100%	-	-	-	-
Azithromycin	-	-	S	11.11%	-	-	-	-	-	-	S	50%
Aztreonam	-	-	-	-	-	-	-	-	-	-	-	-
Cefixim	-	-	S	11.11%	-	-	-	-	-	-	-	-
Cefepime	S	17.64%	S	22.22%	-	-	-	-	-	-	S	50%
Cefotaxime	S	47.05%	S	11.11%	S	100%	-	-	S	100%	S	50%
Ceftriaxone	S	41.17%	S	11.11%	S	100%	-	-	-	-	S	100%
Ceftazidime	S	17.64%	S	22.22%	-	-	-	-	-	-	S	50%
Ciprofloxacin	S	58.82%	S	55.55%	S	50%	S	100%	-	-	-	-
Clarithromycin	-	-	S	11.11%	-	-	-	-	-	-	S	50%
Chloramphenicol	S	23.52%	S	33.33%	S	50%	S	50%	-	-	-	-
Doxycycline	S	76.47%	S	44.44%	S	50%	S	100%	-	-	S	50%
Erythromycin	-	-	-	-	-	-	-	-	-	-	-	-
Imipenem	S	100%	S	100%	S	100%	S	100%	-	-	S	100%
Meropenem	S	82.35%	S	100%	S	100%	S	100%	-	-	S	100%
vancomycin	S	52.94%	-	-	-	-	S	50%	-	-	S	50%
Norfloxacin	S	47.05%	S	55.55%	S	50%	S	100%	S	100%	-	-
Nalidixicacid	-	-	-	-	-	-	-	-	-	-	-	-
Nitrofurantion	S	82.35%	S	77.77%	-	-	-	-	S	100%	-	-
Neomycin	-	-	-	-	-	-	-	-	-	-	S	50%
Piperacillin	S	5.88%	-	-	S	50%	-	-	-	-	-	-
Rifampicin	S	52.94%	S	22.22%	-	-	S	100%	S	100%	S	50%
Levofloxacin	S	64.70%	S	55.55%	S	50%	S	100%	S	100%	-	-
Trimethprim	S	23.52%	S	44.44%	S	50%	S	50%	S	100%	-	-
Tobramycin	S	47.05%	S	22.22%	S	50%	S	50%	S	100%	-	-
Tetracycline	S	52.94%	S	33.33%	S	50%	S	100%	-	-	-	-
Gentamycin	S	47.05%	S	55.55%	S	50%	S	50%	S	100%	S	50%
Clindamycin	S	23.52%	-	-	-	-	-	-	-	-	-	-

1 S: Sensitive bacteria.

2 %:Percentage of sensitive bacteria.

8 Conclusions

The current study shows *Staphylococcus aureus* and *E. coli* to be the most common pathogens in our study, with very high antibiotic sensitivities to Amikacin, Cefotaxime, Ceftriaxone, Imipenem and Meropenem and according to the C&S results. Using the guidelines in the management of suspected and confirmed cases of UTI, lucid and decrease random usage of Antibiotics for the suspected and confirmed bacterial infection cases in general and UTI in a specific.

Conflict of Interest: None

Ethical consideration: from ethical committee in the Conflict of Interest: None

Ethical consideration: from ethical committee in the Al-Furat Al-Awsat University Technical Institute, Samawah, Iraq

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How to cite

Alhamadani, Y. S. T.; Oudah A. S.; Study of the Bacterial Sensitivity to different Antibiotics which are isolated from patients with UTI using Kirby- Bauer Method. *Journal of Biomedicine and Biochemistry*. 2022;1(2):1-6. doi: 10.57238/jbb.2022.19387