RESEARCH ARTICLE

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Antibiotics resistances pattern of *Escherichia coli* and *Staphylococcus spp* and associated with Otitis media and other site of infection

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ABSTRACT

The results was indicated about 25 samples which collected form different site of infection, (40%) infection by *Escherichia coli* form vaginitis patients samples, (12%) *Escherichia coli* form urinary tract infection,(8%) *Staphylococcus hominis* in blood, (28%) infection by *Staphylococcus haemolyticus* in UTI , (12%) infection by *Staphylococcus aureus* from wounds infection. Some antibiotics was used against *Escherichia coli* pathogens to antibiotics, namely (Amikacin, Gentamicin, Ceprofloxacin, Norfloxacin, Fosfomycin, Amoxicillin/ clavulanic acid, Piperacillin/ Tazobactam, Ertapenem, Imipenem, Meropenem, Nitrofuranation, Ampicillin, Trimethoprim/ Sulfamethoxa zole, Cefotaxime, Cefepime, and Ceftazidime), while *Staphylococcus spp* sensitive for antibiotics,namely (Clindamycin,Linezolid,Tecoplanin,Vancomycin,Tetracycline,Tigecycline,Gentamicin,Ceprofloxacin, Moxifloxacin, Trimethoprim/Sulfamethoxa zole, Rifampicin, Fusidic acid). The study also found that Chloramphenicol was 100% effective in treating the identified bacterial species. These findings could aid in the development of personalized treatment regimens for vaginal infections, leading to improved management of this condition in women.

Keywords: Otitis media, Vaginal infections, Urine tract infection, Bacterial species, Diagnosis, Sensitivity, Antibiotics.

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INTRODUCTION

There are interactions extremely complex between environment and organisms, which play an important role in nature, especially in microbial environments. In bacterial communities, there are large numbers of strains growing and growing together. In this environment, they form diverse and multiple communities with dynamics and mechanisms of complex interactions between them, including mutualism, antagonism, parasitism, commensalism, and amensalism[1]. In this study, we dealt with different types of bacteria that caused different infections and in various places. We dealt with the *Escherichia coli*, which caused urinary tract infections and also caused vaginal infections in the infected people who were selected in this study. We also dealt with the *Staphylococcus spp* bacteria which caused urinary tract infections, also caused wound infections and bacteremia. Urinary tract infections are common diseases caused by certain types of bacteria that affect different parts of the urinary system, such as the prostate, kidneys, bladder, and urethra. Urinary tract infections are the second most common disease in humans. It is estimated that urinary tract infections affect approximately 150 million people worldwide annually, making them a global concern About 90% of gram-negative bacteria cause urinary tract infections, but they represent only 10% of bacterial infections in genera. Most of the urinary tract injuries are caused by *Escherichia coli*, which represent approximately 65-90% of infections in general[2]. In addition to infections caused by *Escherichia coli*, many other pathogens contribute significantly to urinary tract infections. As for infections caused by *Staphylococcus aureus* in the urinary tract, they are very rare. However, in some individuals, some types of *Staphylococcus aureus* can cause ascending colonization and infection in the urinary tract and also in other sites such as endocarditis. Also, *Escherichia coli* and *Staphylococcus spp* can cause vaginal infections in some women, as some studies have indicated that among 55 samples from women with vaginal infections, Staphylococcus species was responsible for the (53%) and *Escherichia coli* (7%)of the infections[3]. *S .haemolyticus* bacteria are widespread in hospitals and by the hands of health workers, as this bacteria *S .haemolyticus* causes severe infections in many different parts and systems of the body, as it causes endocarditis, inflammation of artificial joints, blood poisoning, peritonitis, otitis media, and diabetic foot ulcers[4]. It is possible to treat these infections with antibiotics but there are some types of bacterial strains that show resistance for some antibiotics through Microorganisms have different mechanisms and patterns such as incorporation of foreign nucleic acids into bacterial chromosomes, horizontal gene transfer, and genetic modifications. These patterns can vary across regions, countries, and environments, such as hospital environments and community environments. Also, *Staphylococcus aureus* has evolved in individuals due to its high adaptability and development of resistance to various antibiotics, which has led to its high ability to infect individuals in different conditions and environments. More than 50% of cases of staphylococcal aureus (MRSA) are acquired from hospitals, which are characterized by their ability to resist methicillin (MRSA)[5]. Antibiotic resistance in *Staphylococcus aureus* has emerged through the production of β-lactamases enzyme and other different mechanisms such as the use of plasmids and other mechanisms .Additionally, the susceptibility of these bacterial pathogens to seven antibiotics, namely Tetracycline, Penicillin, Ampicillin, Norfloxacin, Chloramphenicol, Gentamicin, and Streptomycin, was determined. The findings demonstrated that Chloramphenicol was found to be 100% effective in treating the bacterial species. These findings can be utilized to develop personalized treatment regimens for vaginal infections, which could lead to improved management of this condition in women[3].

METHODS

Morphological Examination: In order to detect morphological characteristics such as (shape, size, color, and odor of colonies), as well as their ability to analyze blood, rich and selective media were used, such as the medium (blood agar, MacConkey agar, and chocolate agar) were utilized[5].

Wet Amount Technique: According to Raghad Abdul Wahid and Zahrah A. Alshammarri.

Gram Stain: Was used Gram stain to detect the bacteria which were isolated on culture media[5].

Biochemical Tests: In this study, different biochemical tests such as catalase and oxidase were performed to diagnose unknown bacterial isolates. The diagnosis was confirmed by a sophisticated diagnostic system with VITEK 2 system.

Preparation of Nutrient Agar (NA) media: The NA culture medium is one of the simplest and most commonly used non-selective media containing peptone, meat extract and agar which is used for a wide range of microorganisms. To prepare the nutrient broth medium, 2.8 g of powder was added to 100 ml of distilled water and after dissolving and sterilizing in the autoclave (15 min-121 ° C), kept in the refrigerator.

Bacterial culture and purification of the clinical samples: In this study, clinical specimens (*E. coli* and *Staphylococcus spp*) were collected from patients who visited the Al - Sadr hospital. In order to cultivate and purification of the bacterial strains, the suspension from each strain were separately inoculated and cultivated on the plates containing the NA medium. After culture, all plates were incubated for 24 hr at 37 ° C and the colonies were investigated for the colony formation (shape and size).

RESULTS

Bacterial infection in many countries of the world, urinary tract infections are considered common diseases. Urinary

tract infections are ranked second after respiratory infections. The main cause of urinary tract infections is bacteria that can infect any part of the urinary system **(Table 1)**.

After research and scrutiny, we found that the rate of urinary tract infections among females is higher than that of males, as found in other similar studies .The incidence of urinary tract infections was higher among women than men. This is due to the anatomical aspect of the female body, as the urethra in women is shorter than the urethra in men, as bacteria have a shorter distance to reach the bladder. This increases the likelihood of infection more. In addition, hormonal changes during pregnancy, menstruation and menopause can change the pH of the vagina. This facilitates the rapid growth of bacteria and increases the risk of urinary tract infections. On the other hand, sexual activity also contributes to the introduction of bacteria into the urinary tract, which increases the risk of infection, as well as not maintaining personal hygiene, such as wiping from back to front after using the toilet. All of these things combined lead to or increase the risk of urinary tract infections to a higher degree in women. This is consistent with recent studies that have shown a higher incidence of urinary tract infections in women than in men[4]. Therefore, in this study we dealt with *Escherichia coli* and *Staphylococcus aureus*, where we found that there are many infections with these bacteria, as shown in **(Table 2)**.

We also found that it is possible for these bacteria (*Escherichia coli* and *Staphylococcus spp*) to cause vaginal infections in some women, as shown in Table 2. Based on the above, we discussed in this study infections caused by the bacteria *Escherichia coli, Staphylococcus hominis,* Staphylococcus *haemolyticus,* and *Staphylococcus auras*. We studied 25 cases of infections in different places with the above-mentioned bacteria as shown in Table 1, and we found that there were 12% cases of infection with *Escherichia coli* and 28% cases of infection with bacteria. *Staphylococcus haemolyticus,* causing urinary tract infections. We also found 12% cases of infection with Staphylococcus auras bacteria, causing wound infections. We also found 8% cases of infection with *Staphylococcus hominis*, causing otitis media. We also found 40% cases of vaginal infections in women with *Escherichia coli* as shown in **(Table 2)**.

Antibiotics have a prominent role, through the great and amazing achievement that occurred in the twentieth century, where they played a vital and important role in eliminating or inhibiting the growth of bacteria. However, recently, bacterial strains resistant to antibiotics have appeared in isolates of *Escherichia coli* bacteria and different types of staphylococci bacteria, as these bacterial strains were obtained from the urinary tract infected with these bacteria, and therefore these infections have become a major global concern in the field of public health. Therefore, it is important to evaluate the resistance patterns of isolates represented by *Escherichia coli* bacteria and *Staphylococcus aureus* bacteria in order to produce accurate and appropriate antibiotic prescriptions. Also, one of the purposes of this study is to discover the level of resistance of *Escherichia coli* bacteria and staphylococci bacteria of different types to a group of antibiotics. As for the *Escherichia coli* bacteria, the results showed that the highest rate of resistance appeared to the antibiotic ampicillin, reaching 8.5%, followed by the antibiotics cefotaxime, ceftazidime, cefepime, trimethoprim/sulfamethoxa zol, where the resistance rate reached 5.4%. To a lesser extent, it showed resistance to the antibiotics ertapenem, imipenem, meropenem, and ciprofloxacin, where its resistance reached 1.5%, and its resistance reached a very small percentage to the antibiotic gentamicin, where it reached 0.7%. On the other hand, the results of allergy to *Escherichia coli* appeared, where the highest percentage of sensitivity appeared to the antibiotic ceftazidime at 5.3%, followed by the antibiotics gentamicin, ceprofloxacin, piperacillin/ tazobactam, ertapenem, imipenem, meropenem, nitrofuranation, ampicillin, trimethoprim/sulfamethoxa zole, where it appeared at 5%. At a rate of 2.5% for the antibiotic amikacin, followed by a rate of 2.3% for

Table 1: A Percentage of bacterial infection.

Type of bacteria	Percentage %
E.coli	13(52)
Staphylococcus lentus	1(4)
Staphylococcus haemolyticus	6(24)
Staphylococcus hominis	2(8)
Staphylococcus aureus	3(12)
Total	25(100)%

Table 2: Site infection of bacteria.

Site of infection	Type of bacteria	Percentage %
Vagina	E.coli	10(40)
Urine	E.coli	3(12)
Otitis media	Staphylococcus hominis	2(8)
Urine	Staphylococcus haemolyticus	7(28)
Wound	Staphylococcus aureus	3(12)
Total		25(100)%

Table 3: Culture isolates and antibiotic sensitivity.

Bacteria	Antimicrobial	R%	Antimicrobial	S%	Antimicrobial	%
E.coli	Norfloxacin	1.5	Amikacin	2.5	Nitrofuranation	10
	Ampicillin	8.5	Gentamicin	5		
	Amoxicillin/ clavulanic acid	1.5	Ceprofloxacin	5		
	Piperacillin / Tazobactam	1.5	Norfloxacin	2		
	Cefotaxime	5.4	Fosfomycin	2		
	Ceftazidime	5.4	Amoxicillin/ clavulanic acid	2		
	Cefepime	5.4	Piperacillin / Tazobactam	5		
	Ertapenem	1.5	Ertapenem	5		
	Imipenem	1.5	Imipenem	5		
	Meropenem	1.5	Meropenem	5		
	Trimethoprim/Sulfamethoxa zole	5.4	Nitrofuranation	5		
	Gentamicin	0.7	Ampicillin	5		
	Ciprofloxacin	1.5	Trimethoprim/Sulfamethoxa zole	5		
			Cefotaxime	2.3		
			Cefepime	2.4		
			Ceftazidime	5.3		
Staphylococcus spp	Erythromycin	9.3	Clindamycin	3	Moxifloxacin	50
	Clindamycin	7	Linezolid	2	Ceprofloxacin	10
	Tecoplanin	0.7	Tecoplanin	3.5	Gentamicin	10
	Ceprofloxacin	3.5	Vancomycin	3.5	Clindamycin	20
	Vancomycin	0.7	Tetracycline	4.5	Vancomycin	10
	Fusidic acid	8.5	Tigecycline	4.5		
	Rifampicin	3.5	Gentamicin	5		
	Benzylpenicillin	8.5	Ceprofloxacin	3		
	Oxacillin	7.5	Moxifloxacin	1		
	Gentamicin	1.5	Trimethoprim/Sulfamethoxa zole	3		
	Trimethoprim/Sulfamethoxa zole	3.5	Rifampicin	1		
	Tetracycline	4.5	Fusidic acid	2.5		
Total Staphylococcus spp +E.coli		128(100) %		244(100)%		10(100)%

the antibiotic cefotaxime, followed by a rate of 2% for the antibiotics norfloxacin, fosfomycin, amoxicillin/ clavulanic acid. It appeared moderately for the antibiotic nitrofuranation at 10%, as shown in **(Table 3)**.

In a similar study, the results of the bacteria were shown *E. coli*, the results show that the isolate had the highest response to norfloxacin, followed by chloramphenicol, tetracycline, and ampicillin. Penicillin and gentamicin showed intermediate responses, while cotrimoxazole and streptomycin exhibited the lowest responses[2].

As for *Staphylococcus spp*, the results showed the highest resistance rate, which was 9.3%, to the antibiotic erythromycin, followed by the antibiotics fusidic acid and benzylpenicillin, at a rate of 8.5%. It is followed by the antibiotic oxacillin at a rate of 7.5%, and then the antibiotic clindamycin at a rate of 7%. Then the antibiotics tetracycline, ceprofloxacin, trimethoprim/ sulfamethoxa zole, gentamiycin, tecoplanin, vancomycin in varying proportions respectively (4.5%,3.5%,1.5%, 0.7%). While the results of their sensitivity appeared, reaching 5%, the highest percentage of sensitivity was to the antibiotic gentamycin, followed by the antibiotics tecoplanin, vancomycin, trimethoprim/ sulfamethoxa zole, ceprofloxacin, Clindamycin,fusidic acid,linezolid, moxifloxacin, refampicin, In varying percentages, respectively (3.5%, 3%, 2.5%, 2%, 1%), the results appeared in moderate percentages, as 50% appeared for the antibiotic moxifloxacin, followed by 20% for the antibiotic clindamycin, followed by 10% for the antibiotics. ceprofloxacin, gentamicin, Vancomycin. While a similar study showed that *Staphylococcus aureus* the results show that the isolate had the highest response to penicillin and norfloxacin, followed by chloramphenicol and gentamicin. Tetracycline and cotrimoxazole showed intermediate responses, while ampicillin and streptomycin exhibited the lowest responses[2].

CONCLUSION

Overall, the results suggest that different isolates exhibit varying responses to different antibiotics, highlighting the importance of tailoring treatment regimens to the specific isolate causing the infection. The results of this investigation could contribute to the development of more effective treatment strategies for vaginal infections caused by these isolates.

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