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Prevalence of bacterial Uropathogens in patients with acute, recurrent and chronic urinary tract infection in Kirkuk city, Iraq

Fatma Mustafa Mohammed[1*], Mahmood K. Saleh[2]
[1]College of Dentistry, University of Tikrit, Iraq; fatmajaff@tu.edu.iq (F.M.M).
[2]Collage of Education for Pure Sciences Department of Biology. University of Tikrit, Iraq; Dr.mahmod1978@tu.edu.iq (M.K.M.).

Abstract: Urinary tract infections (UTIs) are one of the most common types of infections. They place a huge burden on health systems worldwide. Urinary tract infections (UTIs) are one of the most common bacterial infections and are a major problem worldwide. The most important problem is recurrence of infection and may develop into chronic cases. This study aimed to evaluate the pathogens and their types in acute, recurrent and chronic urinary tract infections in Kirkuk Governorate. 151 urine samples were collected from patients with urinary tract infections who visited private clinics in Kirkuk Governorate. They were diagnosed by a urologist for the period from December 2022 to October 2023. The ages of the patients ranged from 21-76 years. Microscopic examination, laboratory tests, culture and isolation of pathogens were performed and the diagnosis was confirmed using the Vitek device to diagnose bacterial isolates with a high degree of accuracy after confirming them by initial biochemical tests. In the current study, the number of male patients with urinary tract infections was 62, representing 41.1%, while the number of female patients was 89, representing 58.9%. The case was diagnosed as acute, recurrent or chronic. The results of the current study showed that the number of samples for patients with acute urinary tract infections was 91 samples, representing 60.3%. The number of males was 37, representing 40.7%, and the number of females was 54, representing 59.3%. As for the cases of patients with recurrent urinary tract infections, their number was 23, representing 42.6% of males, while the number of females was 31, representing 57.4%. As for the chronic cases, the number of males was 2, representing 33.3%, while the number of females was 4, representing 66.7%. After the cases of the patients to be studied were diagnosed, the diagnostic results showed the difference in the types of bacteria isolated, and it was found that they were for. E coli, where their number was 76 and their percentage was 50.4%, while Klebsiella pneumonia was also among the most common isolates in our study, where their number was 23 and their percentage was 15.3%, and these two isolates were the most common in all the clinical cases that were studied. The results of this work showed that the two most common isolates in patients with acute, recurrent and chronic urinary tract infections are Klebsiella. Pneumonia and E coli.

Keywords: *Bacterial Uropathogens, Chronic urinary tract infection, Patients.*

1. Introduction

UTI Urinary Tract Infection is one of the most common bacterial infections worldwide and with the increasing burden of the disease worldwide, more than 404 million people suffer from urinary tract infections and approximately 237,000 deaths due to this disease. 1 Urinary tract infections refer to the presence of microorganisms in the urinary tract, mainly bacteria, but may be viruses or fungi, especially in those who often suffer from weak immunity. 2 It is necessary to distinguish between urinary tract infections and sexually transmitted infections, as they share similar symptoms. 3 Urinary tract

* Correspondence: fatmajaff@tu.edu.iq

infections are usually associated with large numbers of bacteria, either symptomatic or asymptomatic, and any type has serious consequences unless appropriate treatment is found. 4

About 60% of women will suffer from urinary tract infections at least once in their lives, and 30-40% will suffer from recurrence. Recurrence of infection is one of the most exciting manifestations of particular concern 5 is that symptomatic, asymptomatic, acute, chronic and recurrent infections represent the most important disorders that can be caused by urinary tract infections. 6. Urinary tract infections, especially chronic infections, are complex microbiologically and immunologically, and little is known about the causes of the disease or the role of the immune system. Infection with different types of pathogens, the virulence factors they possess and methods of circumventing immunological detection have played an important role in making the disease more complex. 7 Infection with urinary tract infections represents a threat to public health care, which is caused by a diverse group of bacteria, including Escherichia coli, Klebsiella pneumoniae, Proteus spp., and Staphylococcus saprophyticus. The increasing frequency of infection with these types and the increase in resistance to antibiotics increases the economic burden of these infections. 8

This study aimed to evaluate the bacterial isolates that cause for acute, recurrent and chronic urinary tract infections

2. Materials and Methods

2.1. Study Area

This study was conducted in Kirkuk Governorate for patients visiting private clinics in Doctors Street

2.2. Patient selection

The clinical cases required in this study were diagnosed by a urologist whether their condition was chronic, acute or recurrent. 151 samples were between 21-78 years old, and the number of male samples was 62, while the number of female samples was 89

2.3. Exclusion and Inclusion Criteria

The samples that were studied were those whose condition was diagnosed by a specialist physician, whether their infection was acute, recurrent or chronic, by observing the symptoms of the disease for women and men. The specific information was recorded on the questionnaire sheet accurately from each sample under study, where medical data was recorded. Information related to the socio-demographic characteristics was collected, which included age, gender and the clinical condition diagnosed by the physician. As for the survey criteria, patients suffering from chronic diseases, blood pressure, diabetes, heart disease, asthma, pregnant women, immune diseases and immunosuppressive drugs were included, as well as those taking treatment, where those suffering from lipid disorders, diabetes, high blood pressure, kidney, heart and artery diseases, various acute infections and liver diseases were excluded. And other chronic diseases as these cases were exclusion criteria for this study individuals who were currently taking or had taken antibiotics or any other medication in the past three months. Individuals who were suffering from any systemic disease and pregnant/lactating women. Individuals suffering from any other bacterial or viral infection.

2.4. Collection of Samples

2.4.1. Collecting Urine Samples

Samples were collected in sterilized screw-capped tubes. Patients were instructed on the correct method of collecting the sample in collecting the sample from the midstream (Clean-Catch-Midstream Urine) to avoid contamination with the natural flora present in this area.

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Five ml of urine sample was taken in a sterile, clean centrifuge tube and centrifuged at 3000 rpm for 5 minutes. The sediment was then examined microscopically at high magnification for the presence of pus, red blood cells, epithelial cells, crystals and yeast cells.

2.4.2. Sample Culture

Samples were cultured directly on blood agar, MacConkey agar, and blood agar, and all plates were incubated aerobically at 37°C for 24 hours. Based on routine laboratory tests including Gram stain, some cultural characteristics, and biochemical tests, isolates were identified and culture results were obtained to confirm the diseased cases to be studied.

2.4.3. Statistical Analysis

The analysis was performed using SPSS (version 20). Data are presented as percentages through

Table 1.
Numbers and percentages of samples by gender.

Gender	No	%
Male	62	%41.1
Female	89	%58.9
Total	151	%100

3. Discussion

In the current study, the number of male patients with urinary tract infections was 62, representing 41.1%, while the number of female patients was 89, representing 58.9%. The results indicate, as shown in Table 1, that the number of female patients with urinary tract infections is higher than the number of male patients. These results were consistent with a group of studies conducted in Kirkuk Governorate9, where the percentage of males was 23.4% and females was 76.6%. Females are usually more susceptible to the risk of urinary tract infections than males due to the anatomical and physiological differences in the urinary system between males and females10 and that the lack of estrogen contributes to the increase in infections in females. Births Pregnancy Methods of delivery Contraceptive membranes Frequent intrauterine examinations11 The prostate gland also contains a germicidal substance and zinc, which play a crucial role in killing microorganisms12

Table 2.
Numbers and percentages according to the clinical cases to be studied.

Study group	Acute		Recurrent		Chronic	
Gender	No	%	No	%	No	%
Male	37	40.7	23	42.6	2	33.3
Female	54	59.3	31	57.4	4	66.7
Total	91	100	54	100	6	100

Table 2 shows the clinical cases from which samples were collected for urinary tract patients. They were diagnosed by a urologist and based on the patients' clinical symptoms, laboratory tests and culture, the case was diagnosed as acute, recurrent or chronic. The results of the current study showed, as shown in the table above, that the number of samples for acute urinary tract patients was 91 samples, representing 60.3% for both males and females. The number of males was 37, representing 40.7%, and the number of females was 54, representing 59.3%. This is consistent with a study conducted by13 that showed that 40-60% of women suffer from urinary tract infections once. It showed that 60% of women will develop acute infection. Females are more susceptible to acute infection, as it heals on its own within a few days and is still easy to treat with antibiotics. However, sometimes the infection may recur within weeks or months.14 Pregnancy, childbirth, sexual activity, hormonal changes, menstruation and

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age Elias Immune status Genetic predisposition Unhealthy lifestyle Personal hygiene Weak innate or adaptive immune response Bacterial isolates and their virulence may also play a role in the development of acute urinary tract infections. As for the cases of patients and recurrent urinary tract infections, the percentage of males was 42.6% with 23 samples, while the percentage of females was 57.4% with 31 samples. Half of the women with recurrent urinary tract infections suffer from recurrence of infection within one year. 13 In a Canadian study, 14 out of 3085 people were exposed to urinary tract infections for more than one attack during the two-year period in which the study was conducted. They were exposed to 6 attacks in males. 15 Studies have also shown that recurrent urinary tract infections may occur due to a complete structural cause such as an enlarged prostate, an endoscope, or tools used in bladder endoscopy, a catheter, intestinal diseases, or congenital malformations. 16 Recurrent infection occurs with two attacks within 6 months or more than 3 attacks within 12. Immunity also plays an important role in Recurrence of infection, for example, a decrease in TLR4, which is responsible for recognizing LPS in Gram-negative bacteria, and it has a role in the emergence of recurrent bacterial infections. The condition can develop from recurrent to chronic 17. Therefore, caution must be taken when receiving treatment to prevent the development of the condition, prevent kidney damage, prevent recurrence of infection, and strengthen the immune system. As for samples for patients with chronic urinary tract infection, the total number of samples was 6, and the number of males was 2 and females 4. The samples were very few due to the difficulty of diagnosis, as they require a very long period, and the period of collecting samples is not sufficient to obtain more numbers, as the difficulty of diagnosis does not respond to treatment and the difficulty of culturing bacteria. The results are 90% negative. The doctor relies on long-term treatment by giving antibiotics for 383 days, and it responds and may be cured. The percentage of males was 33.3%, with 2, while females had a percentage of 66.7%, with 4.

This study was consistent with 18, which showed that women suffer more than men in chronic urinary tract infection in many cases, and when not cared for, and treatment in the form Correct: Recurrent infection can turn into chronic infection, as chronic kidney patients are caused by recurrent infection 19 Chronic kidney stones Urinary stones are a risk factor for treatment failure, as patients are more susceptible to many problems, so early management of urinary stones is important to prevent further subsequent infection, kidney damage, recurrent infection, and recurrent catheterization cases, which can lead to a chronic infection. Acute infections can also develop into chronic infections, as they colonize for weeks, months, or years. Uropathogenic infection also plays a role in chronic infection that lasts for months, and a history of infection is a major risk factor for chronic infection. Behavioral patterns of vaginal douching, failure to control recurrent infections, and weak immunity are all indicators that may help in the development of urinary tract infections and the deterioration of the patient's condition. In a study, it was shown that 84 of the patients' condition improved after 383 days of continuous treatment and reaching a resolution of symptoms. 20, therefore, treatment was stopped in 221 patients whose condition deteriorated and some of them needed to be hospitalized and recovered after re-treatment. The development of the condition into a chronic one due to shortcomings in the diagnosis and development of the condition, mismanagement of previous attacks, and failure to adhere to the correct treatment may lead to a worsening of the condition and enhance bacterial resistance and circumvent the immune system. Taking treatments accurately and not interrupting, i.e. following the doctor's instructions.

Table 3.
Numbers and percentages of microbial isolated.

Bacterial isolate	No	%
Escherichia coli	76	50.4
Klebsiella pneumoniae	23	15.3
Proteus mirabilis	19	12.6
Staphylococcus saprophyticus	13	8.6
Pseudomonas aeruginosa	10	6.6

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Staphylococcus aureus	6	3.9
Staphylococcus epidermidis	4	2.6
Total	151	100

Taking supplements may reduce strains that threaten to transform cases into chronic and recurrent ones. Prevention by taking supplements to treat recurrent urinary tract infections. It is preferable to refer patients to a center that has a special interest in urinary tract diseases and not to a general gynecology clinic.

After the diagnosis of the patients to be studied, the results of the diagnosis showed a difference in the types of bacteria isolated. The results showed, as shown in Table 4, that the most common types of bacteria isolated from urinary tract infections were E. coli, as its percentage was 50.4%. Our results were consistent with 21. As for Klebsiella pneumonia, it was also one of the most common isolates in our study, as its percentage was 15.3%, with 23 isolates. The result was consistent with 22. Its percentage was close to our study, reaching 21%. E coli has virulence factors that allow for adhesion and tissue invasion, and P fimbriae, type 1 pili play an important role in cytokine stimulation, tissue inflammation, and the initiation of biofilm formation. The fimbriae play a major role in adhesion and in the initiation of inflammation. 23 Biofilm develops into a dense mature environment that is very difficult to eradicate and thus contributes to chronic recurrent infection. 24 Klebsiella pneumoniae is an opportunistic pathogen that colonizes mucosal surfaces without causing disease; however, Klebsiella is a cryptic pathogen, failing to stimulate innate immune responses. 25 As for the other isolates, their percentage varied with other studies. For P mirabilis bacteria, their percentage was 12.6%, which agreed with 26. Their percentage was 12%, which contradicted 27. The percentage of this bacteria was very low, reaching 2%. P mirabilis bacteria possesses many virulence factors. Urea is secreted, which is an important virulence factor. This enzyme leads to Hydrolysis of urea and release of ammonia, which converts the pH of urine to an alkaline environment and precipitates calcium and magnesium and forms urinary stones composed of ammonium phosphate and calcium. These stones are directly linked to higher rates of recurrent urinary tract infections because they act as an ideal safe haven to hide bacteria from the host's defenses. 28

Table 4.
Prevalence of microbial isolates in acute, recurrent, chronic UTI.

Study group / **Causative agents**	**Acute**		**Recurrent**		**Chronic**	
	%	**No**	**%**	**No**	**%**	**No**
E. coli	48	52.7	24	44.5	4	66.7
K. pneumoniae	13	14.3	8	14.8	2	33.3
P. mirabilis	12	13.2	7	12.9		
S. saprophyticus	6	6.6	7	12.9		
P. aeruginosa	6	6.6	4	7.5		
S. aureus	4	4.4	2	3.7		
S. epidermidis	2	2.2	2	3.7		
Total	100	91	54	100	6	100

As for P aeruginosa, its percentage was 6.6%. These bacteria play a role in resistance and membrane formation and cause a general immune system disorder. As for the Staphylococcus species, their types recorded different percentages, as the percentage was 3.9% for S aureus and 2.6% for S epidermidis. Staphylococcus is considered part of the natural flora in the body. When appropriate conditions are available, such as a person's low immune system or contamination with these germs and in high doses, infection occurs. In other studies, varying percentages were recorded when compared with other studies. The differences in percentages between studies are due to differences in study design and study

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population. The age groups and groups from which the samples were isolated. The reason for the difference in results may be due to the nature, type and size of the sample taken and the geographical location from which the samples were collected.

In cases of acute urinary tract infections, E. coli was the most common bacterial species isolated from these patients, with a percentage of 52.7%. This result was consistent with 29. E. coli was the most common bacteria isolated from the urine of patients suffering from acute infections, with a percentage of 38%. The results were also consistent with 30. E. coli constituted 80% of cases of acute pyelonephritis in women and men. Virulence factors, which are a measure of the ability of bacteria to cause disease and their ability to resist the host's immune defense mechanisms, play a major role in infection and, in conjunction with the patient's conditions, may help cause infection. One factor helps to stimulate the patient's response 31. As for K pneumoniae, the number of isolates in acute cases was 13, with a percentage of 14.3%, consistent with 32. K pneumoniae possesses a set of virulence factors that enable it to overcome the patient's innate defenses to remain in the tissues. As for recurrent and chronic cases, the most numerous isolates were E coli and K pneumoniae bacteria. In patients with recurrent urinary tract infections, the percentage of E coli was 44.5%, while K pneumonia was 14.8%. This study confirmed that the deficiency of lactobacillus played a role in increasing the numbers of these species and is responsible for the recurrence of infection. Due to ineffective adaptive immunity, many patients infected with E coli develop recurrent infections. 33 Regarding bacterial isolates in the chronic case, 6 cases diagnosed by a doctor were collected. Their results showed that E coli was 66.7%, and K pneumonia was 33.3%. E coli plays a role in chronic cystitis that lasts for months, and some acute indicators may predict the development of the condition into a chronic one. 34 As for the other bacterial isolates that were isolated from the different clinical case groups, their percentages varied. As shown in Table 4, in acute cases, P mirabilis was 13.2%, while in recurrent cases, the results were recorded at 12.9%. As for S saprophyticus, in acute cases, its percentage was 6.6%, and in recurrent cases, it was 12.9%. As for P aeruginosa, its percentage in recurrent cases was 6.6%, with 6 isolates. In acute cases, the results were recorded at 7.5%, with 4 isolates. As for S auras, its percentage in recurrent cases ranged from 4.4% isolates, and in acute cases, 3.7%. S epidermis bacteria constituted 2.2% in acute cases, while in recurrent cases, its percentage was 3.7%. All of these isolates have virulence factors that help them cause infection in the urinary tract, whether acute or recurrent cases. Infections with Gram-negative bacterial strains are more susceptible to recurrence of infection. Chronic kidney disease patients may suffer from recurrent urinary tract infections, and bacterial cells may survive the effect of antibiotics. In the name of persistencepersister and may be a cause of chronic infection36

The spread of resistance with primary infection as a result of excessive use of treatments and poor selection of antimicrobial agents and long duration of treatment without awareness, i.e. the increase in the use of experimental antibiotics in addition to the virulence of the isolated bacterial species can turn the condition into recurrent and chronic in some cases

According to the urine bacteria and the relatively small sample size, determining the diagnostic role is inaccurate or the presence of variables from diseases with previous treatment of antibiotics, which may confuse the risk of urinary tract infection with these different bacterial species and in the three clinical cases of this

When infected with urinary tract infection, caution must be taken by following the instructions and taking full treatment courses because failure to treat and abandon treatment helps the emergence of resistant strains that increase recurrent infections and may turn them into chronic cases Lack of awareness social status Education level Personal hygiene are all factors that play a role in infection with these bacterial strains

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