



A Study on the Isolation and Identification of Bacteria in Patients with Urinary Tract Infections in Libyan Laboratories

Maesm Ahmed Mohamed Ben Hsin^{1*}, Hamza Ahmed Mohammad Emsaed², Ahmed Ramadan Abujarida³, Mona A. Sauf⁴, Sana Ali Soof⁵, Mohamed Omar Abdalla Salem⁶

¹ Department of Medical Laboratory, College of Sciences and Medical Technology, Tripoli, Libya

² Department of Medical Laboratory, Libyan Authority for Scientific Research, Libya

^{3,4} Department of Medical Laboratory, the Higher Institute of Sciences and Technology Mesallata, Libya

⁵ Department of Medical Laboratory, the Higher Institute of Sciences and Medical Technology Mesallata, Libya

⁶ Biology Department, Faculty of Education, Bani Waleed University, Bani Waleed, Libya

دراسة حول عزل وتحديد البكتيريا لدى مرضى التهابات المسالك البولية في المختبرات الليبية

ميسم أحمد محمد بن حسين^{1*}، حمزة أحمد محمد مساعد²، أحمد رمضان أبو جريدة³، منى أ. سوف⁴، سناء علي سوف⁵، محمد عمر عبد الله سالم⁶

¹ قسم المختبرات الطبية، كلية العلوم والتقنية الطبية، طرابلس، ليبيا

² قسم المختبرات الطبية، الهيئة الليبية للبحث العلمي، ليبيا

^{3,4} قسم المختبرات الطبية، المعهد العالي للعلوم والتقنية مسلاتة، مسلاتة، ليبيا

⁵ قسم المختبرات الطبية، المعهد العالي للعلوم والتقنيات الطبية مسلاتة، مسلاتة، ليبيا

⁶ قسم الأحياء، كلية التربية، جامعة بني وليد، بني وليد، ليبيا

*Corresponding author: maesmbenhsein50@gmail.com

Received: September 04, 2025

Accepted: October 02, 2025

Published: October 04, 2025

Abstract:

Urinary tract infection (UTI) is a prevalent microbial infection impacting individuals of all ages throughout their lifespan. The current study intended to identify the microorganisms responsible for urinary tract infections and assess the antibiotic activity against these bacteria. Eight-two samples were gathered and analyzed from some private laboratories to collect the samples such (Saray, Al-razi, and soug elguma laboratories). Bacterial species recovered from urine samples included *Enterobacter* spp., *Neisseria gonorrhoeae*, *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella* spp., *Citrobacter*, and *Pseudomonas aeruginosa*. *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Staphylococcus hemolyticus*, *Streptococcus* spp. In the current study, the number of female cases exceeded that of male cases, with females comprising 62 cases at a rate of 75.6%, while males accounted for 20 cases at a rate of 24.4%. This investigation demonstrated that *E. coli* and *Klebsiella* sp. isolates were the main pathogens. *Escherichia coli* accounted for 39 cases, representing 47.5%, followed by *Klebsiella* species with 15 cases, corresponding to 18.2%. The antibiotic sensitivity test results indicated that the *E. coli* bacterium was susceptible to seftazidime, ceftriaxone, Augmentin, and cefixime, while exhibiting resistance to amikacin, ciprofloxacin, and imipenem. The *Klebsiella* bacterium exhibited sensitivity to cefuroxime and resistance to amikacin, ciprofloxacin, imipenem, ceftazidime, cefixime, and Augmentin.

Keywords: Urinary tract infection, Microbial infections, Pathogens responsible, antimicrobial activity, Bacterial.

الملخص

تعد عدوى المسالك البولية (UTI) من الالتهابات الميكروبية الشائعة التي تؤثر على الأفراد من جميع الأعمار طوال حياتهم. هدفت الدراسة الحالية إلى تحديد الكائنات الحية الدقيقة المسؤولة عن التهابات المسالك البولية وتقييم فعالية المضادات الحيوية ضد هذه البكتيريا. تم جمع 82 عينة وتحليلها من مختبر السراي، مختبر سوق الجمعة، ومختبر مصحة الرازي طرابلس. وشملت أنواع البكتيريا المعزولة من عينات البول: *Klebsiella pneumoniae*، *Escherichia coli*، *Neisseria gonorrhoeae*، *Enterobacter* spp، وكذلك *Staphylococcus aureus*، *Staphylococcus saprophyticus*، *Staphylococcus hemolyticus*، *Streptococcus* spp. وفي الدراسة الحالية، تجاوزت عدد الحالات الأنثى عدد الحالات الذكورية، حيث شملت 62 حالة بنسبة 75.6%، في حين كانت الذكور 20 حالة بنسبة 24.4%. أظهرت هذه الدراسة أن *E. coli* و *Klebsiella* sp. هما العاملان الرئيسيان. *Escherichia coli* كانت مسؤولة عن 39 حالة، تمثل 47.5%، تليها *Klebsiella* species بـ 15 حالة، تمثل 18.2%. أظهرت نتائج اختبار الحساسية للمضادات الحيوية أن بكتيريا *E. coli* كانت حساسة لـ سيفتازيديم، سيفترياكسون، أوجمنتين، و سيفكسيم، في حين أظهرت مقاومة لـ أميكاسين، سيفلوكساسين، وإميبينيم. أما بكتيريا *Klebsiella* فكانت حساسة لـ سيفوروكسيم، ومقاومة لـ أميكاسين، سيفلوكساسين، وإميبينيم، سيفتازيديم، سيفكسيم، وأوجمنتين.

Streptococcus spp، و*Staphylococcus hemolyticus*، و*saprophyticus* في الدراسة الحالية، تجاوز عدد الحالات لدى الإناث عدد الحالات لدى الذكور، حيث شكلت الإناث 62 حالة بنسبة 75.6%، بينما شغل الذكور 20 حالة بنسبة 24.4%. أظهر هذا البحث أن عزلات *E. coli* و *Klebsiella sp*. كانتا المرضين الرئيسيين. حيث مثلت الإشريكية القولونية 39 حالة بنسبة 47.5%، تليها أنواع *Klebsiella* بـ 15 حالة بما يعادل 18.2%. أشارت نتائج اختبار الحساسية للمضادات الحيوية إلى أن بكتيريا الإشريكية القولونية كانت حساسة للسيفتازيديم والسيفترياكسون والأوغمنتين والسيفيكسيم، بينما أظهرت مقاومة للأميكاسين والسيبروفلوكساسين والإيميبينيم. وأظهرت بكتيريا *Klebsiella* حساسية للسيفوروكسيم ومقاومة للأميكاسين والسيبروفلوكساسين والإيميبينيم والسيفتازيديم والسيفيكسيم والأوغمنتين.

الكلمات المفتاحية: عدوى المسالك البولية، الالتهابات الميكروبية، مسببات الأمراض المسؤولة، النشاط antimicrobial، البكتيريا.

Introduction

Urinary tract infections (UTI) are serious health problems affecting millions of people each year. They are the most common type of infections in the body [1]. This problem occurs more often in women than men because a woman's urethra is shorter. The short urethra makes it easier for bacteria from the anus or genital area to reach the bladder [2]. Patients with catheters or patients suffering from complaints of prostatitis are also prone to UTI. Transmission occurs in four ways; namely through sexual intercourse, from mother to fetus via placenta, through poor personal hygiene, and via communal sponge and towel usage [3]. The most common symptoms are burning with urination and having to urinate frequently (or an urge to urinate) in the absence of vaginal discharge and significant pain. For patients who have frequent UTIs, their bacteria may become resistant to antibiotics over time, making careful selection of antibiotics and the full course of treatment essential [4].

Urinary tract infections are categorized into three types: acute pyelonephritis, lower urinary tract infection, and asymptomatic bacteriuria. Over 95% of urinary tract infections are attributable to a singular bacterial species. *Escherichia coli* is the predominant pathogen associated with acute infections [5]. Other organisms that may cause UTIs include Gram-positive cocci, such as *Enterococcus faecalis*, *Staphylococcus aureus*, and coagulase-negative staphylococci (CoNS) [6]. Additional Gram-negative organisms implicated in urinary tract infections comprise *Klebsiella* species, *Proteus* species, *Pseudomonas aeruginosa*, and *Enterobacter* species [7]. May also encompass fungal and viral infections. In this research, one in 38 women advanced from simple cystitis to pyelonephritis without intervention [8]. Gram-negative bacilli are the predominant organisms. *Escherichia coli* is responsible for 80% of community-acquired urinary tract infections (UTIs) in otherwise healthy people, with around half of UTIs occurring in hospitalized and diabetic patients. Additional bacteriuria encompasses gram-negative rods, including *Proteus*, *Klebsiella*, and *Enterobacter*. Antibiotic resistance has emerged as a significant consideration in the management of infections. Resistance may manifest in infections occurring in ambulatory, institutionalized, and hospitalized settings [9]. *E. coli* resistance has been advancing for almost a decade [10].

A study was conducted at numerous hospitals in Baghdad, including the city of the Two Imams Teaching Hospital, Central Child Teaching Hospital, Baghdad Teaching Hospital [11], educational labs, and Child Protection Teaching Hospital in the Medical City . Bacterial isolates were identified using traditional methods, followed by confirmation of their diagnosis using molecular detection of the diagnostic gene *SrRNA16* via polymerase chain reaction (PCR) technology, specifically for one clinical isolate of *E. coli* type. The antibiotic sensitivity test findings indicated that the *E. coli* bacterium exhibited multidrug resistance (MDR), with 1 (1.1%) isolate resistant to carbenicillin and 42 (94%) isolates resistant to erythromycin. Forty-nine rifampin-resistant isolates, twenty-two percent (99) ceftazidime-resistant isolates, seventy-seven percent (82) cefotaxime-resistant isolates, seventy-nine percent (87) novobiocin-resistant isolates, eighty-eight (77%) tetracycline-resistant isolates, eight percent (08%) ciprofloxacin-resistant isolates, eighty-one percent (81%) gentamicin-resistant isolates, and two isolates (9%) resistant to nitrofurantoin [6]. The results showed that 90 (41%) bacterial isolates were biofilm-forming Two isolates exhibited varying degrees of adherence: 9% were classified as very adherent, 8% as moderately adherent, and 79% (87 isolates) as weakly adherent [12].

Urinary tract infection in pregnant women with type 2 diabetes is of particular relevance since it can result in consequences that may be hazardous to the mother and fetus. Bacteria responsible for urinary tract infections were isolated and identified from 40 samples representing pregnant women with type 2 diabetes exhibiting signs of urinary tract infection. Five bacterial species were identified in urine samples (n=40): *Proteus mirabilis*, *Klebsiella pneumoniae*, *Escherichia coli* [13], *Staphylococcus aureus*, and *Streptococcus agalactiae*. Six bacterial species were identified from the cohort comprising women with type 2 diabetes exclusively: *Proteus mirabilis* and *Klebsiella pneumoniae*. *Streptococcus agalactiae*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* were detected through microscopic and cultural analysis of urine, followed by an assessment of the samples' antibiotic sensitivity [14]. Thirty-eight samples were identified as belonging to the genus *Escherichia coli*, thirty samples to the genus *Staphylococcus*, thirteen samples to the genus *Streptococcus*, nine samples to the genus *Proteus*, nine samples to the genus *Klebsiella*, seven samples to the genus *Enterobacter*, six samples to

Candida albicans, and four specimens to *Aeromonas* [15]. The findings of the present study indicated that the largest infection rate occurred in the 1–10-year age group, with a prevalence of 48.3% in females compared to 43.5% in males. The lowest infection rate occurred in the age group of 61 to 70 years, with a rate of 3.3% for females, while no infections were documented among males in this age group. A drug sensitivity test was performed on bacterial samples identified through antibiotic treatment. *E. coli* germs were demonstrated [16]. and *Staphylococcus* bacteria. The highest proportion of resistant strains was observed, whereas *Aeromonas* and *Candida albicans* exhibited the lowest resistance levels [17].

Material and methods

• Urinary tract system

The urinary tract is the body's drainage system for removing urine, which is made up of wastes and extra fluid. For normal urination to occur, all body parts in the urinary tract need to work together, and in the correct order.

The urinary tract includes two kidneys, two ureters, a bladder, and a urethra. **Kidneys.** Two bean-shaped organs, each about the size of a fist [18]. They are located just below your rib cage, one on each side of your spine. Every day, your kidneys filter about 120 to 150 quarts of blood to remove waste and balance fluids. This process produces about 1 to 2 quarts of urine per day.

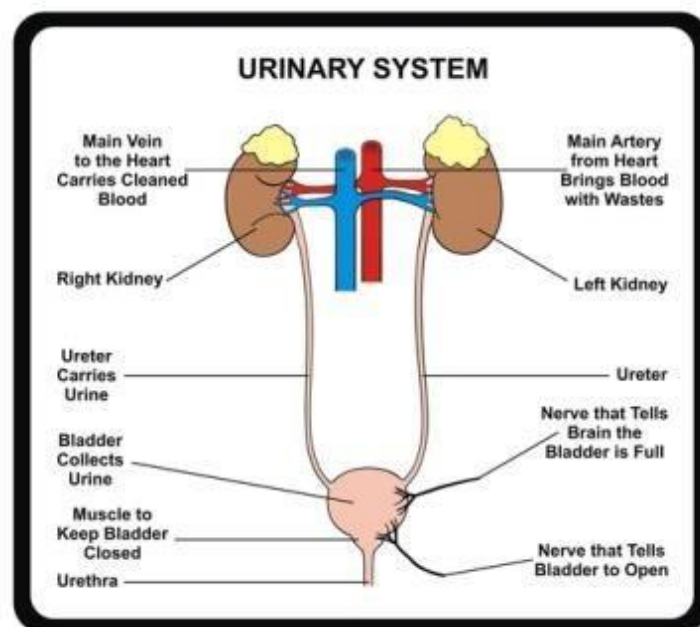
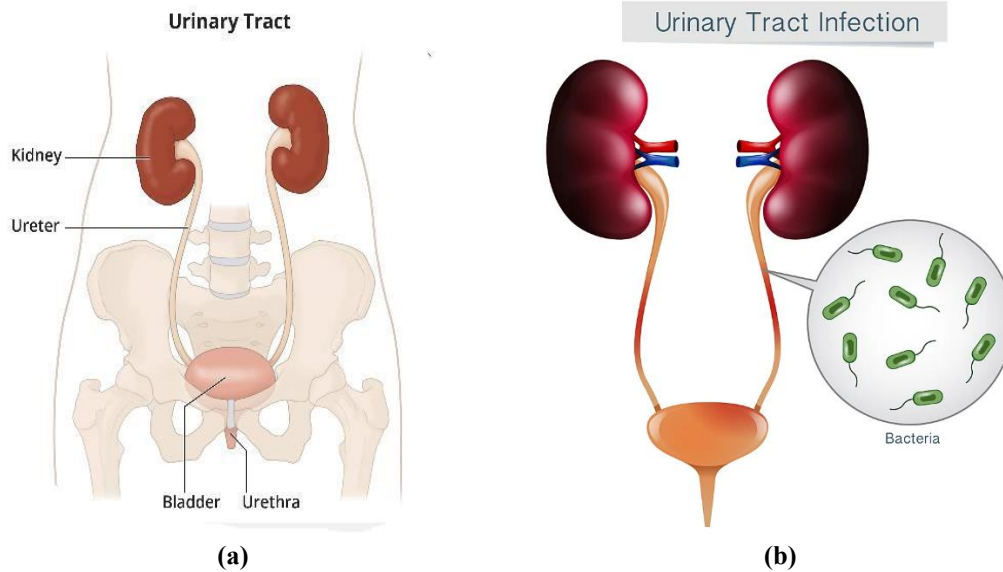


Figure.1 Anatomical structure of urinary tract infection.

Ureters. Thin tubes of muscle that connect your kidneys to your bladder and carry urine to the bladder.

Bladder. A hollow, muscular, balloon-shaped organ that expands as it fills with urine. The bladder sits in your pelvis between your hip bones. A normal bladder acts like a reservoir. It can hold 1.5 to 2 cups of urine. Although you do not control how your kidneys function, you can control when to empty your bladder. Bladder emptying is known as urination [19].

Urethra. A tube located at the bottom of the bladder that allows urine to exit the body during urination. All parts of the urinary tract the kidneys, ureters, bladder, and urethra—must work together to urinate normally.



The urinary tract includes two sets of muscles that work together as a sphincter, closing off the urethra to keep urine in the bladder between your trips to the bathroom.

Table 1: Summary of Common UTIs



STAGES OF A URINARY TRACT INFECTION

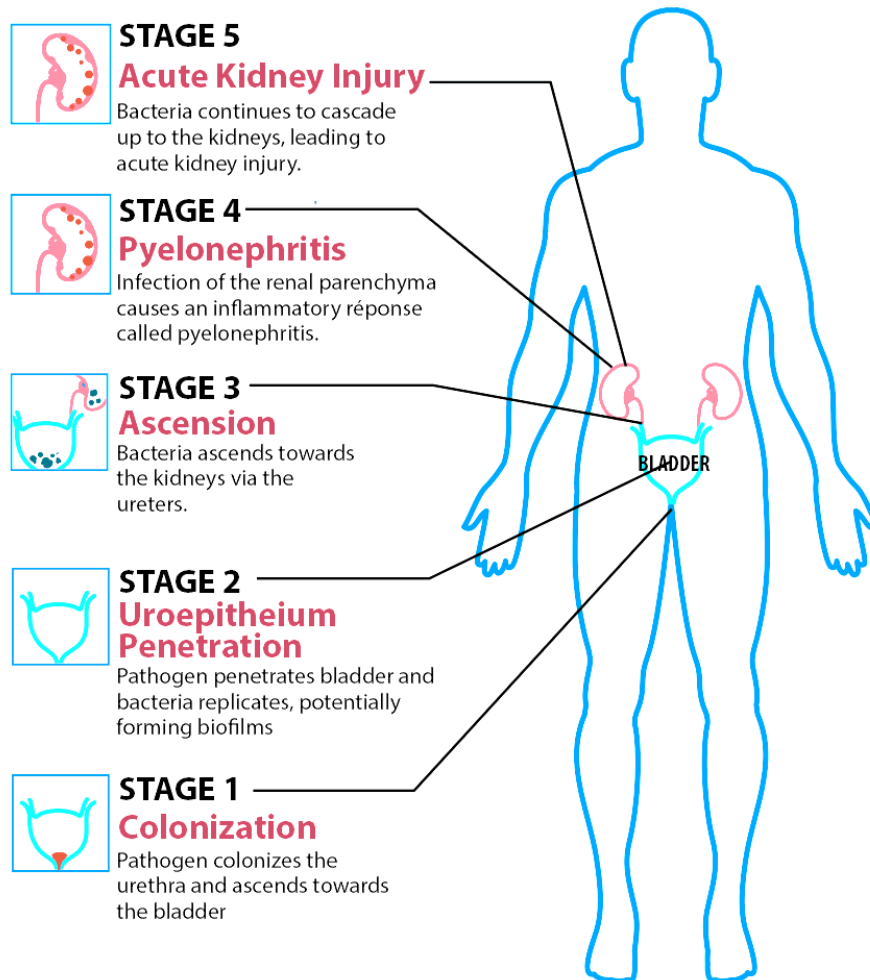


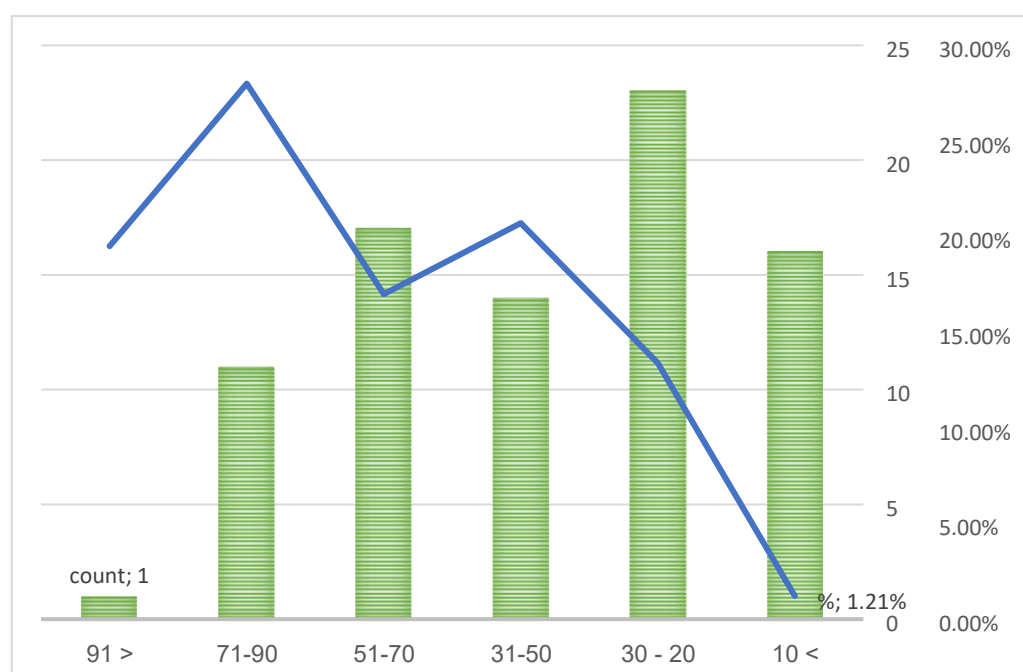
Figure 13: Stages of urinary tracks infection.

Results and Discussion

Through the results, we divided the age of the cases in to seven age groups, where the number of cases in the age group of less than 10 years was 16 cases with a rate of 19.5 % And the age group (11 - 30) year was cases with 23 cases, at a rate of 28 % and the age group (31 – 50)year was cases with 14 at a rate of 17 % and the age group (51 – 70) year was cases with 17 at a rate of 20.7 % and the age group (71 – 90) year was cases with 11 at a rate of 13.4 % while the age group more than 90 year was cases with 1 at a rate of 1.21 % .

Table 2: Distribution of cases according to age.

Age (year)	Count	%
< 10	16	19.5%
11- 30	23	28%
31-50	14	17%
51-70	17	20.7%
71-90	11	13.4%
> 91	1	1.21%
Total	82	100%

**Figure 14:** Distribution of cases according to age.

2- Distribution of cases according to gender

Through the results, there were the number of male cases 20 with a rate of (24%) and the number of female cases 62 with a rate of (75.6%).

Table 3: Distribution of cases according to gender.

Gender	Number	Percent
Male	20	24.4%
Female	62	75.6%
Total	82	100%

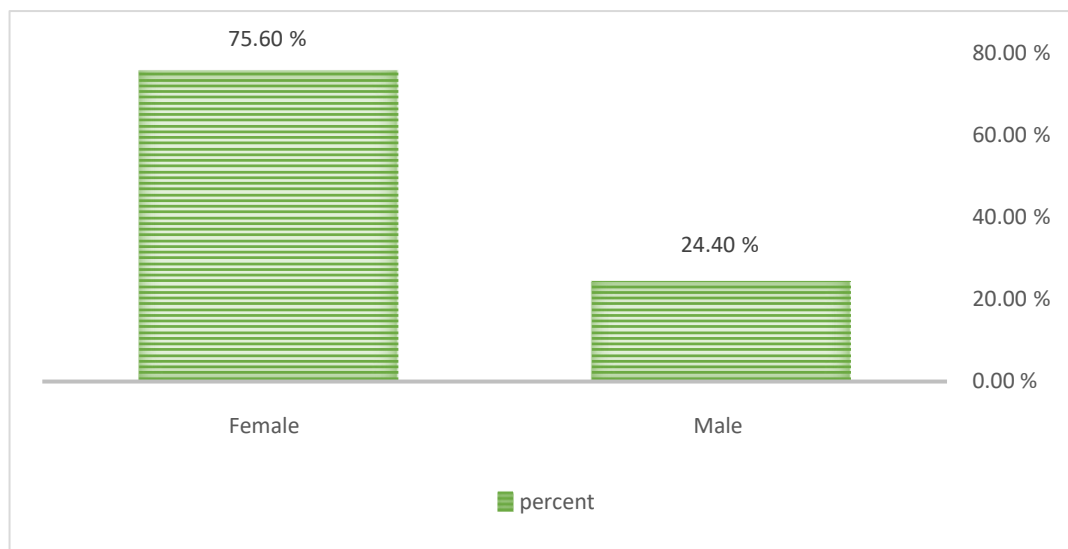


Figure 15: Shows distribution of cases according to gender.

3- Distribution of cases according to the type of bacteria that causes urinary tract infection:

Though the results, most of the study cases suffering from urinary tract infection were caused by bacteria *E. coli* with 39 cases in the rate of 47.5 %, followed by bacteria *klebsiella sp*, with 15 cases in the rate of 18.2 %.

Table 4: Distribution of cases according to the type of infection.

Type of bacteria	Count	%
<i>E. coli</i>	39	47.5%
<i>Staphylococcus aureus</i>	3	3.65 %
<i>Staphylococcus saprophylicus</i>	4	4.87%
<i>Enterobacter spp</i>	2	2.43%
<i>Klebsiella sp</i>	15	18.2%
<i>Klebsilla pneumonia</i>	1	1.21%
<i>Staphylococcus hemolytic us</i>	1	1.21 %
<i>Streptococci spp</i>	8	9.75%
<i>Neisseria gonorrhoeae</i>	1	1.21%
<i>Pseudomonas aeruginosa</i>	1	1.21%
<i>Citrobacter</i>	4	4.87%
<i>Pseudomonas sp</i>	3	3.65%
Total	82	100%

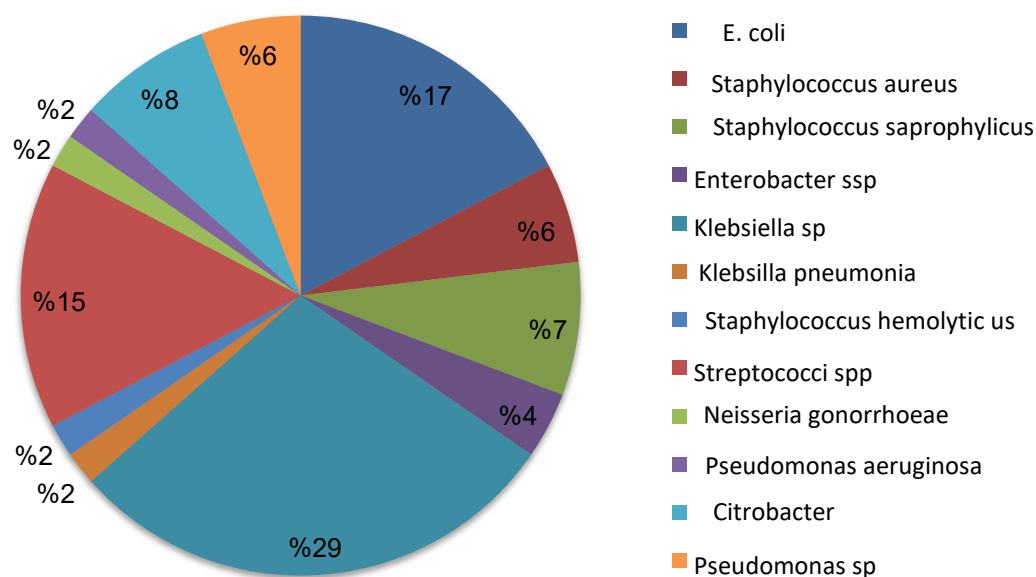


Figure 16: Shows distribution of cases according to the type of infection.

4- Sensitivity and resistance of bacteria to antibiotics

Results of the antibiotic sensitivity test showed that the E. coli bacterium was sensitive to seftazidime, ceftriaxone, Augmentin, cefixime and resistant to amikacin, ciprofloxacin and impenam. While klebsiela bacterium was sensitive to cefuroxime and resistant to amikacin, ciprofloxacin, impenam, ceftazidime, cefixime and Augmentin. Also, Amikacin was affected against k. pneumonia, While S. asprophyticus showed high sensitivity against ceftriaxone and Augmentin showed Intermediate effect against N. gonorrhoeae

Table 5: Significant antimicrobial activity against the 12 different pathogens of UTI [21].

Antibiotic	E. coli	Klebsiella sp	Pseudomonas Sp	S. saprophyticus	S. aureus	K. pneumon Iae	P. aeruginosa
Amikacin	R	R	R	R	R	S	R
Ceftriaxone	S+	R	R	S+	R	R	R
Cefuroxime	S+	S+	R	R	R	R	R
Augmentin	S+	R	R	R	S+	R	R
Ciprofloxacin	R	R	S+	S+	S+	S	R
Cefixime	S+	R	R	R	R	R	R
Impenam	R	R	R	S+	R	S	S
Ceftazidime	S+	R	R	R	R	R	R

Table 5: Continue to the previous table

Antibiotic	Enterobacter spp	S. hemolyticus	Sstreptocci spp	N. gonorrhoeae	Citrobacter
Amoxycillin	R	R	R	R	R
Ceftriaxone	S	S	S+	S	S
Cefuroxime	S	R	R	S	R
Augmentin	R	R	R	I	S+
Ciprofloxacin	S	S	R	S	S+
Cefixime	R	R	R	R	S+
Impenam	S	S	R	S	R

S = Sensitivity, R = Resistance, I = Intermediate, S+ =Highly sensitive

Conclusion

This research has examined urinary tract infections, encompassing symptoms, complications, risk factors, diagnosis, and treatment. UTIs are common in women. A significant number of women get multiple urinary tract infections throughout their lives due to their shorter urethra compared to men. Consequently, the distance for bacteria to traverse to the bladder is reduced. Isolated and identified various bacterial causes of urinary tract infections (UTIs) in 82 individuals, considering criteria such as age and gender, while also determining the sensitivity and resistance of these bacteria to medications using the diffusion method.

In this study, there were 62 (75.6 %) females and 20 (24.4 %) males in patients with urine positive culture. Most of the study cases suffering from urinary tract infection were caused by bacteria *E. coli* with 39 cases in the rate of 47.5 %, followed by bacteria *klebsiella* sp, with 15 cases at the rate of 18.2 %. Results of the antibiotic sensitivity test showed that the *E. coli* bacterium was sensitive to seftazidime, ceftriaxone, Augmentin, cefixime and resistant to amikacin, ciprofloxacin and impenam while *klebsiella* bacterium was sensitive to cefuroxime and resistant to amikacin, ciprofloxacin, impenam, ceftazidime, cefixime and Augmentin. The risk factor of urinary tract infection is minimized by drinking lots of fluids, urinate before and after intercourse, Wipe from front to back after using the bathroom and Urinate at least every four hours.

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