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A RESEARCH ARTICLE

Prevalence and Antibiotic Susceptibility of Uropathogenic Bacteria in Patients with Urinary Tract Infections

Fitua M. Al-Saedi [a,c], Ban M. Al-Shaboot [b], Sajad A. Numan [c]

[a] Polymers research unit, college of Science, Mustansiriyah University, Baghdad, Iraq.
[b] Fatima AL-Zahraa (A) Hospital, Baghdad, Iraq.
[c] Clinical Laboratory Sciences, Pharmacy college, Mustansiriyah University, Baghdad, Iraq.

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Correspondent author:

Fitua M. Al-Saedi, Polymers research unit, college of Science, Mustansiriyah University, Baghdad, Iraq.

Abstract

Urinary tract infections (UTIs) are among the most common bacterial infections, affecting individuals of all ages, particularly women. The rising rate of antimicrobial resistance among bacteria presents a serious public health issue, necessitating continuous surveillance and updated local data. The current study aims to detect the prevalence of bacterial pathogens responsible for UTIs and estimate their antibiotic susceptibility profiles. Midstream urine samples were collected from patients presenting with UTI symptoms and subjected to standard microbiological culture techniques for isolation and identification of pathogens. The identification of bacterial isolates and antibiotic sensitivity test were performed using Vitek 2 system. Escherichia coli was the most common bacteria with 212 (62.4) isolates, followed by Klebsiella pneumonia 50 (14.7), Proteus mirabilis 19 (5.6), Pseudomonas aeruginosa13 (3.8) and S.aurus 9 (2.6%). Other bacteria isolated were Enterobacter cloaca 7(2.1%), Enterococcus faecalis7(2.1%), S. saprophyticus 6(1.8%), Acinetobacter baumanii 5 (1.5%),S.haemolyticus3 (0.9%),Burkholderia capacia2 (0.6%), Enterobacter aerogenes2 (0.6%), Proteus vulgaris2 (0.6%), Citrobacter koseri 1 (0.3%), Klebsiella oxytoca1 (0.3%) and Morganella morganii1 (0.3%),with varying degrees of resistance observed against commonly prescribed antibiotics. The isolates revealed high sensitivity to imipenem (82.4%) and amikacin (82.1%), with moderate sensitivity to gentamicin (60%).These results underscore the importance of carbapenems and aminoglycosides in managing UTIs, while emphasizing the need for ongoing monitoring of resistance trends.

1. Introduction

Urinary tract infections (UTIs) refers to an infection in the urinary system including the kidney, ureters, bladder, and urethra [1]. These infections are a key source of morbidity in both community and hospital settings, affecting millions of individuals annually [2]. UTIs occur when pathogens, mostly bacteria, invade and grow in the urinary tract, result in symptoms ranging from mild discomfort to severe complications.

UTIs can affect both genders, particularly women due to anatomical and physiological factors, that aids bacterial entry and colonization of the urinary tract [3]. In addition, other factors can significantly affect the frequency rate of UTIs such as age, hospitalization, past antibiotic treatment and catheterization [4].

A wide range of pathogens cause UTIs, but most commonly by Escherichia coli. It has been reported that uropathogenic E coli caused around 80% of UTIs [5], with different virulence factors that aid bacterial infection, like toxins, adhesion factors and iron acquisition [6]. E. coli is considered as member of intestinal microbiota. However, it can cause extra intestinal illness such as bacteremia, meningitis, pneumonia and urinary tract infection. Extra intestinal disease results from a translocation of the bacterium from gastrointestinal (GI) tract into other sites of the body [7]. Other Gram-negative bacteria can cause infection include, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa. Gram-positive bacteria such as Staphylococcus saprophyticus, Enterococcus sp.and fungi such as Candida can also cause UTIs [6]. In addition, viruses [8] and parasites can also cause

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infection, particularly in immunocompromised people [9]. The extensive and incorrect use of antibiotics has contributed to the development of resistant strains. The rate of UTIs caused by multidrug resistant pathogens is increasing, resulting in a significant increase in the risk of treatment failure and the economic burden of these infections. Various studies revealed that the emergence of multi-drug resistant bacteria demands the appropriate use of antibiotics to combat the problem [10, 11, 12].

In Iraq, and particularly in Baghdad, the burden of UTIs remains substantial. Several studies have investigated the prevalence of bacterial pathogens responsible for urinary tract infections (UTIs) and their antimicrobial susceptibility patterns to facilitate appropriate treatment. Previous studies reported that Escherichia coli, Klebsiella pneumoniae, and Staphylococcus spp. were the most frequently isolated uropathogens [13]. Similarly, another Iraqi study identified Escherichia coli as the predominant causative agent of UTIs, followed by Klebsiella spp., Enterococcus faecalis, Streptococcus spp., Pseudomonas aeruginosa, Staphylococcus spp., Proteus mirabilis, and Acinetobacter baumannii [14]. Recent studies conducted in Baghdad have reported high rates of antimicrobial resistance among uropathogenic bacteria, with E. coli remaining the predominant pathogen and showing considerable resistance to several first-line antibiotics [15]. Furthermore, multidrug-resistant (MDR) strains and biofilm-producing isolates have been increasingly reported, raising concerns regarding treatment failure and recurrent infections [16]. Recent investigations have demonstrated persistent resistance among uropathogens to commonly used antibiotics, whereas susceptibility remains relatively preserved to a limited number of agents, including carbapenems and nitrofurantoin [17,18]. These findings indicate the continued emergence of multidrug-resistant (MDR) organisms and underscore the growing challenge of antimicrobial resistance. However, despite several recent reports documenting high resistance rates among E. coli, K. pneumoniae, and other Gram-negative uropathogens, comprehensive and up-to-date epidemiological data from many hospitals in Baghdad remain limited. Therefore, this study was undertaken to determine the current prevalence of uropathogenic bacteria and evaluate their antibiotic susceptibility patterns among patients with UTIs in selected hospitals in Baghdad.

2. Methods

2.1. Subjects

A total of (400) urine samples were collected from patients of all ages and genders presenting with clinical symptoms suggestive of UTIs, who were admitted to Baghdad Hospitals during the entire period of study from September 2024 to November 2025.

This study included all patients who presented with symptoms of UTIs and those who did not take treatment in the last two weeks. Patients who were under antibiotic treatment and those without UTI symptoms were excluded from our study.

2.2. Bacterial isolation and Identification

Midstream urine specimens were gathered from patients in sterilized screw cap containers, and a loop full (0.01ml) of urine specimen was inoculated on the culture media (MacConkey agar and Blood agar) and incubated aerobically at 37°C for (18-24) hours, and then examined for bacterial growth. Bacterial identification and sensitivity testing were done using the Vitek-2 compact system. This instrument uses identification/antimicrobial susceptibility cards (ID/AST cards).

2.3. Statistical analysis

Statistical analysis was achieved with the Chi-square test by Statistical Package for Social Sciences (SPSS) version 24. P-value less than0.05 was considered as statistically significant.

3. Results and discussion

3.1. Distribution of UTI patients in relation to some factors

The improper and uncontrolled use of antimicrobial agents in the treatment of infections plays a major role in the emergence and spread of antimicrobial resistance. Therefore, it is important to continuously investigate the state of antimicrobial resistance. This concern formed the main aim of the current study, particularly in the case of urinary tract infections.This study investigated the isolation, distribution, and antibiotic susceptibility profiles of pathogenic bacteria causing UTIs in hospitals in Baghdad.

In the current study, a total of [400] urine samples, 300 from females and 100 from males, were collected and processed during the study period. Out of these, [340] showed significant bacterial growth.

Analysis of the data showed that the majority of UTI patients were female. The prevalence of UTIs was high in females 262 (77.1%) than males 78)22.9(% with a significant difference at P≤0.05. This finding was consistent with several previous studies [19,20,21]. Females are more vulnerable to urinary tract infections due to their anatomy: their urethra is shorter than men's urethra and it is closer to the anus [22,23]. In addition, hormonal changes during pregnancy and menopause affect significantly to the rise of UTIs risk [24].

The results also revealed that UTIs were more incidence in age group of 1-9 years (21.8 %), followed by the age group >60 (15 %). (Table 1, Figure 1).

Table 1. Characteristics of UTIs patients with significant bacterial growth.

Total n*(%)	Sex n(%)		Age group Year n(%)	Female	Male	Value n (%)
340(100)	Male	78(22.9)	<1	21	17	38(11.2%)
	Female	262(77.1) **	1-9	66	8	74(21.8 %)
			10-19	36	2	38(11.2 %)
			20-29	41	4	45(13.2 %)
			30-39	30	7	37(10.9 %)
			40-49	19	15	34(10.0 %)
			50-59	17	6	23(6.8 %)
			>60	32	19	51(15 %)

N number of patients, **p≤0.05*

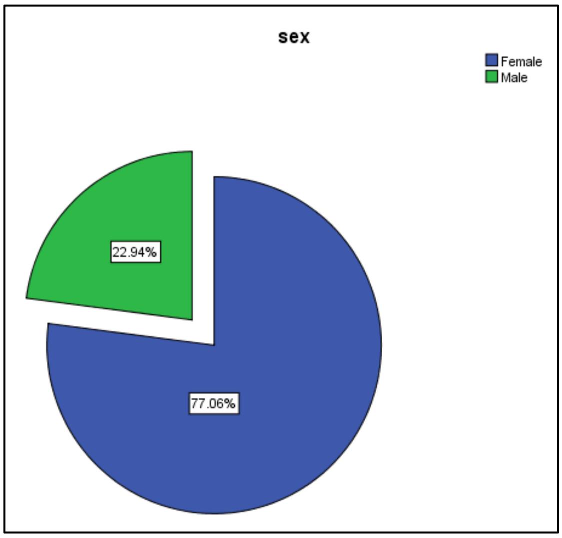

Figure 1. The incidence of UTIs in relation to gender

3.2. Distribution of bacterial isolates from urine sample

A total of 340 bacterial isolates were identified, 322(94.7%) isolates revealed Gram-negative bacteria, and 18(5.3%) revealed Gram-positive bacteria (Table 2). Escherichia coli was the most common bacteria with 212 (62.4) isolates, followed by Klebsiella pneumonia 50 (14.7), Proteus mirabilis 19 (5.6), Pseudomonas aeruginosa13 (3.8) and Staphylococcus aureus 9 (2.6%). Other bacteria isolated were Enterobacter cloaca 7(2.1%), Enterococcus faecalis7(2.1%), Staphylococcus saprophyticus 6(1.8%), Acinetobacter baumanii 5 (1.5%), Staphylococcus haemolyticus 3 (0.9%),Burkholderia capacia2 (0.6%), Enterobacter aerogenes2 (0.6%), Proteus vulgaris2 (0.6%), Citrobacter koseri 1 (0.3%), Klebsiella oxytoca1 (0.3%) and Morganella morganii1 (0.3%). The distribution of uropathogens is shown in Table 2.

Table 2. The distribution of uropathogens

	Bacterial isolates	Value n(%)
1.	Acinetobacter baumanii	5 (1.5)
2.	Burkholderia capacia	2 (0.6)
3.	Citrobacter koseri	1 (0.3)
4.	Escherichia coli	212 (62.4)
5.	Enterobacter aerogenes	2 (0.6)
6.	Enterobacter cloaca	7 (2.1)
7.	Enterococcus faecalis	7 (2.1)
8.	Klebsiella oxytoca	1 (0.3)
9.	Klebsiella pneumonia	50 (14.7)
10.	Morganella morganii	1 (0.3)
11.	Proteus mirabilis	19 (5.6)
12.	Proteus vulgaris	2 (0.6)
13.	Pseudomonas aeruginosa	13 (3.8)
14.	Staphylococcus aureus	9 (2.6)
15.	Staphylococcus haemolyticus	3 (0.9)
16.	Staphylococcus saprophyticus	6 (1.8)
	Total	340 (100)

In this work, gram-negative bacteria were identified as the main causative pathogens of UTIs, which agrees with previous studies [21,25]. Their predominance may be because of their virulence factors, comprising toxins, enzymes, iron-acquisition systems, and adhesion factors that facilitate adherence to and colonization of uroepithelial cells [26]. Urinary tract infections (UTIs) are caused by a variety of uropathogens; however, Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Enterococcus faecalis, and Staphylococcus saprophyticus are the most frequently reported [6]. The results demonstrated that Escherichia coli was the most frequently isolated pathogen, accounting for 212 isolates (62.4%). The predominance of E. coli observed in this study is consistent with findings from previous studies conducted in Iraq and other Arab countries, which also reported E. coli as the leading cause of UTIs(27,28).In addition, this result is consistent with global epidemiological data, where E. coli accounts for 70–90% of community-acquired urinary tract infections (UTIs) due to its array of virulence factors including adhesins, hemolysins, and siderophores that facilitate colonization and persistence in the urinary tract [6]. In the current study, K. pneumoniae was the second most common isolate (14.7%), which aligns with reports from Asia and the Middle East showing prevalence rates between 10–20% [29]. The clinical significance of K. pneumoniae lies in its ability to acquire extended-spectrum β-lactamases (ESBLs) and carbapenem resistance, posing challenges for empirical therapy (30,31). Proteus mirabilis (5.6%) and Pseudomonas aeruginosa (3.8%) were also notable. Gram-positive organisms such as Staphylococcus aureus (2.6%), Enterococcus faecalis (2.1%), and Staphylococcus saprophyticus (1.8%) were also identified. S. saprophyticus is a recognized cause of UTIs in young women, while Enterococcus species are associated with hospital-acquired infections and intrinsic resistance to many antibiotics [32]. Less frequent isolates, including Morganella morganii, Citrobacter koseri, and Burkholderia cepacia, underscore the diversity of uropathogens. Although their prevalence is low, they may reflect hospital environments, immunocompromised patients, or prior antibiotic exposure.

3.3. Antibiotic susceptibility patterns of uropathogens to antibiotics used in the treatment of UTI

The antibiotic susceptibility profiles shown variable susceptibility among the isolated uropathogens. The isolates showed highly sensitive to imipenem (82.4%) and Amikacin (82.1%) with significance differences at $P \leq 0.05$. In addition, they were sensitive at a percentage of 60% ,45.6%, and 45.3% for gentamycin, ciprofloxacin and pipracillin/Tazobactam respectively. Furthermore, they showed low sensitivity to Ceftazidime, cefepime and trimethoprime at a percentage of 28.8%,32.1% and 27.6% respectively (Table 3). The highest antibiotics sensitivity of E. coli was to imipenem and Amikacin at a percentage of (89.6%, 86.3%), respectively. A. baumanii was sensitive to cefepime and imipenem at a percentage of 60%. However, no isolates were sensitive to ciprofloxacin and Trimethoprim/ Sulfamethoxazole. Burkholderia capacia was sensitive to Ceftazidime 100%. While no isolates were sensitive to ciprofloxacin to gentamycin. Klebsiella pneumonia was sensitive at a highest percentage (84.0%) to Amikacin, followed by imipenem (76.0%). Proteus mirabilis was sensitive to Amikacin at a percentage of (63.2%), followed by Piperacillin/ Tazobactam and ciprofloxacin at a percentage of (57.9%) for each. Proteus vulgaris. was sensitive to imipenem, Ceftazidime, Amikacin,gentamycin and ciprofloxacin at a percentage of (100%). While no isolates were sensitive to Piperacillin/Tazobactam. Citrobacter koseri exhibited complete susceptibility (100%) to imipenem, amikacin, gentamicin, ciprofloxacin, piperacillin/tazobactam, and trimethoprim. Conversely, no susceptibility was observed to ceftazidime and cefepime.. Klebsiella Oxytoca was sensitive to Amikacin, gentamycin, ciprofloxacin (100%). In contrast, it showed no sensitivity to imipenem, pipracillin/Tazobactam, trimethoprim Ceftazidime, cefepime at a percentage of (100%).

Enterococcus faecalis was sensitive to imipenem, Amikacin (71.4%, 85.7%), respectively. Pseudomonas aeruginosa showed high sensitivity to imipenem at a percentage of (92.3%), followed by Amikacin and gentamycin at a percentage of 84.6% for each. S. aureus showed sensitivity to Amikacin, gentamycin and trimethoprim at a rate of 55.6% for each. In contrast, it showed no sensitivity to pipracillin/Tazobactam and Ceftazidime. S. haemolyticus was sensitive to Ceftazidime, Imipenem and Amikacin at a percentage of 100%. However, no isolates were sensitive to Trimethoprim. S. saprophyticus was sensitive to Imipenem and Trimethoprim at a percentage of 100% and 83.3%, respectively.

Table 3. Antibiotic susceptibility profile of common uropathogens

Bacterial species	Antibiotic sensitivity n(%)								
	n	PIP/TAZ	CAZ	CE	IMP	AK	CN	CIP	TMP
Acinetobacter baumanii	5	1(20)	2(40)	3(60)	3(60)	2(40)	1(20)	0(0.0)	0(0.0)
Burkholderia capacia	2	1(50)	2(100)	1(50)	1(50)	1(50)	0(0.0)	1(50)	1(50)
Citrobacter Koseri	1	1(100)	0(0.0)	0(0.0)	1(100)	1(100)	1(100)	1(100)	1(100)
Escherichia coli	212	93(43.9)	51(24.1)	53(25)	190(89.6)	183(86.3)	126(59.4)	88(41.5)	42(19.8)
Enterobacter aerogenes	2	2(100)	0(0.0)	1(50)	2(100)	2(100)	1(50)	0(0.0)	0(0.0)
Enterobacter cloaca	7	3(42.9)	3(42.9)	4(57.1)	4(57.1)	5(71.4)	5(71.4)	5(71.4)	6(85.7)
Enterococcus faecalis	7	2(28.6)	1(14.3)	3(42.9)	5(71.4)	6(85.7)	3(42.9)	2(28.6)	4(57.1)
Klebsiella oxytoca	1	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(100)	1(100)	1(100)	0(0.0)
Klebsiella pneumonia	50	26(52)	22 (44)	24(48)	38 (76)	42(84)	37(74)	29(58)	22(44)
Morganella morganii	1	1(100)	1(100)	1(100)	1(100)	1(100.)	0(0.0)	0(0.0)	0(0.0)
Proteus mirabilis	19	11(57.9)	3(15.8)	4(21.1)	8(42.1)	12(63.2)	7(36.8)	11(57.9)	2(10.5)
Proteus vulgaris	2	0(0.0)	2(100)	1(50)	2(100)	2(100)	2(100)	2(100)	1(50)
Pseudomonas aeruginosa	13	8(61.5)	4(30.8)	5(38.5)	12(92.3)	11(84.6)	11(84.6)	5(38.5)	5(38.5)
Staphylococcus aureus	9	0(0.0)	0(0.0)	3(33.3)	4(44.4)	5(55.6)	5(55.6	4(44.4	5(55.6)
Staphylococcus haemolyticus	3	2(66.7)	3(100)	2(66.7)	3(100)	3(100)	2(66.7)	2(66.7)	0(0.0)
Staphylococcus saprophyticus	6	3(50)	4(66.7)	4(66.7)	6(100)	2(33.3)	2(33.3)	4(66.7)	5(83.3)
Total	340	154 (45.3)	98 (28.8)	109 (32.1)	280 (82.4)**	279 (82.1)**	204 (60.0)	155 (45.6)	94 (27.6)

*n: number of bacterial isolates,**P≤0.05.*
PIP/TAZ: Piperacillin/Tazobzctam, CAZ: Ceftazidime, CE: Cefepime, IMP: Imipenem, AK: Amikacin, CN: Gentamicin, CIP: Ciprofloxacin, CE: Cefepime, TMP: Trimethoprim Sulfamethoxazole

The resistance patterns detected in this work confirm the growing challenge of multidrug-resistant pathogens. Most isolates demonstrated resistance to at least three antibiotics, underscoring the limited therapeutic options available. Antibiotic susceptibility testing revealed high sensitivity to imipenem (82.4%) and amikacin (82.1%), with moderate sensitivity to gentamicin (60%). These findings underscore the importance of carbapenems and aminoglycosides in managing UTIs, while highlighting the need for ongoing monitoring of resistance trend. Similar findings have been reported in recent Iraqi studies. A study conducted in Baghdad during 2024 found that uropathogenic Escherichia coli exhibited high resistance to ampicillin and trimethoprim-sulfamethoxazole, whereas imipenem and nitrofurantoin remained the most effective agents against the isolates [33]. Likewise, another study from Baghdad reported widespread multidrug resistance among uropathogenic E. coli isolates and highlighted the growing prevalence of resistance determinants associated with urinary tract infections [34].

Among the Gram-negative isolates in the current study, Acinetobacter baumannii exhibited complete resistance (100%) to ciprofloxacin and trimethoprim-sulfamethoxazole and high resistance to gentamicin and piperacillin/tazobactam (80%). Similarly, Klebsiella oxytoca demonstrated complete resistance to piperacillin/tazobactam, ceftazidime, cefepime, and imipenem. These findings are concerning because both species are recognized as important nosocomial pathogens capable of acquiring multiple resistance mechanisms [35,36].

Comparable resistance patterns have been reported in Iraq, where A. baumannii isolates showed high resistance to piperacillin (80%) and carbenicillin (81.2%), gentamicin (82%), amikacin (72.6%), cefotaxime (70.2%), ceftazidime (70.2%), and ceftriaxone (71.6%.)(37), reflecting the widespread dissemination of multidrug-resistant strains in healthcare settings (37,38). Furthermore, a study conducted in Najaf on urinary isolates of K. oxytoca reported no susceptibility to Ampicillin, Cloxacillin, Ceftazidime, Penicillin, Piperacillin with a resistance rate of 100%., highlighting the increasing prevalence of β-lactam resistance among this species [39].

Therefore, the resistance rates observed in the present study are consistent with, and in some cases exceed, those reported in recent Iraqi investigations, suggesting continued antimicrobial selection pressure and the emergence of highly resistant hospital-associated strains.

Similarly, E. coli and Proteus species showed high resistance to ceftazidime, cefepime, and trimethoprim, consistent with global reports of increasing resistance among Enterobacterale [36]. Enterobacter aerogenes was resistant at percentage of 100% for each of Ceftazidime, Ciprofloxacin and Trimethoprim. Citrobacter Koseri was highly resistant to Ceftazidime, cefepime (100%).The detection of complete resistance in Enterobacter aerogenes and Citrobacter koseri further emphasizes the spread of resistance mechanisms across diverse genera. Alarmingly, resistance among Gram-positive isolates such as Enterococcus faecalis and Staphylococcus aureus was also substantial, particularly against cephalosporins and piperacillin/tazobactam, echoing recent findings of rising multidrug resistance in Gram-positive pathogens [40]. Similar observations have been reported in recent Iraqi studies, which documented increasing multidrug resistance among Gram-positive urinary pathogens [41]. These results align with the latest WHO Global Antimicrobial Resistance Surveillance System (GLASS) report, which documented increasing resistance in urinary tract pathogens worldwide [42]. Taken together, these findings emphasize the urgent need for antimicrobial stewardship programs, routine surveillance, and the judicious use of last-line agents such as carbapenems and aminoglycosides to preserve their efficacy.

4. Conclusion

The current study provides valuable insight into the distribution and antimicrobial resistance profiles of uropathogens isolated from patients in Baghdad hospitals. Escherichia coli was confirmed as the predominant pathogen, followed by Klebsiella pneumoniae, Proteus mirabilis, and Pseudomonas aeruginosa, consistent with global epidemiological trends. Most isolates exhibited multidrug resistance, highlighting the growing challenge of antimicrobial resistance in urinary tract infections. These findings emphasize the urgent need for continuous antimicrobial resistance surveillance, rational antibiotic prescribing, and the implementation of effective antimicrobial stewardship programs. Future studies should expand surveillance to include the molecular mechanisms underlying antimicrobial resistance and evaluate the impact of stewardship interventions on clinical outcomes.

References

1. Boye, A. Siakwa, P.M. Boampong, J.N. Koffuor, G.A. Ephraim, R.K.D. and Amoateng, P. (2012). “Asymptomatic urinary tract infections in pregnant women attending antenatal clinic”, Journal of Medical Research, Vol. 1, No.6, pp. 074-083.
2. Mancuso G, Midiri A, Gerace E, Marra M, Zummo S, Biondo C. (2023). Urinary Tract Infections: The Current Scenario and Future Prospects. Pathogens, 20;12(4):623, doi: 10.3390/pathogens12040623.
3. Czajkowski K, Broś-Konopielko M, Teliga-Czajkowska J. (2021). Urinary tract infection in women. Prz Menopauzalny,20(1):40-47, doi: 10.5114/pm.
4. Anton, C.-I.; Ștefan, I.; Zamfir, M.; Ghiațău, C.F.; Sima, C.S.; Osman, C.L.; Ștefan, T.A.; Streinu-Cercel, A. (2025). Etiology and Risk Factors of Recurrent Urinary Tract Infections in Women in a Multidisciplinary Hospital in Romania. Microorganisms , 13, 626, ,doi.org/10.3390/microorganisms13030626
5. Klein, R. D., and Hultgren, S. J.(2020). Urinary tract infections: microbialpathogenesis, host-pathogen interactions and new treatment strategies. Nat.Rev. Microbial, 18, 211–226. doi: 10.1038/s41579-020-0324-0

6. Flores-Mireles, A. L., Walker, J. N., Caparon, M., and Hultgren, S. J.(2015). Urinary tract infections: epidemiology, mechanisms of infection and treatment options.Nat. Rev. Microbiol., 13, 269–284. doi: 10.1038/nrmicro3432
7. Berg RD. (1999). Bacterial translocation from the gastrointestinal tract. Adv Exp Med Biol. 473:11-30. doi:10.1007/978-1-4615-4143-1_2.
8. Luciani LG, Mattevi D. (2022). Urinary Tract Infections: Virus. Encyclopedia of Infection and Immunity,32–43. doi: 10.1016/B978-0-12-818731-9.00139-7.
9. FM Murad, RN Hamoo. (2022). Diagnostic study of parasites of the urinary tract infection in Nineveh governorate. J Adv Microbiol Res,;3(2):17-24, ,doi: 10.22271/micro.2022.v3.i2a.42.
10. Shirani K, Seydayi E, Boroujeni KS. (2019). Prevalence and antibiotic resistance pattern of extended-spectrum beta-lactamaseproducing Escherichia coli in clinical specimens. J. Res. Med. Sci. 24: 103. doi: 10.4103/jrms.JRMS_634_18
11. Mishra MP, Sarangi R, Padhy RN.(2016).Prevalence of multidrug resistant uropathogenic bacteria in pediatric patients of a tertiary care hospital in eastern India. J. Infect. Public Health 9: 308-314. doi: 10.1016/j.jiph.2015.10.002.
12. Lee DS, Lee SJ, Choe HS. (2018). Community-acquired urinary tract infection by Escherichia coli in the Era of antibiotic resistance. Biomed Res. Int, 2018: 7656752. doi: 10.1155/2018/7656752
13. Abdulrahman IS. (2018). Antimicrobial Susceptibility Pattern of Pathogenic Bacteria Causing UrinaryTract Infections at Azadi Hospital In Duhok City\Kurdistan Region of Iraq. Sci J UnivZakho, 6(2):46–50, doi.org/10.25271/2018.6.2.435
14. Al-Tulaibawi NAJ. (2019). Prevalence and sensitivity of bacterial urinary tract infection among adult diabetic patients in misan province, Iraq. J PureAppl Microbiol,13(2):847–953. doi.org/10.22207/JPAM.13.2.20
15. Abdallah, M. M. (2025). Emerging Antimicrobial Resistance Patterns among Uropathogens in Baghdad. Journal of Asian Multicultural Research for Medical and Health Science Study, 6(1), 58-71. https://doi.org/10.47616/jamrmhss.v6i1.644
16. Obaid, W. A. (2025). Prevalence, Antimicrobial Susceptibility, and Distribution of Biofilm Associated Virulence Genes in Multidrug-Resistant Acinetobacter baumannii Isolated from Various Environmental Sources in Baghdad Hospitals", Iraqi Journal of Science, vol. 66, no. 7, pp. 2756–2775, doi: 10.24996/ijs.2025.66.7.
17. Salih, A., Hussein, S., Najm, D., Alazzawi, H., Modher, M., & AHMED, A. (2025). Antibiotic resistance patterns among uropathogenic bacteria isolated from patients with urinary tract infections in Baghdad hospitals. Microbes and Infectious Diseases, (), -. doi: 10.21608/mid.2025.425641.3243.
18. Khudiar HH. (2026). Clinical Impact of Multidrug-Resistant Uropathogens in Urinary Tract Infections in Baghdad: A Cross-Sectional Study. Research Square. doi: 10.21203/rs.3.rs-9284867/v1.
19. Naqid IA, Balatay AA, Hussein NR, Ahmed HA, Saeed KA, Abdi SA.(2020).Bacterial strains andantimicrobial susceptibility patterns in male urinary tract infections in Duhok Province, Iraq.Middle East J Rehabil Heal Stud., 13;7(3):1–6,
20. Marwa Ibrahim, Haval Mohammed Khalid, Wijdan M S Mer. (2021). The prevalence of uropathogenic escherichia coli strains among outpatients with urinary tract infection in Zakho Hospitals-Zakho City, Duhok Province/ Iraq.Al-Qadisiyah J Pure Sci., 26(5):26–40. doi: 10.29350/qjps.2021.26.5.1366
21. Vakilzadeh MM, Heidari A, Mehri A, Shirazinia M, Sheybani F, Aryan E, et al.(2020). Antimicrobial resistance among communityacquired uropathogens in Mashhad, Iran. J Environ Public Health. 2020:3439497. doi: 10.1155/2020/3439497
22. Al-Badr A, Al-Shaikh G. (2013). Recurrent urinary tract infections management in women: Areview. Sultan Qaboos Univ Med J, 13(3):359–67. doi: 10.12816/0003256
23. Tan CW, Chlebicki MP. (2016).Urinary tract infections in adults. Singapore Med J.,57(9):485–90.doi: 10.11622/smedj.2016153.
24. Hindi NKK, Hasson SO, Hindi SKK. (2013).Bacteriological study of urinary tract infections with antibiotics susceptibility to bacterialisolates among honeymoon women in Al Qassim Hospital, Babylon Province, Iraq. British Biotechnol J., 3:332. doi: 10.9734/BBJ/2013/3573

25. Wanja F, Ngugi C, Omwenga E, Maina J, Kiiru J. (2021).Urinary Tract Infection among adults seeking medicare at kiambu level 5 hospital, kenya: prevalence, diversity, antimicrobial susceptibility profiles and possible risk factors.Adv Microbiol. 11(08):360–83. doi: 10.4236/aim.2021.118028
26. Kot B. (2017). Virulence Factors and Innovative Strategies for the Treatment and Control of Uropathogenic;Escherichia coli -Recent Advances on Physiology, Pathogenesis and Biotechnological Applications. InTech doi.org/10.5772/67778.
27. AL-Nasrawi MM, AL-Hashimy AB. (2020). Molecular study of some virulence genes of Escherichia coli isolated from women with urinary tract infection in AL-Najaf City. Iraq J Biotechnol 3:2020.
28. Mohamed Hayir T, Mohamed Y, Shaba A, Elmi S, Hassan A. (2019). Bacterial uropathogens in urinary tract infections and Antibiotic, Curr Res, 7:2, DOI: 10.4172/2327-4360.1000171
29. Hyun M, Lee JY, Kim HA, Ryu SY. (2019). Comparison of Escherichia coli and Klebsiella pneumoniae Acute Pyelonephritis in Korean Patients. Infect Chemother.51(2):130-141,doi: 10.3947/ic.2019.51.2.130.
30. Gupta, K., & Bhadelia, N. (2014). Management of urinary tract infections from multidrug-resistant organisms. Infectious disease clinics of North America, 28(1), 49–59. https://doi.org/10.1016/j.idc.2013.10.002
31. Pitout, J. D., & Laupland, K. B. (2008). Extended-spectrum beta-lactamase-producing Enterobacteriaceae: an emerging public-health concern. The Lancet. Infectious diseases, 8(3), 159–166. https://doi.org/10.1016/S1473-3099(08)70041-0
32. Murray B. E. (1990). The life and times of the Enterococcus. Clinical microbiology reviews, 3(1), 46–65. https://doi.org/10.1128/CMR.3.1.46
33. Salman HS, Majeed HM, Shallal YF. (2026). Prevalence, Etiology, and Antibiotic Resistance Patterns of Urinary Tract Infections in a Baghdad Hospital: Focus on Uropathogenic E. coli and Virulence Factors. International Journal of Microbiology.;2026:9117996. doi: 10.1155/ijm/9117996.
34. Khalaf, Z. Z., & Flayyih, M. T. (2024). Detection of Uropathogenic Specific Protein Gene (usp) and Multidrug Resistant Bacteria (MDR) of Pathogenic Escherichia coli Isolated from Baghdad City. Iraqi Journal of Science, 65(3), 1239-1249. https://doi.org/10.24996/ijs.2024.65.3.6
35. Seifert, H., & Paterson, D. L. (2008). Acinetobacter baumannii: emergence of a successful pathogen. Clinical microbiology reviews, 21(3), 538–582. https://doi.org/10.1128/CMR.00058-07
36. Pitout, J. D., & Laupland, K. B. (2008). Extended-spectrum beta-lactamase-producing Enterobacteriaceae: an emerging public-health concern. The Lancet. Infectious diseases, 8(3), 159–166. https://doi.org/10.1016/S1473-3099(08)70041-0
37. Rahi AA. (2024).Phenotypic and Genotypic Detection of Carbapenemases in Clinical Isolates of Acinetobacter baumannii. medRxiv. doi: https://doi.org/10.1101/2024.11.20.24317647
38. Wajid Odhafa, M., Al-Kadmy, I., Pourmand, M. R., Naderi, G., Asadian, M., Ghourchian, S., & Douraghi, M. (2024). The context of blaOXA-23 gene in Iraqi carbapenem-resistant Acinetobacter baumannii isolates belonging to global clone 1 and global clone 2. BMC research notes, 17(1), 300. https://doi.org/10.1186/s13104-024-06890-w
39. Abdulla NY, Aljanaby IAJ, Hasan TH, Aljanaby AA. (2022). Assessment of β-lactams and Carbapenems Antimicrobials Resistance in Klebsiella oxytoca Isolated from Patients with Urinary Tract Infections in Najaf, Iraq. Archives of Razi Institute;77(2):669–673. doi: 10.22092/ARI.2022.356957.1947
40. Gupta K, Bhadelia N. (2017). Management of urinary tract infections from multidrug-resistant organisms. Infect Dis Clin North Am., 31(4):739–52.
41. Jawad AA, Kadhim AJ, Hashim MH. (2024). Prevalence of Multi-Drug Resistant Staphylococcus aureus and Escherichia coli Isolated from Urinary Tract Infections. Journal of Medical and Life Science. 6(3):410–419. doi:10.21608/jmals.2024.38309
42. World Health Organization. Global. (2024). Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2024. Geneva: WHO;https://www.who.int/publications/i/item/9789240098456 (who.int in Bing)

انتشار البكتيريا المسببة لالتهابات المسالك البولية وحساسيتها للمضادات الحيوية لدى المرضى المصابين بالتهابات المسالك البولية

الملخص

تُعد عدوى المسالك البولية (UTIs)من أكثر أنواع العدوى البكتيرية شيوعاً، حيث تصيب الأفراد من جميع الأعمار، ولا سيما النساء. ويشكل تزايد معدلات مقاومة البكتيريا لمضادات الميكروبات تحدياً خطيراً للصحة العامة، مما يستلزم إجراء مراقبة مستمرة وتحديث البيانات المحلية. تهدف الدراسة الحالية إلى تحديد معدل انتشار مسببات الأمراض البكتيرية المسؤولة عن عدوى المسالك البولية وتقييم أنماط حساسيتها للمضادات الحيوية. تم جمع عينات بول من منتصف مجرى البول من مرضى تظهر عليهم أعراض العدوى، وأُخضعت لتقنيات الزرع الميكروبيولوجي القياسية لعزل مسببات الأمراض تم تشخيص العزلات وتشخيص حساسيتها للمضادات الحيوية باستخدام نظام " Vitek 2". وكانت بكتيريا Escherichia coli هي الأكثر شيوعاً بواقع 212 عزلة (62.4%)، تلتها بكتيريا Klebsiella pneumoniae (14.7%)، وProteus mirabilis (5.6%)، وPseudomonas aeruginosa (3.8%)، و Staphylococcus aureus* (2.6%). وشملت البكتيريا الأخرى المعزولة: Enterobacter cloacae* (2.1%)، و*Enterococcus faecalis (2.1%)، و *Staphylococcus saprophyticus (1.8%)، وAcinetobacter baumannii (1.5%)، و*Staphylococcus haemolyticus (0.9%)، Burkholderia cepacia * (0.6%)، وEnterobacter aerogenes* (0.6%)، وProteus vulgaris (0.6%)، وCitrobacter koseri* (0.3%)، و Klebsiella oxytoca* (0.3%)، وMorganella morganii* (0.3%)، مع ملاحظة درجات متفاوتة من المقاومة للمضادات الحيوية الشائعة الاستخدام. وأظهرت العزلات حساسية عالية تجاه عقاري إيميبينيم (82.4%) وأميكاسين (82.1%)، وحساسية متوسطة تجاه جنتاميسين (60%). وتُبرز هذه النتائج أهمية مجموعتي الكاربابينيمات والأمينوغليكوزيدات في علاج عدوى المسالك البولية، مع التأكيد على ضرورة المراقبة المستمرة لاتجاهات المقاومة.

الكلمات المفتاحية: مسببات الأمراض البولية، التهابات المسالك البولية، الحساسية للمضادات الحيوية، مقاومة متعددة للأدوية، نظام Vitek 2