



Original Article

Uncomplicated Cystitis in Female Patients in Erbil City:

What is the best antibiotic according to culture and sensitivity?

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ABSTRACT

Urinary tract infections, especially cystitis, are the second most prevalent cause of antibiotic prescriptions. Most urinary tract infections in women are acute uncomplicated cystitis caused by *Escherichia coli* (*E. coli*). This study aimed to assess the bacterial profile of uncomplicated cystitis and their antimicrobial susceptibility patterns among clinically suspected women in Erbil city. A prospective clinical study was conducted between January 2023 and April 2025, at urology consultation unit and laboratory department of Rizgary and Hawler Teaching Hospitals. Midstream urine was obtained from each participant with a suggestive history of cystitis, specimen then cultured on different media, positive culture after that submitted for identification and antibiotic susceptibility profile by Vitek2 system. To carry this study, 322 samples were collected from patients, their ages ranged between 16-55 years. The results showed that most of the infections were recurrent. Although gram positive bacteria isolated in 38% of the sample, *E. coli* was the commonest uropathogen (48.6%). Resistance to Trimethoprim/Sulfamethoxazole was 37.8 for gram negative and 28.9 for gram positive microorganisms, followed by Ciprofloxacin 32.6 % and 16.9% for gram negative and gram positive, respectively. The resistance of bacteria against Nitrofurantoin observed 19.3% and 13.3% for gram negative and positive, respectively. Although *E. coli* is still the predominant bacteria causing cystitis in females in our cohort, other significant bacteria need to be considered, especially gram positive bacteria. The results also observed that the best antibiotic to be used as empiric treatment for simple cystitis was Nitrofurantoin.

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Keywords: Urinary tract infections, cystitis, *E. coli*, Antibiotic Resistance.

1 Introduction

Urinary tract infections (UTIs) result from invasion of the urinary system by bacteria or other microorganisms [1]. Urine is no more regarded sterile as previously known and many microbiome may be present and colonize the urinary tract in healthy human [1, 2]. Uncomplicated cystitis mean bladder infection in anatomically and functionally normal bladder in non-pregnant women [3] and it can be distinguished from complicated infection that may occur in male patient or females with certain local functional and anatomic abnormalities or systemic diseases that affect urinary tract function [4]. Most UTIs in women are acute uncomplicated

cystitis and about 80% are caused by *E. coli* [5]. Classical lower urinary tract symptoms include dysuria, urinary frequency, urgency and sometimes haematuria with absence of vaginal discharge [6]. Physical examination is typically normal or positive for suprapubic tenderness and clinical diagnosis depend on presence of pyuria (WBC $\geq$ 10/ μ L) and at least two of mentioned symptoms [7, 8].

Urinary tract infections are common bacterial infections in women, with more than half of all women experiencing at least one in their lifetime, they are the second most prevalent cause of antibiotic prescriptions in community pharmacies [9, 10] and 25-30% of them develop recurrent infections, defined as two infection in last 6 months or three/year, unrelated to any functional or anatomical abnormality of the urinary tract [11, 12]. Although acute uncomplicated cystitis may not be thought of as a serious condition, it affects the patient's quality of life by

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causing an estimated six days of discomfort and may affect the quality of life of the patients ^[13].

Urine culture is necessary to identify the infecting microorganisms. Accordingly, the most appropriate diagnostic criterion for urine culture specimens obtained through suprapubic aspirate or catheterization is a bacterial concentration of equal to and greater than 10^5 colony forming unit/mL ^[14]. Although about 20% of females with symptoms of cystitis has negative culture but quantitative PCR for *E. coli* and *Staphylococcus saprophyticus* still showed infection ^[15]. Antibiotic safety profile is an important issue regarding uncomplicated cystitis treatment and current guidelines recommend to use empirical prescription of selected specific types of antibiotics ^[16-18]. In recent years, Food and Drug Administration (FDA) announced the risk of Fluoroquinolone uses in cases of uncomplicated cystitis and recommended to be remained for patients with no alternatives ^[19, 20]. This study aimed to assess the bacterial profile of urinary tract infection (uncomplicated cystitis), and their antimicrobial susceptibility pattern among clinically suspected women in Erbil city and detecting the rate of resistance of isolated bacteria to different classes of antibiotics as a step toward establishing our local guideline, that's lacking, for better treating different types of UTI.

2 Materials and methods

A prospective clinical study was conducted between January 2023 and April 2025. A total of 322 women patients with symptoms suspected to have uncomplicated cystitis attended Rizgari and Hawler Teaching Hospitals in Erbil city were enrolled in this study. Ethical committee approval taken from college of medicine-Hawler medical university on 29th March 2023, meeting code 6 and paper code 7. A questionnaire was used to collect data through face-to-face interview. Data were about age, gender, education level, marital state and symptoms of cystitis.

2. 1 Exclusion Criteria

Patients were excluded if they were: with functional or anatomical abnormality of UT, male gender, pregnant, diabetic, menopausal, immunocompromised, patients received antibiotics during last few days and patients with urethral catheterization.

2. 2 Specimen Collection

10 ml clean-catch midstream urine samples were collected from females with a suggestive history of cystitis, and then cultured on blood and MacConkey agar plates. The culture medium incubated at 37°C for 24 hrs. In addition, cultures were incubated for an extra 24hrs to exclude any slow growing bacteria, which considered as negative.

2. 3 Bacterial Identification

All isolates were identified primarily according to general cultural characteristic of colonies (colour, shape, texture and size) on MacConkey agar and Blood agar. Other characteristics were observed like lactose fermentation, blood lysis and Mannitol fermentation. Then Vitek2 system used to confirm the identification and antimicrobial susceptibility profile of all bacteria using gram positive (GP), gram negative (GN) and AST cards.

2. 4 Statistical analysis

Statistical analyses were performed using SPSS version 27.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics, including frequencies and percentages, were calculated to summarize the distribution of categorical variables. Frequency counts were used to quantify the number of occurrences for each category, while percentages represented the proportion of each category.

3 Results

Demographic data

In this study 322 female patients were included. The age of the patients in this study, ranged from 16 to 55 years, the majority of the patients were in the age group 16-35years (62.5%) as shown in **Error! Reference source not found.**, the average age among participant was 32.73 ± 0.615 years and 88.8% of them live in urban, 75.2% were married. Only 6.5% of them had high education degree. 78.3% of them had recurrent urinary tract infection. Moreover, the majority of the patients suffered from numerous symptoms (**Error! Reference source not found.**); including Dysuria (89.1%), Urgency (79.2%), Frequency (82.9) and Suprapubic pain (77.6%) and culture testing revealed a high rate of positive results (75.7%).

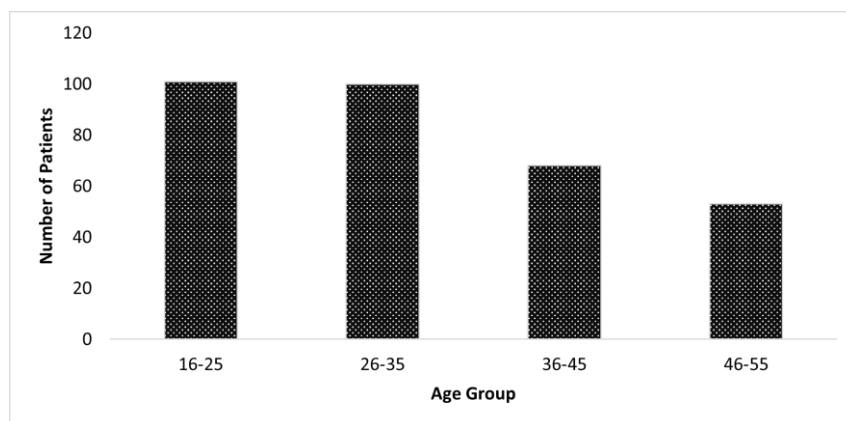


Figure 1: Age incidence among 322 patients with UTI in Erbil city.

Table 1: Demographic and clinical data among 322 patients with UTI in Erbil city.

Patient characteristics	Value
Age in years (means $\pm$ SE)	32.73 $\pm$ 0.615
Residency	
Urban	286 (88.8%)
Rural	36 (11.2%)
Education Level	
Illiteracy	53 (16.3%)
Primary	59 (18.3%)
Secondary	87 (27.0%)
High school	48 (14.9%)
Undergraduate	54 (16.8%)
Postgraduate	21 (6.5%)
Marital status	
Single	70 (21.7%)
Married	242 (75.2%)
Widow	06 (1.9%)
Divorced	04 (1.2%)
Type of Infection	
First time	70 (21.7%)
Recurrent	252 (78.3%)
Symptoms	
Dysuria	287 (89.1%)
Urgency	255 (79.2%)
Frequency	267 (82.9%)
Suprapubic pain	250 (77.6%)
Culture results (288 patients)	
Positive	218 (75.7%)
Negative	70 (24.3%)

Microbiological Findings

Results of culture and sensitivity tests are collected only from 288 patients and the remaining 34 were lost to follow-up and did not return for subsequent evaluation. By looking at **Error!**

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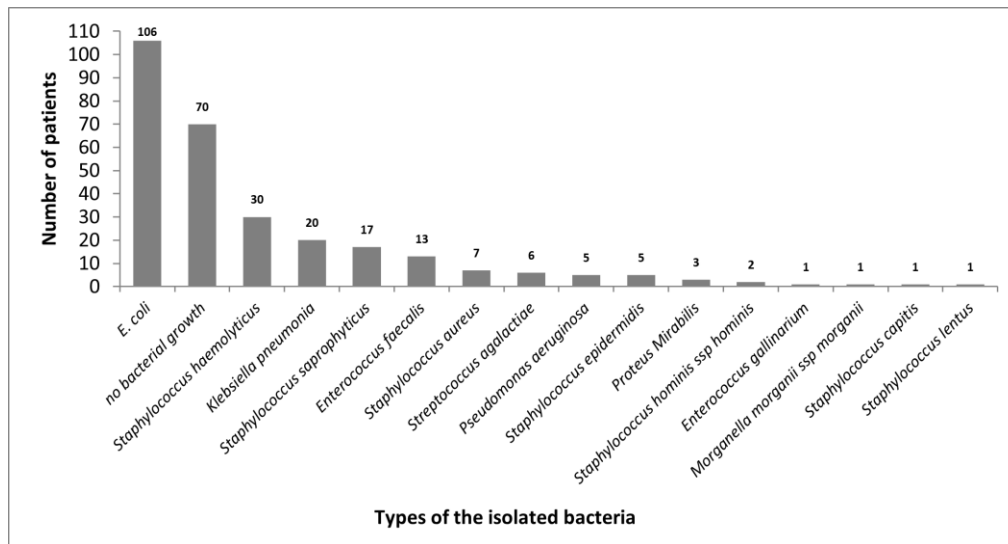


Figure 2: Gram +ve and Gram -ve bacteria isolated from 218 female patients with UTI in Erbil city.

Antimicrobial susceptibility Profile

Error! Reference source not found. illustrates antimicrobial susceptibility profile of three antibiotics which are considered as the empiric treatment for uncomplicated cystitis; Fosfomycin is

tested only in 14.2%, and the resistance in the tested patients was about 1.4%, Nitrofurantoin resistance was 16.5% and for Trimethoprim/Sulphamethoxazole was higher than them (34.4%).

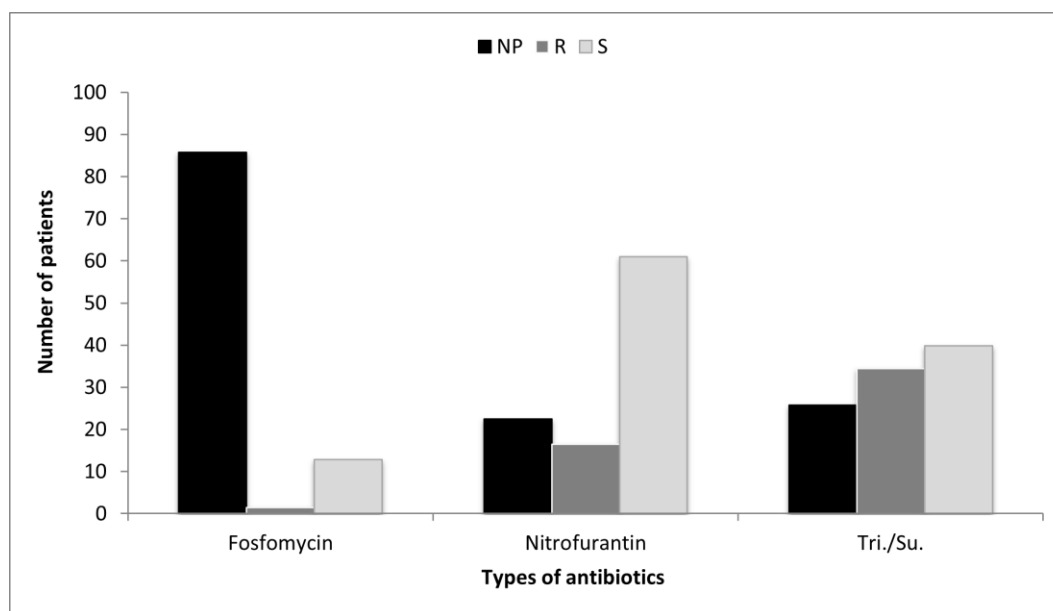


Figure 3: Antimicrobial susceptibility profile of 218 bacteria to empiric therapy (Fosfomycin, Nitrofurantoin, Trimethoprim/Sulphamethoxazol) in patients with UTI in Erbil city.

*NP= Not performed, R = Resistant, S= Susceptible, Tri./Su. = Trimethoprim/Sulphamethoxazol

Regarding non empiric therapy, there was observable resistance to these antibiotics, in 83 Gram positive isolates, resistance to Levofloxacin, gentamycin and Amikacin were 31.3%, 27.7% and 18.1% respectively (**Error! Reference source not found.**): while in 135 Gram negative bacteria, highest level of resistance was

showed against fluoroquinolone drugs as ciprofloxacin and levofloxacin (32.65 %, 26.7%) and also ceftriaxone 28.5% and gentamycin 22.2% have a high resistance rate (**Error! Reference source not found.**).

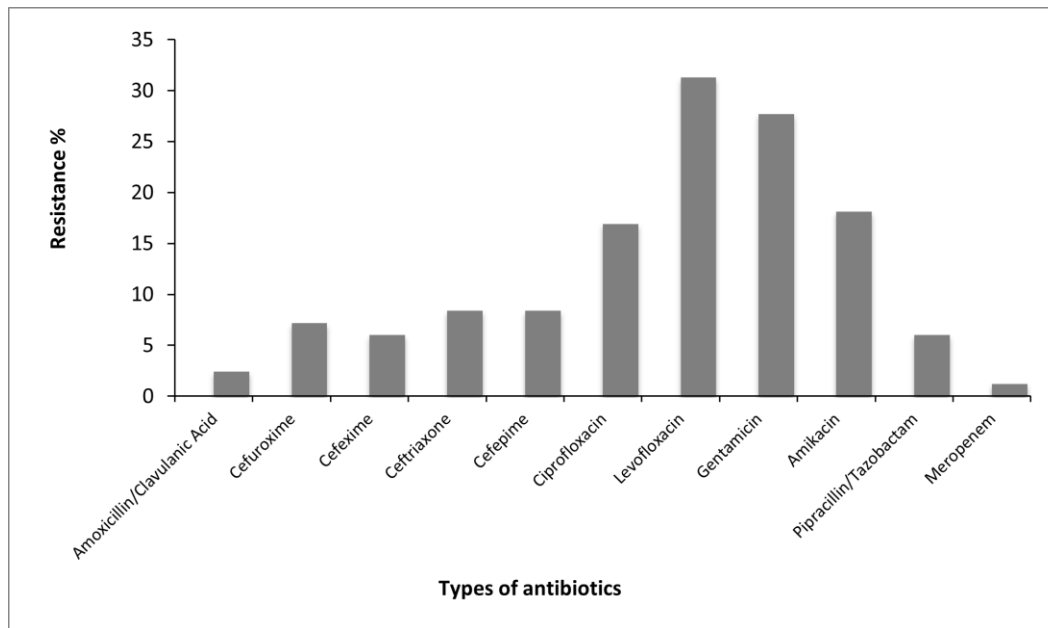


Figure 4: Antibiotic resistance patterns of 83 Gram positive bacteria to non-empiric antibiotics.

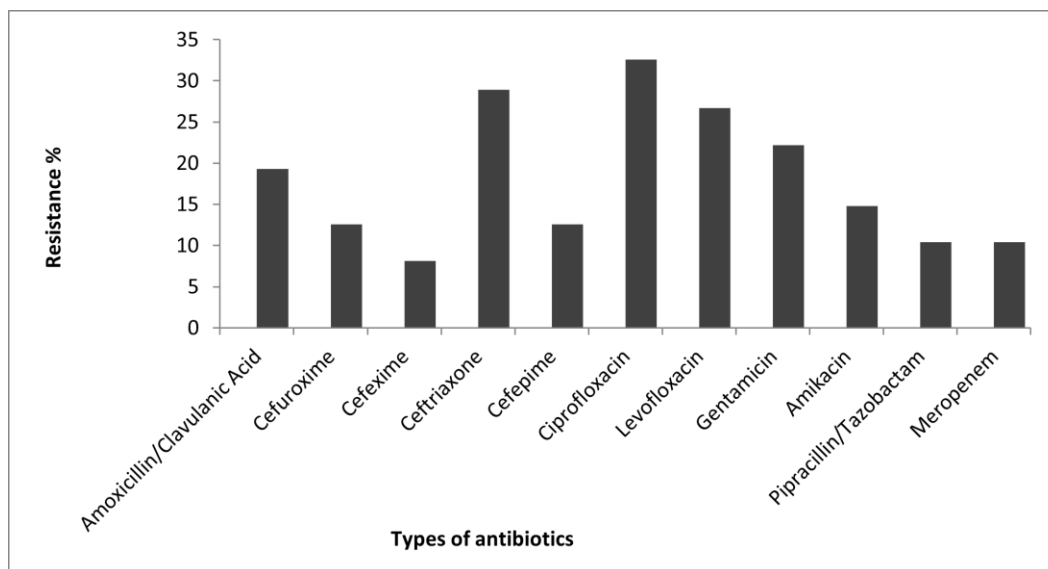


Figure 5: Antibacterial resistance pattern of 135 Gram negative bacteria to non-empiric antibiotics.

4 Discussion

The main findings indicate that the socio-demographic factors, young age, low education and living in a large city are all independently associated with increased risks of being diagnosed with first event uncomplicated cystitis. Although this study does not examine possible mechanisms behind the increased risk of uncomplicated cystitis in regard to the investigated socio demographic exposures, the findings were suggestive of an unequal distribution of this illness among women aged 16–55 years.

In this study, the most common presentation was dysuria, which may represent simple cystitis rather than pyelonephritis.^[21] and the *E. coli* was commonest uropathogenes (48.6%) which is less

than recorded in studies in the world^[5, 22], Coagulase negative staphylococcus species also cause significant percentage of our study culture results (38%)^[23].

Negative culture results is also one of the important finding as it approach about 24.3% of the cultures done for patients with symptoms typical for cystitis, this may due to low bacterial count, nonbacterial infection, *E.coli* with biofilm, and sometime non-infectious causes as interstitial cystitis^[24, 25].

Usually, cystitis is treated with antibiotic therapy and the drug is selected according to the patient risk factors and the regional antibiotic resistance level, if there is no specific indications, first line drugs are prescribed which include nitrofurantoin, Fosfomycin and trimethoprim-sulfamethoxazole^[26].

The rate of recurrent cystitis in our study (78%) is somewhat higher than other studies [11, 12, 27] which may be due improper hygiene or antibiotic resistance and this may affect the patient quality of life, reduce the sexual and social relationship and ability to work effectively [28].

Treatment of uncomplicated cystitis depend on severity of symptoms, in mild conditions, it can treated just symptomatically by giving simple analgesic as Ibuprofen in consultation with the patient [29].

One of the defects that we observed in laboratory techniques is the sensitivity test for some antibiotics for example, Fosfomycin that it is regarded as first line empiric antibiotic for treatment of UTI [30, 31] is tested only in 14.2%, and the resistance in the tested patients was 1.4% in contrast, many strong and intravenous antibiotics are assessed for bacterial sensitivity that many of them used in complicated and serious situations and some of them have no indication in UTI treatment for example, in Gram positive bacteria sensitivity test, Gentamycin used in 72% of cases while Amoxicillin/clavulanic acid only in 7%.

Use of broad spectrum antibiotics also regarded as a causative factor for increase of level of resistance as they affect the normal flora [32]. In our region, antibiotic is given to the patients by paramedics and nurses without physician prescription papers, this led to high resistance level as for Trimethoprim-sulfamethoxazole reached near to 35% and accordingly it should no more prescribed as empiric treatment for uncomplicated cystitis as resistance exceeded 20% [16, 33]. Nitrofurantoin is excreted in high concentration in the urine and it not affect the gut and vaginal flora, for that it regarded as a very good choice in treatment of uncomplicated cystitis [16, 34] and fortunately, it is the best drug according to present study results as the resistance is 16.5% that is somewhat higher than existing studies elsewhere [35, 36].

One of the facts we reached, although Fluoroquinolone specially Ciprofloxacin is not regarded as first or second line treatment of uncomplicated cystitis due to many collateral damage and significant side effects as Achilles's tendon rupture, blood sugar disturbance, QTc interval prolongation and memory impairment [37] and it regarded to be prescribed in complicated cases as chronic bacterial prostatitis [38], its wide use make it difficult even to use it for treatment of uncomplicated cystitis as resistance is higher than 32% comparable to developing countries or even lower than their results [39, 40] and too higher than developed countries, 5-17% [41-43] and it is mostly due to plasmid mediated quinolone resistance [44]. Ceftriaxone, intravenous third generation antibiotic also have increased resistance (29%) at a time it's not regarded in the lines of treatment of cystitis and this result in comparison to studies in other countries regarded as elevated, 13-21% in England [36] and 13% in Romania [45].

5 Conclusion

E. coli is still the major cause of uncomplicated cystitis in female. Nitrofurantoin is the best empiric antibiotic for treatment due to the low level of resistance. Frequent usage of fluoroquinolones by local physicians, despite it is not regarded as first or second line of uncomplicated cystitis treatment, which might lead to

development of high level of resistance. Bacterial resistance against various types of strong antibiotics will become a significant problem in the near future in the studied region as the level is rising. There are urge needs for warning the health authorities and physicians also about the excessive use of strong and intravenous antibiotics for female uncomplicated cystitis, suggesting the need for referral to sensitivity tests, and creation of local guidelines to combat risk of resistances.

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