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ARTICLE

Testing the Ciprofloxacin and Erythromycin Antibiotics Potency Against *E. coli* Bacteria Isolated From Pregnant Women With Urinary Tract Infections

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Abstract

The current study included collecting data on pregnant women who suffer from urinary tract infections by 70 patients from the Women's and Children's Teaching Hospital in the city of Al-Diwaniyah.

The distribution of the severity of the injury for the studied cases was divided into four severity cases (mild +, moderate ++, severe +++, and very severe ++++). The most cases admitted to the hospital were from the severity (+), and the least was (++++). As for the frequency of urinary tract infections in women before pregnancy, the results showed that 22 (31.43%) of the investigated cases had urinary tract infections before pregnancy, while 48 (68.57%) of the cases were not. Women whose ages ranged between 17 and 25 were the largest number compared to the rest of the cases, so the percentage 52.85 of recording the severity of urinary tract infection, as for the least recorded cases they were for ages between 35 and 44. There are 44 cases that did not suffer from symptoms, and about 20 cases of them suffer from urinary tract infection from the severity mild (+), while only 3 cases of them suffer from urinary tract infection from the severity (++++) This might be because there weren't many samples taken from pregnant women who were infected in the later stages of their pregnancies. This might be because there weren't many samples taken from pregnant women who were infected in the later stages of their pregnancies. After culturing the specimens, the following results were obtained on *Escherichia coli* bacteria, *E. coli* appeared as pink-colored colonies on MacConkey Agar, and under a microscope, Gram-negative bacilli or red bacilli were visible, and it appeared in a bright green color on the center of the EMB agar. When conducting a sensitivity test using two antibiotics (erythromycin and ciprofloxacin), the isolates were highly resistant to erythromycin. As for their sensitivity to ciprofloxacin, it was very sensitive to this antibiotic.

Keywords: Urinary tract infection during pregnancy, *E. coli*, Erythromycin, Ciprofloxacin, Sensitivity test

1. Introduction

Bacteria that colonize and infect the urinary system are what cause urinary tract infections (UTIs). Common signs of the illness include increased urination frequency and burning discomfort when passing urine [1,2].

Due to physiological differences, women experience UTIs more frequently than males do. Over 50% of women experience at least one UTI incident in their life time [3,4]. Women's shorter urethras make it simpler for gut bacteria to enter the urine tract and spread illness. Acute cystitis, which affects the bladder, pyelonephritis, which affects the kidneys,

and asymptomatic bacteriuria are the three different types of UTIs [5]. Bacterial UTIs can be categorized as simple/uncomplicated or complicated. A simple infection is a bacterial urinary tract infection without any underlying anatomical, neurological, or functional abnormalities. Although a response can be visible in as little as 3 days, it is often successfully treated with a 10–14 day course of the proper antimicrobials [6].

During pregnancy, the most frequent bacterial infection is a UTI, which raises the risk of morbidity and mortality for both the mother and the unborn child. Acute cystitis, pyelonephritis, or asymptomatic bacteriuria are all possible symptoms of urinary tract

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infections. The most frequent pathogen connected to both symptomatic and asymptomatic bacteriuria is *Escherichia coli*. Acute pyelonephritis can develop in up to 30% of mothers who have asymptomatic bacteriuria, increasing the risk of a number of maternal and newborn problems include pre-eclampsia, preterm birth, intrauterine growth restriction, and low birth weight. In order to improve antenatal screening of pregnant women, urinary diagnostics such as urine culture or novel technologies such as high-throughput DNA sequence-based studies should be adopted. Urinary tract infection is a major but preventable cause of pregnancy problems [7,8].

Although antibiotics are quite efficient at treating UTIs, they are also linked to the global health concern of antimicrobial resistance (AMR). The term “AMR” refers to the process through which microbes evolve to acquire traits that make them immune to antimicrobial therapy [9]. There is evidence to show that pregnant women abuse antibiotics to treat UTIs, which can lead to an increase in resistant UTIs in a pregnant woman [10,11].

2. Materials and method

2.1. Materials

Sabouraud dextrose agar, Nutrient media, EMB agar, Gram stain, antibiotics (erythromycin, ciprofloxacin).

2.2. Methods

2.2.1. Specimens

In this study, samples and data were collected from pregnant patients with urinary tract infection diagnosed by the doctor and the laboratory at the woman's and Children's Teaching Hospital in the city of Diwaniyah. We recorded cases of urinary tract infection among pregnant women during that period. Data were collected (the age of the patient, the month of pregnancy, the presence of symptoms or not, and whether they suffered from urinary tract infections before pregnancy or not) and this specimens were cultured in the laboratory of the Research Unit in the College of Science to identify the pathogens. And study the effectiveness of antibiotics for pathogens.

2.2.2. Identification of pathogen

It was diagnosed in the laboratory by culture the urine of the patients on two mediums, one of which is sabroaud dextrose agar for the growth of fungi and Nutrient Agar medium for the growth of

bacteria as a primary isolate [12]. This medium was prepared according to the manufacturer's instructions and sterilized with autoclave at 121 °C and at 1 atm pressure for 20 min, then cooled to 45 °C, then it was poured into Petri dishes [13]. Then, after the medium is poured and we wait for it to solidify, the urine specimen are cultivated on those media prepared by the swap, at the rate of three dishes per specimen, and incubated in the incubator for 24 h.

After the appearance of bacterial or fungal growth on these dishes, bacterial identification was based on macroscopic examination (shape and color of colony on the Petri dish) and microscopic examination under the microscope. Culture of bacteria on selective media, which is Eosin Methylene Blue (EMB) Agar medium that is used for the isolation of gram-negative enteric bacteria [14]. Bacterial growth was examined under a microscope by preparing slides and staining them with gram stain [15].

2.2.3. Antibiotics sensitivity test

The sensitivity of antibiotics for the pathogen that causes urinary tract infection was tested in this research according to Vandepitte et al., in 2003 [16]. 3–4 colonies growing on the nutrient medium were transferred to tubes containing 5 ml of Normal saline, then a cotton swab was inserted, passed on Mueller-Hinton Agar dishes, and antibiotic tablets were placed on The dishes were pressed gently on the medium and incubated for 24 h at 37 °C.

2.2.4. Statistical analysis

The results of the current study were statistically analysis by the Statistical Package for Social Sciences version 30. Chi-square test (X^2) was used for the assessment of association between the variables studied. An estimate was considered statistically significant if its calculated P value less than 5% [17].

3. Result

In this study, cases of urinary tract infection associated with pregnant women were studied. Data were collected on 70 cases of pregnant women with urinary tract infection. Distributed in tables according to age (Table 1).

In this study, the specimens were cultured, and the results were cases appeared, including *E. coli* bacteria, As shown in Fig. 1 Where *E. coli* appeared in the form of colonies with a pink color on MacConkey Agar, and under the microscope, gram-negative bacilli, i.e. red in color, appeared, and it appeared in a bright green color on the center of the EMB agar Fig. 2 [18,19].

Table 1. Distribution of pregnant patients according to the age.

The patient age	No.	%
17–25	37	52.85
26–34	28	40
35–44	5	7.14
Total	70	100
χ^2	35.01	
P value	<0.001 ^a	

^a Significant difference at $P < 0.05$.

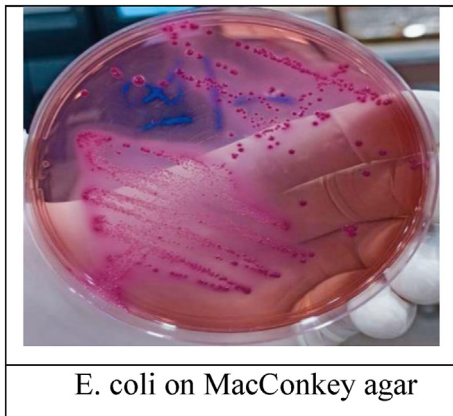


Fig. 1. E. coli on MacConkey agar.

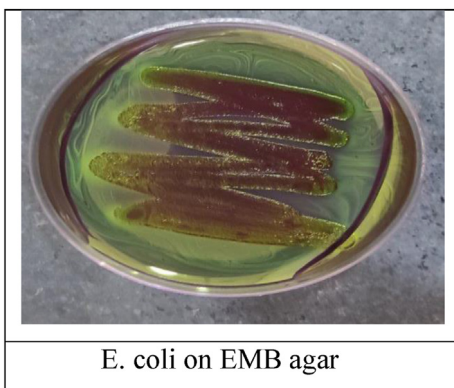


Fig. 2. E. coli on EMB agar.

The sensitivity of the bacterial isolates was tested for two types of antibacterials, erythromycin and ciprofloxacin, where all the isolates were sensitive to the anti-ciprofloxacin of the quinolones group, while this study showed that all the isolates were very highly resistant to the erythromycin of the macrolides group, as shown in Fig. 3.

4. Discussion

UTIs are the most common bacterial infections during pregnancy. They are characterized by the presence of significant bacteria anywhere along the



Fig. 3. E. coli sensitivity to ciprofloxacin.

urinary tract. Enterobacteriaceae account for 90% of UTIs [20].

The results of this study, after recording cases from the Women's and Children's Hospital, collected 70 cases of urinary tract infection in pregnant women, as shown in Table 1. 52% of the cases were among women between the ages of 17–25, while only 5 cases were recorded among women between the ages of 35–44. This is supported by Scholes, D et al., 2000 [21], as he indicated that the cases of women between the ages of 18–30 are recorded, and the reason for this was attributed to the sexual activity of this group more than others. It is also possible that this is due to the fact that there are more pregnant women at these ages than in other groups.

As for Table 2, it shows the distribution of the severity of infection in relation to the studied cases, which were divided into four severity (mild +, moderate ++, sever +++, and very sever ++++). The most cases admitted to the hospital were from the severity (+), and the least was (++++). As for the Table 3, It is the distribution of whether women suffer from urinary tract infection before pregnancy or not. The result was that 48 (68.57%) of the studied cases did not suffer from urinary tract infections

Table 2. Distribution of pregnant patients according to the severity of infection.

Severity of infection	No.	%
+	28	40
++	21	30
+++	14	20
++++	7	10
Total	70	100
χ^2	18.66	
P value	<0.001 ^a	

^a Significant difference at $P < 0.05$.

Table 3. Distribution of pregnant patients according to present of UT infection prior to the pregnancy.

Present of UT infection prior to pregnancy	No.	%
Yes	22	31.42
No	48	68.57
Total	70	100
χ^2	19.31	
P value	<0.001 ^a	

^a Significant difference at $P < 0.05$.

before pregnancy, and 22 of them had UT infections before pregnancy. This supports what Johnson, C. Y. et al., in 2021 [22], also studied general urinary tract infection between 3 months before pregnancy and the birth of the child. Mothers were asked whether urinary tract infection occurred (before pregnancy or during pregnancy in the first, second, or third trimester). The results were there Urinary tract infection during pregnancy, but cases of Candida infection were recorded before pregnancy. And Shaheen, H. M. et al., in 2016 [23] found that 58.3% of pregnant women with a UTI had a previous history of a UTI and 41.7% do not.

Kumar in 2019 [24] mentioned in his book the presence of a urinary tract infection before pregnancy may increase the severity of the disease and an increased risk of complicated urinary tract infection.

As for the diagnosis of pathogens, Ibrahim and Hamza Khalifa [25] identified in 2017 the types of bacteria that cause urinary tract infections in women, and they were *E. coli*, Klebsiella, and Staphylococcus albus, and this corresponds almost to what we found in our study, which are the two types of bacteria *E. coli* and Klebsiella. Also, Barcella, L., Barbaro & Rogolino [26] diagnosed in 2016 that 73% of the causes of urinary tract infection are *E. coli* from hospitalized patients and 27% from outpatients. Brown and Foxman, 2000 [27]; Badran et al., in 2015 [28] stated that the mechanical action of sexual intercourse may facilitate entry of *E. coli* strains into the urethra and bladder, because sexual intercourse alters the normal lactobacillus-dominant vaginal flora and facilitates *E. coli* colonization of the vagina.

Pathogenic strains of *Escherichia coli* express distinct bacterial characteristics as virulence factors because they help the organism overcome host defenses and colonize or invade the urinary tract. Virulence factors of recognized importance in the pathogenesis of urinary tract infection (UTI) include P fimbriae, some other mannose-resistant aerobics and the aerobactin system, hemolysin, K-capsule, and serum killing resistance. The higher the

virulence factors expressed by the strain, the more severe the infection it can cause [29,30].

In this study, *E. coli* bacteria were isolated from urine, and this was similar to what was reported by Hegazy et al., in 2018 [31] and also Pounusamy and Nagappan in 2013 [32]. When conducting a sensitivity test using the two antibiotics mentioned, the resistance of the isolates was great for erythromycin, similar to what was reported by Kibert and Abera in 2011 [33] where the resistance rate was It ranges between 81.8 and 100%. Bacteria resistance to such antibiotics may be due to hydrolysis, which degrades the antibiotic and inhibits its effectiveness. As for her sensitivity to ciprofloxacin, it was identical to that found by Tajbakhsh et al., in 2016 [34] and Ramirez et al., in 2018 [35] it was very sensitive to this antibiotic.

5. Conclusion

Urinary tract infection cases in Pregnant women whose ages ranged between 17 and 25 are the most frequently recorded cases, and the least were among women whose ages ranged between the of 35–44 years. Most of the cases were recorded from pregnant women suffering from urinary tract infection without symptoms. The most pathogenic cause of urinary tract infection in pregnant women is *E. coli*. It was also found that there is a significant sensitivity to ciprofloxacin by *E. coli* bacteria isolated from urinary tract infections of pregnant women.

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