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Gentamicin And Ciprofloxacin Sensitivity Against *E. Coli* Clinically Isolated From Urinary Tract Infection

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ABSTRACT

Background: *Escherichia coli (E. coli) is common bacteria that can be pathogenic and develop resistance to various antibiotics by different ways, making them difficult to treat with standard therapies. So monitoring antibiotic resistance is urgent.*
Material and methods: E. coli was isolated from urinary tract and cultured in three media (blood agar, macConkey agar, and EMB agar), then they were incubated for 24 hours at a temperature of 37oC to grow. The antibiotics discs (Ciprofloxacin, Gentamicin) were used by disc diffusion method. All the statistical analysis was done by using SPSS 26 software and Excel app.
Results: The participants in this study were 70% women, while 30% were men with significant differences (P< 0.05). Gentamicin showed high rate of sensitivity (85%). The sensitive isolates to ciprofloxacin were 75%.
Conclusions: *We have found that 85% of bacteria are sensitive to gentamicin, and thus it can be used as an empirical treatment. Ciprofloxacin showed high rate of sensitivity against E. coli 75%.*
Keywords: Urinary Tract Infection, E. Coli, Ciprofloxacin, Gentamicin, Antimicrobial Agents.

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INTRODUCTION

E. coli is a gram-negative, non-sporulating, rod-shaped, facultative anaerobic and coliform bacterium pertaining to the genus Escherichia that commonly inhabits the environment, foods, and warm-blooded animals' lower gut [1-2].

Urinary tract infections (UTIs) are the most common bacterial infection requiring medical care [3-4]. Over 10.8 million patients in the United States visited the emergency department for the treatment of UTIs between 2006 and 2009 and 1.8 million patients (16.7%) were admitted to acute care hospitals [5]. The economic burden for the treatment of UTIs is estimated at $2 billion annually. In addition, UTIs rank as the number one infection that leads to an antibiotic prescription [6-7].

Catheter-associated UTIs (CA-UTIs) are the most common type of health care-associated infections reported up two-thirds of hospital-acquired UTIs [8]. The symptoms of UTIs are generally mild, and inappropriate use of

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antibiotics can lead to antibiotic resistance; therefore, it is important to establish the appropriate criteria for treatment using narrow-spectrum antibiotics for the optimal duration [9-10].

Gentamicin is an antibiotic commonly used to treat infections caused by *E. coli* [11-12]. However, the resistance of *E. coli* to gentamicin has been increasing in recent years. A study found that the resistance of *E. coli* to gentamicin was as high as 45.7% in some regions of India [13].

Aminoglycosides (AGs) have been used for decades as effective agents against most Gram-negative pathogens including Escherichia coli, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* [14-15].

Ciprofloxacin is a fluoroquinolone antibiotic commonly used to treat infections caused by Gram-negative bacteria, including *E. coli*. However, increasing resistance to this antibiotic has been observed in recent years, which can lead to treatment failure and the need for alternative antibiotics [16]. The aims of the study were detection of the effect of gentamicin and ciprofloxacin on the growth of *E. coli*.

METHODS

A total number of 20 positive culture patients (subjects) were enrolled in this study during the period 5/9/2022 to 3/3/2023.These patients from the urology department, each patient suffering from complaint of frequent urge to urinate and painful, burning feeling in the bladder or urethra during urination.

To reduce the risk of contamination, participants were informed to clean their hands with water and their genital area with swab soaked in normal saline before collection of the clean catch mid-stream urine samples. After the urethra is properly cleaned, the collection may begin by discarding the initial stream of urine into the toilet. Then, 10-15 milliliters (ml) of urine collected in the provided sterile specimen cup by directly urinating into the cup. Once an adequate amount is collected, then the remaining urine should be voided in the toilet. For men, the opening of the urethra (tip of the penis) should be wiped clean with a cleansing wipe before the collection is begun. The collected urine sample should be analyzed soon within 1 hour after collection.

The disc diffusion method, also known as the Kirby-Bauer method, is a widely used technique to determine the sensitivity of bacteria to different antibiotics by using a sterile swab to transfer bacteria from the plate to a sterile saline solution. Adjust the bacterial suspension to match the turbidity of a (0.5) McFarland standard. The method involves placing a small paper disc containing a specific antibiotic on a culture of the bacteria and observing whether the antibiotic inhibits the growth of the bacteria. The disc of gentamicin 30 µg was tested, as well as ciprofloxacin 5 µg.

All the statistical analysis was done by using SPSS 26 software and Excel app. For statistical analysis, SPSS software 26 (SPSS Inc., Chicago, USA) was used. Means and standard deviations were used to represent the data. T test was used to examine measurement data, P value < 0.05 considered significant. For correlation analysis, Spearman's correlation for non-parametric analysis was used. Chi- square was used for non- parametric variables. P value < 0.05 was taken into account to denote statistical significance additionally.

RESULTS

The out of the total number of participants in the study, 70% were women, while 30% were men with significant differences (P< 0.05) [Figure 1]:

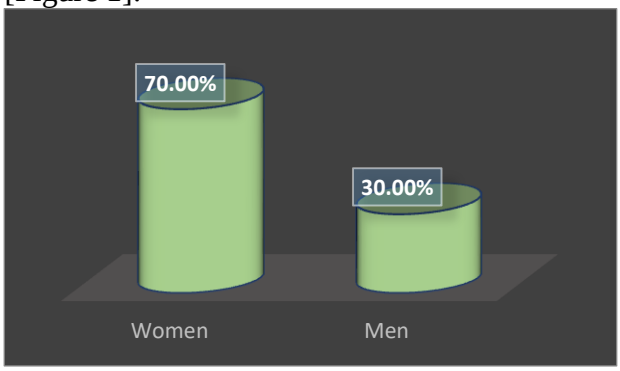

Figure 1: The distribution of gender

Figure (2) showed the inhibition zone in millimeter of various agents; Gentamicin showed high rate of sensitivity (85%). The sensitive isolates to ciprofloxacin were 75%.

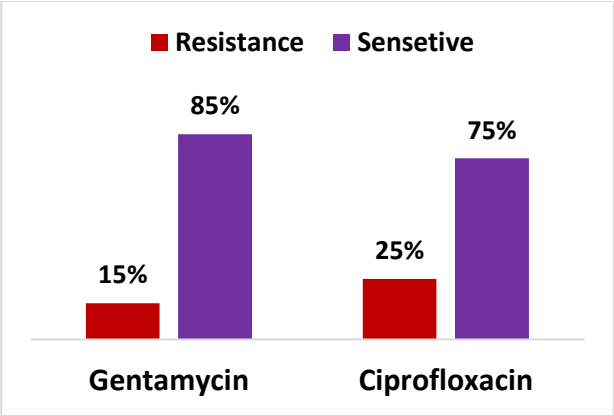

Figure 2: percentage of Sensitive & Resistance antibiotics of *E. coli*

The current study showed no correlation among the ciprofloxacin and gentamicin (r= -0.13, P= 0.73)

DISCUSSION

The comparison of mean inhibition zone of different agents is an important aspect of antimicrobial susceptibility testing. The inhibition zone is the clear area surrounding a disc containing an antibiotic or other antimicrobial agent, which indicates the extent to which the agent can inhibit the growth of a particular microorganism [17]. Overall, the comparison of mean inhibition zone of different agents can provide valuable information for clinicians and researchers in selecting the most effective antimicrobial agents for treating specific infections. There have been many studies comparing the mean inhibition zone of different antimicrobial agents against various microorganisms [18].

This study showed that women are more prone to UTIs than men as 70% and 30% respectively, because women have short and wider female urethra and bacteria can travel from the anus to the urethra [19]. Furthermore, women lack the bacteriostatic properties of prostatic secretions [20-21].

Urinary tract infection is less common in men than in women because the male urethra is long, making it difficult for bacteria to spread to the bladder .Women are more prone to UTIs than men because the urethra is much closer to the anus and is shorter than in males; furthermore, women lack the bacteriostatic properties of prostatic secretions [22]. Among the elderly, UTI frequency is roughly equal in women and men. This is due, in part, to an enlarged prostate in older men. As the gland grows, it obstructs the urethra, leading to increased frequency of urinary retention [23].

In the current study, gentamicin showed high rate of sensitivity (85%) with (15%) resistance. Many studies revealed high sensitivity of *E. coli* to gentamicin [24-25]. Another study mentioned that the resistance of *E. coli* to gentamicin was as high as 45.7% in some regions of India [13]. Another study reported a similar trend of increasing resistance of *E. coli* to gentamicin in hospitals in Iran [26]. On the other hand, some studies have reported a lower level of resistance of *E. coli* to Gentamicin. For example, a study found that only 4.4% of *E. coli* isolates from a hospital in Brazil were resistant to Gentamicin [27].

The current study showed the percentage of resistance (25%) and sensitivity (75%) of ciprofloxacin against *E. coli* that can be vary depending on various factors such as geographic location, patient population, antibiotic usage, and local resistance patterns.

Several studies have investigated the resistance and sensitivity of *E. coli* against ciprofloxacin. One study published in the Journal of Global Antimicrobial Resistance found that the percentage of *E. coli* strains that were resistant to ciprofloxacin ranged from 5.9% to 60.5% in different regions of Iran (Safari et al., 2019). Another study published in the International Journal of Infectious Diseases found that the percentage of *E. coli* strains that were resistant to ciprofloxacin was around 20-25% in a hospital in India [28].

Overall, the resistance and sensitivity of *E. coli* to ciprofloxacin can vary depending on the bacterial strain, geographic location, and other factors. Antimicrobial susceptibility testing is necessary to determine the most effective treatment for infections caused by *E. coli*. There have been several studies comparing the effectiveness of ciprofloxacin and ofloxacin against gram-negative bacteria [16].

CONCLUSION

We have found that 85% of bacteria are sensitive to gentamicin. Ciprofloxacin showed high rate of sensitivity against *E. coli* 75% and thus they can be used as an empirical treatment.

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