Isolation, Identification and antibiotic resistance profile distribution of clinical E. coli in Iraqi patients

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ABSTRACT

Introduction: Escherichia coli is a Gram-negative, rod-shaped bacterium that belongs to the Enterobacteriaceae family and the Gammaproteobacteria class. E. coli is one of the most prevalent organisms that cause bacterial illnesses. Globally, the rise of multidrug-resistant E. coli poses a significant risk to public health. Antimicrobial resistance in E. coli is causing havoc in the world's healthcare system

Aim this study: The goal of this study was to find out how resistant clinical isolates of E. coli were to antibiotics.

Methods: Between November 2021 and January2022, a total of 67 clinical samples were obtained from patients, including urine, wound, ear, feces, and sputum samples. The Vitek-2 compact system was then used to confirm E. coli and test susceptibility to various antibiotics.

Result: E. coli was discovered to be extremely susceptible to ertapenem, imipenem and amikacin (97.0%), but resistant to ampicillin (94%), and through this study, different resistance patterns to E. coli appeared to us, ranging from MDR, XDR, and PDR.

Conclusion: E. coli isolated from different clinical specimens exhibited varying antibiotic sensitivity patterns, with high resistance to conventional antibiotics. Ertapenem, imipenem, and amikacin were found to be the most effective antibiotics against E. coli isolates. Clinical isolates of E. coli, on the other hand, had high resistance to ampicillin, Trimethoprim/ sulfamethoxazole and Ceftazidime Therefore, it is advised that physicians conduct antibiotic sensitivity testing to choose the most effective medications.

Keywords: E. coli, Antibiotic, resistance, vitek2

1-Introduction

Escherichia coli is a Gram-negative, rod-shaped bacterium that belongs to the Enterobacteriaceae family and the Gammaproteobacteria class. One of the most well-studied microorganisms is *E. coli* (1,2). This bacterium's pathogenicity is attributed to the presence of various virulence factors (3). these virulence factors contribute to the establishment of pathogenic resistance against immune defense (4). Antimicrobial resistance is a major public health issue all over the world (5). Inappropriate antibiotic use by humans, factories, and farms, poor hygiene and sanitation, and ineffective infection prevention and control in healthcare settings are all thought to be important factors in the emergence and spread of antibiotic-resistant

bacteria (6). Multidrug-resistant (MDR) and ESBL-producing *E. coli*, which can cause life-threatening infections, are a good example of antibiotic resistance (7). Antimicrobial resistance in *E. coli* is causing havoc in the world's healthcare system. This complicates treatment outcomes, raises treatment costs, and limits therapeutic options, all of which contribute to the global spectral of a postantimicrobial age in which some of the most effective drugs lose their efficacy. Numerous prior researches have demonstrated that the bacterium is growing increasingly resistant to commonly used antibiotics (both newer and older medications). Antimicrobial resistance of *E. coli* is reported to be a significant factor in the failure of infectious illness treatment in impoverished nations (8). The World Economic Forum declared in 2016 that multidrug resistance (MDR) is "one of the great health challenges of our time," and that without immediate action, global deaths from MDR might reach 10 million by 2050. In the clinic, there is a clear need for new antibiotics with novel modes of action (9).

2-Materials and Methods

2-1-Collection of samples

Sixty-seven isolates of *E. coli* were obtained from two hundred and fifty specimens collected from different infections in humans: ear infection, urinary tract infection, sputum, burns, wounds and feces, which were collected from patients of different ages for the period from November 2021 to January2022, in Al Fallujah General Hospital and Fallujah Women and Children Hospital. The isolates were identified grown on Eosin methylene blue as a selective medium for *E. coli*, along with the other media such as MacConkey agar and blood agar.

2-2-Isolation and Identification of *E. coli*:

The microbial isolates of pathogenic microorganisms used in this study were incubated under aerobic conditions on brain heart infusion broth (BHI) and incubated overnight at 37°C, after which the samples were cultured by loopful on solid media Eosin methylene blue, macConkey agar, blood agar and incubated at 37°C for 24 hours. Initial identification of *E. coli* isolates was based on visual characteristics on solid media Eosin methylene blue, macConkey agar, blood agar The Vitek-2 technology was used to confirm the *E. coli* that had been identified.

2-3-Antibiotic Susceptibility Testing

The antibiotic susceptibility of the isolates was determined using the Vitek 2 System

3-Results

Two hundred and fifty samples of ear infection, urinary tract infection, wounds, feces, burns were collected from Fallujah teaching hospital and Fallujah Women and Children Hospital, where the ages of the patients ranged between (4-55) years. Among 250 samples were of them ,200 samples were positive growth of which 67 samples grew on the medium of the Eosin methylene blue, while the rest were negative growth, and after morphological, microscopic and biochemical tests were done and Vitek 2 System implementation was done, 67 isolates were obtained from multiple source *E. coli*. Distribution of *E. coli* isolates in the table (3-1). The percentage of samples distributed as follows: ear infections 3%, urinary tract infections 73.1%, wound infections 14.9%, diarrhea 7.5%, sputum 1.5%

(3-1) Distribution of *E. coli* isolates according to the source of isolation.

Source of sample	No. of sample
Ear	**2**
Urine	**49**
Wounds	**10**
Feces	**5**
Sputum	**1**

The identification of *E. coli* was primarily based on culture and the Vitek 2 compact system. When cultured on MacConkey agar, the isolate produced vivid pink colonies as illustrated in Figure (3-1) A, while on EMB media, the colonies produced a green metallic shine as illustrated in Figure (3-1) B. The isolates were also grown on blood agar to see if they could lyse red blood cells and produce hemolysis as illustrated in Figure (3-1) C.

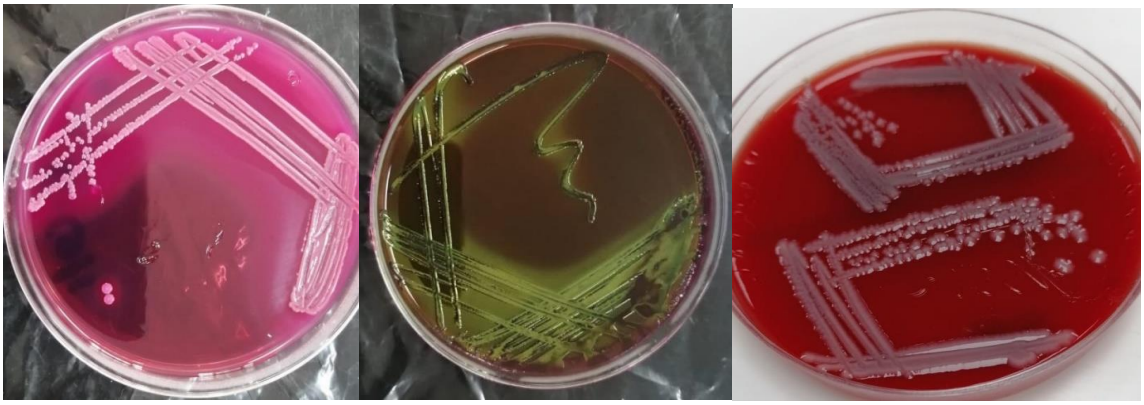

Figure (3-1) bacterial growth on three different types of mediums A: On MacConkey agar, you can see the bright pink colonies. B: On EMB media, sheen green metallic colonies. C: Hemolysis on blood agar plates, Colonies that are circular, convex, and smooth.

According to the results of antimicrobial susceptibility testing performed by the Vitek2 Compact System, *E. coli* isolates exhibited the highest levels of resistance to trimethoprim/sulfamethoxazole (89.5 %). followed by ampicillin at an (94%) rate. In the case of ciprofloxacin, a (59.7%) resistance rate was observed. Ceftriaxone and aztreonam resistance rates were (58%), (58%), cefepime resistance rates were approximately (56.7%), gentamycin resistance rates were (22%), and tobramycin resistance rates was (15%). The lowest level of resistance to both Nitrofurantoin and Amikacin was found to be (2.9%), (2.9%). On the other hand, the resistance of *E. coli* to carbapenems antibiotics (imipenem, ertapenem) was (2.9%). Table (3-2) shows the findings of the *E. coli* antimicrobial susceptibility test. In this study it was found that thirty-one (46.3%) isolates multi drug resistance (MDR), twenty-five (37.3%) isolates were within the extensive drug resistance (XDR), and eleven 16.4% isolates were within the pan drug resistance (PDR). As shown in the figure (3-2)

Table (3-2): Antimicrobial resistance patterns of *E. coli*.

Antimicrobial agents	Resistance percentage	Intermediate percentage	Sensitive percentage
	R%	I%	S%
Amikacin	2(2.9%)	0	65(97.0%)
Ampicillin	63 (94%)	0	4(5.9%)
Cefepime	38(56.7%)	0	29(43.2%)
Ceftazidime	45(67.1%)	0	22(32.8%)
Ceftriaxone	39(58%)	0	28(41.7%)
Ciprofloxacin	40(59.7%)	0	27(40.2%)
Ertapenem	2(2.9%)	0	65 (97.01%)
Gentamycin	15(22%)	0	52(77.6%)
Imipenem	2(2.9%)	0	65 (97.01%)
Levofloxacin	43(64.1%)	0	24(35.8%)

Nitrofurantoin	2(2.9%)	0	65(97.0%)
Trimethoprim/ sulfamethoxazole	60(89.5%)	0	7(10.4%)
Piperacillin/tazobactam	5(7.4%)	0	62(92.5%)
Cefoxitin	10(14.9%)	0	57(85%)
Cefazolin	43(64.1%)	0	24(35.8%)

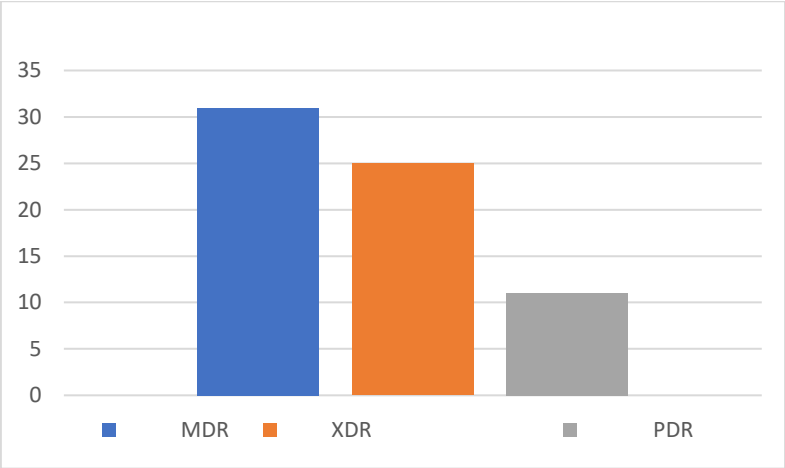

Figure (3-2) Shows the patterns of resistance of *E. coli* to antibiotic

Discussion

The results reached by (10),and (11) in which they showed that the ratio of resistance to gentamycin (19.6%), and amikacin (2.1%) was close to the low level of resistance to aminoglycoside obtained in this study. In this study, the resistance of *E. coli* to ampicillin was (94%), which is close to the results obtained by (12) , where the resistance to ampicillin in their study was(93.3%). While this result was in contrast to what was reached by (13) , the sensitivity ratio for ampicillin was (49.5%). Furthermore, (14) found that nitrofurantoin resistance was (5.9%), which was consistent with this study's findings. In another study reached by (15), it was found that the resistance of *E. coli* to nitrofurantoin was (32.0%). The proportion of resistance to cefepime in a prior study by (16) was (64.8%). (17) found that about 65% of the bacteria were resistant to ceftriaxone, but (18,19) found that resistance to cefepime, ceftriaxone, was lower at (35.9%), (36.6%), these results were relatively close to the results obtained in this study. Also this study found resistance to the antibiotic ceftazidime, which was similar to what (20) discovered when he found that 65.5% of the isolates were resistant to ceftazidime. In contrast, (21) reported that 36% of *E. coli* isolates were resistant to ceftazidime. While the rate of resistance to levofloxacin was 64.1% and this is consistent with a study conducted by the (22) , where he found a high resistance to levofloxacin 74.8%, by *E. coli.* Piperacillin/tazobactam resistant was determined (7.4%), this ratio is consistent with the findings (21)found that the resistance to Piperacillin/tazobactam was low to *E. coli* (5.1%),while the (23) found that the resistance to Piperacillin/tazobactam was (56.4%). The resistance of *E. coli* to cefoxitin and cefazolin was (14.9%) and (64.1%), respectively, this result does not match what Mark found that the percentage of resistance to cefoxitin and cefazolin was (6%), (13%), respectively. Resistance to trimethoprim/sulfamethoxazole was observed at a high rate of (89.5 %) in this investigation. In contrast to this finding, (24) discovered a (39.7%) resistance rate to trimethoprim/sulfamethoxazole. *E. coli* isolates were resistant to imipenem by (2.9%). This is consistent with the results of (25) which showed that the rates resistance of imipenem by E. *coli* were (3%). On the other side, in a study conducted by (26), it was found that *E. coli* bacteria were resistant to ertapenem

(100%), this is inconsistent with what we found in this study, where the percentage of resistance of *E. coli* to ertapenem was (2.9%).

Conclusion

In this study, *E. coli* isolates showed a high rate of resistance to different antibiotics (MDR, XDR, PDR), which could indicate: the bacteria's potential to generate a resistance system quickly as well as the ability to acquire it from other strains and sources. In terms of the environment. The investigation also discovered that different isolates have different resistance patterns. The isolates of *E. coli* showed high resistance toward Ampicillin and Trimethoprim/sulfamethoxazole, whereas the most effective antibiotics against isolates were Carbapenems and Amikacin.

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