

Antimicrobial Resistance Rate In Escherichia Coli And Klebsiella Pneumonia: A Retrospective Study

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ABSTRACT

Background: Antibiotics are type of treatment used to keep away from infection and treat recent urinary tract bacterial infections. Antibiotic resistance is rising to a hazardous level worldwide.

Aim of the study: To estimate the expansion of the main Gram-negative rods resistant rate to most commonly used antibiotics.

Patients and methods: A cross-sectional study of 1000 G-negative bacterial strain from urine samples of patients complaining from urinary tract infection during the period January-2017 to April-2019. The identification of bacterial strains was identified. The antibiotic susceptibility test was performed by disc diffusion method.

Results: The most frequent types of isolated bacteria were Escherichia coli (40.5%) and Klebsiella pneumonia (25.7%). They showed most resistant to Ceftriaxone (60.31%), Cefixime (74.01%).

Conclusions: The antimicrobial-resistant rate of K. pneumonia was higher than E. coli.

Keywords: urine; infection; antibiotics.

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INTRODUCTION

Antibiotics are type of treatment used to keep away from infection and treat recent urinary tract bacterial infections. Antibiotic resistance is rising to a hazardous level worldwide and bacteria change its genome in response to the usage of these drugs and had different resistance mechanisms to evade host defense mechanisms. (1) This leads to higher medical costs, life-threatening complications, extended hospital stays, and increased mortality rate (2). Extensive usage of antibiotics that inflict strong continuous selection pressure for resistance development took a stronghold over the health care system globally (3). Worsening community health enhancing appearance among pathogenic and commensally bacteria of resistance strains leads to globally predicament and dilemma (4). Many resistant bacteria survive under adverse environments and conditions, for example, Gram-negative rods resistant to third generation cephalosporins, carbapenems, fluoroquinolones, and aminoglycosides. This can be done by different methods like production of class β -lactamases, permeability alterations, extrusion by efflux pumps, and PBP (Penicillin-binding protein) alterations (5). The problem is more serious with G -ve bacteria that cause multiple infections like urinary tract infections, wound infections, periprosthetic joint infection, and septicemia. *Escherichia coli* and *Pseudomonas aeruginosa* are among the most common bacteria that resist fluoroquinolone (6). Other G-ve bacteria like *Enterococcus faecium*, *Klebsiella pneumonia*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species bacteria that represent a high incidence of drug resistance every year (7). Sometimes these bacteria showed multidrug resistance or pan drug resistance which is not susceptible to all agents in all antibiotics classes (8). Thus, national regulatory conditions needed to promote the rational use of antibiotics and lower antibiotic consumption. This needed Standard Treatment Guidelines for hospital care and pediatric cases, the non-availability of antibiotics without an instruction, and the continuation of teaching

modules for pharmacists covering normal use of medicines gave noteworthy results (9).

This study aimed to evaluate the development of the main Gram-negative rods resistant rate to most commonly used antibiotics like cephalosporins (Ceftriaxone, Cefixime), fluoroquinolones (ciprofloxacin), aminoglycosides (gentamicin, amikacin) in samples of urine culture.

PATIENTS AND METHODS

A cross-sectional study of 1000 G-negative bacterial strain from urine samples of patients complaining from urinary tract infection during the period January-2017 to April-2019. The inclusion criteria were only cultures from patients with symptoms of urinary tract infections like dysuria, frequency, and loin pain while the exclusion criteria were other cultures like a wound, burn and ear infections. The study was approved by the Scientific and Ethical Committee at Al-Kindy College of Medicine and Al-Kindy Teaching Hospital.

Identification of bacterial strains was identified starting from mid-stream urine samples and culture after a general urine examination on blood and MacConkey agar. The urine culture that considered positive for urinary tract infection when the colony counts greater than 100,000 colonies of bacteria/ml. The detection of bacteria that isolated was made by typical biochemical methods (10). The antibiotic susceptibility test was performed by the method known as disc diffusion method using a specific media known as Muller-Hinton agar and chooses of antibiotic discs according to type of isolated bacteria. If there is any expansion of bacterial growth around antibiotics disc in inhibition zone this means that the bacteria were sensitive to this antibiotic and vice versa if there is no growth (11).

The research was registered in www.clinicaltrial.gov with NTC= 04196387

(Link:<https://register.clinicaltrials.gov/prs/app/action/LoginUser?ts=111&cx=-c7egx0>)

Statistical analysis: The data were expressed as percentages and the level of significance was done using

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the Chi-square test using Minitab software (Version 3.0). The level of significance was (P-value)0.05.

RESULTS

The study consisted of 1000 urine samples from patients with urinary tract infection for a period from January-2017 to April -2019. Mean patients' age was 38.5 ± 0.5 (6ms to 88ys.). Females were represented the higher frequency (72.2%) and the rest was (27.8%) males (P=0.000) (Table-1-). Bacteria were isolated from only 311 urine samples when colony count in urine culture was greater than 100,000 colonies/ ml. and the rest were less than 100,000 colony count /ml.

The most frequent types of isolated bacteria were *Escherichia coli* (40.5%) and *Klebsiella pneumonia* (25.7%) (Table-2-). These two bacteria were tested for most frequently used types of antibiotics Aminoglycosides (gentamicin, amikacin), Fluoroquinolones (ciprofloxacin), Cephalosporins (Ceftriaxone, Cefixime). They showed most resistant to Ceftriaxone (60.31%), Cefixime (74.01%) (Table-3-). The

antimicrobial-resistant rate of *K. pneumonia* was higher than *E. coli* as demonstrated in table-4-.

Table- 1- Sex distribution of patients with urinary tract infection.

Sex	Number (No.)	Percentages (%)	P=value
Males	278	27.8	0.000
Females	722	72.2	
Total	1000	100	

Table-2- Types of isolated bacteria from urine samples.

Types of isolated bacteria	Frequency No.	Percent %
<i>Escherichia coli</i>	126	40.5
<i>Klebsiella pneumonia</i>	80	25.7
Other types of rare bacteria	105	33.8
Total	311	100.0

Table-3-Antibiotics susceptibility test for *E coli* and *K pneumonia*.

Antibiotic	Total (126+80)=206	Resistance No.	Resistance %	Susceptibility No.	Susceptibility %
Gentamicin	206	60	29.12	146	70.87
Amikacin	164	17	10.3	147	89.63
Ciprofloxacin	198	86	43.43	112	56.56
Ceftriaxone	126	76	60.31	50	39.68
Cefixime	127	94	74.01	33	25.98

Table-4- Antimicrobial resistance rate of *E. coli* and *K. pneumonia*.

Type of antibiotics	Total	Resistance <i>E.coli</i> No.	Resistance <i>E.coli</i> %	Antimicrobial resistance rate <i>E.coli</i>	Resistance <i>K. pneumonia</i> No.	Resistance <i>K. pneumonia</i> %	Antimicrobial resistance rate <i>K. pneumonia</i>
Gentamicin	60	34	56.66	26.98 %	26	43.33	32.50 %
Amikacin	17	01	5.88	00.79 %	16	94.11	20.00 %
Ciprofloxacin	86	44	51.16	34.92 %	42	48.83	52.50 %
Ceftriaxone	76	37	48.68	29.36 %	39	51.31	48.75 %
Cefixime	94	36	38.29	38.29 %	58	61.70	72.50 %

DISCUSSION

Monitoring antimicrobial prescription practices and resistance in hospitals is an important instrument of antimicrobial program. Antibiotic resistance is a main global public health problem due to miss use of antibiotics (12). In this study, the most common bacteria that were isolated were *E coli* and *K pneumonia* and the most common antibiotic resistance were in urine culture was Ciprofloxacin while the antimicrobial resistance rate was higher in *k pneumonia* than *E coli*. Other studies demonstrated that the resistance rate of *E coli* was for amoxicillin-clavulanic acid, piperacillin-tazobactam, quinolones, and trimethoprim-sulfamethoxazole while the resistant rate for *K. pneumonia* was for amoxicillin-clavulanic acid and trimethoprim-sulfamethoxazole (13). Mabboux P and Rouveix B. 2019 (14) showed that the resistance rate of *E. coli* to trimethoprim-

sulfamethoxazole below 20% and used in the probabilistic management of simple acute cystitis. Molecular Characterization of resisted *E. coli* showed serogroups O15 (32.8%), O22(23.4%) and O25(15.6%) serogroups with resistance rate to cephalosporins (43%) and fluoroquinolones (31%)(15). Other research showed that *E coli* (48.6%), and *Klebsiella spp.* (8.1%) were common bacterial isolates with resistance to ampicillin (81-100%), amoxicillin/clavulanic acid (77-93.6%), cotrimoxazole (55 72.3%), nalidixic acid (57.4%) and tetracycline (46-55.5%) was showed by most isolates(16).Another study showed that *Escherichia coli* 51% and *Klebsiella pneumoniae*20.0 were isolated with higher antimicrobial drug resistance (17).

Thus in most studies, the commonly isolated bacteria were *E coli* which colonize the epithelial cells of the

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bladder by invading the cells into the cytoplasm and evade the host immune system(18)and second bacteria were *K. pneumoniae* which is in agreement with our result but with different resistant rate. The resistant rates were higher in developing countries like Latin America, Asia, and the Middle East and lower in developed countries like South Pacific, Europe, and North America (19). It ranged from (3.3-8%) for *E. coli* and 9.1-18.6% for *K. pneumoniae*(20). This resistant may be due to plasmid-mediated β -lactamases that hydrolyze penicillins and cephalosporins and these plasmids usually carry additional resistance genes to other drugs like aminoglycoside, sulfonamides, and quinolones, to make the bacteria multidrug-resistant(21).

The causes of these differences with the results of this study may be due to sampling size, age and sex of the patients like age of frequent infection was 60 years in male and female was 16-35 year(22), criteria of patients' selections like patients with diabetes mellitus(23), presence of complications, abuse of antibiotics, methods of isolation, and characterizations of the bacteria like use of CHROM agar Orientation medium which is a better media for isolation bacteria and antimicrobial Susceptibility tests without the need for subcultures for identification(24), presence of indwelling catheter, history of recurrent urinary tract infection and use of antibiotics within 3 months are most common causes (25).

This recommends restricting the usage of empirical therapy of second-generation cephalosporins and fluoroquinolones and should reconsider in the community and population. Health education about the transmission of the pathogens and causes of urinary tract infection are recommended for the populations. Cephalosporin and fluoroquinolones should be cautiously used for the treatment of urinary tract infections.

CONCLUSIONS

E. coli and *K. pneumoniae* were frequent pathogens that cause UTI with a high resistant rate to antibiotics.

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