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Original Research Article

Detection of Aminoglycosides Resistance among Strains of *Escherichia Coli* Isolated From Patients with Urinary Tract Infection

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Abstract: ***Background:*** Urinary tract infections attack about 150 million people each year globally and nowadays there is a high emergence of antibiotic resistance strains among *E. Coli* species that cause UTI. The objective of this study was to detect Aminoglycosides resistance among *E. Coli* strains isolated from patients with urinary tract infection. ***Method:*** A total of 70 urine specimens were collected from patient with symptoms of urinary tract infection in sterile urine containers, and then inoculated in CLED media, incubated at 37c for 24 hours. *E. Coli* species were identified according to their colonial morphology, indirect gram staining reaction, and biochemical tests. Identified species were tested for antimicrobial susceptibility against the following aminoglycosides: Amikacin, Kanamycin, Streptomycin, Gentamicin, and Tobramycin using Kirby-bauer disc diffusion method. ***Results:*** The study revealed that 55.7% of urinary tract infections were caused by *E. Coli*. The study also showed that 12.8% of isolated *E. Coli* species were resistant to Amikacin, 28.2% to Gentamicin, 43.6% to Streptomycin, 48.7% to Kanamycin, and 53.8% to Tobramycin. ***Conclusion:*** The study concluded that the overall resistance of isolated *E. coli* species to aminoglycosides was 37.4% the most powerful Aminoglycoside against *E. Coli* species was Amikacin.

Keywords: Aminoglycosides, resistance, Escherichia coli, UTI.

INTRODUCTION

Urinary tract infections (UTIs) are among the most common types of bacterial infection acquired both from the community and nosocomial. There are two types of UTI: hospital associated urinary tract infection (HAUTIs), and community-associated urinary tract infection (CAUTIs).Women are the predominant group of the patients with CAUTIs [1]. UTIs were estimated to represent 100,000 hospitalizations, 7 million visits and 1 million admissions to emergencyservices in USA. The economic and public health loads of UTIs is radical and markedly affect the quality of life of infected patients [2].

The plurality of UTIs are caused by *E. coli* bacteria followed by *proteus* and other *Enterobacteriaceae*. However, among bacteria causing UTIs, *E. Coli* is considered as the most dominant cause of both community and hospital acquired UTIs. Because *E. Coli* accounts for up to 80% of community-acquired uncomplicated UTIs, these bacteria should be targeted when choosing experimental antibiotics [3].

Antibiotics commonly recommended for treatment of UTIs include co-trimoxazole, Nitrofurantoin, Ciprofloxacin and Ampicillin. How-ever there is worldwide increase in antibiotic resistance among urinary tract pathogens which limit treatment options. The Aminoglycosides are strong bactericidal agents that inhibit bacterial protein synthesis by joining to the 30S ribosomal subunit. They are often used in combination with either a b-lactam or a glycopeptides, particularly in the treatment of *E. coli* UTI, as these drugs act synergically[4].

The application may be limited by occurrence of resistant strains in treatment. Various mechanisms are playing a role in the development of Aminoglycoside resistance but the existence of Aminoglycoside of modifying enzymes is the most clinical and epidemiological value. Antimicrobial resistance of urinary pathogens is increasing globally. Antibiotic resistance analysis showed among 276 *E. coli* isolated from clinical specimens, 39% of isolates were found to be resistant to most popular antibiotics [5].

Other study showed that out of 247 *E. coli* isolates about 82 % of isolates were found to be resistant to numerous antibiotics [6].Therefore the current study is conducted to detect the percentage of resistant of E. coli strains that causes UTI to selected aminoglycosides.

METHOD

Specimen and sample processing

A total of 70 urine specimens were collected consecutively from in and out-patients at Shendi Teaching Hospital and AlmakNimer University Hospital, Shendi, Sudan. The collection was done by trained medical personnel avoiding contamination. Clean-catch mid-stream urine samples were collected from consenting patients. The specimens were immediately transported to the laboratory after collection and processed. All contaminated urine specimens and all patients refused to fill the consent form were excluded from the study [7].

Isolation and identification

A loop-full (0.001 ml) of well mixed uncentrifuged urine was streaked onto the surface CLED agar. The plates were incubated aerobically at 370 C for 18-24 hours and counts were expressed in colony forming units (CFU) per milliliter (mL). A count of 10[5] CFU/Ml or more was considered significant bacteruria. E.coli species were identified based on colonial morphology, indirect gram staining reaction, and biochemical tests [8].

Antimicrobial susceptibility testing

This was done using the Kirby Bauer Disc diffusion method with reference to the Clinical Laboratory Standard Institute (CLSI) performance guideline for antimicrobial susceptibility testing. Quality was assured by testing the E. coli quality control strain, ATCC 25922, in every batch. All zones of inhibition determined were within the ranges prescribed by the CLSI. Five aminogycosides were applied; Tobramycin 10mg, Kanamycin 30mg, Streptomycin 10 mg, Gentamicin 10mg, and Amikacin 30mg [9].

RESULTS

This study was conducted in Shendi town, River Nile state to detect Aminoglycosides resistance among *E. coli* species isolated from patients with urinary tract infection. In this study a total of (70) participants were included the majority of them (84.3%) were females and (15.7%) were males (Table 1). Their age rangedfrom (4) to (67) years, more than 41% were within the age group (31-60 years) (Table 2). In this study *E. coli* was the most frequent isolated pathogen among UTI patients (55.7%) (Table 3).

The study revealed that the resistance of isolated *E. coli* species to Aminoglycosides was: 53.8% to Tobramycin, 48.7%to Kanamycin, 43.6% to Streptomycin, 28.2% to Gentamicin, and 12.8% to Amikacin,. The isolated species of *E. coli* showhighest resistance to Tobramycinand the lowest resistance level was detected against Amikacin. The study also revealed that the overall resistance of isolated *E. coli* species to aminoglycosides was 37.4 % (Table 4).

Table-1: Shows distribution of study population according to gender

Gender	Number	Percent (%)
Male	11	15.7%
Female	59	84.3%
Total	70	100%

Table-2: Shows distribution of study population according to age

Age group (years)	Number	Percent (%)
1-30	18	25.7%
31-60	29	41.4%
Above 60	23	32.9%

Table-3: Shows the Percentage of UTI caused by *E. coli*:

Causative agent	Number	Percent (%)
E. Coli	39	55.7%
Others	31	44.3%
Total	70	100%

Table-4: Shows the resistance of *E. coli* to selected Aminoglycosides

Pattern	Tobramycin		Gentamicin		Streptomycin		Amikacin		Kanamycin		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Sensitive	18	46.2%	28	71.8%	22	56.4%	34	87.2%	20	51.3%	122	62.6%
Resistant	21	53.8%	11	28.2%	17	43.6%	5	12.8%	19	48.7%	73	37.4%
Total	39	100	39	100	39	100	39	100	39	100	195	100

DISCUSSION

This study was conducted to detect Aminoglycosides resistance in *E. coli* isolated from patients with urinary tract infection.

The study shows that the infection was highest in females with 84.3% as compared to 15.7 in men. This is in similar to previous studies conducted by Dason *et al*. which showed that the UTI was more commonly occurred in women than men [10].

The prevalence of bacterial UTI was highest in the age group 31-60 years (41.4%); this finding was disagreed with results obtained by Martin Odoki *et al*. in Uganda, who reported that the prevalence was highest in 20-29 age groups. This difference may be due to that in our own study we collect mostof samples from pregnant UTI patients whomainly found in this age group [11].

In this study *E. coli* was the most predominant causative agent which was responsible of (55.7%) of urinary tract infections, This finding is in agreement with result obtained by Devanand P. and Ramchandra S. who indicated the same result [12].

The study showed that the resistance of *E. coli* to Amikacin was (12.8%), Gentamicin (28.2%), Tobramycin (53.8%), this result different from other result obtained by Helio *et al.* who reported that resistance of *E. coli* to the same antibiotic was (0.4%), (6.5%), (6.5%) respectively[13].

Also the study denoted that the resistance of isolated *E.coli* species to streptomycin was (43.6%), and to Kanamycin (48.7%), and this disagreed with result of Sumera *et al*. who showed that the resistance of *E. coli* to streptomycin (30%), and to Kanamycin (19.9%). This difference of findings may be attributed to the difference in the period between the two studies, in which the less resistance level was detected in the studies conducted in time earlier than this current recent study, and this may be justified by distribution of the resistant strains of E. *coli* among patient either due to bad community practices or deficient in implementation of infection control guidelines in hospital and health care facilitates [14].

The study revealed that the resistance of *E. coli to* Aminoglycosides was (37.4%), this finding is in difference with result obtained in America by Michael *et al*. who reported that the percentage of resistance in *E. coli*species to Aminoglycosides was (0%); this difference may be attributed to misuse of antibiotics which defined as the use of a substance for a purpose not consistent with legal or medical guidelines, and overuse which means taking a larger dose thanyou are supposed to. These bad habits in our country result in an increased risk of antibiotic resistance [15].

CONCLUSION AND RECOMMENDATIONS

The research established that the total resistance of isolated *E. coli* species to aminoglycosides between the participants was 37.4% the most influential Aminoglycoside against *E. Coli* was Amikacin. Further studies are recommended with large sample size.

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