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Antimicrobial Susceptibility of Urinary *Escherichia coli* from Outpatients with Community Acquired Urinary Tract Infections, Report from Tertiary Health Care Center, Egypt

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Background: Urinary tract infection (UTI) is one of the most common infections at the community setting. *Escherichia coli* are the main agent of UTIs. Antibacterial resistance spreads rapidly among community acquired urinary *E. coli*.
Objectives: The aim of this prospective study was to describe antimicrobial susceptibility profile and prevalence of multidrug resistant (MDR) urinary *E. coli* isolated from outpatients with community acquired UTI.
Methods: Urine samples were collected from patients attending outpatient departments of Mansoura University Hospitals in Egypt presented with symptoms of UTI. Samples were cultured and *E. coli* isolates were identified by colonial morphology, Gram stained film, and analytical profile index (API) 20E. Antibiotic sensitivity testing was performed by standard Kirby-Bauer disk diffusion method.
Results: One hundred and forty one *E. coli* uropathogen were isolated. The highest resistance was to beta lactam antibiotics. Amoxicillin susceptibility was 2.1%. Resistance to 3rd generation

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cephalosporins was (57.4%, 40.4%, 46.8% to cefotaxime, ceftazidime, and cefoperazone) respectively. The resistance to norfloxacin was (46.8%). While resistance to nitrofuantoin was (27.7%). The least resistance was to cefoperazone-sulbactam and amikacin (8.5% and 12.8% respectivelly). Most of the isolates were multidrug resistant (87.9%).
Conclusion: High level of antibiotic resistance among *E. coli* causing community acquired urinary tract infection.

Keywords: Urinary tract infection; Escherichia coli; antimicrobial resistance; multidrug resistant.

1. INTRODUCTION

Urinary tract infection (UTI) remains one of the most common community acquired infections which necessitate the prescription of empirical antibiotics [1]. *Escherichia coli* is the most important uropathogen which cause about 80% of these infections [2-3]. The high incidence of UTIs caused by *E. coli* is linked to its presence among facultatively anaerobic flora of the gastrointestinal tract. From there, seeding occurs to urogenital areas such as the vaginal interoitus, the periuretheral area, and the male prepuce, providing a local site for introduction and subsequent development of ascending UTI [4]. Community acquired UTIs treatment is empirically, as the result of antimicrobial susceptibility testing are usually reported after 72hr. Antibiotics like trimethoprim-sulphamethoxazole, quinolones, cephalosporins, semi-synthetic penicillins with or without inhibitors, gentamicin and nitrofurantoin, are widely used as empirical treatment for community acquired UTIs [5-7].

The inappropriate prescribing of broad spectrum antibiotics leads to the increased resistance to important groups like fluoroquinolones and cephalosporins [8-9]. In addation to the rapid emergence of multidrug resistance (MDR) *E. coli* which is associated with poor clinical outcomes and lower cure rates [10-11].

For proper empirical therapy and prevention of antibiotic resistance, it is essential to evaluate the antibiotic sensitivity of the common etiological agents which differ from country to country according the antibiotic usage [12-13].

Few studies reported resistance pattern of urinary *E. coli* and prevalence of MDR among patients with community acquired UTI in Egypt. The present study was performed to identify antibiotic susceptibility profiles of *E. coli* implicated in community acquired UTIs among patients attending outpatient departments of Mansoura University Hospitals (Mansoura, Egypt).

2. METHODS

This study was performed in outpatient departments of Mansoura University Hospitals in Egypt during period extending from March 2014 to December 2015. A total of 270 urine samples were collected from patients presented with symptoms of urinary tract infection (burning, urgency, and frequency). Urine samples is collected from the same patient only after 3 month of the initial *E. coli* positive culture. Patients previously admitted to hospital in the last 2 weeks and catheterized were excluded. Midstream urine samples were collected using clean catch technique in sterile container, after instructing patients for washing the perennial area. Early morning samples were collected as possible. Collected samples were stored at 4℃ till they were transported to Microbiology Lab in faculty of medicine, Mansoura university. Samples were inoculated on cystine lactose electrolyte deficient (CLED) agar using calibrated loop (10 µ). Cultures were incubated for 24hr at 37℃, and they were considered positive if colony counts $\geq 10^5$ CFU/ ml. *E. coli* was identified by colonial morphology, Gram stained film, and API 20E (bioMerieux, Marcy-l'Etoile, France) [14]. Antibiotic sensitivity testing was done by standard Kirby-Bauer disk diffusion method, on Mueller-Hinton agar (Oxoid Ltd., Basingstoke, UK) [15].

We considered the isolates not susceptible to one or more agents of at least 3 antimicrobial groups as MDR. The tested antibiotics were classified into groups: penicillins (amoxicillin) non-extended spectrum cephalosporins (cefuraxime, and cefaclor), extended-spectrum cephalosporines (cefotaxime, cefoperazone, ceftazidime, and cefpime), penicillin beta latamase inhibitor (amoxicillin-clavulanic acid, ampicillin-sulbactam), cephalosporine beta latamase inhibitor (cefoperazone-sulbactam), aminoglycosides (gentamicin and amikacin),

quinolones (norfloxacin), nitrofurans (nitrofurantoin), trimethoprim-sulphamethoxazole, and nalidixic acid [16]. All antibiotic discs were obtained from (Oxoid Ltd., Basingstoke, UK).

The Statistical Package for the Social Sciences (SPSS) 16.0 for Windows was used for statistical analyses. Descriptive statistics was described as mean, standard deviation (s.d), minimum, maximum and percentage.

3. RESULTS

A total of one hundred and forty one *E. coli* strains were isolated from 270 urine sample collected from patients presented with symptoms with UTI during period extending from March 2014 to December 2015 in outpatient departments of Mansoura University Hospitals. *E. coli* strains were isolated from 120 female patients (85.1%) and 21 male patients (14.9%). The mean age was 32 years (range 4-70 years). Female patients aged from (15-40 years) represent the major sector (44.7%) Table 1. All male patients were aged above 40 years. The least resistance was to cefoperazone-sulbactam (8.5%) and the highest was to amoxicillin (97.9%). Regarding 3rd generation cephalosporins, the resistance pattern to cefotaxime, cefoperazone and ceftazidime was (57.4%, 46.8%, and 40.4% respectively). Resistance to norfloxacin was 46.8%. Resistance to nitrofurantoin was (27.7%). The resistance to beta lactam- beta lactamase inhibitor combinations was (48.9% and 59.6%) to amoxicillin clavulanic acid and ampicillin-sulbactam respectively. Amikacin resistance was lower than gentamicin (12.8% versus 29.8%) Table 2. Majority of the isolates were MDR (87.9%).

Table 1. Patients' demographic characters

Sex	**No (%)**
Male	21 (14.9)
Female	120 (85.1)
Age	
Mean ±SD (min-max)	32± 20.9 (4-70)
Age groups	**No (%)**
<15	36 (25.5)
15-40	63 (44.7)
>40	42 (29.8)

4. DISCUSSION

The majority of urinary *E. coli* were from female patients 120 (85.1%), sixty three (44.7%) were in the child bearing period (15-40 years). This result is expected as females especially in reproductive age are in higher risk for UTI than males [17-18]. This result agrees with most studies in other countries like Ethiopia, Nigeria, and Iran [19-21]. Antibiotics belong to beta lactams and fluroquinolones groups are the most widely used agents for empirical therapy of UTI [22]. The current study finds high rates of resistance to amoxicillin about 98%. This result confirms Infectious Diseases Society of America (IDSA) guidelines, it better to avoid use of amoxicilin in treatment of UTIs due to poor efficacy [1].

Table 2. Antibiotic susceptibility pattern of *E. coli* isolates

	S	**I**	**R**
	No%	**No%**	**No%**
Amoxiacillin	3 (2.1)	-	138 (97.9)
Cefaclor	9 (6.4)	3 (2.1)	129 (91.5)
Cefuraxime	27 (19.1)	15 (10.6)	99 (70.2)
Cefotaxime	54 (40.4)	6 (4.3)	81 (57.4)
Ceftazidime	57 (40.4)	27 (19.1)	57 (40.4)
Cefoperazone	54 (38.3)	21 (14.9)	66 (46.8)
Cefpime	96 (68.1)	12 (8.5)	33 (23.4)
Cefoperazone-sulbactam	126 (89.4)	3 (2.1)	12 (8.5)
Norfloxacin	75 (53.2)	-	66 (46.8)
Gentanicin	93 (66)	6 (4.3)	42 (29.8)
Amikacin	93 (66)	30 (21.3)	18 (12.8)
Nalidixic acid	27 (19.1)	3(2.1)	111 (78.7)
Nitrofurantoin	84 (59.6)	18 (12.8)	39 (27.7)
Trimethoprim-sulfamethoxazole	27 (19.1)	12 (8.5)	102 (72.3)
Amoxacillin- clavulanic acid	42 (29.8)	30 (21.3)	69 (48.9)
Ampicillin-sulbactam	42 (29.8)	15 (10.6)	84 (59.6)

S: susceptible; I: intermediate; R: resistant

Regarding extended spectrum cephalosporins; the least resistance was to fourth generation agent cefpime and 3rd generation ceftazidime (23.4% and 40.4%) respectively. Resistance to fluroquinolones agent (norfloxacin) in this study was (46.8). This result is similar to other previous results like kresken et al. and Sanchez et al. [23-24]. Trimathoprim-sulphamethoxazole which an agent used widely for treatment of UTI, have high resistance (72.3%). This result is consistent with results of studies in other areas by Mamani et al and Rasamiravaka et al. [21,25]. This high resistance may be due to overuse of these antibiotics as a self medication, or over prescription by private pharmacies and clinics. Most patients did not ask medical advice in hospital except after failure of these therapies. In addition, these agents are used widely as an empirical treatment for other community associated infections like upper respiratory tract and GIT infections. This over use of antibiotics leads to development of resistance as reported previously [26]. As a part of gut flora, *E. coli* was exposed to selective pressure produced by antibiotic overusage [27]. Lower resistance rates were described in areas that restrict use of these antibiotics in community setting, for example amoxicillin resistance which ranges from 48% in Netherland to 60% in Belgium [28]. In our study, we test one antibiotic agent which not used as empirical therapy or self therapy; cefoperazone-sulbactam. The resistant to this agent was only (8.5%). This augments our explanation for the higher rates of resistance described for other agents. High prevalence of MDR bacteria was obtained relative to other studies. This is an expected result due to higher resistance to antimicrobial agents also may be due to the inclusion of the intermediate group in the definition of MDR. This study has some limitations. First, the lack of medical data about the patients like DM and other chronic illness which represent risk factors for recurrent infections and repeated antibiotic courses. Second, the study did not investigate the type of UTI upper or lower. Furthermore, we did not test for extended spectrum beta lactamases which represents important cause of antibiotic resistance. However, our study presents preliminary information about the state of antibiotic resistance community acquired *E. coli* causing UTIs.

5. CONCLUSION

High level of antibiotic resistance to beta lactam antibiotics among *E. coli* causing community acquired urinary tract infection was detected. While agents like nitrofurantoin is still retaining some activity against this organism. Multidrug resistant *E. coli* is a serious problem in community setting.

ETHICAL APPROVAL

Ethical approval was given by local Ethical Committee in Mansoura Faculty of Medicine (Mansoura, Egypt).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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