Antimicrobial Resistance of *Escherichia Coli* in Urine Samples from Children and Adults in El-Beida City

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Abstract: *This study was designed to investigate the distribution and antimicrobial resistance in urinary tract pathogens, primarily Escherichia coli, in two age groups, children 1-16 years and adults 17-55 y, over a period of 6 months at Al - Thawra Central Educational Hospital - El – Beida City. A total of 265 mid-stream urine samples were collected and cultured, 99 (37.4%) samples isolated with E.coli growth and the remaining 166 (62.6%) samples were negative(found be sterile or another bacteriuria). E. coli was the most common pathogen in both age groups. E. coli resistance to ampicillin and trimethoprim was higher in children than in adults. Resistance to Colistin Sulphate, tobramycin and Cefamandole were higher in children than in adults. Levofloxacin, Ciprofloxacin, Azithromycine and imipenem were found sensitivity in both groups. This data was described E.coli as the common causing of UTI and it showed the resistance of E.coli to several antibiotics. Depend on this study, the appropriate antibiotics for UTI are levofloxacin, ciprofloxacin.*

Keywords: *Urinary tract infection, Escherichia coli and Antimicrobial resistance*

I. Introduction

Urinary tract infection (UTI) is the second most common infectious presentation after respiratory tract infection both in the community and hospital settings. It is a serious health problem affecting about 150 million people around the world which are diagnosed with UTI each year(McLellan and Hunstad, 2016), costing the global economy in excess of 6 billion US dollars(Gupta *et al.,* 2014). UTIs are the predominate infection requiring medical care in developing countries(Seifu and Gebissa, 2018).The infection may involve any part of urinary tract, which divided into the upper (kidneys and ureters) and lower tract (bladder and urethra) (Tan and Chlebicki, 2016). The infection in upper tract called pyelonephritis and lower tract called cystitis(Akram *et al.,* 2007). The prevalence of lower UTIs (Cystitis) in female is significantly higher than male. This because the difference of anatomy structure including moist periurethral and the urethral lengths shorter in women (Helen and Jennifer Le, 2018). However, there are important factors associated with prevalence of UTIs for example poor hygiene, low socio-economic status and malnutrition (Ahmed and Avasarala, 2008).

Bacteria is the most common cause of UTI(Amdekar *et al.,* 2011). It is most often caused due to gram negative bacteria, but gram positive bacteria may also be involved (Kline and Lewis, 2016). The most frequent isolated uropathogens in UTI is *Escherichiacoli (E.coli),* followed by *Enterococcus faecalis, Klebsiella pneumonia* (Akram *et al.,* 2007). Although, many types of bacteria are causing UTI, *E. coli* is considered the major cause of infection (Alanazi *et al.,* 2018).In the last few years, the emergence and wide dissemination of *E. coli* strains showing resistance to broad-spectrum of antimicrobial agents has been reported (Bartoloni *et al.,* 2006, Oteo *et al.,* 2005, Sahm *et al.,* 2001). There are multiple types of antibiotics prescribed on a daily basis to the management of UTIs along with other infectious diseases. However, the un appropriate use of antibiotics contributing significantly to appear antimicrobial resistance in organisms because of repeated misuse of antimicrobials (Tambekar *et al.,* 2006).

In developing countries, like Libya, it is difficult to assess the accurate incidence of UTI besides bacterial resistance due to underreporting, lack of surveillance as well limited published data. The pattern of resistance of community UTI uropathogens has not been also extensively studied in the Libyan community. The current study is aimed to determine and compare the prevalence of antimicrobial resistance for *E.coli* among outpatient (children and adult) attending Al-Thawra Central Educational Hospital in El- Beida City-Libya, which may constitute an epidemiological importance regarding the wide-spread of multi-drug resistant bacteria in this country.

II. Materials and Methods

Samples collection, handling and processing

A total of 265 urine samples were collected from patients, who attended to Al-Thawra Central Educational Hospital, El-Beida in Libya and local diagnostic in medical laboratories in the hospital, during the period from March to August 2017. The collected samples were, individually, labeled with patient information including age, gender, clinical symptoms and results of physical examination, then sent to the microbiological laboratory for isolation and identification of any bacterial pathogen, in which samples were processed immediately within 30 min. The patient instruction for appropriate collection has been followed to reduce probable contamination. In adult and toilet-trained children, urine samples were collected, using clean-catch midstream specimens, in wide-mouthed sterile containers with tight-fitting lid to prevent leakage. In infants, adhesive urine collection bags were used for specimen collection.UTI was confirmed by positive urine culture reports.

Sample collection and processing

Collected samples were, separately, inoculated onto MacConkey agar (Oxoid, UK), by using streak plate method (Sanders, 2012) and then plates were incubated, aerobically, at 37 °C for 24 h extended to 48 h in negative samples.

Antimicrobial susceptibility testing

The antimicrobial agents which were tested from different categories. All antimicrobials discs (Levofloxacin, Ciprofloxacin, Azithromycine, Imipenem, Gentamicin, Erythromycin, Amoxicillin, Tobramycin, Streptomycin, Nalidixic acid, Colistin Sulphate, Tetracyclin, Penicillin G, and Cefamandole) were used for sensitivity. Discrete colonies obtained were tested for Antibiotic sensitivity testing by disc diffusion test method (Bauer *et al.,* 1966).

Statistical analysis

Data from patient was compared between adults and children. Statistical analysis was carried out in Minitab software; statistical significance was assessed using two samples T- test analysis. After detection normal distribution to the data and appropriate $P < 0.05$ consider significant (Paulson, 2008).

III. Results

In this study, out the 265 urine samples tested, 99 (37.4%) samples yielded bacterial growth while 166 (62.6%) were negative *E. coli*. The isolate yielding bacterial growth 69 (96.7%) urine cultures belonged to female samples and 30 (30.3%) belonged to male patients. In term of age 36 (36.4%) were children and 63 (63.6%) were adults **(Table 1).** About the distribution of infection among patients' age groups, which ranged between 1year and 65 years, the highest (36.4%, 36/99) occurrence was in young age, then adults (16–25 years), followed by (26-35 years). The lowest (1.01%, 1/99) incidence was among over 56 years.

Frequency of resistance among isolated uropathogens to tested antimicrobials was shown in **(Table 2)**. In this study, *E. coli* showed increased resistance to wide range of used antimicrobials including recently produced and expensive ones with adults and children. Our results established that the isolated *E.coli* showed increased sensitivity ranged from 76% to 16% in adults and children. Considering our results, sensitivity to tetracyclin and Colistin Sulphate were significant between children and adults. Levofloxacin and Ciprofloxacin were the most active agent against *E.coli*, followed by Azithromycine and imipenem. Cefamandole and Penicillin G were the most (0% resistance) powerful antimicrobial followed by Nalidixic acid (16% and 0% with children and adults respectively).

Table 1. Prevalence of urinary tract infection among tested patients in relation to gender and age.

parameters	Number	Percentage (%)
Examined patients	265	100
Infected	99	37.4
negative	166	62.6
Male	30	30.3
Female	69	69.7
Children	36	36.4
Adult	63	63.6
Age group		
<1	4	4.04
2-15	32	32.3
16-25	21	21.2
26-35	18	18.2
36-45	15	15.1

46-55	8	8.1	
>56	1	1.01	

Table 2: percentage of antibiotic sensitivity in sample of urine from children and adults admitted to the Hospital for a urinary tract Infection (*P < 0.05 upon T- test analysis two samples)

Antimicrobial agent	Short name	Percentage (%) E. coli sensitive		
		Children	Adults	P. Value
Levofloxacin	LEV	66.66667	76.19048	0.33
Ciprofloxacin	CIP	66.66667	57.14286	0.051
Azithromycine	AZM	66.66667	52.38095	0.22
Imipenem	IPM	58.33333	47.61905	0.77
Erythromycin	E	50	52.38095	0.31
Amoxicillin	AMC	41.66667	47.61905	0.86
Gentamicin	GN	41.66667	47.61905	0.59
Tobramycin	TOB	16.66667	23.80952	0.28
Tetracyclin	TE	58.33333	14.28571	0.00*
Streptomycin	S	41.66667	28.57143	0.46
Colistin Sulphate	COL	16.66667	52.38095	0.03*
Nalidixic acid	NA	16.66667	0	-
Cefamandole	CE	0	9.52381	0.002*
Penicillin G	P	0	0	-

IV. Discussion

Urinary tract infection occurs in all populations and ages, however, various factors including race, genetic factors, age, gender, sexual activity, nocturnal enuresis and circumcision in boys, make bacteriuria more or less to occur for any individual (Heffner and Gorelick, 2008). This study provides valuable laboratory data to monitor the status of antibiotics sensitivity pattern of *E coli* from patients with UTI at Al - Thawra Central Educational Hospital - El - Beida to improve treatment. From total 265 urine samples diagnosed with UTI infection (37.4%) isolated *E.coli,* this data described alarming for isolating and antibiotics resistance from *E.coli*. In agreement to our findings, a similar studies in Libyan society *E.coli* remain the most causing of UTI and resist to antimicrobials (Khalifa *et al.,* 2014, Mohammed *et al.,* 2016, Sifaw Ghenghesh *et al.,* 2013). Moreover, another study obtained on a similar value of the prevalence of *E.coli* 36.25% in Sobrta and Algmel (Khalifa *et al.,* 2014). Previous reported Libyan study was lower in culturing positive compression with our data 29% (Elsayah *et al.,* 2017). There are several studies and published information around the world which described *E.coli* as the most frequently causing for UTI (Kline and Lewis, 2016, Obiogbolu *et al.,* 2009, Tessema *et al.,* 2007). The most effective antibiotics in this study were levofloxacin and ciprofloxacin. Another Libyan study has showed the similar effect of sensitivity of ciprofloxacin against uropathogen (Elsayah *et al.,* 2017). In this study, isolated *E. coli* showed high resistance to several antimicrobial, Penicillin G and nalidixic acid were highly resistance in samples from adults followed by cefamanadole 0 and 9.5% respectively, pencillin G and cefamanadole were the highest resistance in samples from children. In addition that isolated *E.coli* exhibit wide range of resistance in pediatric samples against cefamanadole and tobramycin, nalidixic acid 0, 16.6%, 16.6% respectively. The data collected from other places around the world reported that nalidixic acid was also high resistance for *E. coli* (Bodoev *et al.,* 2018, Dwivedi *et al.,* 2015). A similarly to our study, other scientists reported that tobramycin was resistance for *E. coli* (Ojdana *et al.,* 2018). In developing country like Libya, there are inappropriate clinical practices such as unsupervised use or overuse of antibiotics which contributed in wide spread the resistance of antimicrobials. Additionally, the antimicrobial are taken without prescriptions from the pharmacy as self-medications. Some studies reported Similar practices from other developing countries, such as Vietnam and Nepal (Larsson *et al.,* 2000, Rao, 1998).

V. Conclusions

It is concluded that, the *E. coli* is most frequently pathogen causing UTI.In developing country, the misuse of antibiotics contribute in increase the resistance among uropathogens. Our findings strongly suggest that the restrictions should be put on antimicrobial prescribing.

Acknowledgements

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