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Prevalence of escherichia coli and its antibiotic susceptibility profiles among patients presenting with signs and symptoms of UTI in Ramadi city

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Abstract---One of the most prevalent infections, urinary tract infection (UTI) can affect anyone from a newborn to an elderly person. The most common cause is a bacteria called uropathogenic Escherichia coli (UPEC). The ability to adhere to host epithelial cells in the urinary system is the most important predictor of pathogenicity, however fimbriae, pili, flagella, and secreted (toxins) virulence factors all play a role in the pathogenicity of UroPathogenic Escherichia coli strains. Effective management of UTIs requires up-to-date information on the antibiotic susceptibility pattern of uropathogens. Thirty midstream urine samples were collected from patients at Al-Ramadi Teaching Hospital's Urology Clinic. Isolates of E. coli (the most prevalent bacteria) from the cultured samples are tested for susceptibility to the most common antibiotics in use today. Thirty (75%) of the total 40 samples were culture positive; the most common organisms found were Escherichia coli (16 (53.3), Citrobacter freundi 2 (6.7%), Klebsiella pneumonia 8(26.7%), Streptococcus spp 3 (10%), and Staphylococcus aureus 1(3.3%). Females (33.3%) were more likely to be affected than males (20%), and those younger than 13 years old were disproportionately affected. Isolates of Escherichia coli demonstrated great susceptibility to nitrofurantoin (81.25%), and cefotaxime/clavulanic acid (93.75%) but strong resistance to ceftazidime (100%), cefuroxime (75%), and nalidixic acid (56.25

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percent), Conclusion. Escherichia coli, the most prevalent uropathogen, demonstrated extensive multidrug resistance to the antibiotics used most often to treat urinary tract infections.

Keywords---escherichia coli (E.coli), (UPEC), urinary tract infection (UTI), infections, children.

Introduction

Symptomatic urinary tract infections (UTIs) are classified from least to most severe as urosepsis syndrome, pyelonephritis (or upper UTI, with infection in the kidney), and cystitis, all of which are identified by the presence of bacteria in the urine (usually > 105/ml) (or lower UTI, with bacteria into the bladder; Foxman, 2014; Smelov et al., 2016). According to neurological or structural urinary tract abnormalities, UTIs can be clinically classified as either superficial or difficult cases (Zacché and Giarenis, 2016). Women and men are equally at risk for recurring urinary tract infections due to bacterial cystitis (also known as acute cystitis) (Fiore and Fox, 2014). This is because the same or different UTI-causing strains in the stomach can (re)inoculate the bladder, and recurrent urinary tract infections can be interduced from multiple sources. On the other hand, recurrent UTIs might be caused by bacteria that have made their way into the bladder epithelium and remain dormant there (Silverman et al., 2013). Antibiotic prophylaxis is used to prevent UTIs in people who get them frequently, however, surgical intervention may be necessary for severe instances (Tolg and Bagli, 2012). Recurrent urinary tract infections (UTIs) are common during pregnancy and can have serious consequences for the baby and the mother, including premature delivery. Antibiotics are only one type of pharmacologic intervention that may be used here (alternative remedies; Schneeberger et al., 2012).

Risk factors for both new and recurrent UTIs in premenopausal women include engaging in sexual activity more than three times per week, using spermicides, having new or many sexual partners, and having a history of UTI before age 15. As a rule, asymptomatic bacteriuria after menopause does not necessitate treatment, and systemic hormone therapy is ineffective as a preventative measure (Milart et al., 2013). Half of all women over the age of 61–65 experience genital-urine symptoms, and 29% experience bouts of urinary incontinence, both of which have been linked to bacteriuria (Raz, 2001). Antimicrobial resistance is rising rapidly, making it one of the most widespread infections [A. Bryce, 2016]. These infections account for up to 35 percent of nosocomial infections and are the major cause of bacteremia in hospitalized patients. All ages and sexes are equally susceptible to this disease, however females make up 87.5 percent of cases compared to males' 71.3 percent [M. Akram, 2007- M. Ganda's, 2019]. Women are more susceptible since the urethra is shorter and the anus is closer to the urethra than in men. An estimated 50% of women will suffer from repeated bouts of acute cystitis at some point in their lives [L.E. Nicolle, 2001].

Members of the enterobacterial order often cause urinary tract infections due to their ability to adhere to the uroepithelium via a variety of mechanisms [F.S. Nas,2019]. Community and hospital-acquired UTIs are most commonly caused by

Escherichia coli [S. Sabir,1969-M. Gajda'cs,2019]. Pathogens such Enterobacter sp., Citrobacter sp., Klebsiella sp.,Proteus-Morganella-Providencia sp., and Proteus saprophyticus ("honeymoon cystitis") have also been reported [M. Gajda'cs,2019]. Antibiotic-resistant bacteria are becoming more common and seriously risk public health. Lethal dosages of antibiotics with different chemical structures and methods of action are ineffective against resistant organisms, notably Enterobacteriaceae [M. Gajda'cs,2019].

Lower absorption, target change, aminoglycoside degrading enzyme, beta-lactamase enzyme degradation, and overexpression of efflux proteins are all major methods used by enterobacteriaceae like E. coli to evade deadly dosages of medicines. The pace of new medicine development Antibiotic resistance is a growing problem, and its development in the 21st century cannot keep up with the negative trends [E. Medina, 2016]. Since fluoroquinolones were developed in the 1960s to improve upon nalidixic acid's effectiveness, no new broad-spectrum antibiotics have been found or created. Self-medication, abuse, and misuse of medicines are contributing to a shift in the phenotype of pathogens that cause UTIs [N. Kaur,2014]. More and more people are misusing antibiotics, leading to spreading bacteria resistant to treatment.

Antibiotic-resistant bacteria can complicate therapy for any bacterial illness, including urinary tract infections. The use of newer, more effective, broad-spectrum medications is constrained in low-income countries due to a lack of access to health care and the high cost of second-line treatments [M. Akram,2007]. Knowledge of prevalent Ur pathogens and their sensitivity to medications is crucial for enhancing prescription decisions [N. Kaur,2014], however, the patterns of resistance of community-acquired UTI have not been explored extensively. Patients with urinary tract infections (UTIs) at Ramadi Hospital are often treated on a "empirical" basis due to the lack of availability of more advanced laboratory culture and sensitivity testing for UTI urine [M. Odoki, 2019]. The purpose of this study was to examine the antibiotic susceptibility profiles of E. coli isolated from patients in Ramadi City who presented with symptoms of UTI.

Methods

Patients study

Fifty samples of urine were collected from individuals aged 1 to 13 years old; 25 women and 15 males in total. The Urology Clinic for walk-ins and the Urology Ward at Ramadi General Hospital were busy with patients. Our patients provided us with forty (40) midstream clean catch specimens. The patient's or his parents' or relatives' full and thorough history had been gathered and organized in an instructive, clearly defined formula sheet.

Processing of Urine Samples
Laboratory Investigations

During the enrolling process, forty midstream urine samples were collected into a sterile urine container. Most of the samples were evaluated within an hour of

collection, and all of them were analyzed within 24 hours. Before anything else, a semiquantitative culture method was used to instantly start growing bacteria from a urine sample to rule out the possibility of contamination. This method involves streaking a standardized (fixed known volume) 0.025 ml inoculum of urine over sectors of blood and MacConkeys agar medium at 37Co for 24 hr, and if no growth is seen, the plates are incubated for another 24 hr before being reported as negative cultures. The number of colonies per milliliter was determined after incubation. Color, texture, and pH were then assessed using a macroscopic lens. Next, a high-powered microscope was used to look for white blood cell globules, red blood cell globules, crystals, epithelial cells, and casts in the deposit after centrifugation at 3000 rpm for 5 minutes (Baron et al., 1994). The E. coli organisms were verified using morphological colony identification and biochemical assays.

Application of Discs to Inoculated Agar Plates

The inoculated agar plate included antibacterial discs scattered throughout its surface. Each disc must be squeezed down using sterile forceps to make full contact with the agar surface. The discs must be equally spaced, with no more than 24 mm between centers, whether inserted manually or using a dispensing device. There shouldn't be more than 12 discs on a single 150 mm plate and no more than 5 discs on a single 100 mm plate. Once a disc has made contact with an agar surface, it should not be moved since part of the medication will diffuse away instantly. Replace it with a new disc and transfer it to a different spot on the agar.

Reading Plates and Interpreting Results

- After 16 to 18 hours of incubation, each plate is examined. Using a ruler, the inhibition zones were measured to the nearest whole millimeter.
- The sizes of the zones of inhibition were interpreted by referring to Table (1)
- The standard isolate of *(E. Coli* ATCC 25922) was used as control group for antimicrobial susceptibility test as shown in table (1-2).

Data Analysis

The study's data was input and cleaned in Microsoft Excel before being analyzed with SPSS version 20. Descriptive statistics were run with a 95% confidence using the Chi-squared test.

Table 1
Interpret inhibition zones using the disc method (Bauer- Kirby method, 1966)

Name	Code	Disc poleiic) Miero«niiii/dise	Zone Diameter Break points (inm)	
			S	B
Amikacin	K	30	^17	<15
Amoxicillin	AX	25	>21	<14
Ampicillin	AM	10	>19	<14

Augmentin	AUC	20/10	>21	<14
Cefotaxime	CTX	30	>21	<15
Ceftazidime	CAZ	30	>21	<15
Cephalothin	CEF	30	>18	<12
Ciprofloxacin	CIP	5	>22	<19
Cloxacillin	CLO	5	—	—
Gentamicin	GM	15	M3	<12
Nalidixic acid	NA	30	>19	<13
Nitrofurantoin	F	300	M7	<14
Piperacillin	PIP	75	MO	<12
Rifampin	RA	2	>19	<14
Tetracycline	TE	30	M3	<19
Tobromycin	TOB	10	M6	<14
Trimetheprim-sulfamethoxazol	SXT	1.25/23.75 (25)	>16	<10

Table 2
Inhibition zones for the standard strain *E. coli* ATCC 25922

Name	**('ode**	**Disc |)ti1eiic\ Micros' ram/disc**	**/•;.co/Z .VI (< -25922**
Amikacin	AK	30	19-26
Amoxicillin	AX	25	22-26.5
Ampicillin	AM	10	16-22
Augmentin	AUC	20/10	22.0-27.0
Cefotaxime	CTX	30	32.5-37.5
Ceftazidime	CAZ	30	—
Cephalthin	CEF	30	17-22
Ciprofloxacin	CIP	5	30-40
Cloxacillin	CLO	5	—
Gentamicin	GM	15	19-26
Nalidixic acid	NA	30	22-28
Nitrofurantin	F	300	20-25
Piperacillin	PIP	75	24-30
Rifampin	RA	2	—
Tetracycline	TE	30	18-25
Tobromycin	TOB	10	18-26
Trimetheprim-sulfamethoxazol	SXT	1.25/23.75 (25)	24-32

Results

Bacteriological Finding

The patients were used in the present study were distributed into (15) men and (25) women Their age were ranged between 1-13 years. Out of 40 urine specimens, 30 (75%) were culture positive, 10 (25%) showed no growth. Specimens yielded microbial positive growth were distributed as the following: (*Escherichia coli* 16 (53.3%), *Citrobacter freundi 2 (6.7%), Klebsiella pneumonia 8(26.7%), Streptococcus spp 3(10%), Staphylococcus aureus* 1(3.3%) were found in Table (3) Figure (1).

Table 3
Prevalence of E. coli and other bacteria among UTI patients in Ramadi City

Isolate	Number of isolates	Percent
Escherichia coli	16	53.3
Citrobacter freundi	2	6.7
Klebsiella pneumonia	8	26.7
Streptococcus spp	3	10
Staphylococcus aureus	1	3.3

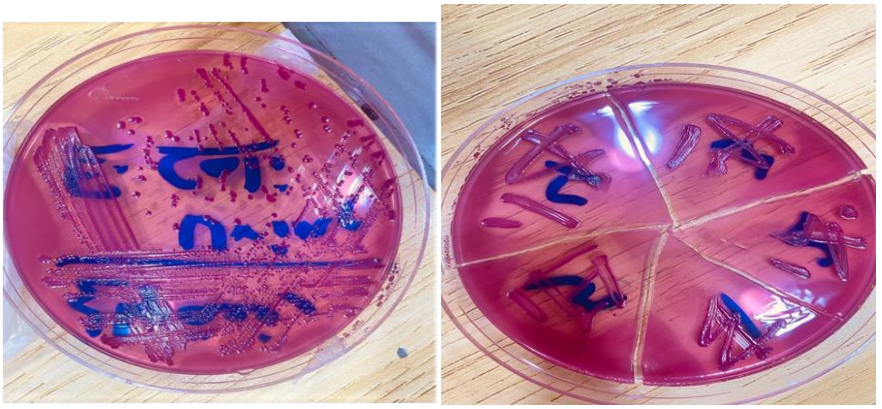

Figure 1. Pure culture MacConkey Agar of bacterial E.coli

Females had a greater incidence of E. coli (33.3%) than men (20 percent). The frequency was similarly highest among those aged 9-13 (31.25%), as seen in Tables 4.

Table 4
Show the prevalence E. coli in Percent with UTI according to sex and age

Variable	Category	*E. coli* (+)	Percent
Sex	Male	*6*	20
	Female	*10*	33.3
Age groups in years	1	*4*	25
	2-5	*3*	18.75

	6-8	*4*	25
	9-13	*5*	*31.25*

Examining Escherichia coli Isolates for Their Reaction to Common Antibiotics

All E. coli isolates tested positive for sensitivity to cefotaxime and clavulanic acid (90 percent). Seventy percent of the isolates tested positive for sensitivity to nitrofurantoin, but only a small percentage (Figure 2) demonstrated sensitivity to nalidixic acid. However, there was universally strong resistance to cefuroxime and ceftazidime across the isolates (100%). Antibiotic resistance patterns are shown in (Table 5).

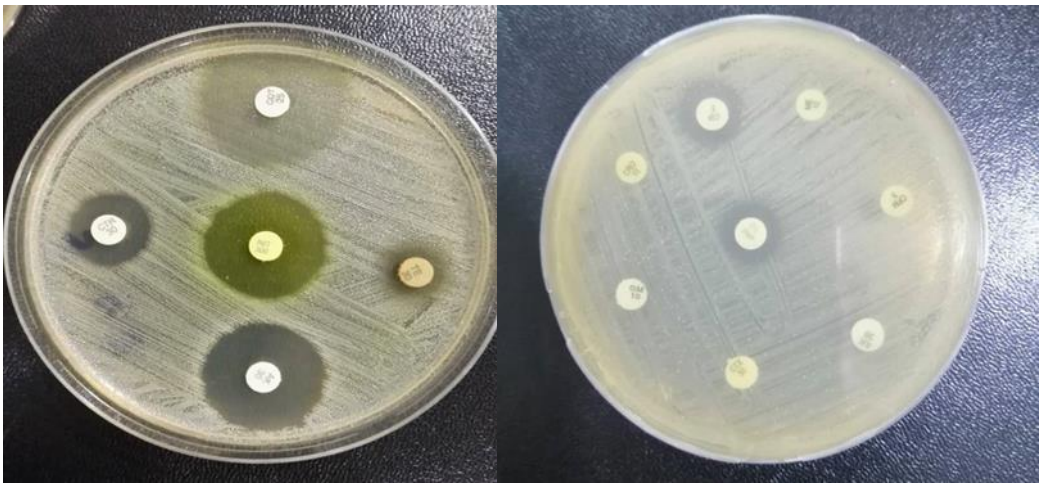

Figure 2. The picture shows the sensitivity test implant

Table 5
E. coli susceptibility to antibiotics was determined from urine samples of UTI patients at Ramadi Hospital

Antibiotic	Concentration of antibiotic in the disc (µg)	Resistant	Susceptible
Ceftazidime	30	16 (100%)	0 (100%)
Cefotaxime/clavulanic acid	30/10	1 (6.25%)	15 (93.75%)
Nalidixic acid	30	9 (56.25)	7 (43.75%)
Nitrofurantoin	300	3 (18.75%)	13 (81.25%)
Cefuroxime	30	12(75%)	4 (25%)

Discussion

Therapeutic therapy of urinary tract infections requires up-to-date data on the prevalence and antibiotic susceptibility pattern of pathogenic microorganisms. This study revealed that the prevalence of E. coli among UTI patients was relatively low (53.3%), compared to other studies in this field. In a prior research

of hospitalized patients in the Fallujah area of east Ramadi and others, the incidence of E. coli was found to be 41.9% [M. Odoki, 2019]. Similarly, prior investigations conducted at Ramadi Hospital revealed a greater frequency of 57.5 and 50 percent, respectively [D. Kabugo,2016, A. D. Mwaka,2011]. This study found a lower prevalence than the previous one, probably due to demographic diversity and substantial sample size differences. It is also probable that substantial advances in the management of urinary tract infections (UTIs) and community cleanliness led to the decline in the prevalence of E. coli germs over time [D. Kabugo, 2016]. Females had a higher prevalence (11.5 percent) than men (8.3 percent), however the difference was not statistically significant. [M. Akram,- M. Odoki,2019; F. S. Nas,2019 ; R.M. Mordi,2006; I. O. Okonko,2009]

This might be because the anus is close to the heated urethral tube. In addition, the female urethral tube is small, which reduces the distance the organism must travel to reach the bladder. These UTI risk factors are exacerbated by insufficient resources, poor cleanliness, and low socioeconomic position [M. Akram, 2007]. Changes in vaginal microflora have a crucial role in promoting coliform colonization of the vagina, which has been linked to UTIs [T. M. Hodgson, 1997]. Compared to other age groups, the prevalence was higher in the 9-13 age group (31.25 percent), however this difference was not statistically significant. The results are comparable to those reported in Nigeria [O. A. Aiyegoro, 2007]. The youngsters have minimal immunity to illnesses and may have never been exposed to them, which may have left them vulnerable to infection. In addition, most young children in our context are misdiagnosed since the symptoms of UTI in newborns match those of other diseases, such as fever, vomiting, and refusal to eat. Adolescents engage in increased sexual activity, which makes them more susceptible to UTIs [M. Odoki,2019, - O. A. Aiyegoro,2007].

Isolated Escherichia coli had a 93.75 percent sensitivity to cefotaxime/clavulanic acid. This may be due to the fact that the organism is not easily resistant to the medication combinations. The clavulanic acid targets the beta-lactamase enzyme, which is responsible for resistance to beta-lactam antibiotics, so enabling the medicine to overcome resistance. Combinations of cephalosporins and beta-lactamase inhibitors are among the first novel medication compositions with potentially significant broad-spectrum antibacterial action. In addition, it has been used seldom to treat urinary tract infections and other illnesses. Therefore, current organisms have limited resistance, since they have not been exposed to it regularly [G. Schmiemann,2012; A. Bryce,2016; F. S. Nas, 2019 -]. In addition, 81.25 percent of the isolates were sensitive to nitrofurantoin, according to the study's findings. [A. D. Mwaka, 2011] An prior study in the identical study setting with nonpregnant women shown that E. coli is very sensitive to nitrofurantoin, with 100% sensitivity rates. Similarly, another research found a susceptibility rate of 78% [D. Kabugo, 2016]. This indicates a reduction in E. coli's susceptibility to this antibiotic. The escalating resistance may be attributable to the rising abuse and overuse of antibiotics.

The persist or cells (defined as metabolically inactive cells that neither grow nor die when exposed to bactericidal concentrations of the antibiotics) present another significant challenge as these cells continue to replicate after the antibiotic therapy has been discontinued [B. Van den Bergh,2017]. It may also be

owing to the drug's low price and accessible availability, since it was recommended by the Uganda Clinical Guidelines 2016 for the empirical treatment of urinary tract infections [M. Odoki, 2019]. In this investigation, it was disturbing that Escherichia coli isolates were extremely resistant to cefuroxime and ceftazidime. In a prior study conducted at the Ramadi Hospital, resistance was significantly lower [D. Kabugo, 2016].

Resistance to nalidixic acid, similar to a recent research in Ramadi that revealed 89.9 percent E. coli resistance [A. D. Mwaka, 2011] empirical therapy has long been used for urinary tract infections. This resistance may be a result of the dramatically increased usage of these medications since the 2010 Uganda Clinical Guidelines endorsed their use for the treatment of UTIs on an empirical basis. Moreover, these medications are quite inexpensive and widely available. This might have made them readily available to patients, so increasing their abuse and leading to resistance.

Conclusions

- ***Escherichia coli*** is found in abundance in women, because the anal opening is closer to the urethral opening and thus facilitates its transmission. In contrast to men, the anus is far from the urethra.
- ***Escherichia coli*** was the most common bacteria isolated from urinary tract infection women.
- The concentration of 100- 1000 mg/dl have remarkable effect in induction the growth of ***Escherichia coli***.
- ***Escherichia coli*** isolated from women was more susceptible to study antimicrobial agents.
- The sensitivity pattern of ***Escherichia coli*** to antimicrobial agents was decreased simultaneously after glucose supplementation.

Recommendations

It’s recommended the following:

- Study the pH effect on *E. coli* growth in vitro.
- Measure the bacterial growth rates for a period of (6-7h), with hourly reading points.
- Measure the viable bacterial count per ml.
- Isolate anaerobic bacteria which caused UTI.
- Study the effect of some substances excreted in the urine as well as Protein on the adherence of *E. coli* to urothelium cells.
- Understand the molecular and genetic basis of *E. coli* adherence and molecular physiology.

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