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ORIGINAL ARTICLE

Detection of E. Coli Bacteria in Urinary Tract Infection in Emergency Department at Alimmam Al-Sadiq Hospital: Hilla \ Iraq

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ABSTRACT

Background: Urinary tract infection (UTIS) is a common microbial infection in community and in all age groups. are alarming worldwide. Therefore, this study aims to detection antibiotics resistance of Escherichia coli (E. coli) bacteria responsible for UTIS Methods: Retrospective chart review for patients admitted to emergency department and diagnosed with UTIS at Al-immam Al-SAdiq Hospital between February to April 2021 was performed. Antimicrobial susceptibility to ampicillin, augmentin (amoxicillin/clavulanate), cefazolin, co-trimoxazole (sulfamethoxazole/trimethoprim), ciprofloxacin, and nitrofurantoin, and cefpodoxime was determined for 101 E. coli urinary isolates. Results: Escherichia coli was the most bacteria causing UTIS representing 93.55, 60.24, and 45.83% of all bacteria isolated from urine culture of pediatric, adult, and elderly, respectively. High rates of resistance to ampicillin (82.76, 58, and 63.64%) and co-trimoxazole (51.72, 42, and 59.09%), among E. coli isolated from pediatric, adult and elderly respectively. Nitrofurantoin was the most active agent, followed by ciprofloxacin, augmentin and cefazolin. 22.77% of E. coli isolates exhibited multiple drug resistance (MDR). Among 66 and 49 isolates resistant to ampicillin and co-trimoxazole, respectively, 34.84 and 42.85% were MDR. In contrast, all isolates resistant to augmentin and nitrofurantoin were MRD, while 72.7 and 82.4% of isolates resistant to ciprofloxacin and cefazolin were MDR. Conclusions: High resistance was observed to ampicillin and co-trimoxazole which commonly used as empirical treatments for UTIS, limiting their clinical use. This necessitates continuous surveillance for resistance pattern of uropathogens against antibiotics.

Keywords: Antibiotics sensitivity , E. coli bacteria , UTIS.

INTRODUCTION

A urinary tract infection, or UTI, is an infection in any part of your urinary system, which includes your kidneys, bladder, ureters, and urethra (1,2). If you're a woman, your chance of getting a urinary tract infection is high. Some experts rank your lifetime risk of getting one as high as 1 in 2, with many women having repeat infections, sometimes for years. About 1 in 10 men will get a UTI in their lifetime. Some people are at higher risk of getting a UTI (3,4). UTIs are more common in females because their urethras are shorter and closer to the rectum. This makes it easier for bacteria to enter the urinary tract(5). ounger children may not be able to tell you about UTI symptoms they are having. While fever is the most common sign of UTI in infants and toddlers, most children with fever do not have a UTI(6,3). If you have concerns that your child may have a UTI, talk to a healthcare professional. When bacteria enter the urinary tract and multiply, they can cause a UTI. To infect the urinary system, a micro-organism usually has to enter through the urethra or, rarely, through the bloodstream. The most common bacterium to cause UTIs is Escherichia coli (E. coli). It is usually spread to the urethra from the anus (9,10,11).

Other micro-organisms, such as mycoplasma and chlamydia, can cause urethritis in both men and women [(5,7)]. These micro-organisms are sexually transmitted so, when these infections are detected, both partners need medical treatment to avoid re-infection. Urinary tract infections (UTIs) are very common – particularly in women, babies and older people. Around one in two women and one in 20 men will get a UTI in their lifetime [(3).] The kidneys control the amount of water in the blood and filter out waste products to form urine [(7,9)]. Each kidney has a tube called a ureter, which joins the kidney to the bladder. The urine leaves the kidneys through the ureters and enters the bladder. The bladder 'signals' the urge to urinate and urine leaves the body through a tube called the urethra [(13)]. The urinary system is designed to minimise the risk of serious infection in the kidneys. It does this by preventing the urine from flowing back up into the kidneys from the bladder [(11,12)]. Most urinary infections are confined to the bladder and, while causing symptoms, are not serious or life threatening [(15)].

MATERIAL AND METHODS

Present study was conducted in the emergency department (ED) of Alimmam Al-Sadiq Hospital , which is a tertiary care hospital in Babil\Iraq . Retrospective cohort study of physician medication prescription over a period February to April 2021 Study population Charts of 100 patients diagnosed with UTIs due to E. coli were reviewed. Samples of those patients showed significant growth, bacteria growing > 105 colony-forming units (CFU/mL) with a single type of bacteria from a properly collected midstream urine sample, were considered as UTIs and processed further for identification and susceptibility testing.

The sensitivity and resistance of E. coli isolates against 6 antibiotics including ampicillin, augmentin, co-trimoxazole (trimethoprim/sulphamethoxazole), ciprofloxacin, nitrofurantoin, and cefazolin were determined using VITEK test method which measure minimum inhibitory concentration (MIC). Susceptibility results are interpreted according to the Clinical Laboratory Standards Institute (CLSI) guidelines. Then association between resistance of E. coli to one or more of three antibiotics (ampicillin, co-trimoxazole and ciprofloxacin) were studied and classified to SSR (sensitive to ampicillin, sensitive co-trimoxazole, and resistance ciprofloxacin); RRR (resistance ampicillin, resistance co-trimoxazole and resistance ciprofloxacin); SSS (sensitive ampicillin, sensitive co-trimoxazole and Sensitive ciprofloxacin); RRS (resistance ampicillin, resistance co-trimoxazole and sensitive ciprofloxacin); SRS (sensitiveampicillin, resistance co-trimoxazole and sensitive ciprofloxacin), and SRR (sensitive ampicillin, resistance co-trimoxazole and resistance ciprofloxacin). Multiple resistance which defined as multidrug resistance (MDR) was defined as resistance to three or more antimicrobials. The population was classified as pediatric, adolescent and adult, and elderly. Pediatric stratified into three groups: less than 2 years, from 2 years to 6 years and between 7 and 12 years. The age category between 13–17 and 18–64 years were defined as adults, while those age 65 years or over were defined as elderly.

RESULTS

During the study period from February to April 2021, a total 283 urinary cultures were collected. Of a total isolate, positive cultures were representing 28.67% of all cultures collected. Gram-negative organisms totaled 74 (91.98%), Gram-positive organisms constituted 7 (6.79%) and fungal 2 (1.23%) of all isolates. There are 56.14% of all pediatric visits requested culture. 35.67% of all adult visits and 39.75% of all elderly. In pediatric, 32.29% of culture was positive, 62.50% was negative, and 5.21% of the result was

mixed of normal flora, while in the adult the result of urine culture showed 68.62% negative, 24.34% positive and 7.05% was mixed. In elderly, the result of culture was 57.81% negative, 37.50% positive and 5.21% mixed of normal flora. The most common uropathogen isolated from urine culture was E. coli, which represent 93.55% of all pathogen that isolated from pediatric urine culture, 60.24% of all pathogen which isolated from adult urine culture and 45.83% of all pathogen that isolated from elderly urine culture (Table 1). Extended Spectrum Beta-Lactamases enzymes (ESBL) producing E. coli detected in 8.33, 4.82 and 3.23% of uropathogens isolated from elderly, adult and pediatric respectively. Other organisms, in elderly, were Enterobacter species (10.42%), Klebsiella species (10.42%), and Acinetobacter species (6.25%), and Pseudomonas aeruginosa (4.14%). Other organisms were caused UTIs in adult were Klebsiella species (10.42%) Pseudomonas aeruginosa (8.43%), and Streptococcus species (8.43%) (Table 1). The overall rate of resistance for 101 E. coli isolates analyzed was provided in Table 2. Of the agents tested nitrofurantoin, ciprofloxacin and augmentin were the lowest rates of resistance in three age categories. Nitrofurantoin was the lowest rate of resistance among three age categories representing (0, 2, 9%) followed by ciprofloxacin representing (6.90, 8, 27.27%), and augmentin representing (10.34, 10, 27.27%) in pediatric, adult and elderly.

Table 1: Distribution of bacteria that cause urinary tract infection according age groups

Bacteria	elderly		Adult		Pediatric	
	No.	%	No.	%	No.	%
E.coli	11	42%	25	60%	15	93%
Enerobacter spp.	4	12%	2	4%	0	0%
Kleibsella spp.	3	10%	4	8%	0	0%
ESBL	2	8%	2	4%	1	3.5%
Acinetobacter spp.	2	8%	1	2%	0	0%
Srteptococcus G B	1	4%	3	7%	0	0%
Pseudomonas auroginosa	1	4%	3	7%	0	0%
Candida Spp.	1	4%	1	4%	0	0%
Morganella morganii	1	4%	1	4%	0	0%
Proteus Merabills	1	4%	0	0%	1	3.5%

Table 2 A: Antimicrobial susceptibility result for E. coli urinary tract isolates in pediatric .

Antibiotic	Sensitive	Resistance
Ampicillin	3 (17.24%)	12 (82.76%)
Augmentin	13 (89.66%)	2(10.34%)
Co-trimoxazole	7 (48.28%)	8 (51.72%)
Ciprofloxacin	14(93.1%)	1 (3.44%)
Nitrofurantoin	15 (100%)	0 (0.00%)
Cefazolin	12 (86.21%)	2 (13.79%)

Table 2 B: Antimicrobial susceptibility result for E. coli urinary tract isolates in adults .

Antibiotic	Sensitive	Resistance
Ampicillin	11 (42%)	15 (58%)
Augmentin	23(90%)	3 (10%)
Co-trimoxazole	14 (58%)	10 (42%)
Ciprofloxacin	23 (92%)	2 (8%)
Nitrofurantoin	24 (98%)	1 (2%)
Cefazolin	22 (86%)	3 (14%)

Table 2 C: Antimicrobial susceptibility result for E. coli urinary tract isolates in elderly .

Antibiotic	Sensitive	Resistance
Ampicillin	4 (36.36%)	7 (63.64%)
Augmentin	8 (72.73%)	3 (27.27%)
Co-trimoxazole	4(40.91%)	7(59.09%)
Ciprofloxacin	8 (72.73%)	3(27.27%)
Nitrofurantoin	10 (90.91%)	1 (9.09%)
Cefazolin	8 (68.18%)	4 (31.82%)

DISCUSSION

Global spread of antibiotics resistance among uropathogens causing UTIs is alarming. This study reports the etiology of UTIs and antimicrobial susceptibility of uropathogens Alimmam Alsadiq hospital . Similar to previous studies that conducted in Babil, E. coli remains the majority of pathogen which isolated from urine culture in pediatric, adult, and elderly [11–14, 16], and other countries [17–19]. In this study, the resistance of E. coli to ampicillin wasmthe highest, followed by co-trimoxazole. The observed resistance pattern of E. coli to ampicillin and co-trimoxazole

are in agreement with the findings of previous studies carried out at different provinces of Babil

[11–13, 16]. Other study taken place in USA showed that that MDR E. coli exhibited 97.8% resistance to Ampicillin, 92.8% to trimethoprim–sulfamethoxazole, and 38.8% to ciprofloxacin [20]. In UK, high rates of resistance to ampicillin (55%) and trimethoprim (40%) were observed

in E. coli isolates [18]. These results suggest the prevalence of ampicillin and trimethoprim/sulfamethoxazole resistance among urinary tract isolates and are consistent with finding of our study. E. coli showed the highest sensitivity to nitrofurantoin in the current study, which are in line with those of previous studies in Babil [12, 14], and other countries [21, 22]. These data further support recommendations made in previous studies, in which, nitrofurantoin may be more effective than co-trimoxazole or amoxicillin in the empiric treatment of UTIs [21, 23]. The current data showed a high percentage of correlation between co-trimoxazole and ampicillin resistance among E. coli isolates (37.62%). Previous data from Canadian study revealed limited activity of ampicillin (79.6% resistance) against co-trimoxazole-resistant E. coli isolates from UTIs patients [24]. In the same study, the rates of co-trimoxazole resistance for ampicillin-resistant E. coli was (35.7% resistance) [24], corroborating finding of our study. In addition, high ciprofloxacin resistant (100%) was found among co-trimoxazole resistance isolates [24].This finding is contrary to current study results as there is no evidence of high prevalence in ciprofloxacin resistant among ampicillin and/or co-trimoxazole resistant E. coli isolates from UTIs.The current study found that 22.77% of E. coli isolates were MDR, which is higher than that observed in ED of previous study [25]. MDR prevalence was higher in E. coli

isolates resistant to augmentin, nitrofurantoin, followed by cefazolin and ciprofloxacin, then co-trimoxazole andampicillin. Despite the lowest rate of nitrofurantoin resistance (3%) when compared to other antibiotics used in the current study (only 3 of 101), these isolates were MDR. Similarly, 100% of isolates resistant to augmentin were also MDR However, in our study we described MDR phenotypes form ampicillin, co-trimoxazole, and ciprofloxacin but not for other antibiotics. Therefore, we cannot conclude the correction between MDR with specific antibiotic. According to patient age, the prevalence of resistance to ampicillin or co-trimoxazole was higher among isolates from patients ≤ 12 years and ≤ 2 years, respectively. This pattern seemed relatively consistent with findings of previous study which revealed higher level of resistance among isolates from patients ≤ 17 years old than among older patients [22]. For augmentin, cefazolin, ciprofloxacin, and nitrofurantoin, the prevalence of resistant isolates were higher among patients aged ≥ 65 years. This match results observed in earlier studies that found

ciprofloxacin resistance was highest among patients older than 65 years (7.1%) [22]. However, nitrofurantoin resistance pattern in our study is contrary to that

described by Sham et al. study, in which resistance prevalence of nitrofurantoin resistance was consistent irrespective of patient age [22]. The present study has some limitations. First, the study

was only conducted only in ED setting, which not representing other health care settings I KAMC. Thus, the findings cannot be generalized. Second, the study period was short (3 months) and small sample size. Third, there was no follow-up study to investigate the consequences of observed resistance. Therefore, large-scale prospective studies are recommended to determine the extent and outcomes of resistance and MDR in UTIs in Babil .

CONCLUSIONS

Increased resistance of urinary tract E. coli isolates to both ampicillin and co-trimoxazole was demonstrated, suggesting revaluation empirical therapies for the treatment of UTIs in ED setting. This continuous evolvement in antimicrobial resistance pattern necessitates national

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