Multi-drug resistant of *Escherichia coli* isolated from urinary tract infections

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Abstract

Urinary tract infection (UTI) is one of the commonest bacterial infections caused by microbial invasion of tissue lining the urinary tract. *Escherichia coli* (*E. coli*) is the primary etiologic agent of UTI, also antimicrobial resistance is an evolving and growing problem in UTI. The aim of this study is toaimed to determine the prevalence of antibiotic resistant of *E. coli* among outpatients with UTI in Mukalla city, Hadhramout-Yemen. Mid-stream urine specimens were collected, aseptically cultured, and the isolates were identified by using standard microbiological techniques. Antimicrobial susceptibility test was performed by disk diffusion method. Of the 295 urine samples, the total growth *E. coli* was 29 (78.38%) of the total positive samples (37). Of total antibiotics used, amoxicillin/clavulanic acid, cefotaxime and cefuroxime sodium showed the highest resistance to *E. coli* with 82.76%, 72.41% and 65.52% respectively, while75.86% of the isolates were susceptible to co-trimoxazole. The study revealed that high resistant and multi-resistant of the urinary *E. coli* isolates to antibiotics. Co-trimoxazole was the most effective antibiotic on *E. coli* isolates in this study.

Key words: UTI, *E. coli*, Antimicrobial susceptibility, Outpatients**.**

Introduction

Urinary tract infection (UTI) is one of the commonest domiciliary and nosocomial bacterial infections caused by microbial invasion of tissue lining the urinary tract. It refers to the presence of significant bacteruria and pyurea in the midstream sample of urine [18].*Escherichia coli* (*E. coli*) being the primary etiologic agent, causing UTI among both inpatients and outpatients[10,11], is also accounted for approximately 90% of first UTI in young women, the symptoms and signs include urinary frequency, dysuria, hematuria, and pyuria; none of these symptoms and signs are is specific for *E. coli* infections [8].Antimicrobial resistance is an evolving and growing problem in UTI. Of more concern is the increasing incidence of infections caused by strains of *E. coli* that are resistant to commonly used antimicrobial agents, especially to trimethoprim, sulphamethoxazole and beta-lactam antibiotics [21]. The extensive and inappropriate use of antimicrobial agents has invariably resulted in the development of bacterial resistance which has become a major problem, therefore it is necessary for continuous surveillance of antimicrobial resistance among these organisms. The aim of this study is to determine the prevalence of *E. coli* and to assess the level of drug resistance in outpatients with UTI in Mukalla city, Hadhramout - Yemen.

Materials and methods

A total of 295 of midstream urine were obtained from outpatients in Mukalla city in a period from January to July 2014. The samples were collected into sterile plastic disposable bottles, then inoculated by calibrated loop capable of delivering 0.001 ml of urine on MacConkey agar (Oxoid) which were incubated aerobically at 37°C for 24 hours. The number and types of colonies grown on the medium was recorded as being insignificant when samples gave a colony count of less than 10^4 CFU ml, while samples with colony count equal to or greater than approximately 10^5 CFU ml of the urine samples were considered to have significant bacteruria[6]. Bacterial isolates were identified by conventional diagnostic methods, and antibiotic susceptibility test carried out using disc diffusion method on Mueller-Hinton agar (Oxoid) that has been performed by Clinical

Laboratory Standards Institute (CLSI). The antibiotic discs used were cefuroxime sodium (30µg), cefotaxime (30µg), amoxicillin/clavulanic acid (30µg), ciprofloxacin (5µg), amikacin (30µg), lincomycin (15µg) and co-trimoxazole (25µg). A suspension of tested organism was adjusted against 0.5 MacFarland standard turbidity and inoculated into media, then incubated at 35-37 °C for 16-18 hours and examined for evidence ofgrowth.Interpretation as 'sensitive', 'moderate sensitive' or 'resistant' was done on the basis of the diameters of zones of inhibition of bacterial growth as recommended by the disc manufacturer (Oxoid).

Results and discussion

Of the 295 samples of urine examined, 37(12.54%) showed significant bacteruria; 26 (8.81%) had insignificant bacteruria, while 232 (78.65%) had no growth (Table 1).*E. coli* was the most common bacterial isolated from the tested individuals with a frequency of occurrence at 29 (78.38%), Table (2).Similar findings regarding the frequency of urinary *E. coli* infection have been observed by other researchers carried out in the European countries and North American[19], Lahore[17], Saudi Arabia[23] andIndia[29]. Another study reported that the most prevalent organism isolated from urine was *E. coli* 86.02% in Nepal [31], 52% in Tikrit, Iraq [12]and 73.0% in Poland [15].
The results of antimicrobial sensitivity test revealed that the most resistance rates of *E. coli* are as follows: 82.76% to amoxicillin/clavulanic acid, 72.41% to cefotaxime, 65.52% to cefuroxime sodium, 41.38% to amikacin and lincomycin, (Table 3).This pattern of resistance is comparable to a study carried out locally in which *E. coli* showed a high resistance against quinolones with 84.6% and penicillin 78.8% [2]as well as other studies carried out abroadtuch as in Bosnia[20], Saudi Arabia[22], Palestine[9] and Nigeria[7].

Regarding to multi-resistant of antimicrobial agents, the organism is considered as multi-resistant if it is resistant to three or more antimicrobials [30]. In this study, susceptibility test showed that the multi-resistance rate among the isolates of *E. coli* was observed (table 3). These results approximately agreed with those studies that showed a significant of high level multi-resistance of antibiotics to *E. coli*in several studies in Spain 20.6% [26], the USA 7.1% [27] and Jordan 59.9% [3].We suggest the high level of resistance *of E. coli* due to easy purchase antibiotics without prescription, not restricted with time and dose of antibiotic, culture and sensitivity test neglected and the empirical treatment dependently.

From this study, it can be seen that co-trimoxazole, followed by ciprofloxacin, were virtually used against urinary *E. coli* as they were effective against 75.86% and 37.93% of all the isolates respectively, whileamikacin and lincomycin were slightly better and showed moderate activity against 51.72% of isolates (Table 3).These results were approximately agreed with those in a study that showed the percentages of sensitivity of urinary *E. coli* isolates to co-trimoxazole and ciprofloxacin were 62.1% and 47.1% respectively[5], other studies showed that the overall susceptibilities of *E. coli* was 58% for ciprofloxacin[25]. Other studyshowed decreased the percentages of sensitivity of *E. coli* to ciprofloxacin 43% and to co-trimoxazole 13% [28].A study carried out in Pakistan it was observed that 16.6% of total tested urinary *E. coli* isolates were sensitive to ciprofloxacin and 13.95% to co-trimoxazole[13], while other studies showed increaseof the percentages of sensitivity of *E. coli* to ciprofloxacin and co-trimoxazole, suchas in Spain, the sensitivity to co-trimoxazole and ciprofloxacin was found at rates of 67.4% and 80.7% respectively [26]. A study carried out in Hong Kong revealed that ciprofloxacin sensitivitywas77.9% and co-trimoxazolewas66% of *E. coli* isolates[14].Other studies documented that 63% sensitivity of *E. coli* isolates to ciprofloxacin[24]. A study carried out in India showed that more than 70% were sensitive to ciprofloxacin [29].Other studies revealed that high sensitivity rates of *E. coli* strains were observed to ciprofloxacin (85.5%)in Jordan [4]. In another study, ciprofloxacin at the rate of 90.4% was considered as the most active agent against *E. coli* isolates[1].

In our results, amikacin showed moderate sensitivity against*E. coli* isolates (51.72%), other studies documented that sensitivity of *E. coli* isolates to amikacin was 88% [24]. A study carried out in India showed that more than 80% of the *E. coli* isolates were sensitive to amikacin[29]. Where as other studies revealed that high sensitivity rates for amikacin 100% were observed in Jordan[4]. In

another study, amikacinwas the most active agent against *E. coli* isolates (82.9%)[1].Also, high sensitivity of *E. coli* to amikacin was observed in Baghdad Hospital, Iraq (94%)[16].

Conclusion

This study revealed high level resistance of the urinary *E. coli* isolates as the problem of resistance and multi-resistance in outpatients UTI. According to our results, co-trimoxazoleis the most effective antibiotic against*E. coli* isolates.

Table 1. Number of urine samples examined during study period

	No.	%
Positive samples (with significant bacteruria)	37	12.54
Negative samples (samples non-significant bacteruria)	26	8.81
Number of samples with no growth	232	78.65
Total	295	100.00

Table 2. *Escherichia coli*isolated from urine samples

Isolates	No.	%
Escherichia coli	29	78.38
Others	8	21.62
Total	37	100.0

Table 3. Antibiotic susceptibility patterns of *Escherichia coli*isolates

Antibiotic	Sensitive (%)	Moderate (%)	Resistant (%)
Cefuroxime sodium	3(10.34)	7(24.14)	19(65.52)
Cefotaxime	2(6.90)	6(20.69)	21(72.41)
Amoxicillin/clavulanic acid	2(6.90)	3(10.34)	24(82.76)
Ciprofloxacin	11(37.93)	11(37.93)	7(24.14)
Amikacin	2(6.90)	15(51.72)	12(41.38)
Lincomycin	2(6.90)	15(51.72)	12(41.38)
Co-trimoxazole	22(75.86)	3(10.34)	4(13.80)

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المقاومة المتعددة لجراثيم الايشريكية القولونية المعزولة من عدوى المسالك البولية

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الملخص

يُعد التهاب المسالك البولية أحد العدوى الجرثومية الشائعة المتسببة باختراق الميكروبات للطبقات المبطنة للجهاز البولي. وتُعد جراثيم الايشريكية القولونية المسبب الأساسي لالتهابات المسالك البولية وبعد ظهور سلالات لهذه الجراثيم مقاومة للمضادات الحيوية مشكلة متنامية في التهابات المسالك البولية. هدفت هذه الدراسة لتحديد انتشار العدوى بجراثيم الايشريكية القولونية وحساسيتها للمضادات الحيوية في مرضى العيادات الخارجية في مدينة المكلا ، حضرموت – اليمن. جمعت عينات البول من منتصف السبيل بطريقة معقمة ثم زرعت على الأوساط الزراعية وتم التعرف على العزلات الجرثومية بتقنيات التشخيص الجرثومية في المختبر وتم إجراء فحص الحساسية للمضادات الحيوية بطريقة الانتشار من الأقراص. بلغ عدد جراثيم الايشريكية القولونية المعزولة 29 (78,38%) من إجمالي 295 عينة، ومن إجمالي المضادات الحيوية المستخدمة في الدراسة تبين أن جراثيم الايشريكية القولونية كانت مقاومة للمضادات الحيوية أموكسيسيللين/حمض الكلافيولينك وسيفوتاكسيم وسيفيوروكسيم الصوديوم 38,33%، 77,78%، 66,67%على التوالي، في حين بلغت حساسية العزلات الجرثومية للمضاد الحيوي كوترايموكسازول 77,78%. يستنتج من هذه الدراسة وجود مقاومة عالية ومقاومة متعددة للمضادات الحيوية بشكل شائع لعزلات الايشريكية القولونية البولية، وأنَّ المضاد الحيوي كوترايموكسازول هو الأكثر فعالية على هذه العزلات في هذه الدراسة.

الكلمات المفتاحية: التهابات المسالك البولية، جراثيم الايشريكية القولونية، حساسية المضادات الحيوية، مرضى العيادات الخارجية.