Antimicrobial Resistant Pattern of *Escherichia coli* Strains Isolated from Pediatric Patients in Jordan

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Received: 31 May 2010; Received in revised form: 7 Jul. 2010; Accepted: 19 Jul. 2010

Abstract- The present study was conducted to investigate antimicrobial resistant pattern of *Escherichia coli (E. coli)* strains isolated from clinical specimens of Jordanian pediatric patients during the period from January to December 2008. A total of 444 *E. coli* strains were isolated from clinical specimens and tested for their susceptibility to different antimicrobial drugs. Overall, high resistance rate was observed for ampicillin (84%), followed by amoxicillin-clavulanic acid (74.3%), cotrimoxazole (71%), nalidixic acid (47.3%), cephalothin (41%). Lower resistance rates were observed for amikacin (0%) followed by Cefotaxime (11%), Ceftriaxone (11.7%), ciprofloxacin (14.5%), Norfloxacin (16.5%), gentamicin (17.3%) cephalexin (20.9%), Ceftazidime (22.5%), cefixime (29.6%), and cefaclor (32.8%). Ampicillin, amoxicillin-clavulanic acid and cotrimoxazole were found to be ineffective at *in vitro* inhibition of the *E. coli* of pediatric origin. Amikacin was highly effective for *E. coli* with susceptibility rate of 100%. The majority of *E. coli* strains were susceptible to third generation cephalosporins and fluoroquinolones.

Acta Medica Iranica 2011; 49(5): 293-295.

Keywords: Antimicrobial resistant; Escherichia coli; Pediatric patients

Introduction

Antimicrobial resistance has become a serious public health problem worldwide. Infections caused by resistant bacteria have been shown to be more frequently associated with increased morbidity and mortality than those caused by susceptible pathogens (1,2). In areas of concentrated use, such as hospitals, this had led to prolonged hospital stays, increased health care costs and in extreme cases, to untreatable infections (3).

The main cause of nosocomial infections in humans is *Escherichia coli* (*E. coli*). It is also a common inhabitant of the human and animal gut and is considered an indicator of fecal contamination in food. *E. coli* is one of the organisms most frequently isolated from different clinical cases of diarrhea (4,5). Several factors results in increasing antimicrobial drug resistance rates in poor countries such as irrational antimicrobial drug usage and conditions of poor sanitation (4-6). Many studies have demonstrated increases in antimicrobial resistance among pathogenic bacteria after introduction of an antimicrobial (7,8). Despite world-wide use of antibiotics, the distribution of the resistance is far from being uniform even in the same area (9). However, there is little information on antimicrobial resistance pattern in Jordan. Therefore, this retrospective study was conducted to determine the rate of resistance to antibiotics by *E. coli* strains isolated from cultures of different clinical specimens received from pediatric patients at Princess Rahmah Hospital during a period of one year, 2008.

Materials and Methods

The study protocol was approved by the Ethics Committee of the ministry of health in Jordan (MOH, REC, 08, 0057).

This study was carried out in the diagnostic Medical Microbiology Laboratory of Princess Rahmah Hospital located in Irbid, Jordan, between January and December 2008. A total of 444 bacterial isolates were identified from different clinical specimens using standard bacteriological methods. These clinical specimens included urine, blood and conjunctival swabs. Microbiological and antibacterial susceptibility data of this study obtained from records of diagnostic Medical Microbiology Laboratory of Princess Rahmah Hospital. These data were filled in a prepared data sheet.

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Table 1. Distribution of isolates in clinical specimens

Clinical specimen	Male	Female	Total (%)
Urine	62	373	435 (98.0)
Blood	5	2	7 (1.5)
Eye swab	2	0	2 (0.5)
Among all Specimens	69 (15.5%)	375 (84.5%)	444 (100)

The antimicrobial susceptibility patterns of these isolates to antibiotics were determined using the Kirby-Bauer method of disc diffusion test **(**10**).** The isolates were tested against the following antibiotics; amikacin, amoxicillin-clavulanic acid, ampicillin, cefaclor, cefixime, cefotaxime, ceftazidime, ceftriaxone, cephalothin, cephalexin, ciprofloxacin, cotrimoxazole, gentamicin, nalidixic acid and norfloxacin.

Statistical analysis

Data were analyzed using SPSS (version 15 for Windows) to calculate the frequencies and cross tables.

Results

During 12 months period (January to December 2008), a total of 444 positive *E. coli* cultures of pediatric patients aged below 15 years old were studied. The distribution of *E. coli* strains from various clinical specimens was 375 (84.5%) female and 69 (15.5%) male (Table 1).

Overall, high resistance rate was observed for ampicillin (84%), followed by amoxicillin-clavulanic acid (74.3%), cotrimoxazole (71%), nalidixic acid (47.3%), cephalothin (41%). Lower resistance rates were observed for amikacin (0%) followed by Cefotaxime (11%), Ceftriaxone (11.7%), ciprofloxacin (14.5%), Norfloxacin (16.5%), gentamicin (17.3%) cephalexin (20.9%), Ceftazidime (22.5%), cefixime (29.6%), and cefaclor (32.8%) (Table 2).

Table 2. Resistance percentage (%) of *E. coli* isolates to antimicrobial agents

Drug	*E. coli* isolates n= 444	
	Tested isolates	R %
Amikacin	29	0
Amoxicillin-clavulanic acid	347	74.3
Ampicillin	339	84.0
Cefaclor	381	32.8
Cefixime	182	29.6
Cefotaxime	379	11.0
Ceftazidime	120	22.5
Ceftriaxone	17	11.7
Cephalothin	195	41.0
Cephalexin	305	20.9
Ciprofloxacin	405	14.5
Cotrimoxazole	370	71.0
Gentamicin	357	17.3
Nalidixic acid	401	47.3
Norfloxacin	411	16.5

Discussion

The present study provides information regarding the distribution of pathogenic *E. coli* isolates and its antimicrobial susceptibility patterns in pediatric patients. Most *E. coli* strains isolated from urine samples of females (84%). This is likely related to contamination with colonic bacteria through urethra in female (11).

Results of this study showed high resistance rate of *E. coli* to antimicrobial agents tested. Similar findings regarding high potentials for developing resistance for pathogenic isolates of *E. coli* were reported (12).

High resistance rate to ampicillin, amoxicillin-clavulanic acid and cotrimoxazole was obtained. These results coincide with results reported high resistance rate of *E. coli* isolates to ampicillin and amoxicillin in Jordan (13) and elsewhere (14,15). This high resistance rate may be due to the widespread and prolonged use of these antibacterial drugs in the world including Jordan.

E. coli remained to be relatively susceptible to third generation cephalosporins but exhibited moderate resistance rates to the first and second generations of cephalosporins. For example, Low resistance rates to cefotaxime (11.0%), ceftriaxone (11.7%), ceftazidime (22.5) and Cefixime (29.6) were observed in this study, which is similar to other findings reported in Jordan (13) and elsewhere (14). However, high resistant rates of *E. coli* to third generation cephalosporins were reported in different studies (16,17). Oral use of cefixime may results in increased its resistant rate compared to injectable third generation cephalosporins. *E. coli* in present study shows low resistant rate to fluoroquinolones i.e. ciprofloxacin and norfloxacin of 14.5% and 16.5% respectively. Similar finding were reported in Jordan (13). However, high resistant rates of *E. coli* to fluoroquinolones were reported in some studies (16,17)

Over all antibacterial tested in this study, amikacin was the most active agent against *E. coli* with susceptibility rate of 100%. Relatively higher resistant rates (30 and 31%) of *E. coli* to amikacin were reported

in literature (14,18). There are many possible reasons for increasing resistant rate of *E. coli* to common used antimicrobial drugs, including inappropriate and incorrect administration of antimicrobial agents in empiric therapies and lack of appropriate infection control strategies (19,20). This problem indicates importance of performing antibiotic susceptibility testing before blind antibiotic therapy.

The data suggest that ampicillin, amoxicillin-clavulanic acid and cotrimoxazole should not be used in treating infections caused by pathogenic *E. coli* and other related bacteria in Jordan. These findings also reinforce the need for ongoing investigation to show trends in antibiotic resistance, which can help clinicians provide safe and effective empiric therapies. Moreover, the data would also help authorities to formulate antibacterial prescription policies.

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