E-test antibiotic susceptibility of *E.coli* strains isolated from hospital acquired infections of Imam Khomeini hospital, Ilam, Iran

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Abstract

Introduction: *Escherichia coli* (*E.coli)* as a main cause of both nosocomial and community-acquired infections in humans have a relative potential to develop resistance. Nowadays, most infections caused by ESBL-producing *E.coli* (ESBLEC) had mostly been described as nosocomial acquired or nursing home related. In this study, we employed E-test assay to detect antibiotic resistance of *E.coli* strains and determine MIC of antibiotics.
Materials and methods: Thirty *E.coli* strains gathered from Imam Khomeini hospital of Ilam, and cultured on TSB and bacterial suspension prepared by 0.5 µF concentration for E-test. Mueller Hinton agar and E-test strips of *Amikacin, Cefepime, Ceftazidime, Ceftriaxone, Gentamicin, Meropenem, Nitrofurantoin, Piperacillin/Tazobactam, Tetracycline, Ticarcillin/ Clavulanic acid, Tobramycin, Trimethoprim* were used
Results: Resistance to *Ceftriaxone, Tobramycin, Gentamicin, Ticarcillin/ Clavulanic, Amikacin were* 19.8%, 26.4%, 23.3%, 62.7%, 70.3%, respectively.
Conclusion: the results indicated, *E.coli* strains in this study were high sensitivity to *Meropenem ,Nitrofuratoin, Ciprofloxacin , Ceftazidime, Cefepime.*

Keywords: E-test, Antibiotic susceptibility, E.coli, Ilam, Iran

Introduction

Escherichia coli (E.coli) as main cause of both nosocomial and community-acquired infections in humans have a relatively large potential for developing resistance (1, 2). Urinary tract infection (UTI) is a common cause of morbidity in women (3). Majority of cases involve only the lower urinary tract, and the most common pathogen is *E.coli* (4). UTI result in approximately 8 million physician visits and more than 100,000 hospital admissions per year in the United States (5).

Nowadays, most infections caused by ESBL-producing *E.coli* (ESBLEC) had mostly been described as nosocomial acquired (6) or nursing home related (7). In this study, we recruited E-test assay to detect antibiotic resistance of *E.coli* strains and determine MIC of antibiotics.

Materials and methods

Sampling: The urine cultures of patients with urinary tract infections in Imam Khomeini hospital of Ilam were selected. Thirty E.coli

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isolates after determined by biochemical standard tests were used.

Antibiotic susceptibility testing by E.test strip: Antibiogram was performed by Kirby-Bauer disk diffusion method using Clinical Laboratory Standard Institute (CLSI) criteria. E.coli isolates was cultured on Muller Hinton broth and bacterial suspension prepared by 0.5 µF concentration for E-test. Suspension of bacteria were cultured on Mueller Hinton agar by swab and E-test strip of amikacin, amoxicillin, cefepime, ceftazidime, ceftriaxone, gentamicin, meropenem, nitrofurantoin, piperacillin/tazobactam, tetracycline, ticarcillin/clavulanic acid, tobramycin, sulfamethaxazole-trimethoprim were used (Table 1).

Results

Table 1 shows the MIC of recruited antibiotics in this study and Table 2 shows result of MIC for isolated strains.

Table 3 indicated 4(13.33%) strains were resistance, 8(26.66%) strains were intermediate and other strains were susceptible for TX. 3(10%) of strains were resistance, 13(43.33%) were intermediate and other were susceptible for TM .

2(6.66%) were resistance to MP. 4(13.33%) were resistance, 10 (33.33%) were intermediate to TZ but other strains shown susceptibility pattern. 3(10%) strains were resistance to GM. All of strains shown susceptibility toVA and LZ.

Table 1. Utilized antibiotics in this study.

ANTIBIOTIC µg/ml	Code	S≤	I	R≥	Quality Control		µg/ml
amikacin 0.016-256	AK	16	32	64	E.coli	ATCC25922	1.4
cefepime 0.002-32 or 0.016-256	PM	8	16	32	E.coli	ATCC25922	0.016-0.064
ceftazidime 0.016-256	TZ	8 2	16 -	32 -	E.coli P.aeruginosa H.influenzae	ATCC25922 ATCC27853 ATCC49247	0.064-0.5 0.5-2 0.125-1
ceftriaxone 0.002-32 or 0.016-256	TX	8	16-32	64	E.coli	ATCC25922	0.032-0.125
gentamicin 0.016-256	GM	4	8	16	E.coli	ATCC25922	0.25-1
meropenem 0.002-32	MP	4	8	16	E.coli	ATCC25922	0.008-0.64
nitrofurantoin 0.032-512	NI	32	64	128	*E.coli*	ATCC25922	4-16
piperacillin/ tazobactam 0.016-256	PTC	16	32-16	128	*E.coli*	ATCC25922	1-4
tetracycline 0.016-256	TC	2	4	8	*E.coli*	ATCC25922	0.5-2
ticarcillin/ clavulanic acid 0.016-256	TLC	16	32-16	128	*E.coli*	ATCC25922	2-8
tobramycin 0.016-256or0.064-1024	TM	4	8	16	*E.coli*	ATCC25922	0.125-1
trimethoprim 0. 002-32	TS	2	-	4	*E.coli*	ATCC25922	0.064-0.25

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Table 2. MIC results for *E.coli* strains by E-test (µg/ml).

Antibiotic / Strain	*GM*	*TM*	*AK*	*TC*	*PTC*	*CI*	*TS*	*TLC*	*PM*	*NI*	*TX*	*AC*	*MP*	*TZ*
1	0.125	0.19	1	256	2	32	0.25	256	0.5	0.19	0.016	256	0.064	0.125
2	0.096	0.096	32	256	2	32	1	256	0.25	0.094	0.016	256	0.032	0.125
3	0.125	0.5	0.75	2	1	6	0.064	1.5	0.125	0.75	0.032	2	0.023	0.094
4	0.064	16	1	256	1.5	32	0.064	256	256	256	256	256	0.032	256
5	0.25	0.25	1	256	4	32	32	256	0.19	0.125	0.25	256	.25	0.25
6	8	4	0.25	256	1	32	32	256	0.047	0.125	0.5	256	0.016	0.094
7	0.5	0.19	0.25	2	1	8	0.19	8	0.023	8	0.125	4	0.016	0.094
8	0.5	0.19	1	256	0.75	32	32	256	1	256	2	256	0.094	2
9	0.25	0.25	1	256	0.75	32	0.125	256	0.094	4	256	64	0.012	0.094
10	0.25	0.19	1.5	256	2	32	1	4	0.094	8	0.19	96	0.032	256
11	96	32	2	8	1	24	0.25	2	0.094	1	1	4	0.125	0.125
12	16	12	1.5	256	4	32	0.5	256	3	2	8	256	0.016	8
13	0.125	1.5	1.5	256	1	32	32	256	2	8	4	256	0.064	8
14	0.064	0.032	1.5	256	256	32	0.5	256	0.032	64	256	256	0.094	2
15	192	64	2	256	8	32	0.25	32	256	24	256	16	0.047	16
16	0.38	0.25	0.064	6	4	6	0.19	8	0.125	8	1	256	0.023	0.5
17	0.25	0.19	0.047	256	1	32	0.064	6	0.125	16	0.125	4	0.012	0.25
18	24	12	1.5	256	16	32	0.25	32	4	8	8	64	0.094	8
19	0.125	0.25	0.25	2	4	32	0.19	256	0.125	0.5	256	12	0.012	0.5
20	0.19	0.19	0.19	256	4	32	1	256	0.125	16	0.125	64	0.023	4
21	0.125	1.5	1.5	256	4	32	0.094	256	0.032	16	0.032	256	0.023	48
22	96	64	32	256	1	32	0.19	12	1	16	1.5	4	0.047	0.125
23	0.064	0.064	2	1.5	1	32	0.125	256	256	8	256	256	0.023	0.125
24	2	2	6	256	24	32	0.5	256	0.032	4	0.032	256	0.032	8
25	48	48	1.5	1	24	1	0.064	256	4	2	12	256	0.094	8
26	48	32	6	256	8	32	0.125	256	1	4	1	256	0.047	1
27	1	1	1.5	4	2	4	0.064	256	32	32	0.032	256	0.032	0.032
28	0.094	0.25	0.25	256	2	32	0.25	256	2	2	4	256	0.016	1
29	0.19	0.25	1.5	256	0.75	32	31	3	0.064	1	0.25	64	0.016	0.094
30	0.064	0.024	1	1.5		2	1	8	0.023	0.25	0.75	256	0.023	0.064
Mean	18.57	3.45	9.77	180.13	13.16	26.23	5.60	164.95	27.33	25.53	52.57	166.86	0.047	20.88

AK; amikacin, AM; amoxicillin, PM; cefepime, TZ; ceftazidime, TX; ceftriaxone, GM; gentamicin, MP: meropenem ,NI; nitrofurantoin, PCT; piperacillin/tazobactam,TC; tetracycline, TLC; ticarcillin/clavulanic acid, TM; tobramycin, SXT; sulfamethaxazole-trimethoprim, CI; ciprofloxacin, AC; ampcillin/cloxacillin.

Table 3. Antibiogram result of *E.coli* strains.

Antibiotic	S	I	R
Ceftriaxone	70.2	-	19.8
Tobramycin	72.6	-	26.4
Meropenem	100	-	-
Ceftazidime	93.4	-	6.6
Gentamicin	73.3	3.3	23.3
Ticarcillin/Clavulanic acid	29.7	6.6	62.7
Nitrofurantoin	90.1	3.3	6.6
Trimethoprim	83.5	-	16.5
Piperacillin/Tazobactam	90.1	6.6	3.3
Amikacin	23.1	6.6	70.3
Tetracycline	83.3	-	16.6
Ciprofloxacin	20	3.3	76.6
Cefepime	90.1	-	9.9
Ampcillin/Cloxacillin	3.3	13.3	83.3

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Discussion

Nowadays, around the world there is increasing antibiotic resistance among bacterial infection, especially in hospital wards such as ICU therefore antibiotic resistance pattern determine as main issue is considered to treat infection. In this cross-sectional study, 30 strains of *E.coli* isolated from Ilam hospitals. Our results indicated *E.coli* is resistance to *Amoxicillin*, *Tetracycline* by 82.5% and 62.7% in row. Also, *E.coli* shown susceptibility to *Meropenem*, *Ceftazidime*, *Cefepime*, *Nitrofurantoin*, and *Piperacillin* by 100%, 93.4%, and 90.1%, respectively.
Most susceptibility was to *Meropenem*, *Ceftazidime*, *Cefepime*, *Nitrofurantoin* and *Piperacillin* and lower susceptibility were to *Amoxicillin* and *Tetracycline* .
Azar Hadadi and colleague study result confirm our results and shown *E.coli* susceptibility to Imipenem, *Ceftriaxone* and *Ceftazidime* were 91%, 21% and 21% (8).
Zohre Torabi study on isolated *E.coli* form UTI indicated among 118 *E.coli* resistance to *Ampicillin* and *Cefexime* were 86.2% and 73.6% in row. In this study *Ciprofloxacin* was most effective antibiotic in all wards of hospital to eliminate Urinary Tract Infection. *Nitrofurantoin, Ceftriaxone* and *Amikacin* by 51.9%, 44.4% and 8.4% resistance were in followed row (9).

Conclusion

Regarding to microbial resistance increasing in hospitals, there is need to collaboration between committee of antibiotic prescribe and infection control committee. To achieve this result, there is need to establish surveillance system in hospital that study microorganism prevalence and their resistance pattern in hospitals.

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