Antimicrobial Resistance of *Escherichia coli* Isolated from urine in Thailand from 2000 to 2005

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Objective: *To study the trends of antimicrobial resistance of Escherichia coli in Thailand during 2000 and 2005.*
Material and Method: *All isolates of E. coli from 28 hospitals across Thailand from 2000 to 2005 were tested for their susceptibility to aminoglycosides, beta-lactams, fluoroquinolones, and trimethoprim-sulfamethoxazole by the disk diffusion method (Kirby Bauer). The relevant data were collected and analyzed by the WHONET software program supported by the World Health Organization.*
Results: *The rate of resistance to ampicillin, ceftriaxone, ceftazidime gentamicin, and ciprofloxacin increased from 79.3% to 85.3%, 12.7% to 28.5%, 10.7% to 15.2%, 25% to 32.9%, and 45.1% to 51% during the 6-year period from 2000 to 2005 among isolates from catheterized urine, respectively. The rate of resistance to gentamicin and ceftriaxone increased from 23.2% to 28.9% and 6.8% to 24.2%, from 2000 to 2005 respectively among isolates in non-intensive care units (non-ICUs). The rate of resistance to gentamicin increased from 18% to 26.1%, and 24.2% to 29.6% among isolates in out-patient department (OPD) and non-OPD, respectively. The rate of resistance to ceftriaxone increased from 2.5% to 15.4%, and 7.9% to 25.9% among isolates in OPD and non-OPD, respectively. The rate of resistance to gentamicin and ceftriaxone increased from 23.2% to 28.9%, and 6.8% to 24.2% among isolates in non-ICU, respectively. The rate of resistance to trimethoprim-sulfamethoxazole decreased from 71.2% to 62.6% among isolates in non-ICUs. Isolates from catheterized urine were significantly associated with imipenem resistance (p >0 .05).*
Conclusion: *The present study shows a significant correlation between ciprofloxacin resistance and fluoroquinolone use, and indicates that prior fluoroquinolone use seems to be the most important risk factor for ciprofloxacin-resistant E. coli bacteremia. Isolates from catheterized urine were significantly associated with resistance to imipenem, and the ICU hospitalization and OPD attention during the previous year were significantly associated with ofloxacin resistant E. coli.*

Keywords: *Anti-bacterial agents, Ciprofloxacin, Drug resistance, Microbial, Escherichia coli, Fluoroquinolones, Microbial sensitivity tests, Thailand, Urinary tract infections*

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Escherichia coli is the most common cause of community-and hospital-acquired urinary tract infection. It results in significant morbidity and mortality, especially in patients with diabetes. Antimicrobial is the main stay of treatment. The most commonly used antimicrobials are aminoglycosides, beta-lactams, and fluoroquinolones. Since certain classes of antimicrobials are widely used in Thailand for the treatment of community-acquired infections in humans and animals, therefore, their inappropriate use may result in an increase in resistance. The resistance may

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result in a failure to treatment with those antibiotics. Therapeutic options have become somewhat limited because of the emergence of organisms carrying extended-spectrum beta-lactamases (ESBLs) and plasmid-mediated AmpC beta-lactamases. Therefore, the present study aimed to explore the resistance trends of *E. coli* in urinary tract to the commonly used antimicrobials for the treatment of urinary tract infections in Thailand.

Material and Method

Data collection

National Antimicrobial Resistant Surveillance Thailand (NARST) has been organized since 1998 and uses the WHONET software program supported by the World Health Organization (WHO) to investigate, surveillance, and improve the standards of microbiology laboratory in Thailand. All data were collected and managed by using this software.

There were 28 hospitals which participated in the surveillance system, 9 small hospitals (less than 500 beds) and 19 large hospitals (equal or more than 500 beds). All the data were sent to NARST located at the Department of Medical Science, Ministry of Public Health, Thailand. The data were entered at the hospitals by using the WHONET software program and were sent to the NARST at the Department of Medical Science every 3 months.

Microbiology

Isolation and identification of *E. coli* were performed according to Farmer[1] and Bopp[2]. At each hospital laboratory, the susceptibility of the isolates was done using standard disk diffusion methods as recommended by the Clinical Laboratory Standards Institute (CLSI) [formerly National Committee for Clinical Laboratory Standards (NCCLS)].

Statistical analysis

Bivariable analysis was conducted to determine the difference between *E. coli* obtained from catheterized and non-catheterized urine, intensive care unit (ICU) and non-ICU, out-patient department (OPD) and non-OPD, respectively. Categorical variables were compared by means of either 2 by 2 analysis or Fisher's exact test, when needed. An odds ratio (OR) and 95% confidence interval (CI) were calculated to evaluate the strength of any association. Continuous variables were compared by use of Student's t-test or the Wilcoxon rank sum test, depending on the validity of the normality assumption.

A 2-tailed p-value of less than or equal to 0.05 was considered significant. All data were analyzed by using a statistical software package (SPSS for Window version 7, License for Department of Medical Sciences, Ministry of Public Heath).

Results

Isolates

A total of 158,352 *E. coli* strains were isolated from the urine from 2000 to 2005. The overall resistance rates of urinary *E. coli* isolates in 2005 to ampicillin, ceftriaxone, ceftazidime, imipenem, cefoperazone-sulbactam, gentamicin, amikacin, ofloxacin, ciprofloxacin, and trimethoprim-sulfamethoxazole, were 81.3%, 3.4%, 3.4%, 0.1%, 44.3%, 27.4%, 11.3%, 44.1%, 19.8%, and 62.2%, respectively (Fig. 1).

Antimicrobial susceptibility test

The resistance rate of *E. coli* (to ampicillin, ceftriaxone, ceftazidime, imipenem, cefoperazone-sulbactam, gentamicin, amikacin, ofloxacin, ciprofloxacin, and trimethoprim-sulfamethoxazole) isolated from catheterized and non-catheterized urine, patients in ICU, non-ICU, OPD, and non-OPD from 2000 to 2005 are shown in Table 1-6.

Catheterized urine and non-catheterized urine

Ampicillin, ceftriaxone, ceftazidime, gentamicin, and ciprofloxacin resistance rates showed a rising trend in both catheterized urine and non-catheterized urine. The rate of resistance among isolates obtained from

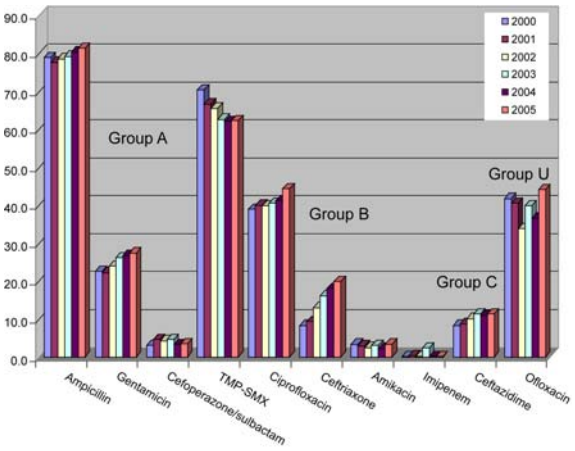

Fig. 1 Rates of antimicrobial resistance of *Escherichia coli* isolates from urine isolates from 2000 to 2005 in Thailand

Table 1. Rates of antimicrobial resistance of *Escherichia coli* isolates from catheterized urine from 2000 to 2005 in Thailand

Year	Ampicillin		Ceftriaxone		Ceftazidime		Imipenem		Cefoperazone/ sulbactam		Gentamicin		Amikacin		Ofloxacin		Ciprofloxacin		TMP-SMX	
	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)
2000	1,319	79.3	551	12.7	1,002	10.7	629	0.3	629	5.7	1,318	25.0	1,202	2.4	39	59.0	742	45.1	1,125	70.2
2001	1,747	79.5	574	12.4	1,386	13.3	758	0.3	698	7.4	1,748	26.1	1,002	1.6	206	56.8	792	47.5	1,540	68.7
2002	1,417	82.1	792	21.7	1,051	14.0	766	0.3	682	9.1	1,418	30.1	1,099	2.2	39	56.4	651	47.5	1,242	67.0
2003	2,013	83.0	1,014	22.9	1,746	16.2	1,293	10.5	1,160	7.2	2,043	33.4	1,951	3.8	290	49.0	954	49.7	1,750	66.2
2004	2,258	84.0	1,222	24.1	2,214	14.4	1,787	0.1	1,201	4.2	2,489	33.1	2,315	2.7	1,147	36.1	1,468	47.1	2,310	64.8
2005	2,320	85.3	1,111	28.5	2,041	15.2	1,876	0.1	1,513	3.9	2,314	32.9	2,216	1.9	318	48.7	1,867	51.0	2,163	64.4

TMP-SMX: trimethoprim-sulfamethoxazole, No.: number, R: resistance

Table 2. Rates of antimicrobial resistance of *Escherichia coli* isolates from non-catheterized urine from 2000 to 2005 in Thailand

Year	Ampicillin		Ceftriaxone		Ceftazidime		Imipenem		Cefoperazone/ sulbactam		Gentamicin		Amikacin		Ofloxacin		Ciprofloxacin		TMP-SMX	
	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)
2000	9,245	78.9	4,215	7.7	6,568	7.9	4,157	0.1	3,923	2.6	9,405	22.2	8,820	3.5	758	40.9	3,816	37.7	8,871	70.4
2001	9,234	77.3	5,266	9.0	6,659	7.8	4,702	0.4	3,278	4.0	9,874	21.5	9,097	3.1	860	36.6	4,337	38.6	9,401	66.3
2002	8,769	78.3	5,734	11.8	6,508	9.5	5,007	0.1	3,565	3.3	9,280	23.0	8,560	2.5	1,461	33.2	4,907	38.9	8,781	65.3
2003	8,487	78.3	5,351	14.9	6,913	10.2	4,687	0.2	3,535	3.8	9,032	24.5	8,069	2.8	797	36.6	4,731	38.6	8,490	61.9
2004	9,910	79.5	6,460	17.0	8,368	10.0	7,002	0.2	5,078	3.1	10,696	25.2	9,802	2.1	878	37.3	6,460	39.8	9,923	61.4
2005	11,394	80.5	7,229	18.5	10,679	10.6	7,783	0.1	6,302	3.3	12,461	26.4	11,689	3.7	738	42.1	7,229	42.6	11,442	61.8

TMP-SMX: trimethoprim-sulfamethoxazole, No.: number, R: resistance

Table 3. Rates of antimicrobial resistance of *Escherichia coli* ICU isolates from 2000 to 2005 in Thailand

Year	Ampicillin		Ceftriaxone		Ceftazidime		Imipenem		Cefoperazone/ sulbactam		Gentamicin		Amikacin		Ciprofloxacin		TMP-SMX	
	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)
2000	92	79.3	74	12.4	82	15.9	34	2.9	28	0	93	29.0	92	5.4	6	16.7	92	65.2
2001	76	81.6	41	14.6	54	11.1	25	0	15	6.7	77	24.0	78	3.8	14	64.3	77	54.5
2002	96	80.2	43	7.0	39	15.4	21	0	21	4.8	96	27.6	96	4.2	22	27.3	95	55.8
2003	77	80.5	56	37.5	61	24.6	42	2.4	31	3.2	78	38.5	75	6.7	40	51.5	74	66.2
2004	83	79.2	83	33.7	87	26.4	66	0	27	14.8	103	36.9	102	3.9	52	50.0	102	57.5
2005	76	81.6	67	32.8	62	25.8	45	0	15	0	94	37.2	77	2.6	57	50.7	92	56.5

TMP-SMX: trimethoprim-sulfamethoxazole, No.: number, R: resistance

Table 4. Rates of antimicrobial resistance of *Escherichia coli* isolates from non-ICU urine isolates from 2000 to 2005 in Thailand

Year	Ampicillin		Ceftriaxone		Ceftazidime		Imipenem		Cefoperazone/ sulbactam		Gentamicin		Amikacin		Ciprofloxacin		TMP-SMX	
	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)
2000	3,113	79.2	1,346	6.8	2,373	8.8	1,397	0.1	1,395	5.7	3,268	23.2	2,807	3.1	1,068	43.3	3,258	71.2
2001	5,053	76.2	2,655	8.0	4,210	7.3	2,486	0.3	1,540	5.9	5,349	21.2	4,620	2.7	1,964	41.9	5,333	67.1
2002	4,570	78.2	2,643	10.6	3,407	9.7	2,059	0.2	1,709	4.7	4,771	23.5	4,173	2.6	1,495	43.8	4,735	67.0
2003	4,992	79.5	3,277	14.4	4,356	11.4	2,354	0.6	2,089	5.6	5,390	24.8	4,614	3.6	2,057	39.4	5,205	63.8
2004	3,828	80.4	2,611	18.6	3,302	11.3	2,041	0.1	1,356	5.2	4,477	26.8	3,718	2.6	1,749	44.8	4,413	62.5
2005	2,908	81.9	1,760	24.2	2,286	15.3	2,611	0.2	1,272	5.5	3,420	28.9	2,708	2.0	1,689	48.8	3,390	62.6

TMP-SMX: trimethoprim-sulfamethoxazole, No.: number, R: resistance

Table 5. Rates of antimicrobial resistance of *Escherichia coli* OPD isolates from 2000 to 2005 in Thailand

Year	Ampicillin		Ceftriaxone		Ceftazidime		Imipenem		Cefoperazone/ sulbactam		Gentamicin		Amikacin		Ciprofloxacin		TMP-SMX	
	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)
2000	432	78.9	198	2.5	302	6.3	104	1.0	102	4.9	449	18.0	319	2.5	81	44.4	446	67.3
2001	844	75.6	446	4.7	599	7.0	225	0	142	7.7	879	16.8	674	1.6	146	40.4	877	68.4
2002	805	77.1	445	8.1	540	7.0	208	0.5	162	3.7	832	17.9	661	2.0	138	48.6	823	65.7
2003	790	79.0	563	11.7	665	7.1	273	0.4	185	4.3	835	21.9	682	2.8	192	50.5	836	64.5
2004	670	78.1	436	8.9	533	6.4	204	0	162	5.6	711	22.8	562	1.4	184	51.6	699	57.5
2005	426	81.5	214	15.4	312	9.0	195	0	159	4.4	468	26.1	342	0	245	41.6	460	63.7

TMP-SMX: trimethoprim-sulfamethoxazole, No.: number, R: resistance

Table 6. Rates of antimicrobial resistance of *Escherichia coli* isolates from non-OPD urine isolates from 2000 to 2005 in Thailand

Year	Ampicillin		Ceftriaxone		Ceftazidime		Imipenem		Cefoperazone/ sulbactam		Gentamicin		Amikacin		Ciprofloxacin		TMP-SMX	
	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)	No.	R (%)
2000	2,788	79.3	1,225	7.9	2,165	9.4	1,339	0.1	1,331	5.4	2,929	24.2	2,595	3.2	1,005	43.0	2,921	71.6
2001	4,308	76.5	2,242	8.8	3,689	7.4	2,294	0.3	1,423	5.8	4,573	22.3	4,049	2.9	1,842	42.2	4,559	66.7
2002	3,882	78.5	2,254	11.2	2,921	10.3	1,878	0.2	1,577	4.9	4,055	24.8	3,625	2.7	1,381	43.1	4027	67.1
2003	4,319	79.7	2,751	15.7	3,793	12.3	2,143	0.6	1,947	5.6	4,678	25.6	4,046	3.8	1,925	38.6	4490	63.8
2004	3,254	81.2	2,267	20.8	2,876	12.6	1,915	0.1	1,229	5.3	3,887	27.8	3,274	2.8	1,629	44.4	3833	63.3
2005	2,571	82.0	1,621	25.9	2,053	16.3	1,477	0.3	1,142	5.5	3,060	29.6	2,463	2.3	1,514	50.2	3035	62.4

TMP-SMX: trimethoprim-sulfamethoxazole, No.: number, R: resistance

catheferized urine are as follow: ampicillin, 79.3% to 85.3%; ceftriaxone, 12.7% to 28.5%; ceftazidime, 10.7% to 15.2%; gentamicin 25% to 32.9%; and eiprofloxacin, 45.1% to 51% during the 6-year. Similar trends were observed in non-catheterized urine, but with lower-level of resistance rates. The rates of resistance to trimethoprim-sulfamethoxazole decreased from 70.2% to 64.4% and 70.4% to 61.8%, among isolates from catheterized and non-catheterized urine, respectively.

ICU and non-ICU urine

Gentamicin and ceftriaxone resistance rates showed a rising trend among isolates from patients in non-ICU. The rate of resistance to gentamicin and ceftriaxone increased from 23.2% to 28.9% and 6.8% to 24.2% during the 6-year period from 2000 to 2005, respectively. The rates of resistance to trimethoprim-sulfamethoxazole decreased from 71.2% to 62.6% in isolates from patients in non-ICU.

OPD and non-OPD urine

Gentamicin and ceftriaxone resistance rates showed a rising trend among isolates from patients in both OPD and non-OPD. The rate of resistance to gentamicin increased from 18% to 26.1% and 24.2% to 29.6% during the 6-year period from 2000 to 2005 among isolates from patients in OPD and non-OPD, respectively. The rate of resistance to ceftriaxone decreased from 2.5% to 15.4% and 7.9% to 25.9% during the 6-year period from 2000 to 2005 among isolates from patients in OPD and non-OPD urine, respectively. The resistance rate of imipenem remained constantly low during the study period.

Urinary tract infection patients with catheterized urine were compared with non-catheterized urine, and the results are summarized in Table 7. *E. coli* isolates from catheterized urine was significantly associated with imipenem resistance (2.0% and 0.2 %, p = 0.549, 95% CI).

Discussion

A urinary tract infection occurs when organisms, usually bacteria from the digestive tract, cling to the opening of the urethra and begin to multiply. Most infections arise from one type of bacteria, *E. coli*, which normally lives in the colon. *E. coli* is one of the most common members of this group isolated from the genital tract and in the urine specimens. It is the causative agent of approximately 70% of urinary tract infections. *E. coli* infections usually are mild, but may occasionally be fulminant. *E. coli* is also commonly identified in bacteremic obstetric and gynecologic patients. Ampicillin-resistant *E. coli* has emerged long ago. In general, more than 40% of *E. coli* (including community-acquired strains) are resistant to ampicillin[4]. In the present study, ampicillin was active against less than 20% of *E. coli* isolates. Gentamicin, tobramycin, amikacin, and chloramphenicol usually are effective against more than 95% of *E. coli* isolates[4]. However our data show that gentamicin is effective against less than 80% of *E. coli* isolates. Although first-generation cephalosporin antibiotics exerted activity against *E. coli* isolates in most hospitals, the second- and third-generation cephalosporins and imipenem are more likely to be active. The resistance to ciprofloxacin and ofloxacin has been increasingly reported in *E. coli*.

Sotto et al indicated that nosocomial UTIs did not seem to be a risk factor for drug-resistant *E. coli* which was consistent with the results of other

Table 7. Prior antimicrobial exposure of patients with infection due to *Escherichia coli* isolates from catheterized urine and non-catheterized urine from 2000 to 2005 in Thailand

Finding No. (% of antibiotic resistance)	Catheterized urine	Non-catheterized urine	p-value
Ampicillin	11,074 (82.58)	57,039 (78.88)	<0.001
Ceftriaxone	5,264 (21.97)	34,255 (13.74)	0.003
Ceftazidime	9,440 (14.31)	45,695 (9.48)	0.001
Imipenem	7,109 (2.05)	33,338 (0.18)	0.549
Cefoperazone/sulbactam	5,883 (5.82)	25,681 (3.31)	0.003
Gentamicin	11,330 (30.72)	60,748 (23.94)	<0.001
Amikacin	9,785 (2.53)	56,037 (2.98)	0.002
Ofloxacin	2,039 (42.82)	5,492 (37.14)	0.046
Ciprofloxacin	6,474 (48.47)	31,480 (39.70)	<0.001
TMP-SMX	10,130 (66.42)	56,908 (64.37)	<0.001

Table 8. Prior antimicrobial exposure of patients with infection due to *Escherichia coli* isolates from ICU and non-ICU from 2000 to 2005 in Thailand

Finding No. (% of antibiotic resistance)	ICU	Non-ICU	p-value
Ampicillin	500 (80.34)	24,464 (78.96)	<0.001
Ceftriaxone	26,675 (24.51)	14,292 (13.77)	0.004
Ceftazidime	385 (20.52)	19,934 (10.36)	<0.001
Imipenem	233 (0.86)	12,948 (0.27)	0.033
Cefoperazone/sulbactam	137 (5.11)	9,361 (5.43)	<0.001
Gentamicin	541 (32.34)	364 (24.48)	<0.001
Amikacin	520 (4.42)	22,640 (2.81)	0.001
Ciprofloxacin	191 (47.91)	10,022 (43.49)	<0.001
TMP-SMX	532 (59.13)	26,334 (65.59)	<0.001

ICU: intensive care unit

Table 9. Prior antimicrobial exposure of patients with infection due to *Escherichia coli* isolates from OPD and non-OPD from 2000 to 2005 in Thailand

Finding No. (% of antibiotic resistance)	OPD	Non-OPD	p-value
Ampicillin	3,967 (78.00)	20,865 (66.13)	0.015
Ceftriaxone	2,302 (8.67)	12,360 (15.13)	0.004
Ceftazidime	2,951 (7.05)	17,497 (11.09)	<0.001
Imipenem	1,209 (0.26)	1,1046 (0.28)	0.040
Cefoperazone/sulbactam	912 (5.04)	8,649 (5.42)	<0.001
Gentamicin	4,174 (20.23)	23,182 (25.53)	<0.001
Amikacin	3,240 (1.82)	20,052 (2.99)	<0.001
Ciprofloxacin	986 (46.23)	9,296 (43.36)	<0.001
TMP-SMX	4,141 (64.60)	22,865 (65.69)	<0.001

OPD: out-patient department

studies[5]. They found that previous antimicrobial exposure was significantly associated with the resistance only to amoxicillin-clavulanic acid. A previous study showed that this risk factor is also associated with the resistance to other antimicrobials, particularly fluoroquinolones and cotrimoxazole.

Ena reported that urinary tract abnormalities (odds ratio 8.0, 95% CI 2.7 to 3.1, $p < 0.001$), patient aged 65 years or older (odds ratio 6.5, 95% CI 2.2 to 19.1, $p < 0.001$), previous treatment with quinolones (odds ratio 19.1, 95% CI 2.2 to 166.5, $p = 0.008$) and urinary catheterization (odds ratio 2.9, 95% CI 1.1 to 8.5, $p = 0.048$) were independently associated with infections caused by ciprofloxacin-resistant strains[6].

There was a statistically significant correlation between the incidence of ciprofloxacin-resistant *E. coli* bacteremia and the upward trend in fluoro-quinolone (norfloxacin and ciprofloxacin) used in the community ($r = 0.974$, $p = 0.005$) as well as in the hospitals ($r = 0.975$, $p = 0.005$). When they compared the 27 case patients with 54 simultaneous control patients who had ciprofloxacin-susceptible *E. coli* bacteremia, the case patients were more likely to have chronic underlying diseases (71% and 37%, $p = 0.004$), urinary tract infection (74% and 50%, $p = 0.03$), prior surgery (22% and 6%, $p = 0.02$), and prior fluoroquinolone use (63% and 4%, $p < 0.001$). Our study also shows a significant correlation between ciprofloxacin resistance and fluoroquinolone use and indicates that prior fluoroquinolone use seems to be the most important risk factor for ciprofloxacin-resistant *E. coli* bacteremia[7].

E. coli isolated from catheterized urine was more resistant to antimicrobial agents than non-catheterized. *E. coli* isolated from ICU were more resistant to many antimicrobial agents than non-ICU. *E. coli* isolated from non-OPD were more resistant than OPD specimens.

In the present study *E. coli* isolated from catheterized urine was significantly associated with resistance only to imipenem. The carbapenems (imipenem, meropenem, and ertapenem) are sometimes the only effective agents for treatment of severe infections caused by ESBL-producing *E. coli*. Carbapenem-hydrolyzing enzymes are beta-lactamases that significantly hydrolyze imipenem, meropenem, and ertapenem and, usually, a wide range of other beta-lactam antibiotics. Carbapenem resistance has been rarely reported in *E. coli.* The occurrence of an outer-membrane porin deficiency and the expression of a plasmid-mediated class C beta-lactamase were reported to be responsible for carbapenem resistance in *E. coli*[8]. Hong et al reported that the emergence of carbapenem-resistant strains occurred after the long-term treatment with imipenem and meropenem for recurrent urinary tract infections. The occurrence of a carbapenem-hydrolyzing enzymes in *E. coli* is disturbing, because carbapenems are often considered to be the drugs of last resort for severe infections caused by ESBL-producing *E. coli*. With the continuing spread of ESBL-producing organisms and the increasing use of carbapenems, it is possible that carbapenem resistance due to *K. pneumoniae-type* carbapenemases (Kpn) will occur more frequently among Enterobacteriaceae[9]. Gupta et al reported the variation in rates of resistance of *E. coli* to ampicillin and TMP-SMZ, according to geographic region and age. There was no clinically significant age-related variation in resistance within each region for either of the antimicrobial agents[10].

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การศึกษาการดื้อยาต้านจุลชีพของเชื้อ *Escherichea coli* ในปี พ.ศ. 2543-2548

ปิติมน พลวิชัย, สุรางค์ เดชศิริเลิศ, ศิริกุล ปานเพชร, ปฐม สวรรค์ปัญญาเลิศ, นลินี อัศวโภคี, ภิรุญ มุตสิกพันธุ์

วัตถุประสงค์: *เพื่อศึกษาแนวโน้มของความไวต่อยาต้านจุลชีพของเชื้อ Escherichea coli ในประเทศไทยในระหว่างปี พ.ศ. 2543-2548*

วัสดุและวิธีการ: *ได้ทำการทดสอบความไวของเชื้อ Escherichea coli ที่ได้มาจากโรงพยาบาลที่เข้าร่วม 28 แห่ง ต่อยาต้านจุลชีพกลุ่ม aminoglycosides, beta-lactams, fluoroquinolones และ trimethoprim-sulfamethoxazole ด้วยวิธีการทดสอบแบบ disk diffusion method (Kirby Bauer) ข้อมูลที่ได้ได้ทำการวิเคราะห์ด้วยโปรแกรมคอมพิวเตอร์ WHONET ที่ได้จากการสนับสนุนจากองค์การอนามัยโลก*

ผลการศึกษา: *อัตราการดื้อต่อยา ampicillin, ceftriaxone, ceftazidime, gentamicin และ ciprofloxacin เพิ่มขึ้นจาก 79.3% เป็น 85.3%, 12.7% เป็น 28.5%, 10.7% เป็น 15.2%, 25% เป็น 32.9% และ 45.1% เป็น 51% ช่วง 6 ปีระหว่าง ปี พ.ศ. 2543 ถึงปี พ.ศ. 2548 ใน catheterized urine อัตราการดื้อยา gentamicin และ ceftriaxone เพิ่มขึ้นจาก 23.2% เป็น 28.9% และ 6.8% เป็น 24.2% ใน non-ICU urine อัตราการดื้อยา gentamicin เพิ่มขึ้นจาก 18% เป็น 26.1% และ 24.2% เป็น 29.6% ในผู้ป่วย OPD และ non-OPD ตามลำดับ อัตราการดื้อยา ceftriaxone เพิ่มขึ้นจาก 2.5% เป็น 15.4% และ 7.9% เป็น 25.9% ในผู้ป่วย OPD และ non-OPD ตามลำดับ อัตราการดื้อยา gentamicin และ ceftriaxone เพิ่มขึ้นจาก 23.2% เป็น 28.9% และ 6.8% เป็น 24.2% ในผู้ป่วย non-OPD ตามลำดับ การเปรียบเทียบอัตราการดื้อยาในกลุ่มผู้ป่วย non-OPD ต่อยา trimethoprim-sulfamethoxazole มีอัตราลดลงจาก 71.2% เป็น 62.6% ใน catheterized urine เกี่ยวข้องอย่างมีนัยสำคัญกับการดื้อยาของเชื้อเมื่อมีการดื้อยา imipenem ($p > 0.05$)*

สรุป: *การศึกษา แสดงถึงความเกี่ยวข้องกันอย่างมีนัยสำคัญระหว่างการดื้อยา ciprofloxacin และ การใช้ fluoroquinolone และแสดงให้เห็นว่าการใช้ fluoroquinolone ช่วงแรกมีความสำคัญที่สุดที่เป็นปัจจัยเสี่ยงสำหรับการดื้อ ciprofloxacin ของเชื้อ E. coli การคาสายสวนปัสสาวะมีความสัมพันธ์กันอย่างมีนัยสำคัญต่อการพบเชื้อดื้อยา imipenem และการเข้ารับการรักษาใน ICU และ OPD ในช่วงปีที่ผ่านมาเกี่ยวข้องกับการดื้อยา ofloxacin ของเชื้อ E. coli อย่างมีนัยสำคัญ*