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Eight-Year Surveillance of Antimicrobial Resistance among Enterobacter Cloacae Isolated in the First Bethune Hospital

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Abstract

This study was to investigate the antimicrobial resistance of Enterobacter cloacae isolated in 8 consecutive years in the First Bethune Hospital. Disk diffusion test was used to study the antimicrobial resistance. The data were analyzed by WHONET 5 software according to Clinical and Laboratory Standards Institute (CLSI). Most of 683 strains of Enterobacter cloacae were collected from sputum 410 (60.0%), secretions and pus 105 (15.4%), urine 69 (10.1%) during the past 8 years. No Enterobacter cloacae was resistant to imipenem and meropenem in the First Bethune Hospital. The antimicrobial resistance of Enterobacter cloacae had increased in recent 8 years. The change of the antimicrobial resistance should be investigated in order to direct rational drug usage in the clinic and prevent bacterial strain of drug resistance from b eing transmitted.

Keywords: Enterobacter cloacae; antimicrobials susceptibility test; drug monitoring

1.Introduction

Enterobacter cloacae is commonly encountered as a nosocomial pathogen[1] and is therefore under intensive selective pressure from broad-spectrum β-lactam usage. It is the most commonly isolated member of the *Enterobacteriaceae*. The seriousness of multi-resistant *Enterobacter cloacae* can vary markedly worldwide and within nations. The objectives of this study were to investigate the antimicrobial resistance of *Enterobacter cloacae* isolated in 8 consecutive years in the First Bethune Hospital.

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2.Materials and methods

2.1.Bacterial isolates

683 Consecutive nonduplicate nosocomial isolates of *Enterobacter cloacae* were collected during the period from 2003 to 2010 in the First Bethune Hospital. Isolates were identified at the species level using standard biochemical tests and microbiological methods.

2.2.Antimicrobial susceptibility testing

The susceptibilities of *Enterobacter cloacae* to 17 antimicrobial agents were determined by the disk diffusion method in accordance with Clinical and Laboratory Standards Institute (CLSI) guidelines.

3.Results

Distribution of specimen type: during the 8-year study period, 683 consecutive clinical isolates of *Enterobacter cloacae* were isolated in the First Bethune Hospital. The strains were cultured from sputum 410 (60.0%), secretions and pus 105 (15.4%), urine 69 (10.1%), blood 50 (7.3%), pleural fluid and *abdominal* fluid 30 (4.4%), others 19 (2.8%).

No *Enterobacter cloacae* was resistant to imipenem and meropenem in the First *Bethune* Hospital. The resistance of *Enterobacter cloacae* is shown in table 1.

4.Discussion

Enterobacter cloacae are significant causes of nosocomial infections. The top three specimen types in the present study were sputum, secretions and pus, urine in the past 8 years in the First Bethune Hospital. It is emphasized that *Enterobacter cloacae* are mainly responsible for pneumonia, wound infection and urinary tract infection in the First Bethune Hospital.

Enterobacter cloacae are intrinsically resistant to aminopenicillins, cefazolin, and cefoxitin due to the production of constitutive chromosomal AmpC β-lactamases. *Moreover*, ESBL-producing *Enterobacter cloacae* have been identified in the United States[2] and Europe[3], and carbapenems are considered the drug of choice in these cases. The resistance rates of *Enterobacter cloacae* for peperacillin, ticarcillin/clavulanic acid, cefoxitin, cefuroxime sodium, trimethoprim/sulfamethoxazole, cefotaxime and ceftriaxone were almost more than 60%, however, in addition to excellent activity of imipenem and meropenem, the resistance rates for piperacillin/tazobactam, cefepime, cefoperazone/sulbactam, amikacin, ciprofloxacin, levofloxacin and gatifloxacin were shown a relative low during 8 years in the First Bethune Hospital. It is associated with different geography, breakpoints, or antimicrobial susceptibility testing.

AmpC β-lactamase is a type of cephalosporinase and its gene is usually *located* in the chromosomes of bacteria. Usually, this enzyme expresses at a very low level, but β-lactam inducers can raise its level of expression. Therefore it is also categorized as an induced enzyme and belongs to group 1 β-lactamases (functional classification) and class C β-lactamases (Ambler classification)[4]. AmpC enzyme can hydrolyze third generation cephalosporins and is not affected by β-lactamase inhibitors. The level of ampC enzymes is related to usage of β-lactams. β-lactams are a type of pentapeptide analogue that can activate hydrolases of cell walls to cause synthetic disturbances of peptidoglycan, so that the expression of ampC gene is induced. ESBLs belong to functional classification group 2 be β-lactamases. They mainly hydrolyze third generation cephalosporins and monobactams. β-lactamase inhibitors can affect them. Because the properties of these two enzymes are different, different antimicrobial agents should be selected to kill bacteria producing different types of enzymes. Therefore, it is very important to eliminate

the rates of AmpC enzymes and ESBLs, which are both produced in *Enterobacter cloacae*, and have important significance in the application of clinical antimicrobial agents[5].

The drug resistant status of *Enterobacter cloacae* is severe. Reasonable use of the third generation cephalosporins may be the key to reduction of stably *derepressed* strains. Monitoring antibiotic use with microbiology laboratory support can promote rational drug utilization, cut costs and delay the emergence of resistant organisms.

References

1. W. Sanders and C. Sanders,"Enterobacter spp.: pathogens poised to flourish at the turn of the century," Clin Microbiol Rev, vol. 10, Apr. 1997, pp. 220-241.

2. M. Levison, S. Mailapur, G. Pradhan, et al, "Regional occurrence of plasmid-mediated SHV-7, an extended spectrum beta-lactamase, in *Enterobacter cloacae* in Philadelphia teaching hospitals," Clin Infect Dis, vol. 35, Dec. 2002, pp. 1551-1554.

3. E.Tzelepi, D.Giakkoupi, V.Sofianou, et al, "Detection of extended-spectrum beta-lactamases in clinical isolates of *Enterobacter cloacae* and *Enterobacter aerogenes*," J Clin Microbiol, vol. 38, Feb. 2000, pp. 542-546.

4. K. Bush, G. Jacoby and A. Mederios, "A functional classification scheme for β-lactamases and its correlation with molecular structure," Antimicrob Agents Chemother, vol. 39, Jun. 1995, pp. 1211-1233.

5. Z. Zhou, L. Li, Y. Yu, et al, **"**The status of drug resistance and ampC gene expression in Enterobacter cloacae," Chin Med J(Engl), vol. 116, Aug. 2003, pp. 1244-1247.

Table 1 Antimicrobial resistance of *enterobacter cloacae* (%)

Antibiotics	2003(*n*=39)	2004(*n*=42)	2005(*n*=47)	2006(*n*=46)	2007 (*n*=58)	2008 (n=121)	2009 (*n*=152)	2010 (n=178)
Piperacillin	51.3	57.1	63.8	73.9	72.4	70.2	75.7	78.7
Ticarcillin/Clavulanic acid	41.0	52.3	61.7	71.7	74.1	70.2	72.4	75.3
Piperacillin/Tazobactam	17.9	21.4	23.4	28.3	24.1	28.9	30.3	33.7
Cefoperazone/Sulbactam	20.5	23.8	25.5	39.1	31.0	32.2	33.6	36.0
Cefoxitin	94.9	95.2	95.7	95.6	96.6	95.9	96.1	97.2
Cefuroxime sodium	51.3	57.1	63.8	78.3	74.1	79.3	82.2	81.5
Imipenem	0	0	0	0	0	0	0	0
Meropenem	0	0	0	0	0	0	0	0
Ceftazidime	33.3	38.1	42.6	47.8	50.0	50.4	52.6	54.5
Cefotaxime	41.0	42.9	51.1	54.3	55.2	62.0	65.1	71.3
Ceftriaxone	41.0	42.9	51.1	56.5	55.2	61.2	65.8	71.9
Cefepime	15.4	16.7	17.0	28.3	24.1	32.2	34.2	36.0
Amikacin	5.1	9.5	12.8	23.9	27.6	30.6	31.6	33.7
Ciprofloxacin	17.9	19.0	21.3	23.9	31.0	34.7	36.2	39.3
Levofloxacin	15.4	16.7	17.0	19.6	20.7	21.5	22.4	24.7
Gatifloxacin	10.3	11.9	12.8	15.2	19.0	19.0	21.1	21.9
Trimethoprim/Sulfamethoxazole	51.3	57.1	63.8	69.6	72.4	66.1	72.4	75.3