

IN VITRO SUSCEPTIBILITY AND RESISTANCE PHENOTYPES IN CONTEMPORARY ENTEROBACTER ISOLATES IN A UNIVERSITY HOSPITAL IN CRETE, GREECE

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BACKGROUND

Enterobacter spp. is a significant cause of nosocomial infections, such as bacteremia and pneumonia, that occur primarily in the intensive care unit (ICU), in neonates and debilitated patients. Development of resistance has been associated with administration of broad spectrum cephalosporins and quinolones. We studied the evolution in the susceptibility of *Enterobacter* spp. in various antibiotics and relevant resistance mechanisms at the University Hospital of Heraklion during a six year period (2010-2015).

METHODS

Enterobacter spp. isolated from outpatients and inpatients at the University Hospital of Heraklion between 2010 and 2015, were included in the study. Resistance to antibiotics and phenotypic mechanisms of resistance were evaluated using automated systems and standard confirmatory tests.

RESULTS

- ✓ *E. cloacae* followed by *E. aerogenes* were the most commonly isolated species.
- ✓ There was no significant difference in the susceptibility between *E. cloacae* and *E. aerogenes* for the majority of individual antibiotics (Table 1).
- ✓ Colistin, carbapenems, aminoglycosides, fluoroquinolones, tigecycline and cefepime were active against *Enterobacter* spp. Aztreonam, 3rd generation cephalosporins and piperacillin/ tazobactam had moderate activity against *Enterobacter* spp.
- ✓ Lower susceptibility was observed among multidrug resistant strains. Carbapenem non-susceptible strains showed lower susceptibility to non-β-lactam antibiotics compared to that of all strains.
- ✓ An increase in antibiotic resistance through the study period was not observed.
- ✓ The most prevalent phenotype was the wild type, followed by production of AmpC, carbapenemase, and ESBL.
- ✓ Several aminoglycoside resistance phenotypes were observed with production of AAC(6')+AAC(3), AAC(6'), and AAC(3)-II being the most prevalent.

CONCLUSION

Although most *Enterobacter* spp. isolates remain susceptible to a number of antibiotics, a significant proportion was resistant to several antibiotics, mostly to beta-lactams.

Table 1. In vitro activities of tested antibiotics against 939 *Enterobacter* spp. isolated from clinical specimens (2010-2015)

Antibiotic	<i>Enterobacter</i> spp. N = 939		<i>E. cloacae</i> N= 655		<i>E. aerogenes</i> N = 275	
	% susceptible	% resistant	% susceptible	% resistant	% susceptible	% resistant
ticarcillin	70.5	29.3	71.0	28.9	69.3	30.3
ticarcillin/ clavulanate	71.7	26.3	72.5	26.1	69.3	27.0
piperacillin	70.9	27.5	71.8	27.2	68.6	28.5
piperacillin/ tazobactam	73.3	26.0	73.9	25.5	71.5	27.4
cefoxitin	0.1	99.9	0.0	100	0.0	100
cefotaxime	73.8	25.8	74.4	25.5	72.3	26.6
ceftriaxone	74.2	25.7	74.7	25.3	73.0	26.6
ceftazidime	74.2	25.7	74.7	25.3	73.0	26.6
cefepime	89.4	10.2	88.2	11.1	91.6	8.4
imipenem	96.1	3.4	96.0	3.4	96.0	3.6
meropenem	93.4	6.3	93.4	6.3	93.1	6.6
aztreonam	76.6	23.0	76.9	22.9	75.5	23.4
ciprofloxacin	92.9	6.4	91.9	7.2	95.3	4.4
ofloxacin	90.8	8.7	89.9	9.5	93.1	6.9
levofloxacin	93.0	6.1	92.2	6.4	94.9	5.1
moxifloxacin	92.4	6.4	91.6	7.0	94.5	4.7
tobramycin	93.3	6.1	91.9	7.2	96.7	3.3
gentamicin	95.7	2.8	94.4	3.8	98.9	0.4
tetracycline	88.4	7.7	87.2	8.1	90.9	6.9
tigecycline	91.8	4.9	91.3	5.2	92.7	4.4
colistin	97.9	2.1	97.7	2.3	98.2	1.8
cotrimoxazole	83.3	11.1	82.9	11.9	83.9	9.1
chloramphenicol	85.8	6.2	83.2	6.4	92.0	5.5