Increase of resistant *Enterobacter* isolates and correlation with antibiotic consumption at the ward level

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Abstract

- We analysed antibiotic use and incidence of resistant *Enterobacter* on the different wards of our hospital.
- Consumption of 2nd generation cephalosporins was associated with increased resistance of *Enterobacter spp*. to 3rd generation cephalosporins.

Introduction and Purpose

- *Enterobacter spp.* have an inducible AmpC beta-lactamase.
- Selective antibiotic pressure selects stably derepressed mutants resistant to 3rd generation cephalosporins.
- 3rd generation cephalosporins and piperacillin/ tazobactam select these mutants; data about 2nd generation cephalosporins are conflicting.
- **Aim of this study:** to analyse the relationship between antibiotic consumption and incidence of resistant *Enterobacter* at the ward level.

Methods

- Between 1/2003 and 12/2004 all patients with *Enterobacter* resistant to 3rd generation cephalosporins and the ward where they were hospitalised at the time of isolation were identified.
- Consumption data of aminoglycosides, carbapenems, cephalosporins, glycopeptides, piperacillin/ tazobactam, quinolones of each ward were collected in DDD/100 patient-days for 2003 and 2004.

Results

- From 2001 to 2003 the incidence of resistant *Enterobacter* in all hospitalised patients remained stable (≈0.1 per 1000 patient days) with a sudden rise in 2004.

Fig. 1: Incidence of resistant *Enterobacter* isolates per 1000 patient days from 2001 to 2004

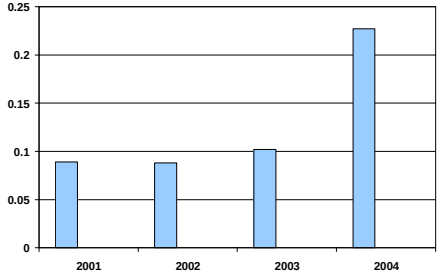
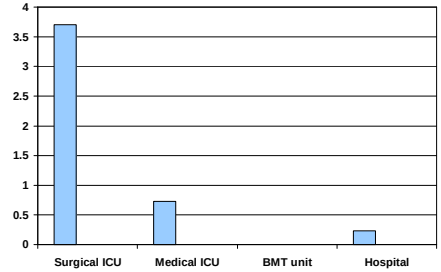


Fig. 2: Incidence of resistant *Enterobacter* per 1000 patient-days on different wards 2004



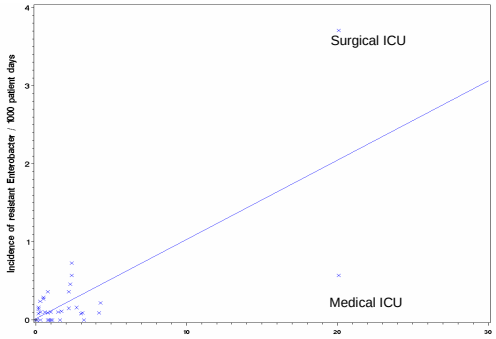
Tab. 1: Use of antibiotics in DDD/100 patient-days of different wards

	Surgical ICU	Medical ICU	BMT unit	Hospital
Total DDD 2003	108.4	99.1	323.1*	56
Total DDD 2004	107.7	85.1	133.3	54.4
2nd gen. cephalosporins 2003	**20.1**	2.4	**0**	1.7
2nd gen. cephalosporins 2004	**20.1**	2.4	**0**	1.8
3rd gen. cephalosporins 2003	3.1	4.5	1.3	1.4
3rd gen. cephalosporins 2004	5.9	4.2	0.8	1.7
4th gen. cephalosporins 2003	1.7	3.9	**56.5**	2.4
4th gen. cephalosporins 2004	4	1.8	**42.5**	2.4
Piperacillin/tazobactam 2003	8.6	6.6	**24.2**	2.2
Piperacillin/tazobactam 2004	9.1	7.3	**18.8**	2.5
Carbapenems 2003	7.5	6	**34.3**	1.9
Carbapenems 2004	13	6.4	**33.1**	2.7

*includes oral antibiotics for treatment of outpatients

- In the linear regression analysis only consumption of 2nd generation cephalosporins was associated with increased resistance of *Enterobacter* ($p<0.0001$).

Fig. 3: Scatter plot of *Enterobacter* resistance versus 2nd generation cephalosporin use



- Overall antibiotic consumption and use of 3rd generation cephalosporins and piperacillin/ tazobactam was not significantly correlated with increased resistance of *Enterobacter*.

Conclusions

- Use of 2nd generation cephalosporins is associated with increased incidence of resistant *Enterobacter.*
- The high incidence of resistant *Enterobacter* in the surgical ICU is probably due to the ample use of 2nd generation cephalosporins for preoperative prophylaxis, which is the only indication for these antibiotics at our institution.
- According to the literature, use of 3rd generation cephalosporins and piperacillin/tazobactam selects *Enterobacter* resistant to 3rd generation cephalosporins.

Our study adds more evidence to the hypothesis that also 2nd generation cephalosporins may select derepressed *Enterobacter* mutants.

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