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Is There a Relation between the Antibiotic Sensitivity of Methicillin-Resistant *Staphylococcus aureus* and the Consumption of Antibiotics in a Hospital?: a Study from April 1993-March 1999

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We investigated a possible relation between antibiotic use and the development of resistance to each antibiotic in methicillin-resistant *Staphylococcus aureus* (MRSA).

The percentage of MRSA isolates resistant to each antibiotic and amount of the antibiotic prescribed were followed in a hospital with 245 beds from April 1993 to March 1999. Antibiotic sensitivity in terms of minimum inhibitory concentration (MIC) was measured using the micro-liquid-dilution method (1). The isolates were grouped into three groups, susceptive (S), intermediate (I), and resistant (R), according to the MIC value (1).

Each graph in Figure 1 shows the follow-up of annual consumption of an antibiotic and the frequency of MRSAs classified according to the grade of resistance to the same antibiotic. Based on this data, the correlation coefficient between the total amount of an antibiotic used in each year

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Table 1. The correlation coefficient between the dose per year and the susceptibility

antibiotic	correlation coefficient	*P* value
imipenem/cilastatin (IPM)	0.937	0.006
sulbactam/ampicillin (SBT/ABPC)	0.960	0.856
cefazolin (CEZ)	–0.520	0.290
cefotiam (CTM)	0.132	0.804
cefmetazole (CMZ)	–0.122	0.819
cefepime (CFPM)	0.513	0.298
minocycline (MINO)	–0.645	0.167
fosfomycin (FOM)	0.163	0.757
levofloxacin (LVFX)	–0.257	0.623

The correlation coefficient between the total amount of an antibiotic used in each year and the frequency of the isolates resistant to the antibiotics in the same year was calculated.

and the frequency of the isolates resistant to the antibiotic in the same year was calculated (Table 1). Only imipenem/cilastatin (IPM) showed a significant positive correlation with a correlation coefficient of 0.93 (*P* value = 0.006). For other antibiotics, no correlation was seen between the development of antibiotic resistance and the amount of the antibiotic used. Namely, increased use of IPM may result in the development of resistance to this drug, but, for other antibiotics, an increase or decrease of their use did not result in the increase or decrease of their resistant strains, respectively. In the case of minocycline (MINO), decreased use did not result in the decrease of the resistant strains though the resistant strains continued to increase (Fig. 1). For vancomycin (VCM), despite the increase of its use, resistant MRSA has not yet appeared.

The process of the development of antibiotic resistance is,

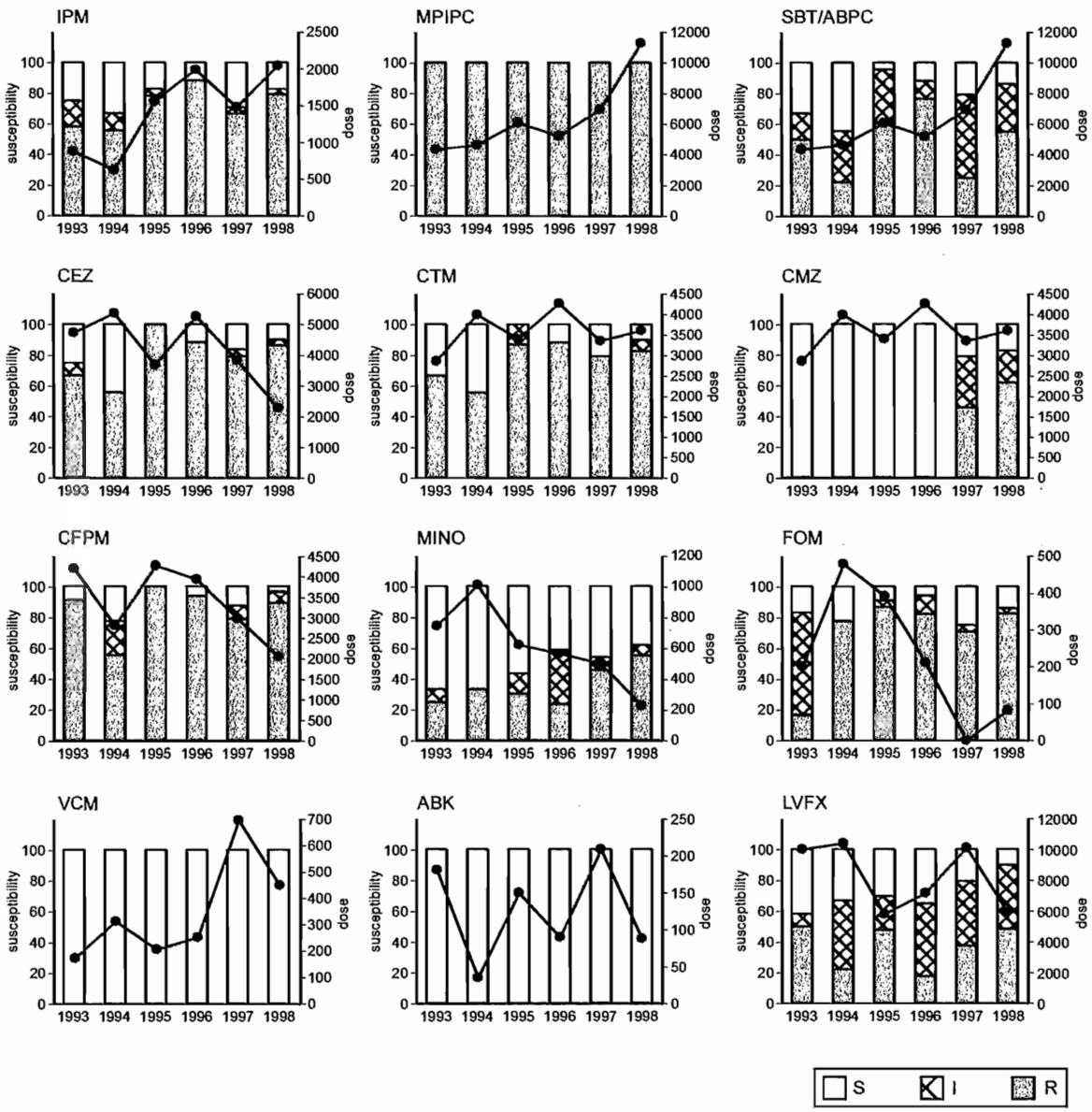

Fig. 1. A consumption of an antibiotic and the frequency of MRSAs classified according to the grade of resistance (S: susceptive, I: intermediate, R: resistant) to the same antibiotics.
IPM: imipenem/cilastatin, MPIPC: oxacillin, SBT/ABPC: sulbactam/ampicillin, CEZ: cefazolin, CTM: cefotiam, CMZ: cefmetazole, CFPM: cefepime, MINO: minocycline, FOM: fosfomycin, VCM: vancomycin, ABK: arbekacin sulfate, LVFX: levofloxacin.

therefore, very complex. For most of the antibiotics studied, no simple relation, such as decreased use resulting in the decreased frequency of the bacteria resistant to the antibiotic. Cross-resistance due to multidrug resistance plasmids, transfer of genes among bacteria, complex processes of selection, interaction of antibiotics, etc. may come into play.

REFERENCE

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