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Changes in antibiotic resistance of the most common Gram-negative bacteria isolated in intensive care units

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Summary We studied the changes in antibiotic resistance of the most common Gram-negative bacteria isolated in the intensive care units at our hospital in 2000 and 2002. Bacterial identification was performed by use of the VITEK 60 analyser, and antibiotic susceptibilities were tested by the VITEK 60 analyser and the disk diffusion agar method. The bacteria isolated most frequently were *Pseudomonas aeruginosa* (132 strains in 2000 and 106 in 2002), *Acinetobacter calcoaceticus* (98 and 109 strains, respectively) and *Klebsiella pneumoniae* (53 and 83 strains, respectively). Acinetobacters presented the highest percentage resistance, with significant increases in resistance to imipenem (15% in 2000 and 67% in 2002) and piperacillin/tazobactam (41% and 72%, respectively). *P. aeruginosa* presented a significant increase in resistance to all antibiotics, except ceftazidime. A large increase was observed in the resistance of *K. pneumoniae* to amikacin (from 10% to 50%), ceftazidime (from 80% to 90%) and tobramycin (from 80% to 90%). No imipenem-resistant strains of *K. pneumoniae* were found.

Introduction

Patients in intensive care units (ICUs) experience high rates of infection,[1,2] and resistance to antimicrobial agents is an increasing problem in ICUs. In surgical ICUs, increased resistance to antimicrobial agents has been attributed to frequent use of broad-spectrum antibiotics.[3] The aim of the present study was to investigate the changes in antibiotic resistance of the most common Gram-negative pathogens isolated from patients in the

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ICUs at a university hospital and to compare the resistance profiles between 2000 and 2002.

Materials and methods

AHEPA Hospital is a public university hospital with 637 beds. It has four surgical ICUs, totalling 48 beds. Around 36 000 patients are admitted each year.

In the surgical ICUs, approximately 2600 patients were hospitalized in the two study years (1100 and 1500 patients in 2000 and 2002, respectively). A total of 283 and 298 Gram-negative isolates, representing 258 and 264 patients of the surgical ICUs, were collected during these two years, respectively. The clinical specimens consisted of: broncho-alveolar lavage (51%); blood (13%); intravenous catheters (12%); pressure sores (8%); urine (5%); wounds (4%); and others (7%). Duplicates were excluded.

Specimens were cultured overnight with 5% sheep blood agar and on MacConkey agar at 37 °C. Bacterial isolates were identified by conventional methods, and determination of antimicrobial susceptibility was carried out using the VITEK 60 automatic system (bioMérieux, Marcy l'Etoile, France) and the disk diffusion agar method. Antimicrobial susceptibilities were determined according to the National Committee for Clinical Laboratory Standards criteria.[4]

Statistical analysis

Data were analysed using the Chi-squared test for pair differences. Differences with a P value <0.05 were considered to be significant. Statistical analysis was performed with SPSS version 11.5 for Windows.

Results

The most common bacteria isolates were: *Pseudomonas aeruginosa* (132 strains in 2000 and 106 in 2002), *Acinetobacter calcoaceticus* (98 and 109 strains, respectively) and *Klebsiella pneumoniae* (53 and 83 strains, respectively).

Pseudomonas aeruginosa

P. aeruginosa accounted for most of the isolates in 2000. Almost half of the isolates were resistant to ciprofloxacin, imipenem and ticarcillin/clavulanic acid (ticarcillin/CA) in 2000, whereas resistance rates for amikacin and piperacillin/tazobactam were relatively low. There was an upward trend in resistance to all the antimicrobial agents studied in 2002, except for ceftazime which remained constant at 35%. The most dramatic increase in resistance was observed with amikacin and tobramycin, from 15% in 2000 to 60% ($P<0.05$) in 2002 and from 30% in 2000 to 60% ($P<0.05$) in 2002, respectively. It is noteworthy that, in 2002, 70% of the *P. aeruginosa* isolates were resistant to ticarcillin/CA and that *P. aeruginosa* was resistant to most of the antimicrobial agents studied (Figure 1).

Acinetobacter calcoaceticus

A. calcoaceticus showed resistance to most of the antimicrobial agents studied in both 2000 and 2002. The only significant trend between 2000 and 2002 was for imipenem and piperacillin/tazobactam resistance, which increased from 15% and 41% in 2000 to 67% and 72% in 2002, respectively ($P<0.05$) (Figure 2).

Klebsiella pneumoniae

K. pneumoniae showed no resistance to imipenem. Nevertheless, there were high resistance rates to most of the antimicrobial agents studied, especially in 2002. Amikacin resistance increased substantially from 10% in 2000 to 50% in 2002 ($P<0.05$), and the same upward trend in resistance was seen for ticarcillin/CA and piperacillin/tazobactam which increased from 75% and 65% in 2000 to 95% and 90% ($P<0.05$) in 2002, respectively (Figure 3).

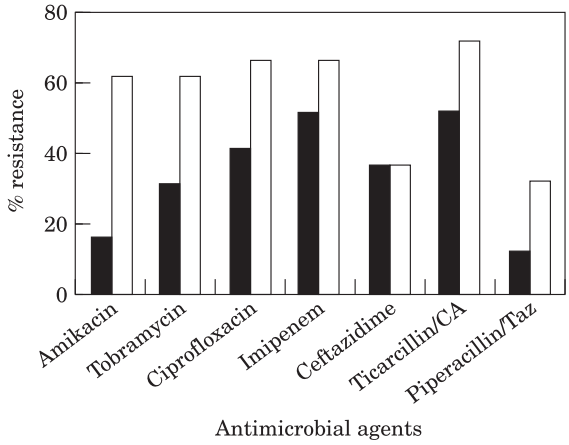

Figure 1 Resistance of *Pseudomonas aeruginosa* to antimicrobial agents. Solid bars, 2000; open bars, 2002.