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Antibiotic resistance patterns of coagulase-negative staphylococcus strains isolated from blood cultures of septicemic patients in Turkey

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Summary

The aim of this study is to determine antibiotic resistance patterns and slime production characteristics of coagulase-negative Staphylococci (CoNS) caused nosocomial bacteremia. A total of 200 CoNS strains were isolated from blood samples of patients with true bacteremia who were hospitalized in intensive care units and in other departments of Istanbul University Cerrahpasa Medical Hospital between 1999 and 2006. Among 200 CoNS isolates, *Staphylococcus epidermidis* was the most prevalent species (87) followed by *Staphylococcus haemolyticus* (23), *Staphylococcus hominis* (19), *Staphylococcus lugdunensis* (18), *Staphylococcus capitis* (15), *Staphylococcus xylosus* (10), *Staphylococcus warneri* (8), *Staphylococcus saprophyticus* (5), *Staphylococcus lentus* (5), *Staphylococcus simulans* (4), *Staphylococcus chromogenes* (3), *Staphylococcus cohnii* (1), *Staphylococcus schleiferi* (1), and *Staphylococcus auricularis* (1). Resistance to methicillin was detected in 67.5% of CoNS isolates. Methicillin-resistant CoNS strains were determined to be more resistant to antibiotics than methicillin-susceptible CoNS strains. Resistance rates of methicillin-resistant and methicillin-susceptible CoNS strains to the antibacterial agents, respectively, were as follows: gentamicin 90% and 17%, erythromycin 80% and 37%, clindamycin 72% and 18%, trimethoprim-sulfamethoxazole 68% and 38%, ciprofloxacin 67% and 23%, tetracycline 60% and 45%, chloramphenicol 56% and 13% and fusidic acid 25% and 15%. None of the strains were resistant to vancomycin and teicoplanin. Slime production was detected in 86 of 200 CoNS strains. Resistance to methicillin was found in 81% of slime-positive and in 57% of slime-negative strains. Our results indicated that there is a high level of resistance to widely used agents in causative methicillin-resistant CoNS strains. However fusidic acid has the smallest resistance ratio, with the exception of glycopeptides. Additionally, most *S. epidermidis* strains were slime-positive, with

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statistically significant ($p<0.001$) association between methicillin resistance and slime production.

Introduction

Coagulase-negative staphylococci (CoNS) found in the normal skin flora and mucous membranes has recently got attention as a potential pathogen, specifically for nosocomial infections (Mandell et al., 2000; Murray et al., 2003; Skov et al., 2003; Mayhall, 2004; Winn et al., 2006). Coagulase-negative bacteremia occurs as a result of long term usage of indwelling central venous catheters, administration of parenteral nutrition and previous antibiotics, patient illness (oncology, burn and high-risk nursery), and other predisposing factors, including intensive-care unit stay, adherence to infection control practices and hand washing practices of medical staff (Mandell et al., 2000; Mayhall, 2004; Winn et al., 2006). There is a significant increase in the methicillin-resistant staphylococci infections and these bacteria have recently started to gain resistance to many widely used antibiotics (Drozenova and Petras, 2000; Livermore, 2000; Mandell et al., 2000; Huang et al., 2003; Murray et al., 2003; Jain et al., 2004; Knauer et al., 2004; Mayhall, 2004; Winn et al., 2006). In spite of the advancements in the antibacterial treatment field, there are still serious difficulties in the treatment of staphylococci infections. In several countries, vancomycin-resistant staphylococci have been isolated (Centers for Disease Control and Prevention, 2002, 2004; Boneca and Chiosis, 2003; Palazzo et al., 2005). One of the most emphasized subjects about pathogenesis of staphylococci infections is the slime production characteristic (Drozenova and Petras, 2000; Huang et al., 2003). Multi-resistant CoNS may adhere to medical devices and surfaces through slime which secretes out of the cell and has a mucopolysaccaride structure, and in this way, they may easily colonize and spread within hospital environment (Mandell et al., 2000; Mayhall, 2004; Winn et al., 2006). Furthermore, the slime factor protects the CoNS from antibiotics, phagocytosis and chemotaxis (Ammendolia et al., 1999; Mandell et al., 2000; Mayhall, 2004).

In this study, we investigated the antibiotic resistance pattern and slime production characteristics of the CoNS-caused nosocomial bacteremia in Istanbul University Cerrahpasa Medical Hospital.

Materials and methods

A total of 200 CoNS strains were isolated from blood samples of patients with true bacteremia who were hospitalized in standard departments and in intensive care units of Istanbul University Cerrahpasa Medical Faculty Hospital between 1999 and 2006. All of these patients had two or more blood cultures positive for CoNS. Among 200 patients, 137 patients were using a central venous catheter or medical device and the others were who have burn and immune deficiency or malignancy. In this study, we used the criteria of true bacteremia (Garner et al., 1988; Herwaldt et al., 1996; Bates et al., 1997). Blood cultures were analyzed with the Bactec 9120 system (Becton Dickinson, France). Positive blood cultures were isolated on Columbia agar base supplemented with 5% horse blood, and the plate was incubated at 35 °C for 24 h. CoNS were detected based on colony morphology, Gram staining and the absence of coagulase activity. The species of CoNS were identified using the API ID 32 Staph (Bio Mérieux, France) and their slime formations were evaluated with Congo red agar method (Freeman et al., 1989).

Antimicrobic susceptibilities of the CoNS strains were determined by the disk diffusion method on Mueller-Hinton agar (bioMérieux, Marcy l'Etoile, France) according to the Clinical and Laboratory Standards Institute (CLSI) (Clinical and Laboratory Standards Institute., 2006). In our study, penicillin, vancomycin, teicoplanin, ciprofloxacin, erythromycin, gentamicin, tetracycline, chloramphenicol, clindamycin, trimethoprim-sulfamethoxazole and fusidic acid (oxoid) disks were used. For fusidic acid, the criteria determined by France Microbiology and Antibiogram Community in 1998 was taken into consideration (Comité de L'antibiogramme de la Société Française de Microbiologie Communiqué, 1998). In this study, the disks containing 10 μg fusidic acid (oxoid) (zone diameter $\geqslant$22 mm sensitive, $<$15 mm resistant) were used for determining the resistance to fusidic acid. The disks containing 1 μg oxacillin (oxoid) (zone diameter $\geqslant$13 mm sensitive, $\leqslant$10 mm resistant) were used for resistance to methicillin (Clinical and Laboratory Standards Institute., 2006). *Staphylococcus aureus* ATCC 25923 and *Staphylococcus epidermidis* ATCC