Journal of Infection and Public Health (2013) 6, 179—185

http://www.elsevier.com/locate/jiph

Prevalence of multidrug-resistant *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in an Italian hospital

M.A. De Francesco*, G. Ravizzola, L. Peroni, C. Bonfanti, N. Manca[1]

Institute of Microbiology, University of Brescia, Italy

Received 3 August 2012; received in revised form 30 November 2012; accepted 30 November 2012

KEYWORDS
P. aeruginosa;
A. baumannii;
Antibiotic resistance;
Infection;
Antibiotics

Summary The severity and extent of disease caused by multidrug-resistant organisms (MDROs) varies by the population(s) affected and the institution(s) at which these organisms are found; therefore, preventing and controlling MDROs are extremely important.

A retrospective study of patients who were infected with *Acinetobacter baumannii* or *Pseudomonas aeruginosa* was performed at the Spedali Civili Hospital in Brescia, Italy, from 2007 to 2010.

A total of 167 (0.52%) *A. baumannii* isolates and 2797 *P. aeruginosa* (8.7%) isolates were identified among 31,850 isolates.

Amikacin and colistin were the most active agents against *A. baumannii* strains. Multidrug resistance (MDR) was observed in 57 isolates (54%). Most MDR isolates (42 out of 57, 73%) were resistant to four classes of antibiotics.

P. aeruginosa was recovered more frequently from the respiratory tract, followed by the skin/soft tissue, urine and blood.

Colistin, amikacin and piperacillin/tazobactam were active against 100%, 86% and 75% of *P. aeruginosa* isolates, respectively. A total of 20% ($n = 316$) of *P. aeruginosa* isolates were MDR. In summary, *A. baumannii* was more rare than *P. aeruginosa* but was more commonly MDR.

Epidemiological data will help to implement better infection control strategies, and developing a local antibiogram database will improve the knowledge of antimicrobial resistance patterns in our region.

* Corresponding author at: Institute of Microbiology, P. le Spedali Civili, 1, 25123 Brescia, Italy. Tel.: +39 030 3995860; fax: +39 030 3996071.
E-mail address: defrance@med.unibs.it (M.A. De Francesco).

[1] The paper is dedicated to the memory of the late Professor Nino Manca.

1876-0341/$ — see front matter © 2013 King Saud Bin Abdulaziz University for Health Sciences. Published by Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jiph.2012.11.006

Introduction

Nosocomial infections are one of the most common complications of hospitalization and lead to increased morbidity and mortality [1,2]. These infections prolong hospitalization, require more extensive diagnostics and treatment and are associated with additional costs [3,4]. Infection with multidrug-resistant pathogens can also complicate treatment.

Antibiotic resistance is a daunting phenomenon with a growing impact on patient safety, particularly in ICUs [5]. Critically ill patients are prone to colonization and infection by antibiotic-resistant bacteria because of the frequent exposure of these patients to antibiotics and the presence of multiple, often invasive, devices. This dangerous array of risk factors drives a vicious cycle of increased infection incidence, increased need for broad-spectrum antibiotics, reduced antimicrobial efficacy and increased selection of antibiotic resistance.

Multidrug-resistant organisms (MDROs) are resistant to one or more classes of antimicrobial agents, such as β-lactams (penicillins, cephalosporins, monobactams and carbapenems), fluoroquinolones and aminoglycosides. During the past several decades, a shift in the MDR dilemma from gram-positive to gram-negative bacteria has been noted, which is in part due to the small number of new antimicrobial agents that are active against resistant gram-negative strains [6]. Gram-negative pathogens that have acquired epidemiological importance among nosocomial infections include *Acinetobacter baumannii* and *Pseudomonas aeruginosa*.

A. baumannii is a cause of outbreaks in hospitals [7,8], and the MDR patterns observed among isolates often leave carbapenems as the only effective treatment for severe infections [8]. However, carbapenem-resistant *A. baumannii* is emerging worldwide and has been observed in different countries [7,9—11]. There are limited therapeutic options for infections caused by these isolates.

P. aeruginosa is also a common gram-negative nosocomial pathogen. This organism is an important cause of hospital-acquired pneumonia and urinary tract, wound and bloodstream infections [12]. Infections caused by this pathogen are often difficult to treat because of the multidrug-resistant nature of this bacterial species, and *P. aeruginosa* strains are often carbapenem resistant, which can severely limit the available therapeutic choices [13].

The purposes of this study were the following:

(a) to determine the prevalences of *A. baumannii* and *P. aeruginosa* in patients with nosocomial infections at Brescia's main hospital; and
(b) to analyze the antimicrobial susceptibility patterns of these two microorganisms determined as part of an internal laboratory surveillance study from 2007 to 2010.

Methods

Bacterial isolates

A retrospective study of all *A. baumannii* and *P. aeruginosa* isolates from different clinical specimens collected from patients with nosocomial infections and processed by the microbiology laboratory between 2007 and 2010 was conducted at the Spedali Civili Hospital in Brescia, Italy. Spedali Civili is a major hospital with an average of approximately 47,000 hospitalizations annually. Infections were considered nosocomial if they first appeared 48 h after admission. Infections that were likely to have been acquired before hospital admission were not considered nosocomial. Blood, urine, tracheal aspirate, bronchi alveolar lavage, sputum, purulent wound, skin ulcer and catheter tip samples collected from patients admitted to all units (ICU and other departments) were eligible. Duplicate isolates were excluded.

Clinical specimens were plated onto blood agar and MacConkey agar and incubated overnight at 37 °C. After incubation for 24 h at 37 °C, the organisms were identified using the VitekTM system (bioMerieux, Marcy-l'Etoile, France).

Antimicrobial susceptibility

Antimicrobial susceptibility was assessed using the Vitek2 system (bioMerieux) and the AST-GN24 card according to the manufacturer's instructions. The results obtained after a maximum of 15 h of incubation were analyzed and interpreted by AES 4.02 software. The MICs determined by the system identified the microorganism as susceptible, intermediate or resistant according to the criteria published by the CLSI [14]. Antibiotic resistance was categorized into five groups: (1) resistance to extended-spectrum penicillins (piperacillin/tazobactam), (2) resistance to cephalosporins (ceftazidime), (3) resistance to carbapenems (imipenem), (4) resistance to aminoglycosides (amikacin) and (5) resistance to quinolones (ciprofloxacin). The breakpoints for these antimicrobials were as follows: amikacin, $S \leq 16$ and $R \geq 32$; ceftazidime, $S \leq 8$ and $R \geq 16$; imipenem,