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ORIGINAL ARTICLE

Predictors of mortality in surgical patients with *Acinetobacter baumannii* bacteremia

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KEYWORDS
Acinetobacter baumannii;
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Background: *Acinetobacter baumannii* has emerged as an important pathogen of nosocomial infection. The aim of this study was to evaluate the predictors of poor outcome in surgical patients with *A baumannii* bacteremia.
Methods: We retrospectively recruited a total of 50 patients who developed *A baumannii* bacteremia within 2 weeks after surgery during a 113-month period. The primary outcome for this study was all-cause 14-day mortality. Clinical and laboratory data, antimicrobial susceptibility, treatment, and Sequential Organ Failure Assessment (SOFA) score were evaluated as possible predictors of outcome.
Results: The 14-day mortality was 20% and there was no association between type of surgery and mortality. The SOFA score was the only independent predictor of 14-day mortality after adjustment for other variables. The calibration was acceptable (Hosmer-Lemeshow $\chi^2 = 3.65$, $p = 0.72$) and the discrimination was good (area under the receiver operating characteristic curve: 0.80 ± 0.07, 95% confidence interval, 0.67–0.94). We found that a SOFA score ≥ 7 was a significant predictor of 14-day mortality in surgical patients with *A baumannii* bacteremia.
Conclusions: The SOFA score assessed at the onset of bacteremia is a reliable tool for predicting 14-day mortality in surgical patients with *A baumannii* bacteremia.

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Introduction

Acinetobacter baumannii is an aerobic, nonfermentative, gram-negative coccobacillus that is widespread in the natural environment.[1,2] It has emerged as an important pathogen of nosocomial infection and has caused epidemic outbreaks in recent years.[3,4,5] Its rapid acquisition of a wide variety of antibiotic resistance genes has caused serious therapeutic problems worldwide.[6] *A baumannii* is associated with a variety of serious infections in the hospital setting, especially in patients staying in intensive care units,[7] in immunosuppressed hosts,[8,9] and in burn patients.[7] The mortality rate associated with *A baumannii* bacteremia ranges from 17% to 63%.[9,10,11,12] Factors independently associated with poor prognosis of patients with *A baumannii* bacteremia include pneumonia as the source of bacteremia, presence of septic shock, disseminated intravascular coagulation, mechanical ventilator use, acute renal failure, inappropriate antibiotic therapy, and recent surgery.[9,12,13,14]

Surgical patients are at high risk of developing a hospital-acquired infection[15] including *A baumannii* bacteremia. The aim of this study was to evaluate the predictors of poor outcome in surgical patients with *A baumannii* bacteremia.

Methods

Hospital setting and study population

Subjects in this retrospective study comprised surgical patients with 2-week postoperative blood cultures positive for *A baumannii* at the Taipei Veterans General Hospital, a 2,900-bed tertiary medical center in northern Taiwan, during the period June 1998 to November 2007. Patients with polymicrobial infections in addition to *A baumannii* were excluded. Patient characteristics, underlying diseases, types of surgeries (based on the *International Classification of Diseases, Ninth Revision, Clinical Modification*), invasive procedures, clinical and laboratory data, antimicrobial susceptibility, treatment, and outcomes were obtained from medical records. The Sequential Organ Failure Assessment (SOFA) score was calculated based on data that had been gathered and recorded at the onset of *A baumannii* bacteremia. Patients with missing values for the calculation of SOFA scores were excluded. The primary study outcome was all-cause 14-day mortality.

Identification and antimicrobial susceptibility testing

The *A baumannii* isolates had been phenotypically identified by ID 32 GN (Biomerieux, St. Louis, MO, USA) and verified to the genomic species level as *A baumannii* (genomic species 2) by a multiplex polymerase chain reaction method.[16] The antimicrobial agents tested were as follows: amikacin, sulbactam, ceftazidime, ciprofloxacin, cefepime, colistin, gentamicin, imipenem, trimethoprim/sulfamethoxazole, and piperacillin/tazobactam. The minimal inhibitory concentrations of sulbactam, colistin, and imipenem was determined by the agar dilution method and interpreted according to the Clinical Laboratory Standards Institute guidelines;[17] the rest of other antibiotics were performed by the disc diffusion method. A reference strain of *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853 was used as the control. Multidrug-resistant *A baumannii* (MDRAB) was defined if the isolate was resistant to three or more classes of antimicrobial agents (including amikin, sulbactam, ceftazidime, ciprofloxacin, cefepime, colistin, gentamicin, imipenem, trimethoprim/sulfamethoxazole, and piperacillin/tazobactam). Extensively drug-resistant *A baumannii* was defined if the isolate was resistant to all commercially available antimicrobial agents except for colistin and tigecycline.

Definitions

The definition of a surgical patient is someone who had operative procedures performed in the operation rooms. *A baumannii* bacteremia was diagnosed in patients with clinical evidence of infection (such as fever, chills, rigor, leukocytosis, elevated C-reactive protein, or sepsis) and one or more blood isolates of *A baumannii* at the same time.[12] The date of the first positive blood culture was considered the onset of *A baumannii* bacteremia, and the survival time was calculated from the onset of bacteremia. The origin of bacteremia was determined when a specific focus of infection was identified during the bacteremia episode. Pneumonia was defined if there was isolation of *A baumannii* from pulmonary secretion with concurrent infiltrates on chest radiography and clinical signs and symptoms of infection. Central venous catheter infection was defined if there was isolation of *A baumannii* from tip cultures with concurrent clinical signs and symptoms. Urinary tract infection was defined if there was isolation of *A baumannii* from urine cultures with urinalysis demonstrating pyuria. Wound infection was defined based on the clinical judgment of the treating physicians along with an isolation of *A baumannii* from the wound. Intra-abdominal infection was defined if there was isolation of *A baumannii* from specimen obtained from the intra-abdominal cavity.[18]

End-stage renal disease was defined as a creatinine clearance rate <5 mL/min that required hemodialysis. Immunosuppressive status was defined in patients with one or more of the following: solid organ or stem cell transplantation, human immunodeficiency virus infection, or treatment with cytotoxic chemotherapy within the previous 6 weeks or more than two doses of steroid or other immunosuppressive agents within 2 weeks before the first episode of *A baumannii* bacteremia.[12] Shock was defined according to the American College of Chest Physicians-Society of Critical Care Medicine consensus conference as evidence of organ hypoperfusion, and either a systolic blood pressure of <90 or >30 mmHg less than baseline values, or the need for vasopressor/inotropes to maintain blood pressure despite adequate fluid resuscitation.[19] Appropriate antimicrobial therapy was defined as treatment with at least one antibiotic that had *in vitro* activity against the pathogen and administered within 2 days on the date of the blood culture obtained, with correct dosage, and with the use of at least 48 hours; otherwise, it was defined as "inappropriate".

Statistical analysis

Patients were stratified into two groups according to survival status on Day 14 after the first positive blood culture had been