

Multidrug-Resistant *Acinetobacter baumannii* Infections in a Cardiovascular Surgery Intensive Care Unit: Risk Factors and Outcome Predictors

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Abstract

Acinetobacter baumannii (AB) is a ubiquitous gram-negative coccobacillus that has the ability to colonize and survive in a variety of environments and develop various resistance mechanisms. In our study; Between 2010 and 2012, 5400 patients were screened, 74 of them had MDR AB infection. MDR AB infection is associated with high morbidity and mortality.

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INTRODUCTION

Infection in the setting of cardiovascular surgery is not infrequent and associated with adverse outcomes and mortality. Multidrug resistant organism related infection cases have augmented in in this setting lately whereas in the other type of ICU's. *Acinetobacter baumannii* (AB) is a gram-negative coccobasillus, which is a ubiquitous microorganism having ability to colonize and survive in diverse environments and improve diverse mechanisms of resistance, due to AB is difficult to control in hospitals. [1-6]. Particularly multidrug-resistant (MDR)-AB infections (isolate is non-susceptible to at least one agent in three or more antibiotic classes) associated with high mortality rates in intensive care units (ICUs) [3,6,7].

After an MDR-AB infection epidemic in our hospital at the end of 2009 we aimed to search the rate of multidrug-resistant *acinetobacter baumannii* infections in cardiovascular surgery intensive care unit (CS-ICU) and risk factors and independent outcome predictors retrospectively for 2 year time period.

MATERIALS AND METHODS

All necessary ethical approvals for conducting the study have been obtained. This is a retrospective study, conducted in a tertiary cardiac hospital ICU's with 30 beds. We evaluated patients who underwent adult cardiovascular surgeries during the period from March 2010 to February 2012. Cases were defined as new acquisitions of MDR-AB from specimen taken [?]48 hours following ICU admission, with clinical signs of infection. Data on the characteristics, laboratory results, applied treatments were collected from the electronic medical records and patients' charts. The Hospital's Infection Committee managed antibiotic treatment. Recorded data were as follows: age, gender, medical history, SOFA score on the day of infection diagnosis, type of surgery, postoperative days until infection, infection site, antibiotic susceptibility, complications (such as organ dysfunction, thrombocytopenia), days of mechanical ventilation after infection and length of CS-ICU stay.

STATISTICS

Analysis of the data was performed using SPSS v.17 statistical program (SPSS Inc., Chicago, IL, USA). Continuous variables were presented as mean \pm standard deviation and categorical variables were expressed as number (%). Comparative analysis was conducted Mann-Whitney U and chi-square tests. Logistic regression analysis was performed to determine the independent risk factors for mortality. p[?] 0.05 is considered as statistically significant differences.

RESULTS

During the study period, 74 (1.3%) of 5400 consecutive cardiovascular surgery patients developed MDR-AB infection and consisted our study population. Demographic and clinical data of the patients are presented in Table 1. The mean age of the patients was 64,2 and the mean SOFA score was 11,2 \pm 3,07. The majority of undergone surgical procedures were 32 coronary artery bypass, 12 coronary artery bypass + valve surgery, 11 bivalvular surgery, and 13 aortic surgery. The lower respiratory tract was the most frequent site (78.4 %) of MDR-AB isolation and followed by surgical site (10.8 %). Colistin was the most active antimicrobial agent. Univariate analysis for mortality is presented in Table 2. None of the preoperative existing comorbidities was affecting mortality except hypertension, which is found protective. In hypertensive group mortality rate was 61.5% whereas in non-hypertensive group was 85.4% (p:0.022). In logistic regression analyse SOFA score, acute renal failure, mechanical ventilation duration, coagulopathy, hypoalbuminemia, inotropic support, acidosis, intensive care hospitalization, elevated glucose value, low lymphocyte count appear as predictors of the mortality.

Mortality rate was 77% with 57 patients. SOFA score was significantly higher in mortal group 11,54 \pm 2,9 vs 9,41 \pm 1,9 (p: 0.008). Beside SOFA score low output syndrome, renal replacement therapy requirement, hypoalbuminemia, coagulopathy, hepatic insufficiency, cerebral dysfunction and hyperbilirubinemia were statistically significant predictors for mortality. In addition, inotrop usage was higher comparing to the survival group. In these patients with significantly lower calculated lymphocyte counts, the association of low lymphocyte levels detected in follow-up with mortality. This may be a poor prognostic factor. While the mean of glucose in the mortal group was high, it was not statistically significant. Whereas acidosis was

more common in the mortal group.

DISCUSSION

Epidemiological surveillance of bacterial infection and resistance to antibiotics are essential for awareness creation, implementation of control measures and effective management of infections. In developing countries as in Sub-Saharan Africa, insufficient measures to prevent infections caused by multidrug-resistant bacteria cause an increase in mortality and morbidity [8, 9]. Cardiac surgical patients may show diversity from other surgical and medical ICU patients

The clinical management of intensive care unit (ICU) patients with infections has been complicated by the emergence and spread of extremely drug-resistant (XDR) *Acinetobacter baumannii* strains [8]. Infections caused by multidrug resistant *Acinetobacter baumannii* strains; may cause life-threatening poor patient outcomes such as ventilator-related pneumonia, sepsis, urinary tract infections, and skin and soft tissue disorders [10, 11]. In our study, the infection affected more of the respiratory system (78.4%). In decreasing rates; surgical site, blood and urinary system were isolated AB.

The pediatric and geriatric patients are usually more disposed to infections due to their immune status. The advancing age are commonly associated with risk factors including reduced immunity, co-morbid diseases such as chronic heart diseases, diabetes mellitus, neurogenic bladder [12, 13] whilst in infants, lack of fully developed immunity, malnutrition as well as inadequate hygiene [14] put them at greater risk of infections. In a study conducted in Ghana, urinary tract infection was 31% [15]. Respiratory system diseases, DM, renal diseases, HL, HT were in our patients risk factors.

MDR *A. baumannii* is a problematic, multidrug-resistant pathogen identified in healthcare settings worldwide, especially in ICUs [16]. *A. baumannii* has a notable ability to capture and express resistance genes. All resistance mechanisms including target modification, efux pump expression, and enzymatic inactivation have been described in *A. baumannii* [17].

A. baumannii is considered as an opportunistic pathogen that can survive in austere conditions. It is responsible of an increasing rate of severe nosocomial infections. They affect especially immunocompromised patients, exposed to prolonged stays in ICUs and having a previous exposure to antibiotics; carbapenems and 3rd generation cephalosporins are the most involved, followed by fluoroquinolones, aminoglycosides and metronidazole (18, 19). Other factors that are associated with the occurrence of *A. baumannii* bacteremia are: assisted ventilation, central catheterization, urinary catheters, and nasogastric probes (20). All the patients included in the study had these risk factors

Katsaragakis et al. (21) investigated the mortality pre-determinants of patients with *A. baumannii* infection in a prospective study of 680 patients with surgical ICU. This study showed that the APACHE II score is one of the predisposing factors affecting mortality due to *A. baumannii* infection. Another study by Pirates et al. (22) showed that the APACHE II score is an independent risk factor when considering the mortality of the patients present at the time of an *A. baumannii* outbreak in the ICU.

In other studies, age, severity of the underlying disease, immunosuppression, recent surgery, mechanical ventilation, septic shock, thrombocytopenia, low serum albumin, multi drug resistance, inappropriate antimicrobial therapy, and invasive procedures such as central venous catheterization, urinary catheterization, nasogastric tube placement, and pulmonary catheterization have been found as factors affecting *A. baumannii* infection-related mortality in univariate analysis (23,25,26,29,31). In multivariate analysis, age, immunosuppression, APACHE II score, multiresistance, mechanical ventilation, recent surgery, septic shock, and respiratory and renal failure have been identified as factors independently correlated with mortality (23,25,29). We have reached similar findings in these studies

Disseminated intravascular coagulation, APACHE II score, inappropriate antimicrobial treatment, and neutropenia have also been reported as predictors of *A. baumannii* bacteremia mortality (24,31). Furthermore, APACHE II score, SOFA score, and inadequate empirical antibiotic therapy have been identified as prognostic factors for ventilator-associated *A. baumannii* pneumonia mortality (32,33). Additionally, age and acute renal

failure have been identified as mortality predictors of multiresistant gram-negative bacteria infections(34) and thrombocytopenia as predictor of mortality in ICU patients.

CONCLUSION

With the increase of extended-spectrum antimicrobial application, AB is rapidly evolving toward multidrug resistance. In our study multidrug resistance AB rate was high. Nosocomial infections caused by AB are very difficult to treat. AB infections are associated with high high morbidity and mortality rate. Knowing the risk factors that indicate mortality in such patients and ensuring early diagnosis are of critical importance with respect to prognosis. Starting appropriate therapy by making the right decisions regarding the severity of acute and underlying conditions will have favorable effects on the management of *A. baumannii* bacteremia.

In conclusion, the risk factors that indicate mortality in patients and these patients are closely watched and bacterial early determination of the importance of the prognosis of the patient bears. Severe acute illness and underlying disease start appropriate treatment by making the right decision, the effect will be better in the *A. baumannii* bacteria. Also avoid unnecessary antibiotic treatment and prophylaxis and can be controlled as strict infection control measures abolition of risk factors, originating from *A. Baumannii* reduce possible bactericides and related deaths.

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