Original Article

Diabetic status and the relationship of blood glucose to mortality in adults with carbapenem-resistant *Acinetobacter baumannii* complex bacteremia

Ching-Hsiang Leung a, Chang-Pan Liu b,c,d,e,*

a Division of Endocrinology and Metabolism, Department of Internal Medicine, MacKay Memorial Hospital, Taipei, Taiwan
b Division of Infectious Diseases, Department of Internal Medicine, MacKay Memorial Hospital, Taipei, Taiwan
c MacKay College of Medicine Nursing and Management, Taipei, Taiwan
d Department of Medicine, MacKay Medical College, New Taipei City, Taiwan
e Infection Control Committee, MacKay Memorial Hospital, Taipei, Taiwan

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**Abstract**  
**Background/Purpose:** Diabetes is associated with increased mortality in *Acinetobacter baumannii* (AB) complex infection. This study investigated the risk factors and relationship of diabetic status and glycemic indices to mortality in patients with carbapenem-resistant (CR) AB complex bacteremia.

**Methods:** Relationship of glycemic indices to mortality were compared in adult diabetes (DM) and nondiabetes (non-DM) patients with CRAB complex bacteremia hospitalized from January 2010 to December 2015 in MacKay Memorial Hospital, Taiwan.

**Results:** Of 317 patients with CRAB complex bacteremia, 146 (46.06%) had diabetes. DM patients were elderly (mean age of 69.23 years) and the mortality rate was higher (64.38% vs 52.05%, *p* = 0.036) than in non-DM patients. By multivariate analysis, septic shock was associated with increased mortality in DM patients. Hypoglycemia was associated with increased mortality in non-DM patients only (100% vs 50.33%, *p* = 0.006). The lowest mortality was for the blood glucose range 70–100 mg/dL in non-DM patients (43.24%) and 100–140 mg/dL for DM patients (56.52%). Increased glycemic variability (coefficient of variation (CV) > 40% compared to < 20%) was associated with increased mortality in non-DM patients (86.36% vs 47.12%, *p* = 0.003).

**Conclusion:** Effects of dysglycemia on mortality due to CRAB complex bacteremia differ according to diabetic status. Mortality was higher in DM patients. In non-DM patients,
Introduction

Community acquired Gram-negative bacillus bacteremia is a leading cause of hospitalization, sepsis and mortality.1 Acinetobacter baumannii (AB) complex is an important Gram-negative pathogen that has become an increasingly prevalent cause of bloodstream infections.2 The Acinetobacter calcoaceticus–baumannii complex includes four genospecies: genospecies 1, A. calcoaceticus; genospecies 2, A. baumannii; genospecies 3, Acinetobacter pittii; and genospecies 13TU, Acinetobacter nosocomialis. Among these, A. baumannii is the most important in the clinical context.3,4 Multidrug resistance has been identified as an independent risk factor for mortality in patients with AB complex bacteremia.5

Diabetes mellitus (DM) and Acinetobacter spp. infection are significantly associated with a poor prognosis in critically ill patients with bacteremia.6 The three domains of glycemic control (hyperglycemia, hypoglycemia, and increased glycemic variability) have been found to be independently associated with increased risk of mortality in critically ill patients.7 However, studies investigating the role of diabetes and dysglycemia to mortality in AB complex bacteremia are rare or none. This study aimed to investigate the risk factors for mortality and the relationship of diabetic status and glycemic indices (hypoglycemia, hyperglycemia and glycemic variability) to mortality in patients with CRAB complex bacteremia.

Methods

Study population and data collection

MacKay Memorial Hospital is a 2200-bed medical center in Northern Taiwan. This retrospective, observational cohort study was conducted by review of medical records of all adult patients aged ≥18 years hospitalized for CRAB complex bacteremia between the first of January 2010 and 31st December 2015. Only the first bacteremia episode from each patient was included for analysis. This study was approved by the institutional review board of our hospital (14MMHIS052).

Medical records were reviewed for demographic characteristics, comorbid conditions, complications, antibiotics used, laboratory examinations and microbiologic tests. Comorbidity included liver cirrhosis, renal disease, malignancy, stroke, heart disease, chronic obstructive pulmonary disease and immunosuppressive status. Chronic kidney disease was defined as a glomerular filtration rate (GFR) < 60 mL/min/1.73 m². End-stage renal disease was defined as a GFR <15 mL/min/1.73 m² or receipt of permanent renal replacement therapy for more than 3 months. Immunosuppression was defined as one or more of the following: solid organ or stem cell transplantation, human immunodeficiency virus infection or receipt of corticosteroids at a dosage equivalent to or higher than 15 mg of prednisolone daily for more than 5 days or cytotoxic chemotherapy or other immunosuppressive agents within 4 weeks prior to the first onset of A. baumannii bacteremia.

The onset of bacteremia was defined as the day when the blood culture that eventually yielded CRAB complex was obtained. Blood glucose values included first random blood glucose and first fasting plasma glucose values at time of admission, and random and fasting plasma glucose values within 24 h of bacteremia obtained by central laboratory from venous and arterial blood samples. In diabetes patients, glucometer blood glucose values within 24 h of onset of bacteremia were recorded. Hemoglobin A1c (HbA1c) was measured using high-performance liquid chromatography method. Minimum blood glucose was the lowest blood glucose value recorded at admission or within 24 h of bacteremia. Criteria for the diagnosis of diabetes was as defined by the American Diabetes Association.8 Hypoglycemia was defined as blood glucose < 70 mg/dL.8 Attributable mortality indicated that a patient died during the period of the CRAB complex bacteremia episode.

Antimicrobial susceptibility testing

Carbepenem-resistant AB complex was defined as resistance to piperacillin, piperacillin-tazobactam, ampicillin/sulbactam, imipenem, ceftazidime, gentamicin, amikacin, tetracycline, chloramphenicol, ciprofloxacin, and ceftriaxone. Resistance to imipenem was defined as MIC ≥ 8 mg/L according to Clinical and Laboratory Standards Institute guidelines.9 Appropriate antimicrobial therapy was defined as administration of ≥1 antimicrobial agent, to which CRAB complex was susceptible in vitro, within 48 h after the onset of bacteremia, with an approved route and dosage appropriate for end organ function.

Statistical analysis

All data were analyzed using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA). Parametric quantitative variables were expressed as mean values ± standard deviations and nonparametric quantitative variables as median and interquartile ranges (IQRs). Categorical variables were expressed as percentages of total number of specific patients analyzed. Continuous variables were compared by the Student t-test. A Mann–Whitney U test was used to analyze...
continuous nonparametric data. Categorical data were analyzed by chi-square test with Yates’ continuity correction or Fisher’s exact test as appropriate. Independent predictors for mortality were identified by logistic regression analysis. Variables with a \( p \) value less than 0.05 by the univariate analysis underwent multiple conditional logistic regression analysis. \( P \) value < 0.05 was considered statistically significant.

**Results**

From January 1st 2010 to December 31st 2015, a total of 428 adult patients were hospitalized for CRAB complex bacteremia; and data from 317 patients were available for analysis. The demographic and clinical characteristics of DM and nondiabetes (non-DM) patients with CRAB complex bacteremia are shown in **Table 1**. The mean age was 66.1 ± 16.87 years, mortality rate was 57.73% and 46.06% (146/317) had diabetes. Compared to those without diabetes, DM patients were elderly (mean age of 69.23 ± 12.88 years) and the mean APACHE II score (29.83 ± 7.82 vs. 27.1 ± 8.65, \( p = 0.006 \)) and mortality rate were higher than in non-DM patients (64.38% vs. 52.05%, \( p = 0.036 \)). More diabetes patients had chronic kidney disease, heart disease, and septic shock than non-DM patients.

Antibiotic susceptibilities of antibiotics used during the study period for carbapenem resistant AB complex were 99.96% for colistin, 44.05% for tigecycline, 6.52% for sulfamethoxazole, 3.90% for gentamicin, 1.92% for ceftazidime and 1.34% for ciprofloxacin. Univariate and multivariate analyses of risk factors for mortality among diabetes patients with CRAB complex bacteremia are shown in **Table 2**. By multivariate analysis, septic shock was associated with increased mortality.

**Fig. 1 and Table 3** show the relation of minimum blood glucose during hospital stay to mortality in 124 DM and 163

### Table 1: Demographic and clinical characteristics of patients with carbapenem-resistant *Acinetobacter baumannii* complex bacteremia.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (n = 317)</th>
<th>DM (n = 146)</th>
<th>non-DM (n = 171)</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>66.1 ± 16.87</td>
<td>69.23 ± 12.88</td>
<td>63.4 ± 19.28</td>
<td>0.002</td>
</tr>
<tr>
<td>Male sex, n (%)</td>
<td>202 (63.72%)</td>
<td>86 (58.90%)</td>
<td>116 (67.84%)</td>
<td>0.126</td>
</tr>
<tr>
<td>Mortality</td>
<td>183 (57.73%)</td>
<td>94 (64.38%)</td>
<td>89 (52.05%)</td>
<td>0.036</td>
</tr>
<tr>
<td>Length of hospital stay (d)</td>
<td>36 (18–67.5)</td>
<td>34.5 (18–63.3)</td>
<td>38 (18–72)</td>
<td>0.324</td>
</tr>
<tr>
<td>ICU stay, n (%)</td>
<td>280 (88.33%)</td>
<td>127 (86.99%)</td>
<td>153 (89.47%)</td>
<td>0.609</td>
</tr>
<tr>
<td>APACHE II score</td>
<td>28.32 ± 8.38</td>
<td>29.83 ± 7.82</td>
<td>27.1 ± 8.65</td>
<td>0.006</td>
</tr>
<tr>
<td>Liver cirrhosis</td>
<td>42 (13.25%)</td>
<td>18 (12.33%)</td>
<td>24 (14.04%)</td>
<td>0.779</td>
</tr>
<tr>
<td>CKD/ESRD</td>
<td>108 (34.07%)</td>
<td>61 (41.78%)</td>
<td>47 (27.49%)</td>
<td>0.011</td>
</tr>
<tr>
<td>Malignancy</td>
<td>87 (27.44%)</td>
<td>34 (23.29%)</td>
<td>53 (30.99%)</td>
<td>0.160</td>
</tr>
<tr>
<td>Stroke</td>
<td>67 (21.14%)</td>
<td>36 (24.66%)</td>
<td>31 (18.13%)</td>
<td>0.200</td>
</tr>
<tr>
<td>CAD/CHF</td>
<td>93 (29.34%)</td>
<td>57 (39.04%)</td>
<td>36 (21.05%)</td>
<td>0.001</td>
</tr>
<tr>
<td>COPD</td>
<td>45 (14.20%)</td>
<td>19 (13.01%)</td>
<td>26 (15.20%)</td>
<td>0.692</td>
</tr>
<tr>
<td>Immunosuppression</td>
<td>105 (33.12%)</td>
<td>42 (28.77%)</td>
<td>63 (36.84%)</td>
<td>0.161</td>
</tr>
<tr>
<td>Septic Shock</td>
<td>214 (67.51%)</td>
<td>110 (75.34%)</td>
<td>104 (60.82%)</td>
<td>0.008</td>
</tr>
<tr>
<td>Acute respiratory failure</td>
<td>276 (87.07%)</td>
<td>133 (91.10%)</td>
<td>143 (83.63%)</td>
<td>0.071</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>172 (54.26%)</td>
<td>83 (56.85%)</td>
<td>89 (52.05%)</td>
<td>0.458</td>
</tr>
<tr>
<td>Sources of bacteremia, n (%)</td>
<td>182 (57.41%)</td>
<td>82 (56.16%)</td>
<td>100 (58.48%)</td>
<td>0.763</td>
</tr>
<tr>
<td>Respiratory tract</td>
<td>3 (0.95%)</td>
<td>0 (0.00%)</td>
<td>3 (1.75%)</td>
<td>0.252</td>
</tr>
<tr>
<td>Intra-abdominal</td>
<td>10 (3.15%)</td>
<td>6 (4.11%)</td>
<td>4 (2.34%)</td>
<td>0.522</td>
</tr>
<tr>
<td>Skin/soft tissue</td>
<td>6 (1.89%)</td>
<td>1 (0.68%)</td>
<td>5 (2.92%)</td>
<td>0.223</td>
</tr>
<tr>
<td>Urinary tract</td>
<td>22 (6.94%)</td>
<td>11 (7.53%)</td>
<td>11 (6.43%)</td>
<td>0.871</td>
</tr>
<tr>
<td>CVC</td>
<td>214 (67.51%)</td>
<td>110 (75.34%)</td>
<td>104 (60.82%)</td>
<td>0.008</td>
</tr>
<tr>
<td>Surgical site</td>
<td>11 (3.47%)</td>
<td>3 (2.05%)</td>
<td>8 (4.68%)</td>
<td>0.335</td>
</tr>
<tr>
<td>Primary</td>
<td>83 (26.18%)</td>
<td>43 (29.45%)</td>
<td>40 (23.39%)</td>
<td>0.273</td>
</tr>
<tr>
<td>Neutropenia, n (%)</td>
<td>7 (2.12%)</td>
<td>3 (2.05%)</td>
<td>4 (2.34%)</td>
<td>0.99</td>
</tr>
<tr>
<td>Thrombocytopenia, n (%)</td>
<td>120 (37.85%)</td>
<td>54 (36.99%)</td>
<td>66 (38.60%)</td>
<td>0.723</td>
</tr>
<tr>
<td>Appropriate antibiotic, n (%)</td>
<td>104 (32.81%)</td>
<td>42 (28.77%)</td>
<td>62 (36.26%)</td>
<td>0.195</td>
</tr>
</tbody>
</table>

APACHE II = Acute Physiology and Chronic Health Evaluation II; CAD = coronary artery disease, CHF = congestive heart failure; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; CVC = central venous catheter; DM = diabetes mellitus; ESRD = end stage renal disease; ICU = intensive care unit; neutropenia = total neutrophil count < 500 neutrophils/µL; non-DM = nondiabetes; thrombocytopenia = total platelet count < 100,000/µL.
non-DM patients with available central laboratory blood glucose data. In patients without diabetes, there was a twofold increase in mortality in the group with hypoglycemia compared to those with blood glucose ≥70 mg/dL (100% vs. 50.33%, \( p = 0.006 \)). Although mortality was increased in diabetes patients with hypoglycemia, there was no significant difference compared to those without hypoglycemia (\( p = 0.747 \)).

Fig. 2 and Table 4 show the relation of blood glucose ranges during bacteremia and mortality in 146 DM and 171 non-DM patients with available central laboratory blood glucose values. Blood glucose in the hypoglycemia range was associated with highest mortality in both DM and non-DM patients (80.00% and 85.71% respectively). In DM patients, mortality was least in the blood glucose range 100–140 mg/dL (56.52%), and was higher (63.24–66.67%) in the blood glucose ranges 70–100, 140–180 and >180 mg/dL. Among the non-DM group, the lowest mortality was for the blood glucose range 70–100 mg/dL (43.24%), with increased mortality for blood glucose ranges 100–140 (50.67%) and 140–180 mg/dL (50.0%), and increased further (62.5%) when blood glucose was >180 mg/dL.

Fig. 3 and Table 5 show the relationship between coefficient of variation (CV) and mortality in 124 DM patients and 163 non-DM patients with available central lab blood glucose values at admission and within 24 h of bacteremia. Among non-DM patients, increasing CV was associated with increase in mortality, with an almost twofold increase in mortality (86.36% vs. 47.12%) for those with CV ≥40% compared to CV < 20% (\( p = 0.003 \)). However, this relationship was not present in DM patients. The relation between CV and mortality in 93 DM patients with available glucometer blood glucose readings obtained within 24 h of bacteremia is shown in Fig. 4. Increasing CV was not significantly associated with increased mortality (\( p = 0.055 \)).

**Discussion**

Our study investigated the relation of the domains of glycemic control to mortality in DM and non-DM patients with CRAB complex bacteremia. We compared our results with those of other studies which focused on dysglycemia in patients who were critically ill or had sepsis.
In CRAB complex bacteremia, hypoglycemia was associated with significantly increased mortality only in non-DM patients. However, when the relation of blood glucose ranges during bacteremia to mortality was compared, mortality rate was highest in patients with hypoglycemia for both DM and non-DM patients. This is in contrast to data from other observational cohort studies on the critically ill which found that hypoglycemia (defined at different threshold levels, ranging from $<70$ to $<81 \text{ mg/dL}$) was independently associated with increased risk of mortality in both DM and non-DM populations.\textsuperscript{10,11} Krinsley et al. found that hypoglycemia was independently associated with increased mortality in critically ill patients both with and without diabetes, although the relation was stronger among patients without diabetes.\textsuperscript{7} Mild hypoglycemia (blood glucose $<70 \text{ mg/dL}$) has also been found to be independently associated with increased risk of mortality in patients with sepsis.\textsuperscript{12} The elderly, chronic kidney disease, severe sepsis and critical illness are risk factors for hypoglycemia, while insulin treatment is an important cause of hypoglycemia. In the landmark Normoglycemia in Intensive Care Evaluation-Survival Using Glucose Algorithm Regulation (NICE-SUGAR) trial, among intensive care unit (ICU) patients, mortality was higher in the intensive than in the conventional insulin therapy group.\textsuperscript{13} Our data suggest that although hypoglycemia is significantly associated with

### Table 3

<table>
<thead>
<tr>
<th>Minimum blood glucose (mg/dL)</th>
<th>Diabetes</th>
<th>Nondiabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mortality rate</td>
<td>Mortality no.</td>
</tr>
<tr>
<td>$&lt;70$</td>
<td>72.73%</td>
<td>8</td>
</tr>
<tr>
<td>$\geq70$</td>
<td>62.83%</td>
<td>71</td>
</tr>
</tbody>
</table>

### Table 4

<table>
<thead>
<tr>
<th>Blood glucose range (mg/dL)</th>
<th>Diabetes</th>
<th>Nondiabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mortality rate</td>
<td>Mortality no.</td>
</tr>
<tr>
<td>$&lt;70$</td>
<td>80.00%</td>
<td>8</td>
</tr>
<tr>
<td>70–100</td>
<td>66.67%</td>
<td>8</td>
</tr>
<tr>
<td>100–140</td>
<td>56.52%</td>
<td>13</td>
</tr>
<tr>
<td>140–180</td>
<td>66.67%</td>
<td>22</td>
</tr>
<tr>
<td>$&gt;180$</td>
<td>63.24%</td>
<td>43</td>
</tr>
</tbody>
</table>

### Figure 2

Relation of blood glucose ranges during bacteremia and mortality in 146 diabetes (DM) and 171 nondiabetes (non-DM) patients with available central laboratory blood glucose (BG) values.
increased mortality only in non diabetes patients, it is of importance in both DM and non-DM patients.

In non-DM patients, mortality was lowest for the blood glucose range 70–100 mg/dL, and highest when blood glucose was >180 mg/dL. However, in DM patients, the lowest mortality was for the blood glucose range 100–140 mg/dL, while other blood glucose ranges had similar mortality. Hyperglycemia in hospitalized patients is

![Graph](image1)

**Figure 3.** Relationship between coefficient of variation and mortality in 124 diabetes (DM) and 163 nondiabetes (non-DM) patients with available central lab blood glucose values at admission and within 24 h of bacteremia.

<table>
<thead>
<tr>
<th>CV (%)</th>
<th>Diabetes</th>
<th>Nondiabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mortality rate</td>
<td>Mortality no.</td>
</tr>
<tr>
<td>&lt;20</td>
<td>59.57%</td>
<td>28</td>
</tr>
<tr>
<td>20–40</td>
<td>78.79%</td>
<td>26</td>
</tr>
<tr>
<td>≥40</td>
<td>56.82%</td>
<td>25</td>
</tr>
</tbody>
</table>

**Figure 4.** Relation between coefficient of variation and mortality in 93 diabetes patients with available glucometer blood glucose values within 24 h of bacteremia.

Dysglycemia and *Acinetobacter baumannii* complex 659
with higher mortality risk than blood glucose in other
increased at higher levels in non-DM patients. Among dia-
victims.15,16,19,20 In an international multicenter study on
demonstrated that the association between hyper-
say in 88.33%), and our findings are similar to other studies
which demonstrated that the association between hyper-
glycemia and increased risk of mortality was much stronger
among nondiabetic individuals than among diabetic in-
dividuals.15,16,19,20 In an international multicenter study on
critically ill patients, mortality was lowest when mean
blood glucose was 80–110 and 110–140 mg/dL, and
increased at higher levels in non-DM patients. Among dia-
betics, mean BG of 80–110 mg/dL was associated
with higher mortality risk than blood glucose in other
ranges (110–140, 140–180, and >180 mg/dL).7 Egi et al.
demonstrated that ICU mortality increased significantly
with increasing mean blood glucose concentration, and
hyperglycemia was strongly and independently associated
with increased mortality in non-DM patients but not in DM
patients.15 In contrast; severe admission hyperglycemia
(blood glucose ≥200 mg/dL) in critically ill sepsis patients
was shown to be associated with increased 30-day mortal-
ity, irrespective of the presence or absence of diabetes.21
Elevated blood glucose levels may be beneficial to the
critically ill individual, and stress hyperglycemia is an
appropriate and adaptive response to life-threatening
illness.22 The “diabetes paradox” suggests that although
diabetes is associated with a large burden of illness in
outpatients; diabetes as a comorbidity is not independently
associated with increased risk of mortality in patients
admitted to intensive care units.15 Our findings suggest that
in both DM and non-DM patients, euglycemia was associated
with the lowest mortality in CRAB complex bacteremia.
Increased glycemic variability was independently associ-
ated with decreased risk of mortality only in non-DM patients
with CRAB complex bacteremia. Glycemic variability has
been defined as acute glycemic fluctuations; with both up-
wards fluctuations (in hypoglycemic correction) and down-
ward fluctuations (in initial overbearing hypoglycemic
treatment).24 Although there are different ways of measuring
glycemic variability, there is no consensus on which methods
are best at present. Some studies showed that glycemic
variability is an independent predictor of mortality in criti-
cally ill patients.25,26 In the Leuven interventional trials,
increasing glycemic variability in critically ill patients was
associated with increased risk of mortality regardless of
diabetic status.27 However, our findings were similar to other
trials which found that low glycemic variability was inde-
pendently associated with lower risk of mortality and high
glycemic variability was independently associated with
increased risk of mortality among non-DM individuals but not
among diabetic individuals.16,20 Krinsley et al. demonstrated
that increased glycemic variability, defined as CV >20%, was
independently associated with increased risk of mortality
only among patients without diabetes, with a more than a
threefold higher mortality among the cohort with CV ≥40%
compared with those with CV <20%.7 It is not known whether
glycemic variability is a cause of poor patient outcomes or is a
marker of severe illness.29 A degree of tolerance to glycemic
variability may occur in diabetic patients due to their glyce-
mic history preceding critical illness.30
Diabetes was present in 46.06% of patients with CRAB
complex bacteremia. In other studies, 24–31.3% of patients
with AB complex bacteremia had diabetes.5,31 The high
prevalence of diabetes reflects the progressive increase of
diabetes worldwide. According to the World Health Orga-
nization (WHO), the number of people with diabetes
worldwide has risen from 108 million in 1980 to 422 million
in 2014, while the global prevalence of diabetes among
adults over 18 years of age has risen from 4.7% in 1980 to
8.5% in 2014.32 Mortality rates for AB complex bacteremia
were 69.9–73% in other studies.6,33 Mortality was higher
among DM patients compared to non-DM patients with CRAB
complex bacteremia. This is in contrast to a meta-analysis
of 10 studies between 2000 and 2016 which showed that
the mortality rate of septic patients with diabetes was
slightly lower than that of non-DM patients.34 The lack of
severity adjustment is a significant limitation of the avail-
able literature relating to mortality risk of critically ill pa-
tients with and without diabetes.3 Nevertheless, the risk
for death among people with diabetes is about twice that of
non-DM people of similar age.35 Diabetes has been pro-
jected by the WHO to be the seventh leading cause of death
in 2030.32 Increased mortality in diabetes with CRAB com-
plex bacteremia could be due to other factors. Compared
to those without diabetes, DM patients were elderly and
had a higher APACHE II score; and septic shock was a risk
factor for increased mortality. Our data are concordant to
other studies which found older age, higher APACHE II score
and septic shock to be risk factors for increased mortality in
CRAB complex bacteremia.36 The status of premorbid gly-
cemic control could affect sepsis outcome in diabetes pa-
tients. In an analysis of critically ill patients with diabetes,
higher (>7%) preadmission levels of HbA1c was associated
with lower hospital mortality compared with the lower
(<7%) HbA1c cohort.37 Our findings are consistent with
Krislnsy et al. who noted that critically ill patients with
diabetes may benefit from higher glucose target ranges
than those without diabetes.7
In order to reduce mortality from dysglycemia in criti-
cally ill patients, glycemic targets should adequately con-
tral blood glucose while avoiding hypoglycemia and
hyperglycemia and minimizing glycemic variability. In non-
DM patients, tight blood glucose control with a target blood
glucose range 70–110 mg/dL could increase the risk of
hypoglycemia. The American Diabetes Association recom-
mends that insulin therapy should be initiated for treat-
ment of persistent hyperglycemia starting at a threshold
≥180 mg/dL.8 Once insulin therapy is started, a target
glucose range of 140–180 mg/dL is recommended for the
majority of critically ill and noncritically ill patients.38
Based on our study results, a target blood glucose goal
between 100 and 140 mg/dL could help reduce mortality
from CRAB complex bacteremia for DM patients. Diabetes is
often asymptomatic and diagnosis delayed. Measurement
of fasting blood glucose, post prandial blood glucose and
HbA1c in hospitalized patients could help detect previously
undiagnosed diabetes as well as provide information on
glycemic control. Optimal glycemic targets and insulin
infusion protocols should consider the patient’s diabetic
status, pre-morbid blood glucose control in DM patients, presence of other comorbidity and risk factors for hyperglycaemia. Limitations in our study were that it was retrospective, conducted in a single center and HbA1c data was not available for all patients. Many patients were excluded due to lack of data on fasting blood glucose and blood glucose levels during bacteremia.

In summary, our study highlights the role of dysglycemia in mortality due to CRAB complex bacteremia. Effects of dysglycemia on mortality due to CRAB complex bacteremia differ according to diabetic status. Mortality was higher in DM patients; while in non-DM patients, hyperglycaemia and increased CV were associated with increased mortality. The lowest mortality was for the blood glucose range 100–140 mg/dL for DM patients with CRAB complex bacteremia. Thus we suggest that maintaining a blood glucose range of 100–140 mg/dL while avoiding hypoglycaemia could help reduce mortality in DM patients with CRAB complex bacteremia. Future prospective studies focusing on the relation of the different domains of blood glucose control to mortality according to diabetes status could help identify strategies to reduce mortality from CRAB complex bacteremia.

Conflicts of interest

The authors declare that they have no conflicting interests.

Funding

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References


