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CONCISE COMMUNICATION

Factors Associated with Recovery of *Acinetobacter baumannii* in a Combat Support Hospital

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A retrospective review of hospital records for *Acinetobacter baumannii* infection at a US Army combat support hospital revealed a monthly infection rate ranging from 20.5 to 0 cases per 1,000 patients admitted. The rate correlated with the mean census of host-nation patients in the intensive care unit, the mean census of host-nation patients on the wards, and length of stay in the intensive care unit.

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The US military healthcare system has seen an increase in the rate of *Acinetobacter baumannii* infection since the beginning of the wars in Iraq and Afghanistan.[1,2] Available evidence suggests that personnel likely acquire *A. baumannii* colonization while undergoing care at combat support hospitals or during care received through the evacuation system.[3,4] *Acinetobacter* infections are known to occur at the combat support hospitals; the factors contributing to the rate and spread of *A. baumannii* infection at these facilities are not well described but might be associated with the prolonged stays of host-nation patients.[5] A combat support hospital in Baghdad, Iraq, saw a decrease in its *A. baumannii* infection rate starting around March 2007. Although the hospital's infection control procedures had not changed, there was an improved ability to evacuate host-nation patients from the hospital, which led to shorter lengths of stay. We undertook this study to evaluate whether healthcare factors such as length of hospitalization contributed to the rate of *A. baumannii* infection.

METHODS

The hospital in the present study is one of several US Army combat support hospitals located in Iraq.[5] The hospital cares for US and coalition service members, US and foreign national civilian contractors, and host-nation patients. The study period was November 1, 2006, through October 31, 2007; this period was chosen because it was the time that the decrease in the *A. baumannii* infection rate was noted and it correlated with a single deployment of the US military hospital staff.

The electronic laboratory records of the hospital were searched to identify all patients who had a culture from which *A. baumannii* was recovered during the study period. Only cultures associated with a clinical infection (as determined by the attending physician, either through a written statement identifying the infection or initiation of antibiotics to treat *A. baumannii*) were included.

The hospital's nursing and patient administration records were used to ascertain the number of patients admitted per month; the number of surgeries performed during a given period; the mean length of intensive care unit (ICU) stay; and the mean daily patient census for the ICU and for medical-surgical wards, stratified according to nationality (US patient or host-nation patient). The monthly values for these variables and the monthly rate of *A. baumannii* infection were compared by using the Pearson correlation coefficient. Statistics were performed by using SPSS for Windows, version 15 (SPSS). *P* values less than .05 were taken to be significant for all tests.

RESULTS

A. baumannii was recovered from 40 patients. The rate of new acquisition ranged from 20.5 cases per 1,000 patients admitted in February 2007 to 0 cases per 1,000 patients admitted in October 2007 (Figure 1). Of the 40 isolates representing new acquisition, 13 (33%) were recovered from sputum, 15 (37%) from wounds, and 12 (30%) from blood. Twenty-two (54%) of the new isolates were recovered from patients in the ICU, 13 (33%) from patients in the medical-surgical wards, 2 (5%) from patients in the operating room, 2 (5%) from patients in the emergency treatment area, and 1 (3%) from a patient in the outpatient clinic. All but 1 of the 40 isolates were recovered from host-nation patients.

The monthly number of patients admitted to the hospital varied from a high of 596 in July 2007 to a low of 348 in September 2007 (Figure 1). The number of surgeries performed also peaked in July 2007, and it reached a low in October 2007 (Figure 1). Neither the number of admissions nor the number of surgeries were correlated with the rate of *A. baumannii* infection during the study period (*R* for number of admissions, −0.296; *R* for number of surgeries, −0.053).

The mean census of host-nation patients in the ICU ranged from a high of 13 patients per day in February 2007 to a low of 4 patients per day in September 2007, and the census was strongly correlated with the monthly *A. baumannii* infection rate (Figure 1) ($R = 0.789$; $P = .002$). The census of US patients ranged from a mean of 1.1 to 3.3 patients per day, and the highest value was seen in June of 2007 (Figure 1). The rate of *A. baumannii* infection was not correlated with the census of US patients in the ICU ($R = -0.377$). The mean length of ICU stay was highest in February 2007 (5.69 days) and reached a low in October 2007 (2.50 days) (Figure 1). This trend was strongly correlated with the *A. baumannii* infection rate ($R = 0.880$; $P < .01$).

The mean census of host-nation patients on the wards tended to decrease during the study period, ranging from a high of 17.8 patients per day in January 2007 to a low of 8.3

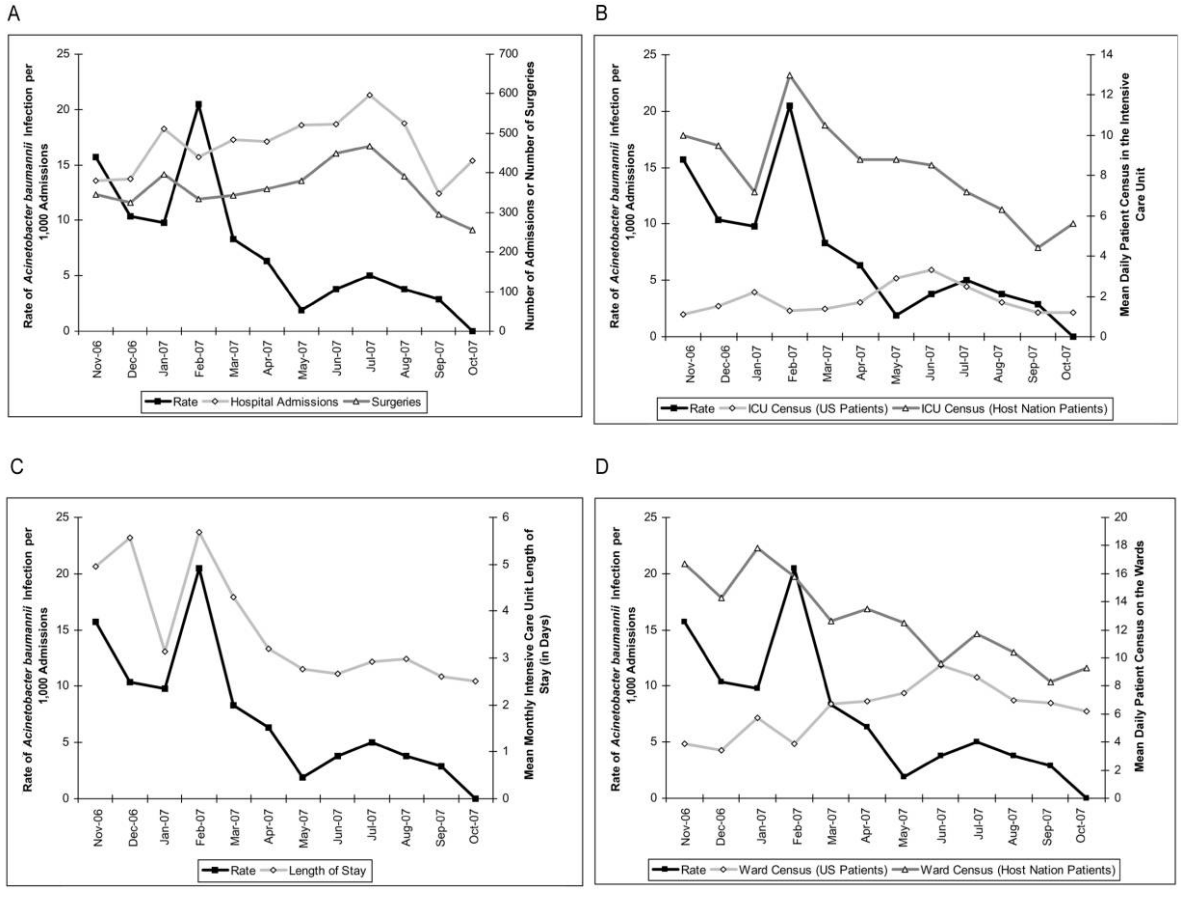

FIGURE 1. Monthly incidence of *Acinetobacter baumannii* infection at the combat support hospital, according to the following healthcare facility factors: monthly admission and surgery rates *(A)*, mean daily census in the intensive care unit (ICU) *(B)*, mean length of ICU stay *(C)*, and mean daily census on the wards *(D)*.

patients per day in September 2007 (Figure 1). This trend was also strongly correlated with the *A. baumannii* infection rate ($R = 0.788$; $P = .002$). The mean census of US patients on the ward, which ranged from 3.4 patients per day in December 2006 to 9.5 patients per day in June 2006, was negatively correlated with the *A. baumannii* infection rate ($R = -0.725$; $P = .008$) (Figure 1).

DISCUSSION

A. baumannii continues to be an important cause of nosocomial infection in the US military healthcare system. Combat support hospitals may serve as the source of *A. baumannii* colonization and infection in wounded combat casualties.[3,4] In this study of a single combat support hospital, we found that a decrease in the census of host-nation patients and a decrease in the length of ICU stay were associated with a decrease in the incidence of *A. baumannii* isolates recovered from patients in the facility.

The strong correlation between the *A. baumannii* infection rate and the host-nation patient census suggests that these patients may serve as a reservoir for *A. baumannii* in the combat support hospital. This finding is in agreement with an earlier observational study, which reported that the vast majority of *A. baumannii* isolates were recovered from host-nation patients who had a hospital stay longer than that of US patients (11% of isolates were recovered from host-nation patients and 1% from US patients).[5] It is possible that this prolonged contact with the healthcare system is a major factor in propagating *A. baumannii* infection. Because prolonged length of stay is a well-established risk factor for *A. baumannii* infection, it logically follows that the host-nation patients would have higher rates of *A. baumannii* colonization and infection.[6-9]

Decreasing the number of nosocomial infections due to *A. baumannii* is an important goal, and the decrease in the *A. baumannii* infection rate at the combat support hospital in the present study suggests that steps are being made in the right direction. What is not clear, however, is whether this decrease in the *A. baumannii* infection rate will result in fewer combat casualty patients becoming infected. The short length of stay at the combat support hospital may simply be masking the fact that patients are still acquiring *A.*

baumannii there, but not manifesting infection until after transfer to other facilities. In addition, patients may still acquire *A. baumannii* at other military hospitals. A decreasing rate of *A. baumannii* infection seen at 2 higher-echelon military hospitals suggests that the decrease in *A. baumannii* infection rate in the combat support hospital is having some effect, though a steady infection rate at a third hospital suggests otherwise (unpublished data). The factors involved in *A. baumannii* transmission are not clearly understood, and a more deliberate, systemwide approach involving all military hospitals will be necessary to fully come to grips with this issue.

In this observational study, we report a decrease in the rate of *A. baumannii* infection correlated with a decrease in the number of host-nation patients in the hospital, likely owing to shortened length of stay. Efforts aimed at decreasing hospital crowding by moving patients through the evacuation chain more quickly may help reduce the incidence of *A. baumannii* infection in individuals with combat-related injuries.

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