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Outbreak of carbapenem-resistant *Acinetobacter baumannii* among non-burn patients in a burn intensive care unit

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Multidrug-resistant (MDR) *Acinetobacter baumannii* is increasingly a cause of healthcare-associated infections associated with increased mortality, increased length of stay in both the intensive care unit (ICU) and hospital, as well as increased healthcare costs.^{1–3} Outbreaks of MDR *A. baumannii* have been attributed to breaks in infection control practices, environmental sources, and the use of antibiotics such as carbapenems and fluoroquinolones.^{4–8} We describe a case-control study of an outbreak of carbapenem-resistant *Acinetobacter baumannii* (CR-AB) among non-burn patients cared for in our burn ICU, in order to help to identify risk factors associated with CR-AB acquisition.

Harborview Medical Center is a 413 bed level I trauma centre with an 18 bed burn ICU. Since 2005, surveillance cultures (sputum/oral, rectal, any open wounds) have been performed for CR-AB in all patients admitted to the ICU at the time of admission, every 7 days during their ICU stay, and on discharge from the ICU. Contact precautions are used for those patients found to be colonised or infected with CR-AB. In December 2008, an outbreak of CRAB was identified in the burn ICU with an increased transmission rate of 14 per 1000 patient-days compared with zero cases in the preceding 4 months, and compared with the overall hospital rate of 0.64 per 1000 patient-days during that same month. During the outbreak that lasted until February 2009, 11 cases of CR-AB were identified. None of the burn patients in the same burn ICU acquired CR-AB during this period.

Cases were defined as those admitted to a non-burn service (mostly general surgery) in the burn ICU with negative surveillance cultures on admission and subsequent positive

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None declared.

surveillance or clinical cultures for CR-AB. Eleven cases were identified. Six of these (54.6%) were identified by clinical cultures and had identical anti-biograms demonstrating resistance to all drugs tested, except for intermediate resistance to tigecycline. Five of the 11 cases (45.4%) were CR-AB identified by surveillance cultures and the complete antibiograms were not available. Sixteen control patients (case: control ratio 1:1.5) were admitted to the same burn ICU for at least 24 h within one week of a case's admission date and cared for by the same primary service, but did not acquire CR-AB. Electronic medical charts were reviewed and univariate and bivariate analyses were conducted using Fisher's exact test to assess odds ratios. A sample of available CR-AB bloodstream isolates from December 2008 through April 2009 was sent for pulse-field gel electrophoresis (PFGE).

The majority of cases and controls were male (81.8% and 75%, respectively) with mean age 51.6 and 46 years, respectively. As indicative of Harborview's role as a trauma referral hospital, 72.7% of cases and 62.5% of controls were transferred from an outside hospital. However, all patients had negative surveillance cultures for CR-AB upon admission. Cases spent a median of 21 days (range: 9–24 days) in the burn ICU, whereas controls spent a median of 4 days (range: 2–21 days) in the same ICU. PFGE was performed on seven available hospital bloodstream CR-AB isolates. Five of the isolates during the 6 month period to April 2009 were identical (including three of our outbreak cases) demonstrating the ability of an *Acinetobacter* clone to persist within the hospital environment over several months. Two isolates (not cases) had one band difference.

Risk factors for acquisition of CR-AB in this population are identified in Table I. Reflecting the challenge of controlling outbreaks due to MDR *Acinetobacter* spp., acquisition of CR-AB was associated with prolonged ICU exposure of at least 5 days, patient factors such as having an open wound (particularly an open abdominal wound), and the interventions required to care for these critically ill patients (frequent trips to the operating room, wound irrigation, and devices such as mechanical ventilation and central lines). In addition, prior receipt of piperacillin–tazobactam was associated with a 10-fold increased risk of acquiring CR-AB.

Unlike previously described outbreaks of *Acinetobacter* spp. in burn and surgical ICUs, this outbreak affected only non-burn service patients in the burn ICU and not the highly vulnerable burn patients even though the unit had the same nursing staff, respiratory therapists, and physical environment. The influence of non-burn versus burn service involvement in the care of these patients was eliminated by the selection of cases and controls from non-burn patients within the burn ICU. Although limited by small sample size, this study suggests that further investigation into the management of open abdominal wounds requiring recurrent peritoneal washouts and lengthy courses of broad spectrum antibiotics are warranted to minimize cross-contamination. The association of CR-AB acquisition with use of a non-carbapenem antimicrobial is particularly concerning and may reflect the ability of *Acinetobacter* spp. to develop resistance through multiple mechanisms. Furthermore, this may be a consequence of the alteration of normal host flora by other broad spectrum agents, thus creating a more favourable environment for colonisation by MDR organisms. Such associations further highlight the need for effective antimicrobial stewardship within the ICU.

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Table IRisk factors associated with acquisition of carbapenem-resistant *Acinetobacter baumannii*

	Odds ratio	95% CI	P-value
Mechanical ventilation	14.2	(1.29, undefined)	0.02
Presence of central line	18.2	(1.69, undefined)	0.01
MRSA colonisation	13.6	(1.08, undefined)	0.04
>5 trips to OR	18.0	(1.43, 881.06)	0.02
Open abdominal wound	19.8	(1.64, undefined)	0.01
Any open wound	29.1	(2.62, undefined)	0.002
Wound irrigation in OR	12.9	(1.16, 618.46)	0.03
Tube feeding	14.2	(1.29, undefined)	0.02
>5 days in burn ICU	37.2	(3.29, undefined)	0.0007
Received piperacillin-tazobactam	9.9	(1.23, 115.79)	0.03

CI, confidence interval; MRSA, methicillin-resistant *Staphylococcus aureus*; OR, operating room; ICU, intensive care unit.