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Universal contact precautions do not change the prevalence of antibiotic resistant organisms in a tertiary burn unit☆

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ABSTRACT

Objective: The prevalence of antibiotic-resistant organisms (ARO) in burn units is increasing worldwide and contributes significantly to morbidity and mortality. Study aims are to describe the burden of AROs in burn patients admitted to a tertiary burn unit, to evaluate the impact of contact precautions implemented after an outbreak of antibiotic-resistant *Acinetobacter baumannii*, and to identify possible predictors of ARO acquisition.

Methods: Data of burn inpatients between 2006 and 2010 were retrospectively reviewed. The antibiotic susceptibility profiles of ARO colonization/infection at or after admission were reviewed in detail. Organisms of interest included: methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), extended-spectrum beta-lactamase-producing *Escherichia coli*, and carbapenem-resistant *Pseudomonas* and *Acinetobacter*. Univariate and multivariate logistic regression analysis was employed with the p-value set at 0.05.

Results: Complete data analysis was available for 340 patients. The mean age was 41.8 years with male predominance. Among the AROs, the most prevalent was MRSA from clinical specimens. Prior to contact precaution implementation, the prevalence of all AROs was 27.9%, compared to 27.6% afterwards. There was an increase in *Pseudomonas* and VRE isolates and a disappearance of *Acinetobacter*. The most common isolate sites were the burn wounds. ICU stay, burns >20% TBSA, and surgical management were significant predictors of ARO acquisition.

Conclusion: This study describes the ARO profile of burn patients admitted to a tertiary burn unit. The results suggest that implementation of unit-wide contact precautions may not significantly reduce the frequency of AROs among burn patients. Contact precautions for patients transferred from the ICU, undergoing surgery, and large burns may be of benefit.

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1. Background

Innovations and developments in different areas of burn management such as fluid management, critical and surgical care, and local and systemic antimicrobial therapy, have contributed towards a reduction in mortality and morbidity rates for moderate and large burns (over 20% TBSA) [1]. However, the incidence of nosocomial infection amongst burn patients is on the rise; extended intensive care, hospital stay, invasive interventions and monitoring are some of the main culprits [2]. The sources of infection are not only the burn wounds, but also the lungs (pneumonia), blood, and gut (bacterial translocation) to enumerate a few [3].

Many of the bacteria isolated and cultured from burn inpatients belong to a group commonly referred to as antibiotic-resistant organisms (AROs). Significant interventions and efforts have been implemented worldwide in the last decade to prevent and decrease ARO infections and colonization in patients admitted with burns. Shifts over time in the predominance of pathogens causing infection among burn patients often lead to changes in burn care practices [4], however there is no consensus on the most effective infection control practices to prevent transmission of infection to and from patients with serious burns [5].

The prevention of transmission of ARO during the hospital stay is based on a multimodal approach which includes development of antimicrobial stewardship programs, increased level of education amongst members of the staff, adherence to hand hygiene and washing policies, and the use of strict barrier and isolation precautions [6]. However, this has not been shown in burn patients. Contact precautions are a standard method used to prevent patient-to-patient transmission of AROs in hospital settings. The Centre of Disease Control defines this as the use of gowns and gloves for all staff who have contact with the patient or the patient's environment [5]. There still remains controversy regarding the necessity and type of barrier precautions for the routine care of burn patients.

An outbreak of multi-drug resistant *Acinetobacter baumannii* in our Burn Unit in 2008 led to implementation of several infection control practices that included clustering and isolation of these patients in the Burn Unit as well as universal contact precautions. Following the outbreak, Infection Control's recommendations included meticulous routine practices, screening for all patients on admission and weekly, and screening for resistant gram-negative organisms for patients admitted from out of country. Discontinuing universal contact precautions of non-ARO patients in the Burn Unit was recommended a year later. However, it was decided that universal contact precautions would remain for all burn patients on the Burn Unit regardless of their ARO status and burn patients admitted to the Intensive Care Unit (ICU).

There are no previous studies describing the prevalence of AROs in the burn patient population admitted to our burn unit and how universal contact precautions that were implemented affected the transmission of ARO. Our study objectives were to describe the prevalence of AROs from burn patients admitted to a tertiary Burn Unit, as well as the impact of universal contact precautions and the predictors of ARO infection/colonization.

2. Patient and methods

2.1. Study sample

This study was approved by the Institutional Review Board. Burn patients admitted to our 24-bed tertiary burn unit from January 1, 2006 to December 31, 2010 were identified from a prospectively maintained Burn Registry Database. This database has been maintained since 1973.

2.2. Study design

We retrospectively reviewed the data of all burn patients identified during the study period from the burn database and hospital electronic medical records. A standard collection form was designed for data collection which included demographic information (age, gender, body mass index, smoking status, comorbidities) and clinical information relevant to burns (date of admission to hospital, etiology, total burn surface area (TBSA), contributing factors to burns (alcohol, drugs), presence of inhalational injury, number of days on the ventilator, admission to the ICU, and need for excision and skin grafting).

The primary outcome measure was the presence of AROs isolated at or during admission from patients with burns. The study did not extend to isolate fungi and yeasts. MRSA, VRE and wound culture and sensitivity swabs are routinely taken on admission and weekly unless they were already positive for MRSA or VRE.

Each positive culture (colonization or infection) was treated as an independent observation. All bacteriology cultures and antibiotic susceptibility testing results for the study sample were reviewed in detail. The AROs of interest included methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), extended-spectrum beta-lactamase (ESBL)-producing *Escherichia coli*, and carbapenem-resistant *Pseudomonas* and *Acinetobacter* species. The ARO data included the culture collection date, specimen type (screening culture versus clinical specimen), collection source (blood; groin/perineum/perianal; stool/rectal swab; urine; catheter tip; wound; other) and also if it was colonization or infection.

To determine the efficacy of universal contact precaution policies on antimicrobial resistance, ARO colonization or infection was compared before and after the implementation. January 1, 2006 to December 31, 2007 represented the time period prior to contact precaution implementation and January 1, 2009 to December 31, 2010 represented the time period after contact precautions. 2008 was the year when universal contact precautions were implemented on the Burn Unit, due to the outbreak of antibiotic-resistant *A. baumannii*. Potential predictors of ARO colonization/infection in ARO patients and non-ARO patients were found and compared.