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Microbiological findings in burn patients treated in a general versus a designated intensive care unit: Effect on length of stay

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ABSTRACT

Background: Infection is one of the most common causes of mortality and morbidity in burn patients. The incidence and frequency of microbiological micro-organisms are known to vary across different models of intensive care units. To date, no study has attempted to describe the different findings in burn patients treated in an open, general intensive care unit (GICU) versus a dedicated burns intensive care unit (BICU). Only limited data is available on the effect of these microbiological micro-organisms on patients' length of stay.

Aim: To characterize and compare the microbiological flora and antibiotic resistance patterns encountered in two different models of burn intensive care and to determine the effect of specific microbiological types on length of intensive care unit (ICU) and overall stay.

Methods: A retrospective case-control study of 209 burn patients treated in two highly specialized, Western burn referral centres between September 2009 and March 2014.

Results: 9710 culture results were analysed, of which 2590 (26.7%) yielded positive results (1537 in the GICU and 1050 in the BICU). Gram-positive cultures were more frequently found in the GICU, whereas Gram-negative and yeast cultures were more prevalent in the BICU. The most frequently encountered micro-organisms in both units were similar and included *Staphylococcus aureus*, *Pseudomonas aeruginosa*, coagulase-negative staphylococci (CoNS) and *Candida albicans*. Significantly more resistant bacteria were detected in the BICU. Testing positive across all types of microbiological isolates, as well as for both Gram-positive

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and -negative bacteria significantly prolonged patient length of stay. This effect was even more pronounced if the micro-organisms were resistant to antimicrobial therapy.

Conclusion: There are notable differences in the microbiological isolate and antibiotic resistance patterns between burn patients treated in a GICU compared to a designated BICU. In both units, testing positive for resistant microbiological micro-organisms is significantly associated with longer hospital stay.

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1. Introduction

In burn patients, infections are one of the most common causes of mortality and morbidity [1–5]. Loss of the mechanical barrier of the skin, respiratory tract injury, the immune-compromising consequences of burns, prolonged hospital stays, and invasive diagnostic and therapeutic procedures increase susceptibility to infections [5,6]. During the long hospital stays of severely burnt patients, nosocomial infections are a challenging problem [7], especially because burn patients have higher rates of septicaemia with inferior outcome, ventilator-associated pneumonia, and wound infections compared to other intensive care patients [8–10]. Furthermore, it is known that patients in an intensive care unit (ICU) generally carry a higher risk of acquiring nosocomial infections than patients hospitalized on general wards [5,6].

The treatment of burn patients is complex and benefits from a multidisciplinary, well-rehearsed specialist team. Many Burn Units (BU) are equipped with beds with attached respirators for patient undergoing breathing support, thus being a dedicated Burns Intensive Care Unit (BICU). Other specialised BUs, possess all standardized treatment facilities, but lack beds with respirators. Therefore, critically ill patients are first observed in the General ICU (GICU), and once stable, transferred to the BU.

Although some data exist in the literature regarding microbiological findings in BUs and dedicated BICUs, no information is available regarding the different microbiological patterns of burn patients treated in a GICU compared to those treated in a BICU. In a recently published review comparing mortality associated with sepsis in the BICU-, trauma ICU-, and GICU-patient, micro-organisms associated with infections in BICU patients were predominantly Gram-negative bacteria, whereas in the GICU Gram-positive bacteria were identified as the principal cause of sepsis [8]. Yildirim et al. compared bacteriological findings in a BICU, other ICUs and the general wards in one single centre and showed that the bacteriological profile and antibiotic resistance pattern for nosocomial infections in patients treated in the BICU are significantly different from those of medical and surgical patients in other ICUs and hospital units [6].

None of these studies compare uniform cohorts of burn victims across the various types of treatment units and hence it remains unclear if being a burn patient results in a different microbiological spectrum, or if the differences described are a consequence of environmental factors. Although complete eradication of infections in burn patients is highly unlikely,

a well conducted surveillance, infection control, and prevention strategy is helpful to reduce the incidence hereof [11]. Thus, the identification of potential environmental contribution to microbiologic findings of burn patients in an ICU setting may be a crucial step in reducing subsequent infections among burn patients.

The aim of this study was to define and compare the microbiological isolate and resistance profiles of burn patients treated in a BICU vs. GICU setting and to determine the impact of these profiles on length of ICU and overall hospital stay.

2. Materials and methods

2.1. Study design and patient population

This is a retrospective case-control study of patients treated in two highly specialized, Western tertiary referral burn centres between September 2009 and March 2014. Patients in the Australian cohort were treated in a GICU, whereas patients in the Swiss cohort were treated in a dedicated BICU. Study inclusion criteria were burn patients receiving intensive care with an ICU length of stay and survival >48 h. All data were collected through hospital-wide databases, by reviewing medical records, and microbiology laboratory data following approval of the institutional review boards of both participating institutions.

An extensive analysis of patient demographics, co-morbidities, microbiological findings, antimicrobial treatments and length of ICU and overall length of stay was performed.

2.2. Study setting

Concord Repatriation General Hospital (CRGH) is a 450-bed tertiary referral facility for burn patients in New South Wales, Australia, and a teaching hospital of the University of Sydney. The Burns Unit (BU) of CRGH is a statewide referral unit for burn patients. Burn patients receiving intensive care treatment are initially admitted to the general intensive care unit (GICU), and once stable, transferred to the BU. The GICU includes 13 beds (of which 4 are isolated rooms), where surgical as well as medical patients are treated. Gloves and gowns are mandatory standard contact precautions regardless of multi-resistant micro-organisms (MRO) colonization status of the patients. Line management is handled in accordance with national guidelines [12]. The BU of CRGH is an enclosed unit, which comprises 12 inpatient beds, a dedicated Burns Theatre (where all burn patients are operated), a skin laboratory on site, and an anesthetic recovery room.

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