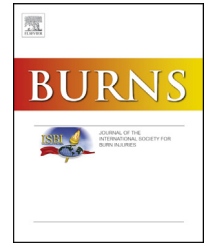


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# Microbiology and antibiotic resistance in severe burns patients: A 5 year review in an adult burns unit

I.A. Bahemia<sup>a,\*</sup>, A. Muganza<sup>a</sup>, R. Moore<sup>a</sup>, F. Sahid<sup>b</sup>, C.N. Menezes<sup>b</sup>

<sup>a</sup> Adult Burns Unit, Department of Surgery, Chris Hani Baragwanath Academic Hospital and Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

<sup>b</sup> Division of Infectious Diseases, Department of Internal Medicine, Chris Hani Baragwanath Academic Hospital and Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

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## ABSTRACT

**Background:** Infections are a major problem in burns patients. Knowledge of the incidence and antimicrobial sensitivities of the microorganisms commonly encountered within each institution's burns unit is important as it informs and directs empiric antibiotic therapy.

**Methods:** This was a retrospective review of patients admitted from 1 January 2008 to 31 December 2012 to an adult burns intensive care unit. Specimens chosen for analysis were wound swabs, blood cultures, venous catheter tips, tracheal aspirates, sputum, urine and wound tissue. Records were accessed from the admission register and laboratory information system to obtain the relevant data.

**Results:** During the study period, 352 patients were admitted to the adult burns intensive care unit, of which, 341 patients were included. The mortality rate was 44.6%. Flame burns were the commonest. Mortality rate amongst patients with bacteremia was 46.9%. *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and methicillin resistant *Staphylococcus aureus* (MRSA) were found to be the most common organisms cultured in most specimens.

**Conclusion:** The main three organisms identified in specimen cultures in our adult burns intensive care unit were *A. baumannii*, *P. aeruginosa* and MRSA. This study has helped establish a better empiric approach to the management of our septic burns patients.

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## 1. Introduction

It is well established that severely burned patients are predisposed to septic complications [1]. The reasons for increased susceptibility to infection include a generalized immune deficit due to impaired function of both the cellular and humoral immune systems, loss of the protective skin

barrier and the massive systemic inflammatory response syndrome (SIRS) causing general systemic disarray [2]. The Nosocomial Infection Surveillance System from the United States Centers for Disease Control and Prevention (CDC) in 2001, demonstrated that amongst all intensive care units (ICUs), burn centres have the highest rates of primary blood stream infection in patients with central venous catheters [3].

\* Corresponding author. Tel.: +27 795427967; fax: +27 86 553 3582.

E-mail address: [imt7@hotmail.com](mailto:imt7@hotmail.com) (I.A. Bahemia).

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By virtue of the significant variability in the bacteriology of different centres around the world, knowledge of the main organisms commonly encountered in each unit is primordial to effectively treat infections. For example, two studies performed in Turkey at different burn units found *Acinetobacter baumannii* and *Pseudomonas aeruginosa* as the most organisms cultured but had a different third most common microorganisms, *Escherichia Coli* vs. MRSA [4,5]. Some possible reasons to support a tailored empiric antibiotic protocol in each unit include differences in climate, location, race and genetic composition, prevalence of co-morbidities such as HIV, and local microbial flora. Hence, burn units across the world routinely study their main organisms cultured and colonized.

To our knowledge, there is limited published literature detailing septic complications, and management thereof, among burn victims in South Africa. This study was therefore proposed as a necessary and informative endeavour intended to improve our burns unit's knowledge of organisms associated with significant morbidity and mortality and consequently allow for a more centre-specific empiric antibiotic protocol.

## 2. Methods

### 2.1. Study setting

The Chris Hani Baragwanath Academic Hospital (CHBAH) Adult Burns Unit is a specialist burns unit that receives patients mainly from the Gauteng province of South Africa (population size: 12.2 million) [6]. The burns unit is divided into a 4 bed ICU section and a burns ward consisting of 20 beds. The unit is run by surgeons. General surgeons in training, plastic surgeons in training and surgical interns rotate through the unit on a 4–6 monthly basis under the strict supervision of two specialist burns surgeons. On a weekly basis, an intensivist from the hospital's main ICU reviews all patients in the Adult Burns ICU (ABICU) and advises on necessary changes in management.

The unit admits approximately 200 patients per year. Mortality rate is in the region of 25%. Accidental burns accounts for about 75% of admissions. The remaining cases are often secondary to assault, arson and acid splashes. On average, the total percentage body surface area burnt (TBSA) of patients admitted to the unit ranges between 1 and 59% (unpublished data). Most burns above 60% are fatal in our setting. The nurse-patient ratio for the ICU section is kept strictly at 1:1: each patient is nursed in a separate cubicle. However, erratic staff complement negatively impacts on the nurse to patient ratio. The criteria for admission to the ICU are: TBSA over 20% and/or presence of inhalational injuries. Attempts are made to adhere to infection control measures, including hand washing prior to entering the cubicles and on leaving the cubicles. Procedures such as daily bathing, dressing changes and line insertions are performed under aseptic techniques. However, there is no written infection control policy specific to the burns unit. The burns ward consists of 5 cubicles, each comprising 4 beds with a nurse-patient ratio of 1:4. These patients are relatively more stable,

have less severe burns and require a lower level of care. In contrast to the ICU patients, these patients have their dressings changed in two dedicated dressing rooms. No special interventions or changes in antibiotic prescribing were made during the study period.

### 2.2. Study design

This is a retrospective descriptive study analyzing microbiological data of patients admitted to the dedicated ABICU of CHBAH, between the 1st January 2008 and the 31st December 2012.

Following ethical clearance from the Ethics Committee of the University of Witwatersrand, information on patients admitted to ABICU was collected from the admission register of the unit: hospital number, age, gender, length of stay, outcome (death or discharge), total body surface area burn percentage (TBSA), mechanism of burn. The following categories of patients were excluded: (1) patients stepped up from the adult burns ward to ABICU during their admission, (2) patients that died within 24 h of admission, (3) patients whose data was not accessible or incomplete due to clerical errors. The National Health Laboratory Services (NHLS) laboratory information system was then accessed to obtain microbiological culture results and antibiotic sensitivities. Blood cultures were sampled using the unilateral double bottle principle. Repeat cultures of the same organism were not included except if they had a different antibiogram. A descriptive analysis of the samples was then performed.

### 2.3. Management of burns patients

The extent of burns was assessed by calculating the TBSA. Excision and skin grafts were performed early as soon as the patient's condition permitted. When faced with the clinical suspicion of sepsis in ICU patients, blood cultures were taken: all lines (central intra-venous lines, arterial lines and urinary catheters) were replaced and sent for microscopy, cultures and sensitivity.

### 2.4. Statistical analysis

Means are presented with standard deviations. Continuous data was compared using the t-test if normally distributed or the Mann–Whitney test if not normally distributed. Comparison of categorical data was performed using the chi-square test. Statistical calculations were performed using Microsoft Excel for Mac 2011 and IBM SPSS Statistics Version 20, release 20.0.0.

### 2.5. Definitions

For uniformity, one definition was applied for pan-resistance of *A. baumannii* and *P. aeruginosa*. Pan-resistance was defined as resistance to all commonly used antibiotics (penicillins, cephalosporins, carbapenems, monobactams, quinolones and aminoglycosides) except colistin (polymyxin E). Antibiotic resistance of other organisms were analyzed individually. Primary bloodstream infections, burn wound infections and urinary tract infections were as defined by the Centers for

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