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Early pathogenic colonisers of acute burn wounds: A retrospective review

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ABSTRACT

Background: Early excision of burns reduces the incidence of local and systemic infections caused by colonising microorganisms, and reduces mortality and length of hospital stay. Appropriate antibiotic prophylaxis can reduce the risk of postoperative wound infections and skin graft loss. Antibiotic selection should be based on likely pathogens. However, there are few studies that have investigated the early pathogenic colonisers of acute burn wounds.
Aim: To describe pathogenic microorganisms found in acute burns and to make further recommendations on the use of early perioperative prophylactic antibiotics.
Methods: All burns patients admitted at the tertiary adult burns centre in Victoria over a 2-year period, who had surface swabs or tissue samples obtained from wounds within 24h of injury were included in this retrospective cohort study. Pathogenic organisms were examined with respect to patient characteristics, burn characteristics, treatment provided and immediate exposure to environmental contaminants.
Results: Nearly one third of burns patients had wounds colonised with pathogenic microorganisms. Gram-negative bacteria were isolated from 52% of these. *Staphylococcus aureus* was the most common isolate. *Pseudomonas* and *Enterobacter* species were the most common gram-negatives. The only independent risk factor associated with early colonisation with gram-negative bacteria was per cent TBSA burn.
Conclusion: Increased colonisation of acute burn wounds with pathogenic gram-negative bacteria was associated with increased size of burn.

1. Introduction

Early excision and grafting of acute burn wounds has been one of the main contributors proven to improve the survival of major burn patients of all ages since the 1970s [1–7]. Burned eschar promotes an inflammatory response from the viable tissues immediately deep and peripheral to the eschar, resulting in edema and burn shock [8–10]. Burn edema, which

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is distinctive in its rapid onset compared to the other types of edema, leads to reduced tissue oxygen diffusion and lack of perfusion, increasing the risk of infection [11]. Therefore, early excision of eschar reduces the incidence of local and systemic infections caused by colonising microorganisms [12], and reduces mortality and length of hospital stay [13].

Transient bacteremia associated with burn wound excision or manipulation is a well-documented phenomenon, occurring in up to 60% within 48h of debridement in severe burn patients [14–19]. Raz-Pasteur et al. demonstrated that patients with severe burns with positive wound swab were found to have blood-stream infection (BSI) caused by the same organism, where wound-to-blood transmission of gram-negative bacteria was more common than gram-positives [20].

The usual pattern of burn wound colonisers over time is from endogenous gram-positive bacteria to gram-negatives, thought to arise from endogenous enteric flora [21–24]. However, exogenous microorganisms may also colonise burn wounds via direct contamination with untreated water, soil or hands of health care workers, resulting in infection [25–28].

In severe burns, wounds are more susceptible to invasive infection by colonising pathogens due to local wound factors, such as the loss of protective barrier and burn edema. Additionally, the patient's immunosuppressed status and burn shock place them at a higher risk of developing sepsis from BSI [29–31]. Infection is one of the common causes of skin graft loss, commonly caused by pathogenic gram-negative bacteria [32]. Skin graft loss in severe burn patients has significant impact on morbidity and mortality due to prolonged immobilization and hospital stay, further sacrifice of limited donor site and increased risk of sepsis. Perioperative prophylactic antibiotics have been shown to control bacterial growth in the wound bed hence lowering the rate of graft failure, shortening hospital stay [33–35] and reducing donor site infection [36]. Therefore careful use of perioperative antibiotics at the time of excision or manipulation of burn wounds is prescribed for averting associated bacteremia and minimizing graft failure due to wound infection. Inappropriate use of prophylactic antibiotics increases both cost and the emergence of multi-drug resistant bacteria. Antibiotics selected should only cover the likely pathogens [37].

The aim of this study is to identify and describe the early pathogenic colonisers of acute burn wounds and identify risk factors associated with the presence of these pathogens. This will better inform guidelines for perioperative prophylactic antibiotics in association with operative wound management within the first 48h of burns.

2. Methods

A retrospective cohort study was undertaken of all patients admitted to the Victorian Adult Burns Service (VABS) at the Alfred Hospital from 1 January 2013 to 31 December 2014, where a new burn was the principal reason for admission. Patients who were admitted and had wound swabs or tissues obtained from burn wounds within 24h of burn were included (Fig. 1). The study was approved by The Alfred Hospital Research & Ethics Committee (Project No. 192/15).

Surface swabs were obtained either in the Emergency Department, in the wards or the Intensive Care Unit (ICU) following admission prior to the application of primary dressings, or in the operating theatre prior to scrubbing of wounds. Burn tissue samples were also obtained during the initial debridement in the operating theatre, after preparation of wounds with Cetrimide (0.15%) antiseptic solution (Baxter Healthcare Pty Ltd., NSW, Australia).

Time prior to admission to the wards or ICU from the time of burn, patient characteristics, the mechanism and the extent of burn, application of adequate first aid (i.e. cooling of burn wounds with clean running water for at least 20min), and subsequent surgical events that followed early in the

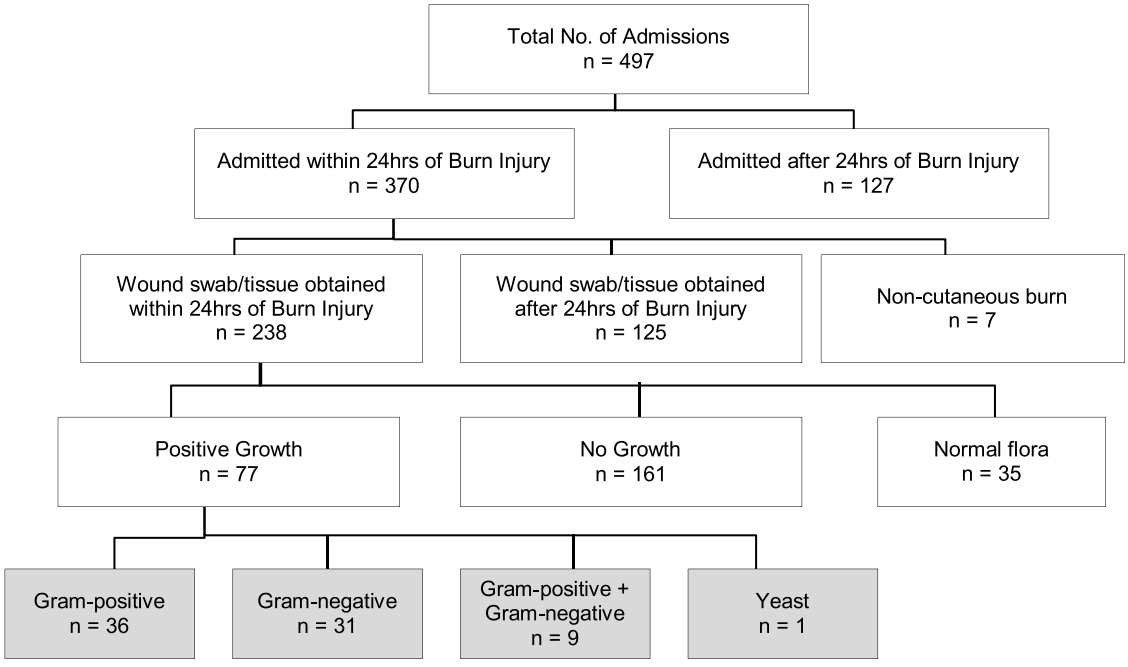

Fig. 1 – Selection criteria and microbiological outcome. Shaded area represents culture-positive group.

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