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Bacteriological cultures on admission of the burn patient: To do or not to do, that's the question

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ABSTRACT

Introduction: In many burn centers, routine bacteriological swabs are taken from the nose, throat, perineum, and the burn wound on admission, to check for the presence of microorganisms that require specific measures in terms of isolation or initial treatment. According to the Dutch policy of "search and destroy," for example, patients infected by multiresistant bacteria have to be strictly isolated, and patients colonized with *β-hemolytic Streptococcus pyogenes* must receive antibiotic therapy to prevent failed primary closure or loss of skin grafts. In this respect, the role of bacteria cultured on admission in later infectious complications is investigated. The aim of this study is to assess systematic initial bacteriological surveillance, based on an extensive Dutch data collection.

Materials and methods: A total of 3271 patients primarily admitted to the Rotterdam Burn Centre between January 1987 and August 2010 with complete bacteriological swabs from nose, throat, perineum, and the burn wounds were included. For this study, microbiological surveillance was aimed at identifying resistant microorganisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), multiresistant *Acinetobacter*, and multiresistant *Pseudomonas*, as well as Lancefield A β-hemolytic streptococci (HSA), in any surveillance culture.

The cultures were labeled as "normal flora or non-suspicious" in the case of no growth or a typical low level of bacterial colonization in the nose, throat, and perineum and no overgrowth of one type of microorganism.

Further, the blood cultures of 195 patients (6.0%) who became septic in a later phase were compared with cultures taken on admission to identify the role of the initially present microorganisms. Statistical analysis was performed using SPSS 20.0.

Results: Almost 61% of the wound cultures are "non-suspicious" on admission. MRSA was cultured in 0.4% (14/3271) on admission; 12 out of these 14 patients (85.7%) were repatriated. Overall, 9.3% (12/129) of the repatriated patients were colonized with MRSA. Multiresistant *Acinetobacter* or *Pseudomonas* was detected in 0.3% (11/3271 and 10/3271, respectively). In total, 18 of the 129 repatriated patients (14%) had one or more resistant bacteria in cultures taken within the first 24 h after admission in our burn center.

On admission, *S. pyogenes* was found in 3.6% of patients (117/3271), predominantly in children up to 10 years of age (81/1065 = 7.6%).

Conclusions: Resistant bacteria or microorganisms that impede wound healing and cause major infections are found only in few bacteriological specimens obtained on admission of

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patients with burn wounds. However, the consequences in terms of isolation and therapy are of great importance, justifying the rationale of a systematic bacteriological surveillance on admission.

Patients who have been hospitalized for several days in a hospital abroad and are repatriated show more colonization at admission in our burn center. The microorganisms identified are not only (multi)resistant bacteria, showing that a hospital environment can quickly become a source of contamination. These patients should receive special attention for resistant bacteria. HSA contamination is observed more frequently in younger children. Bacteria present at admission do not seem to play a predominant role in predicting later sepsis.

1. Introduction

Infections remain one of the major complications after severe burns. They are facilitated by the suppressed innate immune response of the patient and the skin barrier defect, covered with debris and necrotic tissue [1,2]. The human body is host to a number of microbes occurring in various forms of host–microbe associations, such as commensals, mutualists, pathogens, and opportunistic symbionts [3]. Potentially pathogenic microorganisms can be present on the skin as commensal flora, or they may be transferred acutely (e.g., by cooling with contaminated water) or during hospitalization (hospital acquired). The amount and type of microorganisms on and in the burned tissue do influence wound healing, the frequency of invasive infections, and the clinical characteristics of such infections [4]. Therefore, knowledge of the colonization status at any time is important in the treatment of burn patients [4].

For this reason, as in other intensive care units, most burn centers (BCs) use routine surveillance, based on cultures taken on admission and routinely afterwards (e.g., weekly) [2,4]. Apart from the burn wounds, the body sites cultured most often are the nose, throat, and perineum [2,5,6]. Positive surveillance cultures may lead to more infection prevention measures, for example, methicillin-resistant *Staphylococcus aureus* (MRSA), which can guide antimicrobial therapy and may identify and control outbreaks (source determination) [7–11]. Surprisingly, little is known about the initial colonization status of burn patients at admission, as most studies have included few patients or only studied specific microorganisms (e.g., *Pseudomonas* spp.) [13,14]. It might be assumed that deep burn wounds are initially sterile, as they are exposed to the heat source. But is this still the case when the patient arrives in the BC a few hours later? Therefore, the objective of this study was to assess the frequency of colonization on admission, and to identify the microorganisms involved and their potential role in later septic complications in a large cohort of burn patients over a 24-year time period.

2. Methods

2.1. Bacteriological survey in our hospital

In the BC of the Maasstad Hospital in Rotterdam, the Netherlands, routine bacteriological swabs are taken from the burn wounds as well as from the nose, throat, and perineum on admission. Other cultures such as blood, urine, and sputum were only taken when clinically indicated on admission. In the case of exceptional microorganisms, necessary measures such as quarantining patients can be taken. When the cultures of these patients reveal Lancefield group A β-hemolytic streptococci (HSA), antibiotics are started to prevent failure in primary closure or loss of skin grafts. Furthermore, the Dutch medical system uses a ''search-and-destroy'' policy with respect to resistant microorganisms, especially for repatriated patients, with a time difference between accident and secondary BC admission. This study focuses on the bacteriological cultures sampled within the first 24 h of BC admission and the follow-up cultures of septic patients.

2.2. Study design and population

This retrospective cohort study involved all patients admitted to the Rotterdam Burn Centre (RBC) in the Netherlands between January 1987 and September 2010. Data were gathered by merging a database used for epidemiological purposes and a microbiology database. The standard treatment protocols of the BC are described elsewhere [11].

2.3. Routine surveillance

On admission, surveillance cultures were taken from the following four body sites: burn wounds (B), nose (N), throat (T), and perineum (P). The swabs were analyzed in the hospital's microbiological laboratory. Pathogens were identified and their susceptibility to antimicrobial agents was tested using routine microbiological methods. Cultures were labeled as ''normal flora or non-suspicious'' in the case of no growth or a typical low level of bacterial colonization in the nose, throat, and perineum and no overgrowth of one type of microorganism. Based on his or her interpretation, the laboratory technician decided on further analyzing the grown cultures or not. The normal flora for the nose was considered to be *Staphylococcus epidermidis* and diphtheroids. The flora of the nose included *S. epidermidis*, diphtheroids, *Streptococcus viridans* (except for *Streptococcus pneumoniae*), *Neisseria* (except for *Neisseria meningitidis*), whereas that of the perineum included *S. epidermidis* and few Gram-negative bacteria (except for non-fermentatives). Few colonies of *S. epidermidis* or diphtheroids were regarded as the normal flora of burn wounds. Apart from the abovementioned normal flora at various body sites, in the present study, positivity was defined as the presence of the following potentially pathogenic microorganisms: