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The evaluation of nasal mupirocin to prevent *Staphylococcus aureus* burn wound colonization in routine clinical practice

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ABSTRACT

Background: *Staphylococcus aureus* wound colonization frequently occurs in patients with burns and can cause impaired wound healing. Nasal mupirocin application may contribute to the reduction of burn wound colonization of endogenous origin, whereas colonization by the exogenous route can be reduced by blocking cross-infection from other sources. In this study we evaluated whether the implementation of routine treatment of patients and burn center personnel using nasal mupirocin ointment reduces *S. aureus* burn wound colonization.
Methods: We composed three study groups, consisting of a control period (Control), a mupirocin period (MUP), in which patients with burns were all receiving nasal mupirocin at admission, and a mupirocin + personnel period (MUP + P), in which we also screened the burn center personnel and decolonized *S. aureus* carriers by nasal mupirocin.
Results: The patients who carried *S. aureus* in their nose and did not have *S. aureus* burn wound colonization at admission were considered as patients susceptible for the use of nasal mupirocin. In these patients, the *S. aureus* burn wound colonization rate was the same in all study groups. *S. aureus* nasal carriage was a significant independent risk factor for burn wound colonization (OR: 3.3; 95% CI: 1.4–7.6) when analyzed within the three study groups.
Conclusion: Although *S. aureus* carriage is a significant risk factor for developing burn wound colonization, the routine use of nasal mupirocin did not contribute to a reduction of burn wound colonization.

1. Introduction

Burn wounds cause a disruption of the physical skin barrier that normally prevents invasion of microorganisms [1]. Therefore, burn patients are highly vulnerable for burn wound colonization and may subsequently develop burn wound infection [2,3]. The most common burn wound pathogen is *Staphylococcus aureus*, [1,4] which may originate from the patient (endogenous origin), or may be transmitted by cross-infection from other sources, which is defined as exogenous transmission (Fig. 1). Several studies performed in burn

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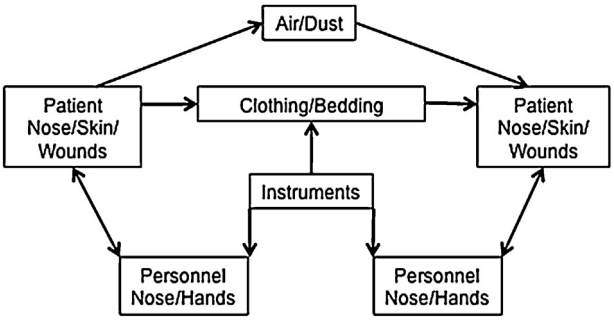

Fig. 1 – Transmission dynamics of *S. aureus* colonization. *Source*: Adapted from M. Kooistra-Smid, FEMS Immunol Med Mircobiol, 57, 2009.

centers show a *S. aureus* burn wound colonization rate with a wide range: 14–95% [5–8]. The negative effects of colonization are delayed wound healing, increased need for surgical interventions and prolonged length of stay at the burn center [5,9].

Therefore, eradication of *S. aureus* nasal carriage may serve two purposes: prevention of infection and prevention of transmission. Mupirocin displays a strong activity against Gram-positive bacteria, including *S. aureus* [10]. Decolonization therapy with nasal mupirocin ointment has been explored during the last decades in a variety of clinical settings and patients, and shown to be effective [10–14]. A pooled analysis of eight studies showed a significant reduction in the infection rate by use of intranasal mupirocin application [15]. Also, a single center study in burn patients showed a decrease of the relative risk of burn wound colonization after mupirocin application at admission [16].

The routine treatment of patients with nasal mupirocin has been implemented from January 2011 in the Burn Center of Beverwijk, The Netherlands. The primary aim of this study was to evaluate whether the use of nasal mupirocin reduces the burn wound colonization rate in clinical practice (blocking endogenous transmission). Secondly, in addition to treating patients, we analyzed the effect of screening the burn center personnel for *S. aureus* carriage and decolonizing carriers with nasal mupirocin (blocking part of the exogenous transmission route).

2. Methods

2.1. Setting

This study was performed at the Burn Center of the Red Cross Hospital, Beverwijk, The Netherlands. The burn center is a closed unit consisting of several quarters, including intensive treatment rooms and an operating theater. By 'closed' we mean that the Burn Center is a section in the hospital which one can only enter by passing a lock. Compared to other wards, the Burn Center is less easy accessible. A dedicated team of health care personnel takes care of the patients and several precautions to prevent transmission of microorganisms are daily routine, i.e., cohort care, hand washing procedures, equipment and environmental cleansing and regulation of positive air-flow in the whole burn center. In terms of isolation, several restrictions were already inserted before the start of this study. All patients with a total burned surface area over 30% were isolated. In case of a positive swab for *Pseudomonas aeruginosa* or for highly resistant microorganisms, including MRSA, a patient was also put in isolation. The presence of microorganisms on admission was detected by samples of nose, throat, perineum and all burns before receiving nasal mupirocin. Also, routine swabs of these body surface areas were obtained twice weekly until burn wounds were closed. All burns of one patient were cultured separately and labeled by the location on the body.

2.2. Study design

In this before-and-after study, consecutive patients admitted to the burn center were included during three different periods. The first period, preceding the implementation of mupirocin, served as a control group (Control: January to December 2010). Only precautions, as described above, were taken in this period. Following mupirocin ointment implementation, we studied two groups. Study group 1 (MUP: February 2011 to October 2011) and study group 2 (MUP + P: December 2011 to May 2012). In both study periods all patients received nasal mupirocin on admission, three times daily for 5 days, according to the manufacturer's guidelines (2% mupirocin calcium cream; Bactroban Nasal, GlaxoSmithKline BV, Zeist, The Netherlands). Additionally, in the second study period (MUP + P), the burn center personnel was screened and *S. aureus* carriers were decolonized by nasal mupirocin. Patient data were obtained by reviewing medical records and swabs that were taken during hospital stay. Burn wound colonization with *S. aureus* during the two study periods (MUP and MUP + P) was compared to the burn wound colonization rate in the control period (Control).

2.3. Definitions

The patients 'at risk for endogenous transmission' were defined as patients who carried *S. aureus* in their nose and did not have *S. aureus* burn wound colonization on admission. This subgroup was considered to be candidates for the use of nasal mupirocin. Secondly, patients 'at risk for exogenous transmission' were defined as patients who did not carry *S. aureus* in their nose and did not have *S. aureus* burn wound colonization on admission. Hereby, this subgroup was considered to be susceptible for the transmission of *S. aureus* by other patients or health care workers.

2.4. Exclusion criteria

The patients hospitalized for less than two days or patients admitted with a different trauma than acute burn (e.g., fasciitis necroticans) were excluded. Moreover, we excluded patients from further analyses in case of insufficient data (i.e., no swabs on admission or the absence of a burn wound swab during admission).

2.5. Statistical analysis

All data were analyzed using SPSS 18.0 (SPSS Inc., Chicago, USA). The crude comparisons were done with Chi-square or