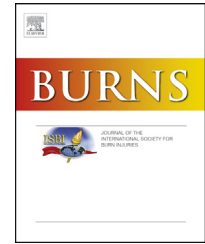


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Prophylactic antibiotic therapy after inhalation injury



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ABSTRACT

Objective: Inhalation injury is suspected in patients with facial and neck burn-injuries and in patients who suffered burns in an enclosed space. Inhalation injury is associated with a disappointingly high morbidity and mortality in spite of advances in diagnostics and therapy. Prophylactic antibiotic therapy in patients with diagnosed inhalation injury is still a controversial subject. The epidemiologic characteristics of the burn patients with diagnosed inhalation injury in our clinic receiving prophylactic antibiotic therapy and mortality of these patients will be referred in this study.

Methods: Patients >16 years of age admitted to the burn unit between January 2008 and December 2012 and fulfilling the burn center referral criteria according the German Burn Association were enrolled in the study.

Results: 58 patients (male:female 47:11) were diagnosed with an inhalation injury by their admission. The average length of hospital stay was 27.5 days, whereas of the patients with no inhalation injury was 16 days ($p = 0.04$). 56.9% of the patients underwent tracheostomy. An escalation of the antibiotic therapy was done in 39.7% of the patients with inhalation injury and in 20.3% of the patients without one. The mortality of inhalation injury patients was 12.1%.

Conclusions: The development of pneumonia is not influenced in a statistical significant way by the use of prophylactic antibiotics. We do recommend the administration of prophylactic antibiotic therapy to patients with diagnosed inhalation trauma, as the mortality of these patients was lower in comparison to other studies.

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1. Introduction

Inhalation injury should be suspected in patients with facial and neck injuries and those who suffered burns in an enclosed space.

Depending on the diagnostic criteria used, inhalation injury is reported in 0.3–43% of the patients with severe burn-injuries. It is one of the major (independent) risk factors for mortality, as it is associated with up to 8–10 fold increased mortality (1).

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Patients with inhalation injury have a two time higher pneumonia rate compared with patients without inhalation injury ($p < 0.001$) (2).

The mortality of patients with pneumonia depends on the presence of inhalation injury. Lionello et al. published a study about the risk of death in severely burned patients in the period 1997–2000 and showed that the mortality rate among patients with inhalation injury was 4 times higher than patients without one (3).

MLcak et al. found also a 40% increase in mortality rate in severely burned patients with pneumonia. However, the mortality rate went up to 60%, if the pneumonia occurred in patients with inhalation trauma (4).

The administration of prophylactic antibiotic therapy in patients with diagnosed inhalation injury is a subject of controversy.

Aim of our clinical study is to determine the epidemiologic characteristics of the patients with diagnosed inhalation injury in our burn care unit, the effect of administrating prophylactic antibiotic therapy on developing pneumonia and on mortality of these patients. By comparing our data with other study we tried also to evaluate the necessity of the use of prophylactic antibiotics.

2. Materials and methods

A retrospectively maintained institutional database containing all patients in our burn care unit consisting of four one-patient rooms was reviewed. We selected all patients who were diagnosed with inhalation injury by their admission.

All patients >16 years of age admitted to the burn unit between January 2008 and December 2012 and fulfilling the burn center referral criteria to a burn care center according the German Burn Association [1] were enrolled in the study.

These conclude:

1. Partial thickness burns greater than 20% total body surface area (TBSA).
2. Burns that involve the face, hands, feet, genitalia, perineum.
3. Third degree burns in any age group.
4. Electrical burns, including lightning injury.
5. Chemical burns.

Exclusion criteria were immunosuppression, pregnancy and ICU admission 48 h after burn trauma.

Inhalation injury was suspected in patients with facial and neck burn injuries and in patients who suffered burns in an enclosed space. All suspected patients underwent bronchoscopy at their admission in our burn unit. The diagnosis of inhalation injury was made by demonstration of inflammatory changes in the respiratory tract such as mucosal erythema, edema, ulceration, or submucosal hemorrhages. All patients with diagnosed inhalation injury received intravenous prophylactic antibiotic treatment with piperacillin and tazobactam.

The following data was registered for each patient: age, gender, co-morbidities, total body surface area burned (TBSA), the American Society of Anesthesiologists (ASA) score, the

abbreviated burn severity index (ABBSI), Zellweger index, length of stay, mortality, presence of tracheostoma, length of mechanical ventilation, presence of pneumonia, microbiology of pneumonia and burn wounds, the antibiotic therapy of the pneumonia and its length.

The TBSA was calculated by adding percentages of dermal and subdermal burns with the help of the program BurnCase[®] (RISC Software GmbH, Hagenberg, Austria).

To assess the injury severity for each patient, the ABBSI was used. The index is a scoring system based on sex, age group, presence of inhalation injury and full thickness burn, and total body surface burn area in percent.

The Zellweger index represents a prognosis in lethality and is calculated by adding TBSA in % with the age of the patients.

Microbiological examination of the tracheal secretion of the patients in our burn care unit was made every 3 days in the patients with an inhalation injury. The swabs and trials were sent for cultivation in the Department of Microbiology. *Candida* antigen titer detection in serum is a reliable method of diagnosis of systemic candidiasis and the elevated titer indicate the antifungal treatment.

Antimicrobial therapy was instituted with the help of an infectious disease consultant from the Department of Microbiology.

SPSS (version 20, SPSS GmbH Software, Illinois, USA) was employed for data analysis. Variables were analyzed using contingency tables and chi-square and Fisher's exact test. p -Values lower than 0.05 were regarded as statistically significant.

3. Results

In total 201 patients fulfilling our study criteria were treated in our burn care unit between January 2008 and December 2012 (male:female 151:50) with a mean age of 47.7 years.

In 58 patients (male:female 47:11) an inhalation injury was diagnosed by their admission in our Burn Unit. The incidence was 28.9%, the mean TBSA 20.5, the mean ASA score 1.55, the mean ABSI score 7, the mean Zellweger index 74.5. The average length of hospital stay of the inhalation injury group was 27.5 days, whereas of the non-inhalation injury it was 16 days ($p = 0.04$). 33 (56.9%) of the patients needed a temporary tracheostomy with a mean duration of 24.4 days. (Table 1)

Microbiological examination of the tracheal secretion of the patients in our burn care unit was made every 3 days in the patients with an inhalation injury. In 30/58 patients microorganisms were isolated in the tracheal secret and in 14/30 patients there were more than microorganisms isolated in the tracheal aspirate. The most common isolated microorganisms were gram positive bacteria as *Staphylococcus* and *Streptococcus* species (isolated in 18 patients) and *Candida albicans* and non-*albicans* species isolated as well in 18 patients (Fig. 1). In the non-inhalation injury group only 3.5% of the patients (5/143) had gram positive bacteria isolated in their tracheal secret and 2.8% (4/143) *Candida albicans* species, so that the isolation of these microorganisms from tracheal secret of patients with inhalation injury differed in a statistical significant manner in comparison to patients without inhalation injury. The incidence of pneumonia is higher in patients with isolated

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