

Original Contribution

Tracheal intubation difficulties in the setting of face and neck burns: myth or reality? ☆



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ABSTRACT

Introduction: Face and/or neck burn (FNB) exposes patients to the double respiratory risk of obstruction and hypoxia, and these risks may require a tracheal intubation. This study aims to describe the incidence and the characteristics of difficult intubation in FNB patients.

Methods: We conducted a 5-year retrospective, single-center study including all patients meeting the following criteria: 18 years of age or older, an FNB at least 1% of burned surface area with a severity equal to or greater than the superficial second degree, and intubation and a burn center admission within the first 24 hours after the burn. Patients were compared according to the difficulty of their intubation.

Results: Between January 2007 and December 2011, we included 134 patients. The incidence of difficult intubation was 11.2% but was greater in the burn center than in the pre-burn center: 16.9% vs 3.5% ($P = .02$). The most important difference between patients with or without difficult intubation was the time between the burn injury and the intubation: 210 (105–290) vs 120 (60–180) minutes ($P = .047$). After multivariate analysis, an intubation performed at a burn center was independently associated with difficult intubation: odds ratio = 3.2; 95% confidence interval, 1.1–528.

Conclusions: This study underlines the high incidence of difficult intubation in FNB patients, greater than 11.2%, and demonstrates that intubation is more difficult when realized at a burn center, probably because it is performed later, allowing for development of cervical and laryngeal edema.

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1. Introduction

Although only 5% of burned patients need to be hospitalized [1], 47% of patients admitted to a burn center present with a face and/or neck burn (FNB) [2]. These data reflect the gravity of this type of lesion. Indeed, FNB exposes patients to a double respiratory risk of obstruction resulting from edema of the upper airways and hypoxia resulting from acute lung injury following smoke inhalation. These risks may often require a tracheal intubation [3]. Furthermore, some authors assert that this specific population presents a higher risk of difficult intubation, estimated to be from 5% to 7% [3], and agree that an intubation performed later seems to be more difficult because of changes in the oropharyngeal anatomy [3–6]. In these patients, an early intubation, before arrival at the burn center, might be justified;

but the literature on this topic is limited, and the practice has not been examined in a well-conducted study. This retrospective study aims to describe the incidence and characteristics of difficult intubation in severe FNB patients.

2. Materials and methods

2.1. Study design and patient selection

We conducted a 5-year retrospective, single-center trial at the burn center of the Sainte Anne Military Teaching Hospital of Toulon (France). Between January 2007 and December 2011, patients who met the following criteria were eligible for the study: 18 years of age or older; presenting an FNB at least 1% of the burned surface area with a severity equal to or greater than superficial second degree (facial or neck localization was not differentiated); underwent an intubation within the first 24 hours after the burn injury; and a burn center admission within the first 24 hours after the burn. Patients presenting with only first-degree FNB were excluded. The institutional review board approved the study and waived the requirement for informed

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consent from the patient or patient's kin given the observational and retrospective nature of the study.

2.2. Data recording and definition

Assessed parameters retrieved from patient files were demographic data, burn characteristics, duration between burn injury and intubation, Cormack and Lehane score, length of stay in the burn intensive care unit (BICU), in-burn center mortality, and different severity scores: the Simplified Acute Physiology Score 2 (SAPS 2), the Baux score [7], and the Unit of Burned Skin (UBS) score [8]. Experienced burn surgeons estimated the total burned surface area (TBSA) on patient arrival at the BICU. Experienced burns anesthesiologists performed all intubations at the BICU.

The SAPS 2 score is designed to measure the severity of disease for patients admitted to ICU and to predict mortality. The score is calculated from 12 physiological measurements during the first 24 hours (eg, age, systolic blood pressure, heart rate). The Baux score is used to predict the chance of mortality due to severe burns. It is the addition of 2 factors: the TBSA and the age of the patient. The UBS score is also used to predict the mortality of burned patient. It is calculated as TBSA + 3 × full-thickness burned surface area. The Cormack and Lehane score is based on the structures seen during direct laryngoscopy (grade I: full view of glottis, grade II: partial view of glottis, grade III: only epiglottis seen, grade IV: neither glottis nor epiglottis seen).

Consistent with previous studies, *difficult intubation* was defined as follows: 3 or more laryngoscopy attempts, 2 or more different operators, and/or Cormack and Lehane grade III or IV laryngoscopic view [9–11].

2.3. End points

The primary end point of this study was the effective incidence of difficult intubation in FNB patients. Secondary end points were results of comparisons of patients with or without difficult intubation and patients with or without pre-burn center intubation.

2.4. Statistical analysis

Statistical analysis was performed with SPSS version 15.0 (SPSS Inc, Chicago, IL). Continuous data were reported as the mean with 95% confidence interval or median with interquartile ranges (quartile 0.25–quartile 0.75) when not normally distributed. Nominal variables are reported as numbers and proportions (%). A univariate analysis was conducted using the χ^2 test or Fisher exact test to compare categorical variables and the Mann-Whitney test or Student *t* tests to compare groups for continuous variables (respectively for comparison of medians and comparison of means). A multivariate analysis using a linear regression was performed to determine if the location where the intubation was performed was a risk factor for difficulty. For all tests, $P < .05$ was considered statistically significant.

3. Results

3.1. Patient characteristics

During the study period, 155 patients were admitted to the BICU with an FNB. Twenty-one patients were excluded for the following reasons: admission 24 hours after the burn ($n = 4$), only first-degree FNB ($n = 2$), and patient not requiring intubation during the first 24 hours ($n = 15$). The remaining 134 patients were enrolled in the study (Figure).

Patient characteristics are summarized in Table 1. Mechanisms of injury were thermal burn ($n = 132$; 98.5%) and electrical burn ($n = 2$; 1.5%). Ten patients (7.5%) had associated carbon monoxide intoxication,

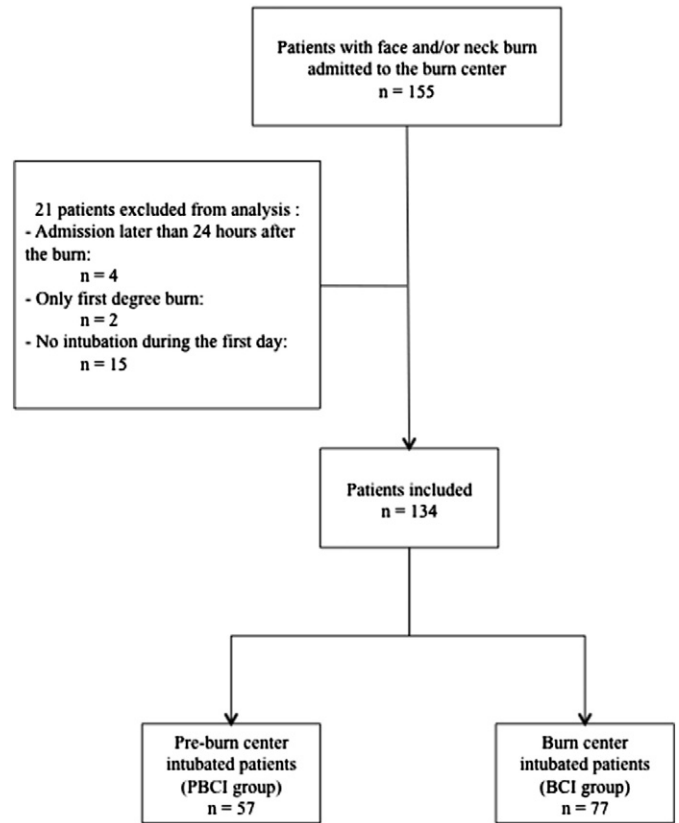


Figure. Flow diagram of the study.

and 3 patients (2%) had associated cyanide intoxication. A total of 57 patients underwent a pre-burn center intubation (PBCI group), and 77 were intubated at arrival in the BICU (BCI group). Duration of mechanical ventilation was less than 24 hours in 32 patients (24%). For the other 102 patients, the median duration of mechanical ventilation was 9 days [3–22]. The median duration of hospitalization in the BICU was 19 days [6–30]. Fourteen patients (10.5%) died during their burn center hospitalization.

3.2. Difficult intubation

Among the 134 patients included, the incidence of difficult intubation was 11.2% (15 patients). For this group, the intubation was most often performed at the burn center ($n = 13$; 87%) rather than in the field before arrival at the burn center ($n = 2$; 13%) ($P < .001$). The incidence of difficult intubation was therefore 3.5% ($n = 2/57$) in the PBCI group vs 16.9% ($n = 13/77$) in the BCI group ($P = .02$). Demographic data, burn characteristics, severity scores, and outcome were not statistically different when comparing patients with or without difficult intubation (Table 1).

Among patients with difficult intubation in the BCI group, 1 had a Cormack and Lehane score equal to 2, 9 had score equal to 3, and 3 had a score equal to 4. This score was not available for the 2 other patients intubated before their arrival at BICU. All patients required more than 3 attempts before their intubation, and 73% ($n = 11/15$) required more than 2 different operators (except for 2 patients in the PBCI group and 2 in the BCI group). To perform tracheal intubation, an Eschmann gum elastic bougie was used successfully in 10 cases; and a laryngeal mask airway (LMA Fastrach; LMA North America, Inc, San Diego, CA) was successfully used in 3 other cases. No case of fiberoptic intubation or surgical direct tracheal access was identified, and no case of failed intubation was reported. The burn was considered to be responsible for difficult intubation in 77% of cases intubated at BICU ($n = 10/13$). The other causes of difficult intubation were 1 case of

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