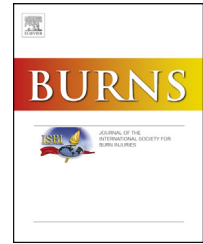


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Review

The diagnosis and management of inhalation injury: An evidence based approach

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ABSTRACT

Introduction: Smoke inhalation injury (II) is an independent risk factor for mortality in burns and its management is inherently complex. We aim to make recommendations for best practice in managing II and its sequelae by reviewing all available current evidence in order to provide an evidence-based approach.

Methods: We conducted a systematic search of the Cochrane database and Embase using PRISMA guidelines with no patient population exclusion criteria. Published work was reviewed and evidence levels graded.

Results: We identified 521 abstracts for inclusion. Of the 84 articles identified for secondary review, 28 papers were excluded leaving 56 papers suitable for final inclusion.

Conclusions: We are able to identify a number of strategies in both diagnosis and treatment of II that have support in the published literature, including the role of bronchoscopy, permissive hypercapnia, nebulized heparin and hydroxycobalamin. Other strategies have not been shown to be harmful, but their efficacy is also not firmly established, such as high frequency oscillatory ventilation and exogenous surfactant. Prophylactic antibiotics and corticosteroids are not recommended. In general, published evidence for II is mostly Level 3 or below, due to a noticeable lack of large-scale human studies. This represents a challenge for evidence-based burns practice as a whole.

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1. Introduction

Burn injury represents an important cause of morbidity and mortality; the World Health Organisation estimates 11 million burns are assessed by medical practitioners yearly [1]. Furthermore, up to 5% of significant trauma presentations in England and Wales are directly related to burn injury [2]. Mortality from burns in England and Wales is improving and is recently estimated at 1.5%, despite an increase in burn service admissions [3].

Smoke inhalation injury (II) remains a major factor complicating burn injury and has a significant impact on all aspects of care and outcome. The pathophysiology of II injury is best considered in three subcategories: direct thermal injury to the upper airway, chemical irritation of the lower (subglottic) airway by smoke, and systemic chemical or metabolic injury caused by specific noxious chemicals such as hydrogen cyanide [4]. The result is progressive airway inflammation with pulmonary shunting and ultimately hypoxaemic respiratory failure [5]. The incidence of II in burns is approximately 7.7% in data from the United States of America [6], although this is directly correlated with increasing total body surface area of burn up to a maximum incidence of 14% with 80-89% TBSA burns [7]. Accurate diagnosis of II is often difficult. In many centres, diagnosis depends on evidence of lung injury in association with a consistent clinical history and examination including factors such as flame burns with prolonged entrapment,

burns to the neck and face, dysphonia, singeing of nasal hairs and carbonaceous sputum [8].

It is well established that II in association with flame burns has a marked adverse impact on mortality; II is an independent risk factor for mortality in burns, and is associated with a 20% increase in mortality, increasing to 60% where pneumonia is also present [9]. Whilst pulmonary complications are not restricted to patients with II, these patients are considerably more likely to develop lung injury, including pneumonia [10]. The management of II is complex and inherently requires a multidisciplinary approach. A number of strategies exist for the diagnosis, upper airway management, mechanical ventilation and pharmacological therapy in II. Any treatment for II should be tailored to an individual patient's requirement and to the particular burn unit's resources.

1.1. Objectives

We aim to make recommendations for best practice in managing II and its sequelae by reviewing all available current evidence in order to provide an evidence-based approach. The review is applicable to all patients with II in the context of cutaneous burns, including both adult and paediatric populations. The range of diagnostic, prognostic and therapeutic interventions are discussed and compared. Recommendations are made on the basis of the strength of published evidence identified through a systematic search strategy.

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