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Review

Predicting length of stay in thermal burns: A systematic review of prognostic factors

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ABSTRACT

Background: Continued improvement in all aspects of the management of thermal injury has resulted in marked improvements in the traditionally reported outcome of mortality. This has resulted in the search for alternative parameters that can be monitored to indicate the performance of burn services. Length of stay (LOS) in hospitalised burn patients has long been considered reflective of injury-associated morbidity, cost and the quality of care, which can be monitored consistently across services.

Aim: We undertook a systematic review of published literature pertaining to LOS prognostication in thermal burns to identify the relevant factors, quantify the risk associated with these factors and identify predictive prognostic models.

Methods: Electronic searches were performed on MEDLINE, CINHAL, EMBASE, Web of Science®, the Cochrane collection and a general web search was performed using Google®. The searches were complemented by a manual search of the contents of leading burns journals. Quality of the studies included in the review was evaluated against published standards for prognostic studies.

Results: Fourteen studies were included in the review after meeting the inclusion/exclusion criteria. Age and %TBSA were the strongest predictors of LOS in these studies. Other significant predictors included % full thickness burn, female gender, inhalation injury, surgery including escharotomy and the depth of burn. Nine studies reported multivariate models for predicting LOS in patients sustaining thermal injury. None of these models were validated and the goodness-of-fit statistic (R^2) ranged from 0.15 to 0.75.

Conclusion: This review has demonstrated that %TBSA and age are the best predictors of LOS in published literature. Current prognostic models do not explain a significant proportion of variation in LOS.

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1. Introduction

Most descriptions of measuring performance and outcomes in burn care have traditionally looked at mortality [1–5]. This is primarily because it is easy to define and measure with reliable data available over many decades allowing useful comparison between time periods. However with continued improvements in all aspects of the management of burn mortality rates have shown marked improvement in developed countries from 54 to 100% at the beginning of the twentieth century to currently reported rates of around 4–6% [6–11]. As a result, the usefulness of mortality rates as a measure of quality of care and burn service performance is increasingly being questioned [12–14]. Outcomes such as quality of life and functional status are instead being examined as long-term consequence of burn care [15–21]. At present these outcomes are difficult to measure in a consistent, efficient and meaningful manner across different services, age groups and ethnic groups. Alternatively LOS data is easy to collect and measure across different services. The initial descriptions of LOS in hospitalised burn patients focused on the analysis of this outcome to predict burn service bed utilisation [22,23]. More recently it has been shown to provide an indirect indication of morbidity and the incidence of clinical complications, and a direct correlation with functional and aesthetic outcomes as well as cost of care associated with thermal injury [24–28]. Several cohort studies have identified risk factors that have an impact on LOS [29,30]. Risk stratification has many uses, including the identification of high-risk patient groups, guiding clinical decision-making, patient/family counselling, and the evaluation of new therapies and techniques. Risk-adjusted prediction models that allow the comparison of observed and expected LOS while taking patient and injury characteristics into account have considerable value in monitoring the performance of services.

The aims of this study were:

- to undertake a systematic review of published literature pertaining to LOS prognostication in thermal burns,
- to identify prognostic factors that impact on LOS,
- to quantify the risk associated with these factors,
- to identify predictive prognostic models.

2. Materials and methods

2.1. Literature search strategy

An electronic search was performed on MEDLINE (1950-September 2011), CINHAL (1981-September 2011) and EMBASE (1980-September 2011) databases via the NHS Evidence interface. Currently there is no widely acknowledged optimum search strategy for identifying prognostic studies and using both natural language and MeSH terms according to published recommendations for identifying prognostic studies optimised the database search [31]. Key terms explored were: burns, outcome, length of stay, prognosis, prediction, index, scoring and model. The search was restricted to English language publications. The titles and abstracts were reviewed and the list of studies for inclusion in the review was narrowed by evaluation against the inclusion/exclusion criteria. Searches were also conducted on the Web of Science® database, the Cochrane collection and a general web search was performed using Google®. The bibliographies of the retrieved full text articles were also reviewed to identify any missed publications. The electronic and bibliography searches were complemented by a manual search of the contents of leading burns journals: Burns (1974-September 2011), the Journal of Burn Care and Rehabilitation (1980–2005) and Journal of Burn Care and Research (2006-September 2011).

2.2. Inclusion and exclusion criteria

To be included in the review, studies must have produced a prognostic estimation of LOS by identifying possible risk factors. In studies that devised or employed prognostic model(s), this model must have predicted LOS. Only multivariate studies were included in the review and both retrospective and prospective studies were included. Studies involving patients of all ages and burn sizes were considered but those focusing on extremes of age (children and/or elderly) were excluded to allow evaluation of comparable study populations. Studies focusing primarily on non-thermal burns (e.g. chemical, electrical) and those investigating the effect of individual factors on LOS were excluded. Studies from multiple etiologies were included if thermal burns comprised the majority of the patient population (>50%) but those focusing on specific causation patterns (e.g. self inflicted burns) were excluded. Those studies reporting composite prediction models were excluded unless the model predicted LOS as the outcome measure.

2.3. Quality assessment

The methodological quality, internal and external validity and applicability of the studies in the review were assessed using guidelines published by the National Institute for Health and Clinical Excellence for evaluating cohort studies [32].

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