Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/burns

Modified first world mortality scores can be used in a regional South African burn service with resource limitations

M.T.D. Smith, N.L. Allorto *, *D.L. Clarke*

Department of Surgery, Pietermaritzburg Metropolitan Complex, University of Kwa-Zulu Natal, South Africa

ARTICLE INFO

Article history:
Accepted 30 March 2016

Keywords:
Mortality prediction
Resource scarce
Quality improvement

ABSTRACT

Introduction: Survival following a major burn is highly dependent on the availability of scare and expensive resources such as critical care services, modern dressings and access to operating theatres. Scoring systems, which predict mortality have been developed and can be used to identify patients in whom the outlay of these resources is futile. The aim of this study was to analyse the mortality at a regional South African burn service and to see if these scoring models developed in a resource rich environment were applicable to our setting.

Methods: Consecutive admissions to the Edendale burn service, South Africa were collected from patient records over a 2-year period from July 2013 to June 2015. Demographic, burn details and final outcome (lived or died) were captured for statistical analysis. Each patient was scored using the Modified Baux, Coste et al., Belgian Outcome of Burn Injury (BOBI) and Abbreviated Burn Severity Index (ABSI) scores. Validation of models and inferential statistics were done to determine new breakpoints more applicable to our sample.

Results: A total of 748 patients were included in the sample, with a mortality rate of 7.1%. The mean Modified Baux score was 27 (range 1–134), with the new breakpoint of 40 predicting 74% of the mortalities compared to the 42% predicted by the old breakpoint of 75. The mean ABSI score was 4 (range 2–15), with a lower break point of 6 predicting 75% of deaths compared to 42% with the old breakpoint of 8.

The mean Coste score for the sample was 12 (range 0–100). With a suggested break point of 85 (predicting 50% mortality), only 6% of mortalities were predicted. The new break point of 17 predicted 91% of deaths. The original break point for the BOBI score was 6 (range 0–7). This included 42% of deaths. With a new breakpoint of 1, 74% of deaths were predicted.

Discussion: Our data has shown that in our environment a significant number of fatalities occur in patients with potentially salvageable burns, and the breakpoints for the mortality prediction scores such as, the Modified Baux score, Coste et al. score, BOBI and ABSI scores are much lower than high-income countries.

However these mortality predictive scores can be used in a resource scarce South African setting to triage patients into risk categories by lowering the breakpoints. This may facilitate

* *Corresponding author at*: PO Box 21740, Durban 4036, South Africa. Tel.: +27 836557660; fax: +27 314670545.
E-mail address: nikkiallorto@gmail.com (N.L. Allorto).

http://dx.doi.org/10.1016/j.burns.2016.03.024

early and more aggressive management of high-risk burn patients, improving survival rates, as well as efficient and judicious use of critical care and other resources.

1. Introduction

Major burns still pose a great threat to life despite the great strides in burn care over the last half a century [1]. Survival following a major burn is highly dependent on the availability of scare and expensive resources such as critical care services, modern dressings and access to blood and allograft as well as operating theatres [1]. Scoring systems, which predict mortality, have been developed and can be used to identify patients in whom the outlay of these resources is futile. These composite models have been formulated based on the presence of a number of independent risk factors. In a review by Hussein et al., 45 such models were evaluated for their methodological integrity and only eight were found to be based on sound methodology [2]. These scoring systems have been proposed as tools to triage burns in high income countries (HICs). However in low-middle income countries (LMIC) the resources available to treat burns are significantly lacking in comparison to HIC's and it is apparent that a scoring system designed in a HIC cannot be directly extrapolated to a LMIC environment. South Africa is defined as an upper-middle income country [3] and our institution serves a large rural population with high levels of poverty. The aim of this study was to analyse the mortality at a regional South African burn service and to see if these scoring models developed in a resource rich environment were applicable to our environment.

2. Methods

A retrospective study was conducted at Edendale Hospital, a regional hospital in the greater Pietermaritzburg area in KwaZulu Natal, South Africa. It is the fourth largest hospital in the country (900 beds) and serves 1.4 million people. The burns service has six dedicated acute care beds, which are interchangeable between children and adults and 24 beds in the general surgical wards.

Consecutive admissions to the Edendale burn service were collected from patient records over a 2-year period from July 2013 to June 2015. Included in the study were patients who were admitted within 72 h of injury with complete records. Demographic features of each patient as well as descriptive details pertaining to the burn injury were tabulated in a spread-sheet. Patients placed in the inhalation injury category were those who had significant risk factors such as flame burns to the face; fire within an enclosed space and also with clinical signs of inhalation injury or the need for mechanical ventilation within the first 72 h. Bronchoscopy for patients at risk of inhalation injury was protocolised in 2015 to make the diagnosis of inhalation injury.

The eventual hospital discharge outcome was captured as ''survived or died''. It was also noted whether patients were deemed not for active management. Descriptive statistics were performed for the entire sample using Statistical Package for the Social Sciences (SPSS) software. Further analysis of the mortalities was also performed. The LA_{50} (average lethal area with predicted mortality of 50%) was calculated for the group using probit analysis.

2.1. *Validation of models and inferential statistics*

Each patient was scored against 8 composite models predicting mortality. Sensitivity, specificity, positive and negative predictive values were calculated after generating 2×2 contingency tables. Receiver operator curve analysis was performed to find optimal breakpoints for each score. In this analysis, the true positive rate was plotted against the false positive rate for all possible breakpoints for each score. This analysis enabled us to identify which breakpoints were more accurate in our sample than those originally published. In this way we could modify our score by modifying the breakpoint of each test so that it would perform better in our sample. Sensitivity, specificity and positive and negative predictive values were calculated using these new break points and compared to the original scores.

The models used were as follows:

1. Ryan model
   This model predicts mortality based on the number of predetermined risk factors present. Three risk factors were identified and equally weighted. These risk factors include: age >60, percentage total body surface area burned (%TBSA) > 40 and inhalation injury (Appendix 1).

2. The Modified Baux score
   This model places emphasis on age and %TBSA. The LD_{50} is a score of 80 (Appendix 2).

3. Coste et al. score
   This score is similar to the Modified Baux score but only includes age over 50 years old (Appendix 3).

4. The Abbreviated Burn Severity Index
   This scores patients using 5 predetermined risk factor categories. A sum total of 8–9 is the LD_{50} (Appendix 4).

5. The Belgian Outcome of Burn Injury score
   This score is similar to the ABSI score but does not take gender or the presence of full thickness burns into account. The LD_{50} is a score of 6 (Appendix 5).

6. Total Burn Severity Index
   This score calculates a score based on the number of individual body parts affected (Appendix 6).

7. The McGwin et al. score