Original Article

Outcome of moderate and severe thermal injuries at Kenyatta National Hospital

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Background: Thermal injuries are a major cause of morbidity and mortality in Kenya. Though a lot is known about burns, the morbidity patterns and mortality rates of burns in this country have not been established. This study was designed with the general objective of investigating the outcome of moderate and severe burns managed at the Kenyatta National Hospital (KNH). It was also the aim of the authors to try to validate an existing simple clinical burn injury score, based on the Abbreviated Burn Severity Index (ABSI) score.
Methods: This was a retrospective study of burn patients treated at KNH between January 1999 and December 2000. The main parameters studied included the age, sex, and depth of burn injury, inhalation injury and percentage total burn surface area (%TBSA). Other parameters recorded were the type of burn, pre-morbid or co-morbid illnesses, specimen culture and sensitivity and the length of hospital stay. Single variable analyses (χ^2-test) were used to determine the value and influence of single variables on burn mortality. Multiple stepwise logistic regression analysis was performed on all the variables used in the ABSI score, as well as on hospital stay and type of burn (scald or flame), to determine their influence on burn mortality.
Results: Out of the 1205 patient records retrieved, 1157 satisfied the inclusion criteria for the study. The findings confirmed the role of percentage total burn surface area, associated inhalation injury and depth of burn as the strongest prognostic variables (multivariate analysis); while age and sex have prognostic significance on single variable analysis. This data was then used to validate the ABSI score, which performed very accurately as a prognostic score.
Conclusion: It is recommended that the ABSI score be adopted into clinical practice in this country, as an objective and accurate predictive clinical score.

Introduction

Burn injuries are common in Kenya. However, lack of resources, preparedness and sometimes poor management decisions have led to less than optimal care of salvageable burn injured patients. There is thus an urgent need to address appropriate and rational use of limited and valuable resources, in managing a common problem. A national protocol giving guidelines on initial thermal-burn-patient care based on a simple but accurate clinical score is lacking.

This study was designed to address these shortcomings.

Patients and Methods

This was a retrospective study. The study population included all patients with moderate to severe thermal injuries admitted into the Kenyatta National Hospital (KNH) from January 1999 to December 2000. The authors classified the burn injury severity using the

Classification adopted by the American Burn Association. In order to simplify patient stratification, the burn depth was divided into two:

- superficial burns (including first and second degree superficial burns) and
- deep burns (which involved deep second and third degree burns).

Patient mortality and morbidity patterns recorded and analyzed. Tobiasen's Abbreviated Burn Severity Index (ABSI) was validated for use locally, using data so obtained.

Results

A total of 1477 patients were admitted and managed for burn injuries at KNH, during the period under review. Of these, only 1205 records were found. 1157 patients satisfied the criteria for inclusion into the study, and of these, 601 (51.9%) were males while 556 (48.1%) were females, giving a male

to female ratio of 1.1 to 1.0. The average age of patients was 11.8 years, (0.083 to 86 years). The 1 to 5 year-olds comprised 568 (49.1%) of the entire study population.

Hospital Stay

The average hospital stay for all the 1157 patients was 23.3 days (total 26,914 days), while the average %TBSA was 17%.

Patients presenting with less than 10% burns accounted for 48.9% of the total number of patients and were hospitalized for an average of 13 days. The length of hospital stay increased gradually, with increasing %TBSA to a maximum of 79 days for patients with a %TBSA of 31% to 40%, before falling rapidly to 2 days for patients with a %TBSA of 91% to 100%.

Burn Depth

Of 323 patients with deep burns, 118 died (70.7% of total deaths). 31.7% of survivors developed complication(s), most of which were related to depth of burn.

Morbidity

A total of 154 patients were reported to have developed a post-burn complication, giving a morbidity rate of 13.3% amongst survivors. Post traumatic stress disorder (PTSD) was reported in 9 (0.8%) of patients. Keloids or scarring occurred in 57.8%, contractures in 53.3%, limb amputations in 12 patients, dyspigmentation in 4 patients, corneal perforation and finger syndactyly in one patient each.

Mortality

A total of 167 patients died, representing a mortality rate of 14.4%; 74 (44.3%) were males while 93 (55.7%) were females, with a male to female ratio of 1.00 to 1.3. One hundred and fifteen (68.9%) of these died within the first week of admission, 20 (12%) in the second week, 6 (3.6%) in the third week, and 26 (15.6%) after the third week of admission. The average age of patients who died was 19.3 years. They had an average %TBSA of 50.4%.

Causes of Burn Injury

A total of 732 (63.3%) of the patients sustained scalds (caused by moist heat), resulting in 40

deaths, while 425 (36.7%) patients suffered flame burns (Dry heat) with 127 deaths (29.9% of total deaths).

Self-inflicted and Alcohol-related Burns

Eighteen 18 (24.7%) of the patients attempted suicide, with a mortality of 77.8%. 17 (94.4%) were female, while 1 (5.6%) was a male.14 patients (all female) died. Six patients suffered burns under the influence of alcohol – 2 of them (both female) died.

Level of Care

Of 133 patients suspected to have had inhalation burns only 23% were admitted into ICU. Sixty of the 85 admitted into the Burn Unit died. Eighty-nine patients had ABSI scores of 10 or less.

Seventy percent of the 47 patients that died with ABSI scores of 10 or less were managed outside the ICU setting. From univariate analysis, females were at a greater risk of dying from the sustained thermal injury than male patients – p-value <0.05.

Multivariate Analysis

a) Percentage total body surface area burnt (%TBSA) with increasing size of %TBSA, there is a rapid rise in the Odd's ratio, translating to a rapid rise in mortality.
b) AGE (years). A statistically significant increase in mortality was noted in patients of age 60 years and above, when compared with patients below 60 years of age.

Multivariate Statistical Regression

Stepwise multivariate logistic analysis was performed on various patient variables. The unadjusted p-value for age was less than 0.0001. The p-value of sex adjusted to age was 0.008. However, with progressive stepwise addition of other variables, sex and age were the least significant variables, with adjusted p-values of 0.3 and 0.04 respectively.

Figure 1
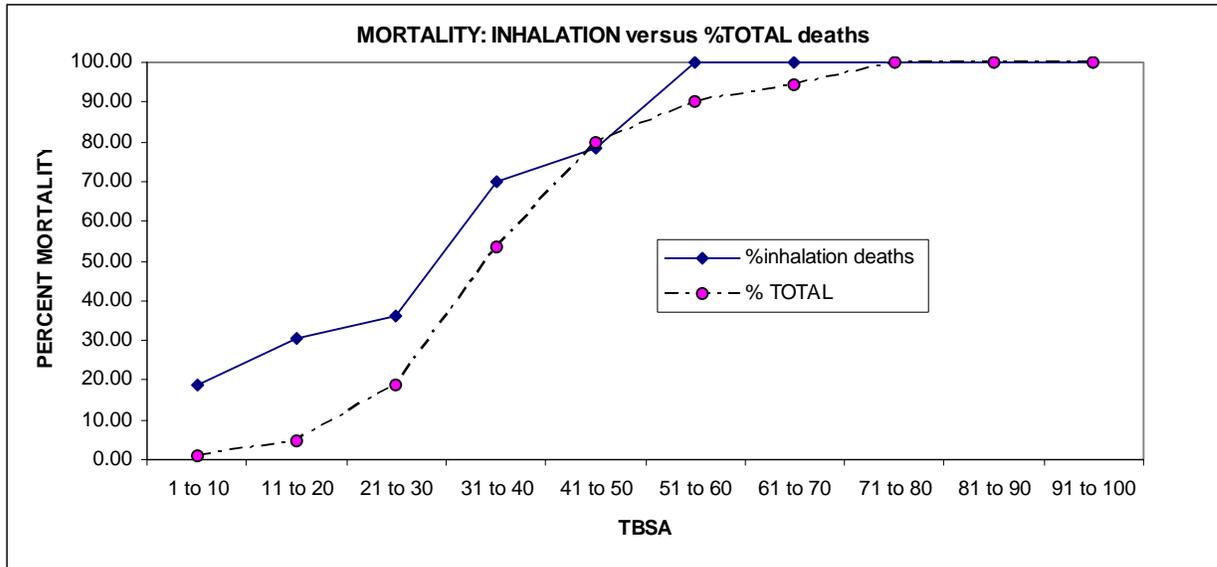
Table 1. Univariate analysis of prognostic factors.

Variable	(P-Value)
SEX (Male/Female)	<0.05
DEPTH (Superficial/Deep)	<0.01
Inhalation Injury	<0.01

Discussion

Admission scoring systems to predict morbidity and/or mortality of trauma patients have received increasing acceptance in recent years[6-10]. They serve multiple purposes and functions including[6-10, 13].

1. Reduction of physician reliance on clinical intuition,
2. Aiding in understanding the relative influences of specific prognostic variables,
3. Classification of the severity of injuries,
4. Stratification of patients groups into various treatment modalities,
5. Evaluation and documentation of the economic impact of treatment, and
6. Facilitation of multi-center studies and comparisons

Tobiasen et al. published the Abbreviated Burn Score Index (ABSI) in 1982. They demonstrated that the inclusion of inhalation, sex and full-thickness burn in addition to age and %TBSA improved the predictive power of the index.[6]

The ABSI score has been validated in a number of studies[6,9,11] and has been shown to achieve acceptable precision, albeit its simplicity, when compared to more complex statistical models. Its simplicity lies in its use of clinical variables, which are easily remembered (Sex, Age, Depth of burn (presence of deep burn), Inhalation injury (present or absent) and %TBSA). Krob et al.[11] in 1991 showed that general trauma scores perform poorly when used to attempt to prognosticate burn injuries, and stressed the importance of burn scores for use in burn injuries. The overall mortality (14.4%) is high when compared to the 4 to 10% reported from the West[12,13] depending on the patient demographic characteristics of the study. Germann et al. reported a mortality of 28.3% in a study that examined the impact of risk factors

and pre-existing conditions on mortality of burn patients.[9]

Interesting to note was the relative shifting of mortality by other risk factors, the most prominent being suicide. Patients who committed suicide had a higher average %TBSA (56.4%). The other significant risk factors such as pregnancy and drug abuse had very few numbers; it was thus difficult to statistically ascertain their influence on mortality patterns. Studies have shown that both pregnancy[14,15] and drug abuse[16-18] independently in burn patients result in poorer outcomes when compared to the general population of burn injured patients.

Wanjeri[1] reported only one patient with 'depression' out of a patient population of 347. Only 1% of our patients were diagnosed with PTSD, likely due to under-reporting. The reported prevalence rate of PTSD in literature varies between 8 and 45 percent[2].

Estimates of the probability of death are vital in the management of patients, but it must be emphasized that for individual patients, these are no replacement for clinical decision. For example, as predictive scales for survival, costs, and other outcomes are developed, they should be used not to limit the care given to these vulnerable patients but to streamline and improve it. They should also assist in redirecting and apportioning appropriate levels of care to maximize survival, where feasible.

With the evolution of burn care and development of accurate mortality score systems, clinicians in many centers have developed strict criteria for patients in whom the outlook is poor, with no chances of survival. Thus some institutions in the West have 'do not resuscitate' (DNR) criteria, a decision usually reached at in concert with the patient and/or patient[13,19]. Forty two percent of ICU burn admissions were unsalvageable in our current environment of practice right from the time of

admission – meanwhile salvageable patients were apportioned lesser care. Although poor triaging may be claimed, perhaps that era has arrived in this country, and the legal framework should be laid down to allow for the legal practice of this difficult clinical decision.

Figure 2 is a graphic representation of the mortality tabulated against the ABSI score. Table 2 gives the probability of survival for each ABSI class. There is a sharp drop in survival between ABSI scores of '6 to 7' and '8 to 9' – from 70% in the former to 20% in the latter. Patients in the ABSI class 8 to 9 require a more aggressive approach to enhance their survival.

This subset of patients had an average TBSA percentage of 47.3%, and was generally young with a mean age of 24.4 years. Patients with ABSI scores of 10 to 11 and 12 have estimated survival rates of 5% and less than 1% in our environment, and thus discussions of DNR would be appropriate, early on in their care.

Conclusion

Burns injuries are an important cause of patient morbidity and mortality in our environment. These injuries have a significant impact on survivors, and their families, with lengthy hospital stays, loss of income; but more importantly, post-burn disfiguring physical and psychological complications, including limb amputations, contractures, keloids and scarring, as well as PTSD amongst others.

There were 167 deaths out of the 1157 patients in this study. It is possible to reduce this figure of 14.4% mortality by optimizing care, and proper patient stratification, allowing for decisions based on objective clinical data. The ABSI score as a tool can used to forecast objectively a number of things, including outcome, possible length of hospital stay and therefore possible estimate of cost of care, amongst a host of other issues[13]. It would help in deciding the level of care given to each patient, thus optimize use of resources as well as patient care and outcome.

Figure 2. Tobiasen's' Abbreviated Burn Score Index (ABSI)
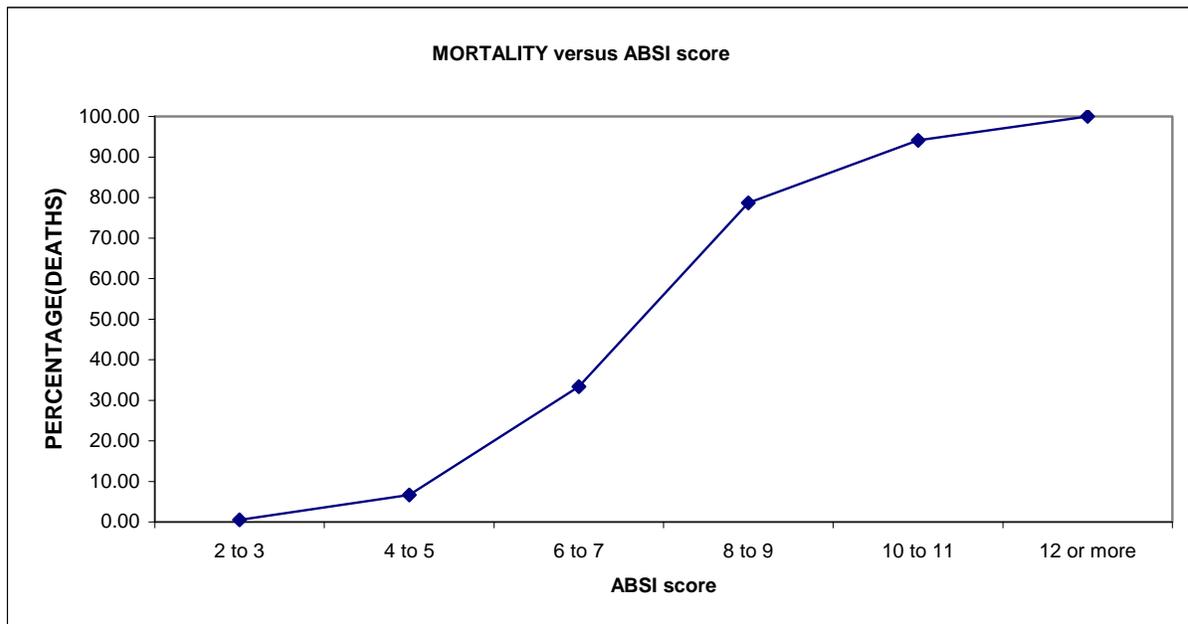
Table 2. Abbreviated Burn Severity Index (Adapted to study population)

Variable	Patient Characteristic	Score	Total Burn Score	Threat to life	Probability of survival %
SEX	Female	1	2 – 3	Very low	>99
	Male	0			
Age in Years	0 – 20	1	4 – 5	moderate	90
	21 – 40	2			
	41 – 60	3	6 –7	Moderately severe	70
	61 – 80	4			
	81 – 100	5	8 – 9	Serious	20
Inhalation Injury	Present	1			
Full Thickness Burn	Present	1	10 – 11	Severe	5
% TBSA burned	1 – 10	1			
	11 – 20	2	12 and above	Maximum	<1
	21 – 30	3			
	41 – 50	5			
	51 – 60	6			
	61 - 70	7			
	71 – 80	8			
	81 – 90	9			
	91 – 100	10			

From the foregoing, this study established, as in many other studies that % TBSA, an associated inhalation injury and the depth of burn injury are the main clinical determinants of burn patient outcome, and that sex and age of burned patients are also important prognostic variables.

(Appropriate resuscitation is presumed in this statement.)

This study has also shown that when these variables are put together and statistically

weighted, forming a clinical score as in the ABSI score, they constitute a very useful clinical tool.

The practicability of the ABSI score in clinical practice has been confirmed by the results of this study. The predictive power is precise. It is the view of the authors that the ABSI score should be introduced into clinical practice in its current format, and be used, along with other available clinical tools, to stratify patients and direct subsequent management – allowing for optimization of available resources, reduce costs of care and enhance optimal patient outcome.

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