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Original Article

Is the target of 1 day length of stay per 1% total body surface area burned actually being achieved? A review of paediatric thermal injuries in South East Scotland

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Abstract: Objectives: Length of stay is a standard variable used to evaluate outcomes in burn care. Is the target of 1 day length of stay per 1% total body surface area burned actually being achieved? Methods: A retrospective analysis of 328 paediatric thermal injuries admitted to the South East Scotland Regional Burn Unit between January 2003 and March 2007 to assess whether the target is met and if not, which factors are contributing to a prolonged hospitalisation. Results: 57% achieved the target and 43% failed the target. Factors associated with a lengthened hospital stay were burn depth, burn location, presence of infection/sepsis and the need for theatre visits for either dressing change or surgical intervention. Conclusions: Many factors can contribute to patients' length of hospital stay. It is valuable to identify areas of practice which can be altered to minimise the impact of these factors. For example, consider the use of laser Doppler imaging to help assess burn depth more accurately; this leading to potentially more accurate requirements for surgery or not, early excision of deep burns, improved infection control and use of dressings may all contribute to reduce the length of inpatient stay with a view to improving patient outcome.

Keywords: Total body surface area percentage burn, length of stay, paediatric thermal injury, paediatric burn

Introduction

Burn injuries occur in around 250,000 people in the UK each year and around 16,000 are admitted to hospital, many to non-specialist units. Approximately 1000 are classified as severe burn injuries requiring fluid resuscitation, half of whom are under the age of 16 years [1]. The National Network for Burn Care aims to improve the quality of NHS Burn Care Services following the National Burn Care Review in 2001 which set out 143 National Burn Care Standards [2]. With the advent of this, an increased emphasis has been placed on the importance of length of stay (LoS) in the burns unit. This is due to evidence suggesting that this parameter is associated with adverse events, morbidity and both functional and aesthetic outcomes. The current European benchmark often referred to in adult burns describes a linear relationship of 1 day per percentage of total body surface area (TBSA) burned as the target that should be achieved. Length of stay has the advantage of being easy to record, but there is not a great deal of evidence pertaining to which factors are important at determining time spent in hospital in the paediatric burns population. A retrospective review of thermal injury data was therefore carried out on patients admitted to the Southeast Scotland Paediatric Burns Unit at the Royal Hospital for Sick Children Edinburgh to assess whether the paediatric burn patients admitted had been meeting the recommended length of stay for burn admissions, and if not, identify those factors contributing to a prolonged stay.

Method

A retrospective analysis of patients notes was carried out on 328 admissions to the Edinburgh Paediatric Burns Service between January 2003 and March 2007. The data failed statistical tests of normality so non-parametric statistical tests (Mann-Whitney U and Kruskal-Wallis) were used for data analysis. We investigated

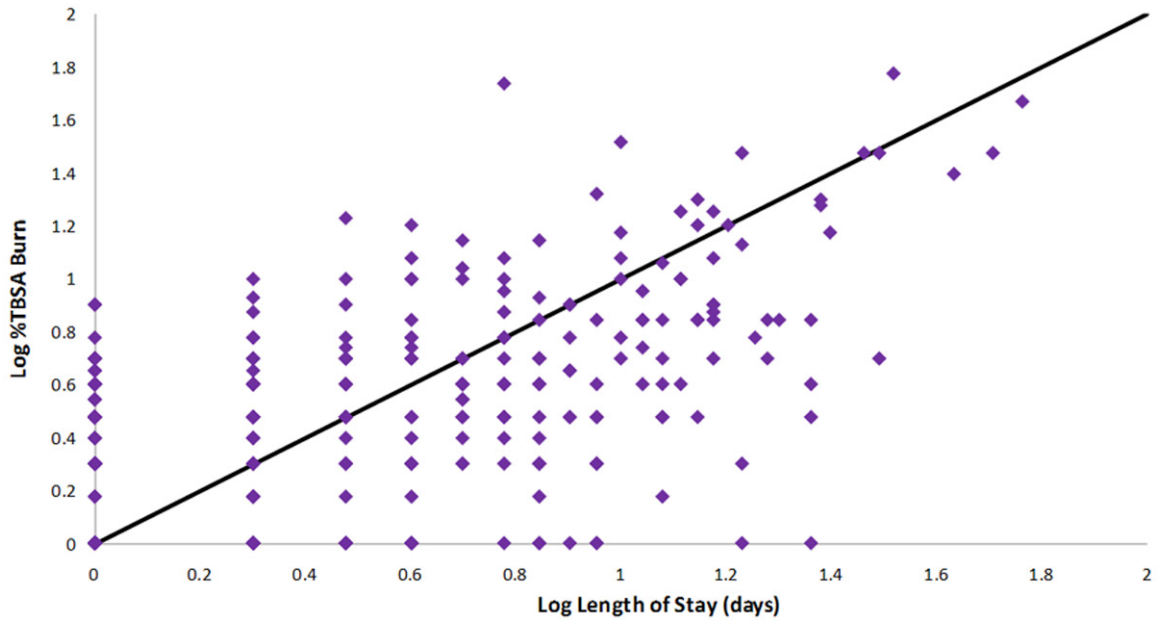

Figure 1. Percentage TBSA is displayed against Length of Stay in days on a Logarithmic scale, with a line showing the ideal 1 day stay per 1 percentage burn.

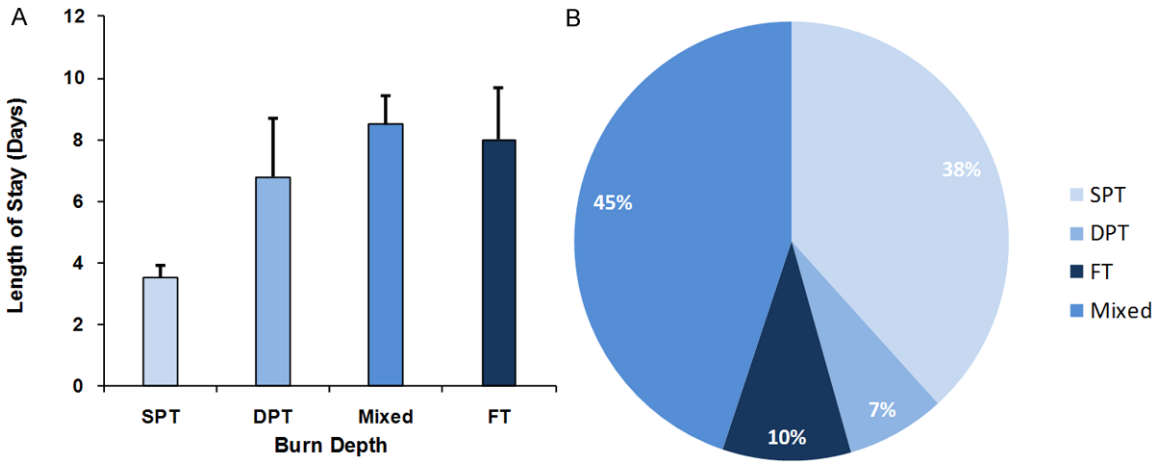

Figure 2. A: Length of Stay is displayed against Burn Depth. B: Proportion of each burn depth in patients with LoS >1 per %TBSA.

the relationship between length of stay and the following factors: (1) Percentage TBSA burn; (2) Depth of burn; (3) Anatomical location; (4) Cause of burn; (5) Presence of infection and/or sepsis; (6) Smoke inhalation injury; (7) Number of visits to the operation theatre and requirement for burn excision and skin grafting.

Results

327 patients were admitted during this period. Median length of stay (LoS) was 1 day per %TBSA burn (mean 1.7, range 0.1 to 26). 188 patients (57%) achieved the level of 1 day stay per %TBSA burn while 139 (43%) had a larger ratio (see **Figure 1**).

After analysing the data collected, factors found to be associated with an increased length of stay were:

Burn depth

Mean LoS for superficial partial thickness burns was 3.5±0.4 days compared to 6.8±1.9 days for deep partial thickness burns, 8.4±0.9

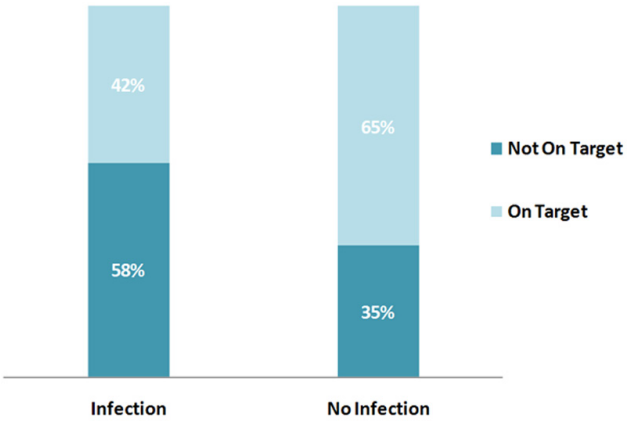

Figure 3. Percentage of patients with/without burn wound infection or sepsis meeting/not meeting the target for Length of Stay.

days for mixed depth burns and 8.0±1.7 days for full thickness burns (p<0.001) (**Figure 2**).

Burn wound infection/sepsis

There were 96 patients with a thermal injury which had demonstrable clinical signs of infection during their admission. Of these, 41 (42%) had a 1 day per %TBSA burn, whilst 55 (58%) did not. Overall LoS was 10.9±1 days in those patients developing infections compared to 3.5±0.3 days in those who did not (p<0.001) (**Figure 3**).

Number of trips to theatre and requirement for burn excision and skin grafting

Those not requiring a trip to theatre had a mean LoS of 3.2±0.3 days compared to 15.0±2.4 days for those going to theatre at least once (p<0.001). For those patients specifically requiring burn excision and skin grafting the mean LoS was 10.3±0.3 days compared to 3.2±0.3 for those who did not require grafting (p<0.001).

Burn location

The location of the burn injury had a detectable effect on length of stay. In particular, those patients with burns on the head, trunk or upper extremity all tended to achieve the target LoS and had a shorter overall length of stay than those with burns on the feet and legs who tended not to achieve the level of 1 day stay per TBSA burn (p<0.001) (**Figure 4**).

Several previous studies have demonstrated that smoke inhalation prolongs LoS in hospital for burn patients, however, smoke inhalation only affected a very small number of patients in our study and was not objectively assessed (i.e. by bronchoscopy) so statistical analysis of its effect on LoS was not possible. The cause of burn injury was not independently associated with LoS in hospital in our patients, although those with scald injuries tended to have more superficial burns and many of them were admitted for less than one day per %TBSA, most likely because of early coverage of the scald area with biological dressings such as Biobrane. This tends to allow earlier discharge (**Figure 5**).

Discussion

The majority of our paediatric patients did achieve a LoS of 1 day per %TBSA burn. In our study it was apparent that a variety of factors caused patients to go over the target of 1 day per %TBSA burn, mainly: deeper burns, burn wound infection, burns requiring excision and skin grafting, and those at specific locations such as the feet.

Previous studies have supported some of our findings by showing that burn size and depth, but also that age (>60 yrs and <1 yr), inhalation injury and the presence of any other illnesses or conditions are important predictors of mortality and length of hospital stay following an acute burn injury [3-6]. Therefore, when assessing a child with thermal injuries, any of the above factors could be seen to disrupt the use of the target in predicting length of stay. Currently the precise role of exactly how each variable may impact on length of stay is difficult to elucidate and therefore anticipating length of stay is not a straight forward task.

A prolonged length of stay is usually a consequence of complications following the burn injury, and this is therefore associated with an increase in morbidity and mortality. Therefore, it may be important to consider the various mortality predictive equations that have been formulated so that one can appreciate that other factors as well as %TBSA burned can affect the length of stay and thus the outcome, in thermally injured patients.

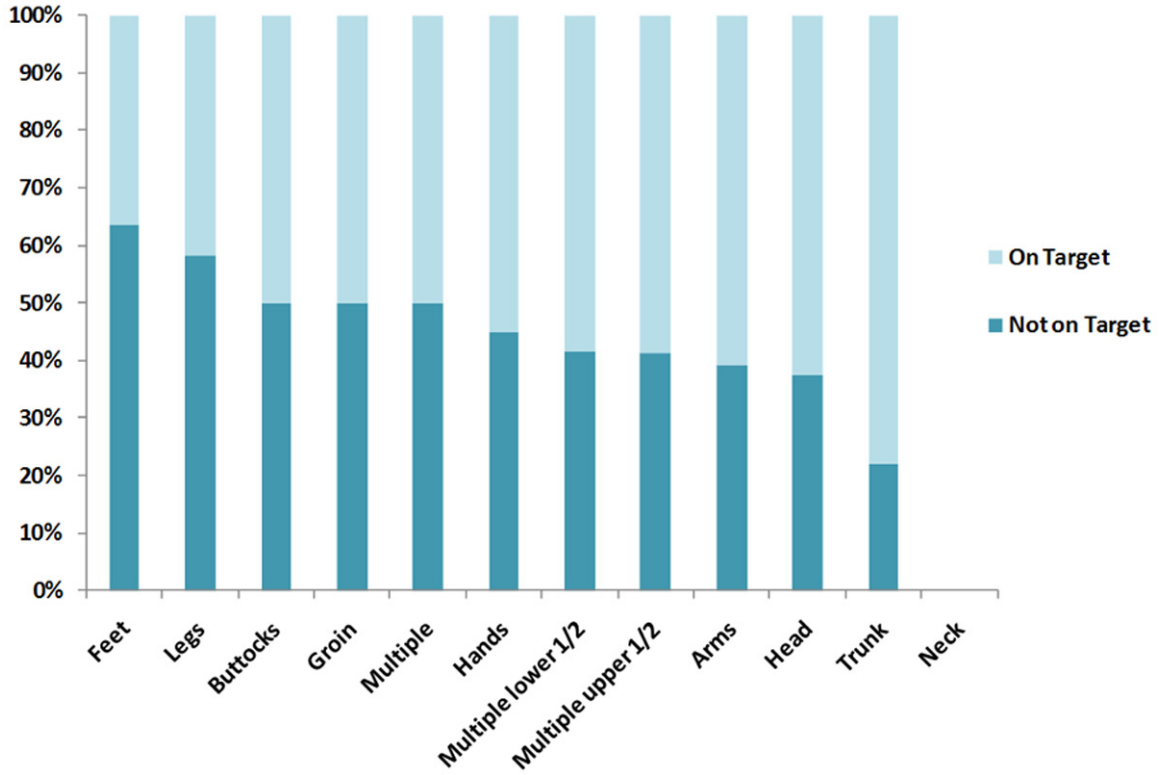

Figure 4. Proportion of patients meeting/not meeting the 1 day per %TBSA burn target for different locations of burn injury.

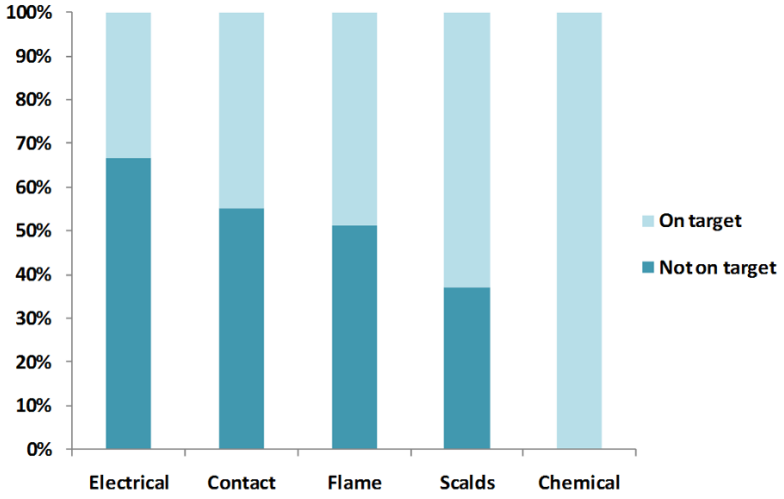

Figure 5. Proportion of patients meeting/not meeting the 1 day per %TBSA burn target for different mechanism of burn.

One analysis involving 68,661 burn patients designed a formula using logistic regression statistics which involved a range of factors namely; full-thickness body surface area burned, presence of inhalation injury, gender, mechanism of injury, delay to the intensive burn care unit (ICBU) admission and mechanical ventilation. It discovered that all the above variables were significantly associated with mortality except mechanism of injury and delay to ICBU admission [7].

Another study examined the relative impact of inhalation injury, burn size, and age on overall outcome following burn injury in 1447 consecutive burn patients over a five and a half year period. Using multivariate analysis, it discovered that inhalation injury was found to be an important variable in determining outcome, but the most important factor in predicting mortality was %TBSA burn or a combination of %TBSA burn and patient age. Co-morbidities and co-existent trauma have been implicated in burn mortality

and impact on reaching the target length of stay but have not been incorporated into predictive models [8].

A positive finding was that the patients in our study with superficial partial thickness scalds who were routinely treated with Biobrane tended to beat this target. Similarly, for the most recent children treated in Bristol, length of stay has been reported as less than 1 day per %BSA and approaches 0.5 days per %BSA [9].

Therefore, the next step will be to identify changes in unit practice that will allow more patients to achieve or even beat the target LoS. This could include the routine use of Laser Doppler imaging to allow a more reliable diagnosis of burn depth, therefore permitting early burn excision where required and minimising LoS for deeper injuries. Early excision and grafting of burn wounds within 48 hours is commonly recommended for children and younger adults with deeper burns instead of serial grafting [10]. It has been reported to reduce infection, mortality, hospital stay and furthermore, improve functional and cosmetic outcome [11] Certain studies have shown that this has led to a reduction in fluid losses, decreased infectious complications, decreased mortality and length of hospitalization. One study which compared 2 groups of paediatric thermal injuries, one which underwent early and the other late excision and grafting, demonstrated a shortened length of hospital stay in the early excision group of 35.3 versus 49.1 days ($p<0.05$) in the late group [12, 13].

In the future, additional factors which may influence the length of admission in paediatric thermal cases could be identified. For example, the involvement of Social Services in thermal injuries with child-protection concerns may prolong patients' length of stay. It is also important to bear in mind that in these cases, length of stay may be misleading if one is using this as a measure of good outcome.

Furthermore eliciting if there had been a delay in admission, although challenging and hard to quantify, could prove to also influence the target. Co-morbidities and concomitant trauma, which were not included in this review, may also increase length of hospital stay.

Conclusion

Despite all the aforementioned factors aside from the %TBSA burned that appear to affect length of stay, we still feel that it is a useful benchmark to aim for the linear trend 1 day per %TBSA burned in thermally injured patients. However, we do feel that the target could be more achievable provided that changes in unit practice are put in place to try to minimise the impact of the identified factors which can prolong hospital stay. For example, the use of Laser Doppler imaging early on to better assess burn depth, early excision of deep burns, improved infection control and the use of Biobrane dressings may help to achieve the target [14].

Disclosure of conflict of interest

None.

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References

[1] National Burn Care Review Committee Report. Standards and Strategy for Burn Care: A Review of Burn Care in the British Isles; 2001.

[2] British Burn Association Standards. National Burn Care Standards 2001.

[3] Ryan CM, Schoenfeld DA, Thorpe WP, Sheridan RL, Cassim EH, Tompkins RG. Objective estimates of the probability of death from burn injuries. N Engl J Med 1998; 338: 362-366.

[4] Smith DL, Cairns BA, Ramadan F, Dalston JS, Fakhry SM, Rutledge R, Meyer AA, Peterson HD. Effect of inhalation injury, burn size, and age on mortality: a study of 1447 consecutive burn patients. J Trauma 1994; 37: 655-659.

[5] Griffe O, Gartner R, Captier G, Brabet M, Baro B, Selloumi D, Otman S. Evaluation of prognostic factors in the burned patient. Ann Chir Plast Esthet 2001; 46: 167-172.

[6] O'Keefe GE, Hunt JL, Purdue GF. An evaluation of risk factors for mortality after burn trauma and the identification of gender-dependent differences in outcomes. J Am Coll Surg 2001; 192: 153-160.

[7] Smith D, Cairns B, Ramadan F, Dalston S, Fakhry S, Rutledge R, Meyer A, Peterson H. Effect of Inhalation Injury, Burn Size, and Age on Mortality: A Study of 1447 Consecutive Burn Patients. J Trauma 1994; 37: 655-659.

[8] Galeiras R, Lorente J, Pértega S, Vallejo A, Tomicic V, de la Cal M, Pita S, Cerdá E, Esteban A. Improving the ability to predict mortality among burn patients. Burns 2008; 34: 320-327.
[9] South West and South Central Specialised Commissioning Group. South West UK Burn Care Network. Annual Report. 2009-2010.
[10] Church D, Elsayed S, Reid O, Winston B, Lindsay R. Burn Wound infections. Clin Microbiol Rev 2006; 19: 403-434.
[11] Orgill DP. Excision and Skin Grafting of Thermal Burns. N Engl J Med 2009; 360: 93-901.
[12] Barret JP, Wolf SE, Desai M, Herndon DN. Total burn wound excision of massive paediatric burns within the first 24 hours post-injury. Ann Burns Fire Disasters 1999; 9: 25-7.
[13] Pietsch JB, Netscher DT, Nagaraj HS, Groff DB. Early excision of major burns in children: effect on morbidity and mortality. J Pediatr Surg 1985; 20: 754-7.
[14] Hoeksema H, Van de Sijpe K, Tondu T, Hamdi M, Van Landuyt K, Blondeel P, Monstrey S. Accuracy of early burn depth assessment by laser doppler imaging on different days post burn. Burns 2009; 35: 36-45.