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Appraising current methods for preclinical calculation of burn size – A pre-hospital perspective

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ABSTRACT

Background: Calculation of the percentage of total body surface area burnt is a vital tool in the assessment and management of patients sustaining burns. Guiding both treatment and management protocols. Currently there is debate as to which method of estimation is the most appropriate for pre-hospital use.

Methods: A literature review was undertaken to appraise current literature and determine the most appropriate methods for the pre-hospital setting. The review utilised MEDLINE and structured hand searching of Science Direct, OpenAthens, COCHRANE and Google Scholar.

Results: Fourteen studies were identified for review comparing various methods. The palm including digits was identified to represent 0.8% of total body surface area with the palm excluding digits representing 0.5%. Wallace's Rule of Nines was found to be an appropriate method of estimation. Variation in accuracy is accountable to expertise, experience and patients body type however current technology and smartphone applications are attempting to counter this.

Conclusions: Palm including digits measurements multiplied by 0.8 is suitable for assessing minor (<10%) burns however for larger burns Wallace's Rule of Nines is advocated. Further development of technology suggests computerised applications will become more commonplace.

1. Introduction

The purpose of this literature review is to appraise the current literature relating to calculation of burn size and its application to the pre-hospital setting. The aim of this review is to identify accurate and appropriate methods for pre-hospital and preclinical calculation.

For the purposes of this review the term 'burn' shall encompass all injuries resulting from burns (thermal, chemical, electrical, friction and radiological) as well as scalds.

2. Background to the review

"In the United Kingdom, burns patients account for about 175,000 emergency department attendances and 15,000 hospital admissions each year. Consequently the first aid and prehospital care for this large group of patients is of great importance and yet in the authors' experience, simple things are often not done very well [1]."

In 2004 the Faculty of Pre-Hospital Care at the Royal College of Surgeons of Edinburgh released their consensus on the pre-hospital approach to burns patient management [1] from

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which the statistics quoted above are taken. This equates to approximately 480 emergency department attendances a day with approximately 41 of those requiring hospital admission.

A search of NHS Pathways system for the 'burns' determinate for the year April 2014 to March 2015 was undertaken which showed that burns accounted for 763 calls to 999 in the South East of England alone.

2.1. *The Royal Colleges' consensus stated*

"To estimate the size of the patient's burned area, use the Wallace Rule of Nines or the "half burnt/half not" approach (serial halves: >1/2, <1/2, 1/4–1/2, <1/4). This latter technique although new, is effective in burn size estimation in prehospital care [1]."

The consensus advocated the use of the then new technique of serial halving for the calculation of %TBSAB which has subsequently been cited for the Burns and Scalds (Adult) guidelines produced by the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) [3].

In contrast, the National Institute for Health and Care Excellence (NICE) in their Clinical Knowledge Summary (CKS) on the Management of Burns and Scalds (2013) [4] firmly advocate the use of the 'Rule of Nines' for assessment of Adults and the Lund and Browder Charts for children [5].

Calculation of %TBSAB is paramount to the management of burns patients both by pre-hospital clinicians and by the receiving medical teams. Numerical representation of %TBSAB is used in the decision for appropriate receiving hospital and activation of specialist medical teams prior to the patient's arrival reducing "time to treatment" for the patient [6]. Choice on appropriate receiving hospitals for burns is aided by the inclusion of burns as a determinate for the Major Trauma Decision Tree used by UK ambulances services. Local variants state that patients with >20–30% burns, circumferential injuries or facial involvement should be conveyed to a major trauma centre in preference to the local hospital due to potential airway compromise [7] (Figs. 1–5).

The complications of haemoglobinuria and myoglobinuria from renal failure secondary to burns injuries are life threatening but avoidable by the early administration of intravenous fluid resuscitation, which was introduced in the 1950s [6,8]. Currently it is approximated 1000 patients a year, who have sustained substantial burns injuries, will require intravenous fluid replacement therapy to reduce the long term complications of renal failure and potential multi-organ failure [6,8].

Fluid requirement is commonly calculated using the modified parkland formula by inputting a calculated percentage of total body surface area burnt:

Box 1.0. [8]

4 mL × (Percentage Total Body Surface Area × Body *weight in Kilogram*)

50% given in the first 8 h post injury
50% given in the next 16 h

Superficial burns rarely require intravenous fluid resuscitation or specialist management [6,8] with partial and full thickness requiring the most urgent care. Difficulty can arise in differentiating between degree of burn which may lead to over or under-resuscitation by pre-hospital clinicians [6]. However, this paper is focussed primarily at discussing percentage of body surface area burnt and not at paramedic's ability to differentiate between severity of burns. This shows that the accurate management of burns victims begins with

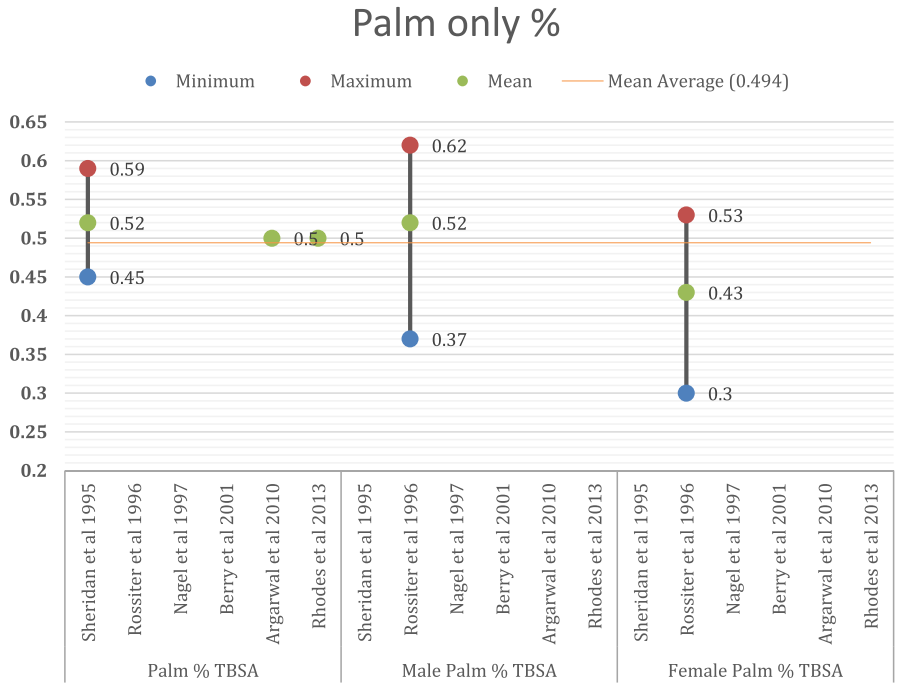

Fig. 1 – Representation of the data equating to the total body surface area percentage (TBSA%) of the palms.

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