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Transfer time to a specialist burn service and influence on burn mortality in Australia and New Zealand: A multi-centre, hospital based retrospective cohort study

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ABSTRACT

Background: In Australia and New Zealand (ANZ), health care is provided for ~26 million people dispersed across the eight million square kilometres of the two countries. Providing optimal care prior to and during transfer across such vast distances is challenging. Lengthening the time taken to definitive burn care has a negative impact on burn outcome. The aims of this study were to determine if transfer time and admission pathway influenced burn mortality and to identify the factors predicting burn mortality in ANZ.

Method: The study included all adult burn patient admission data from 15 of 17 burn services submitted to the Australian and New Zealand Burn Association bi-national registry (2010–2012). Multivariate logistic regression analyses were conducted to address the study aims. **Results:** Of the 2892 patients, 69 (2.4%) died following burn. Time to admission and direct admission to a burn centre did not independently influence burn mortality except when patients with inhalation injury took >16 h to transfer to definitive care. The risk of death was

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increased 5.7 times in the presence of inhalation injury. Burn size and age amplified the risk of death while gender did not.

Conclusion: In ANZ, pre-hospital transport systems and peripheral hospital stabilisation were not associated with an increased risk of death due to burn *except* when inhalation injury was present. The results of this study indicate that burn patients with inhalation injury should be stabilised and transferred to a burn service within 16 h of burn.

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1. Introduction

Seventeen designated burn units in Australia and New Zealand (ANZ) provide care for a population of over 26 million people dispersed across the eight million square kilometres of the two countries. For comparison, within the United States of America, there are 129 burn centres across nine million square kilometres which provide care for almost 320 million people [1]. Providing optimal care prior to the transfer of these patients across vast distances is often challenging simply due to the time taken to mobilise and provide access to medical support. Further, the time from when a patient is injured until arrival at a regional burn centre may be greater than 1 day in extreme cases in Australia (see Section 3). In that, teaching the principles of assessment, safe transfer and stabilisation of burn patients are key elements of telehealth outreach and the well-established education and burn service contact programme which supports non-metropolitan clinicians in complex decision making in ANZ [2,3].

The time taken to reach definitive burn care has been shown to impact negatively on burn outcome in children [4]. Early interventions, provided as part of the multidisciplinary team (MDT) approach, such as prompt fluid resuscitation, eschar excision and wound closure, result in marked improvement in mortality [5]. Increased risks of infection and suboptimal fluid resuscitation have been reported with delayed transfer to a burns unit [6–8]. It follows that the duration from injury to definitive, specialist MDT interventions may also be associated with mortality. For the purposes of this study, definitive burn care was defined as specialist burn care provided at a tertiary burn referral centre. While the pattern of burn patient transfer activity for Victoria has been described previously by Gabbe et al. [9], the influence of transfer time duration on burn mortality in ANZ has not been assessed. Further, it has yet to be determined which patients can be resuscitated and stabilised first in a peripheral hospital and those who received streamlined admission to a regional burn centre.

Thus, the aims of the study were:

- (a) to determine if transfer time was associated with burn mortality;
- (b) to understand if indirect transfer of burn patients to the burn service via another hospital influenced post-burn mortality; and
- (c) to determine and quantify the relative contribution of the factors which influence mortality after burn in an ANZ health systems context.

The subsequent hypotheses were:

- (a) increased transfer time is associated with an increased risk of post-burn mortality;
- (b) direct transfer to a burn service is associated with a reduction in risk of post-burn mortality; and
- (c) the presence of inhalation injury; increasing burn size, age and transfer time; and the female gender are all associated independently with increased risk of mortality post-burn.

2. Methods

2.1. Study design

This is a multi-centre, hospital based retrospective cohort study sourced data from the Burn Registry of Australia and New Zealand (BRANZ). The BRANZ is a clinical quality registry capturing epidemiological, quality of care, and outcomes data for adult and paediatric burn patients across ANZ burn services [10]. It is the responsibility of each participating burn centre to collect the data via medical records and hospital information systems and entered into the web-based database on-site [11]. This data collection is coded using the ICD-10 Australian modification, de-identified and uploaded to the BRANZ. The registry is a collaboration between the Australian and New Zealand Burn Association (ANZBA) and Monash University, Melbourne. At the time of this study, 15 of 17 burn centres were contributing their data to the registry with local ethics approvals confirmed. This study was conducted under supplementary project approval provided by the Royal Perth Hospital Human Research Ethics Committee (Ethics Approval number EC 2012/092) and with approval of the BRANZ Steering Committee. Since inception of the BRANZ in 2009, there have been over 2500 recorded admissions and all data for adult patients from 2010 to 2012 were extracted and included in the study. Specific exclusions were not applied relating to burn size or agent, nor patient demographics. To maximise data completeness and quality, it is assumed that all contributing sites conducted data completeness reports (provided quarterly by BRANZ to the local burn service) and addressed any discrepancies, prior to the central extraction of data for the annual reports.

The limitations in respect to recorded outcomes in a registry such as this must be highlighted at this point. Firstly, identifiable patient records cannot be accessed and therefore detailed examination of patient medical records to determine the nuances of the pre-hospital triage; transfer conditions and cause of death is not possible. This is in keeping with the privacy requirements for storage and ethical management of

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