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Outcomes of burns in the elderly: Revised estimates from the Birmingham Burn Centre

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ABSTRACT

Outcomes after burn have continued to improve over the last 70 years in all age groups including the elderly. However, concerns have been raised that survival gains have not been to the same magnitude in elderly patients compared to younger age groups. The aims of this study were to analyze the recent outcomes of elderly burn injured patients admitted to the Birmingham Burn Centre, compare data with a historical cohort and published data from other burn centres worldwide. A retrospective review was conducted of all patients ≥65 years of age, admitted to our centre with cutaneous burns, between 2004 and 2012. Data was compared to a previously published historical cohort (1999–2003). 228 patients were included. The observed mortality for the study group was 14.9%. The median age of the study group was 79 years, the male to female ratio was 1:1 and median Total Body Surface Area (TBSA) burned was 5%. The incidence of inhalation injury was 13%. Median length of stay per TBSA burned for survivors was 2.4 days/% TBSA. Mortality has improved in all burn size groups, but differences were highly statistically significant in the medium burn size group (10–20% TBSA, $p \leq 0.001$). Burn outcomes in the elderly have improved over the last decade. This reduction has been impacted by a reduction in overall injury severity but is also likely due to general improvements in burn care, improved infrastructure, implementation of clinical guidelines and increased multi-disciplinary support, including Geriatric physicians.

1. Introduction

The United Nations estimate that the proportion of the world population aged over 60 years will triple to reach two billion by 2050 [1]. In the UK, the proportion of the population aged >65 years is currently 17% and it is predicted that this will rise to 23% by 2035. Moreover, the ‘oldest old’, those 85 years and over, are the fastest growing group with a projected 2.5-fold increase in size of this age group to 3.5 million by 2035 [2]. An

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increasingly ageing population will have substantial global implications on health care systems and burn care provision.

The elderly are particularly susceptible to sustaining burn due to impairments in judgement, co-ordination, balance and reaction times together with reduced ability to escape from harm [3]. Following their injury, lower physiological reserves and co-morbid disease may complicate their management and recovery [4]. Age itself is a major prognostic factor after burn. After controlling for percentage total body surface area (TBSA) burned and the presence of inhalation injury, it is a powerful independent predictor of mortality [5–7]. Age has therefore been included in most prognostic scoring systems of burn survival [8–11]. Elderly patients, who survive their injury, experience significantly increased morbidity, particularly from infectious complications such as pneumonia [12]. They are more likely to stay in hospital longer, are discharged back home less often and an age dependent increase in the use of post-hospitalization resources has been shown [13,14].

Survival following burn has improved in recent decades due to advances in burn care; including resuscitation; early excision and wound closure; nutritional support; skin substitutes; and modulation of the hypermetabolic response [15]. However, improvements in survival are lagging behind in the elderly [15–19]. We previously published a cohort of elderly burn admissions, which showed an observed mortality rate of 34.9% [20]. In this current study, we compare epidemiological data and outcomes for elderly burns admissions over a more recent period, with this previously published cohort.

2. Materials and methods

Patients aged 65 years and above admitted to the Birmingham Burns Centre with acute burns from 1st January 2004 to 31st December 2012 were identified from the International Burn Injury Database (IBID) and Hospital Episode Statistics (HES). Between January 2004 and June 2010, all patients were admitted to the Burns Centre based at Selly Oak Hospital, Birmingham, UK. For the remainder of the study, patients were admitted to the Burns Centre at its location in the new Queen Elizabeth Hospital Birmingham (QEHB), Birmingham, UK.

Patients admitted with non-cutaneous burns, skin-blistering conditions and those with no medical notes available for review were excluded. Additionally, patients in whom a comfort care decision was made within 24 h of their admission were excluded from the analysis. The exclusion criteria for the study group was identical to that used in the previously published cohort of elderly burn patients treated between 1999 and 2003 [20].

The aspects of patient management described below have not changed between the two study periods. However, during the second period of study, clinical guidelines were formalized for the treatment of inhalation injury, nutritional support, blood product transfusion and thromboprophylaxis. The fluid resuscitation calculation employed was the Parkland formula (4 ml/kg/% TBSA) for all patients with burns $\geq$15% TBSA, however in cases where there was a history of cardiovascular disease, balanced fluid resuscitation was initiated at 2 ml/kg/% TBSA. Invasive central venous pressure and arterial blood pressure monitoring was utilized for all patients receiving fluid resuscitation. Target urine output was 0.5 ml/kg/h. Decisions regarding excisional surgery were made once a full medical history was obtained from informants and a review by a Consultant anaesthetist specializing in burn care. Patients with full thickness burns who were deemed unsuitable for surgical excision in the first 2 weeks post-injury were treated with daily topical application of silver sulfadiazine (SSD)/ cerium nitrate. The goal of this approach is to maintain a dry adherent eschar until the patient has been medically optimised for excisional surgery. Inhalation injury was primarily diagnosed on clinical grounds if there was history of entrapment in a house or industrial fire or explosion in an enclosed space together with clinical signs, e.g. carbonaceous sputum, respiratory symptoms and signs and change in voice [21]. However, patients undergoing mechanical ventilation had further confirmation of the diagnosis by fibre-optic bronchoscopy according to the minimum presence of carbonaceous deposits and erythema within the bronchi [22]. All decisions regarding the withdrawal of active care were made by a minimum of two Consultants, at least one being a Consultant Burn surgeon.

Data on patient demographics, burn details, co-morbidities, timing of surgery, complications and outcomes, including length of stay (LOS) and in-hospital mortality was extracted from the medical notes and IBID. The revised Baux score [8], Abbreviated Burn Severity Index (ABSI) score [10], Belgian Outcomes in Burn Injury (BOBI) [11] score were calculated for each patient along with a Canadian Study of Health and Ageing (CSHA) Clinical Frailty Scale score [23]. Data was collated in a Microsoft® Excel® spreadsheet (Microsoft® Corporation, Redmond, WA) and statistical analysis was performed using PASW Statistics version 18 (SPSS Inc., Chicago, Illinois, USA). Data was obtained from the previously published 1999–2003 cohort [20] and comparisons were made with the current data set.

The lethal area 50 (LA_{50}), a measure of burn survivability for the TBSA at which there will be 50% mortality, was calculated using both probit analysis and logistic regression analysis as previously described [15]. In brief, probability unit (probit) analysis uses data on a dichotomous outcome and one or more explanatory variables to predict the outcome probabilities based on the assumption that their probits are linearly related to the values of the explanatory variables. The logit of a probability p is the value of log ($p/1-p$). Binary logistic regression analysis uses data on a dichotomous outcome and one or more explanatory variables to predict the outcome probabilities based on the assumption that their logits are linearly related to the values of the explanatory variables. A single logistic regression analysis, with age and TBSA burn as continuous explanatory variables, was performed. To enable valid comparisons with previous data this study follows the format of previous studies produced by this group.

Categorical variables were compared using Fisher's exact test and continuous non-parametric variables were compared using a Mann–Whitney U-test. To assess the effects of age, TBSA and inhalation injury, we constructed multi-variable logistic regression analysis models. Odd ratios were also calculated using these models. Data is presented as medians and interquartile ranges (IQR) unless stated. Statistical significance was considered at a probability of p-value <0.05.