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Long-term survival after burns in a Swedish population

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ABSTRACT

Introduction: As widely reported, the progress in burn care during recent decades has reduced the hospital mortality. The effect of the burns on long-term outcome has not received so much attention, and more study is indicated. The aim of this retrospective study was to investigate the long-time survival among patients who had been treated for burns.
Methods: We studied 1487 patients who were discharged alive from the Linköping University Hospital Burn Centre during the period 1993 until the end of December 2012. We used Cox's regression analysis to study the effect of burns on long-term survival after adjustment for different factors.
Results: Age and a full-thickness burn were significantly associated with mortality after discharge ($p < 0.001$), whereas percentage of total body surface area burned (TBSA %), need for mechanical ventilation, and gender were not. Less than 1% of the patients with burns (13/1487) died within 30 days of discharge and a total of 176/1487 (12%) died during follow-up.
Conclusion: Age and full-thickness burns reduce the long-time survival after discharge from the Burn Centre, whereas the effect of TBSA% and need for artificial ventilation ends with discharge

1. Introduction

Mortality in hospital among patients with burns has decreased considerably during recent decades, as critical care has become more effective and our approach to the care of burns more aggressive [1–10]. For that reason mortality in hospital is generally taken as an important indicator of the quality of care. Analysis of long-term survival is a new way to measure the outcome after a burn. It has been shown that a large proportion of patients treated in intensive care units (ICU) die within the first months of discharge [11], and patients after discharge from ICU are more likely to die than the general population [12], but the long-time outcome after hospital care of burns has not been studied.

Contrary to what has previously been reported [13–16], we have shown that survival time for patients treated for burns compared with an uninjured control group adjusted for age

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and gender was no shorter [17]. This finding deserves to be investigated further, and we hypothesised that the burn per se does not affect the long-term outcome. The aim of this paper, therefore, was to study the long-term survival after burns.

2. Patients and method

In this retrospective study we included all 1487 patients discharged alive from the Linköping University Hospital Burn Centre for all types of burns (thermal, electrical, or chemical) during the period 1January 1993 to 31 December 2012. No age limits or other restrictions were applied in this study. The endpoint for follow up was the 31 December 2012 or, in the case of emigrants, when they emigrated. At this time 176 had died, 1303 were still alive, and eight had emigrated after discharge. The emigrants were included in the survival group. One-year survival was calculated for the period 1993–2011 and 5-years survival for 1993–2007. During the follow up a total of 103 patients were readmitted for the primary diagnosis.

All patients including foreign citizens who are admitted to the Linköping University Hospital Burn Centre have been prospectively recorded since 1993 in the local Burn Unit Database [18]. The reported variables that we have used in this study were: age at discharge, gender, dates of admission and discharge, duration of stay, size of burn (total body surface area, TBSA %), the percentage of full thickness burns, and the need for mechanical ventilation (which includes all those who needed mechanical ventilation at least once after admission). Dates of death are recorded centrally in the Swedish National Inpatient Register [19], which is our source of information in the case of death.

2.1. *Design of the study*

We studied long-term mortality, and compared numbers of survivors and patients who died after discharge until the end of the follow-up period. We also describe the patients who died within 30 days after discharge.

We analysed the effects on long-term survival (Cox's regression) of the variables age at discharge, gender, TBSA%, presence of full thickness burns, and need for mechanical ventilation. Patients were categorised in four age groups based on age at discharge: 0–39 years, 40–59 years, 60–79 years, and 80 years or older and in five TBSA groups: 0–19%, 20–39%, 40–59%, 60–79% and 80% or more.

Finally, we analysed the change in 1-year mortality over time during the year periods 1993–1997, 1998–2002 and 2003–2007 and 2008–2011 adjusted for the same variables.

2.2. *Statistical analysis*

Unless otherwise stated, data are presented as number (%) or median (10th -90th centile). Probabilities of less than 0.05 were accepted as significant. The significance of differences between those with burns who survived and those who died after discharge was assessed with the chi square test or the Mann–Whitney *U*-test, as appropriate. Cox's regression was used to analyse long-term survival among patients with burns adjusted for age at the time of discharge, gender, need for mechanical ventilation during the stay at the Burn Centre, TBSA%, and presence of full thickness burns. The change of 1-year mortality over time was analysed with Cox's regression, including variables age, gender, need for mechanical ventilation, TBSA%, full thickness burns, and years intervals 1993–1997, 1998–2002, 2003–2007 and 2008–2011. The year 2012 was not included in this analysis because the follow-up time of this group was shorter than one year. Statistics were analysed with the aid of STATA (STATA v.12.0, Stata Corporation. LP, TX, USA).

3. Results

During the period 1993–2012, 1487 patients were discharged from the Linköping Burn Centre. The mean (SD) age at discharge was 32 (24) years and TBSA% 10 (13) %. A total of 1073/1487 (72%) were men, mean (SD) duration of hospital stay was 13 (22) days, and mean survival after discharge was 3064 (2281) days. A total of 1311/1487 (88%) were still alive at the end of the follow-up. The risk of death after discharge increased with age, need of mechanical ventilation during the admission, and if the burn was full thickness, whereas the effects of gender and TBSA% were not significant (Table 1). Thirteen patients died within 30 days of discharge (Table 1). The 1 year survival after discharge was 97% (1300/1331), whereas the 5 years survival after discharge was 93% (1003/1083). Cox's regression analysis confirmed that age at discharge and full thickness burns were significantly associated with mortality after discharge, whereas gender, mechanical ventilation, and TBSA% were not (Table 2). The 1-year mortality increased during the study period: Hazard Ratio (95% CI, *p*-value) was 1.1 (0.3–3.9, 0.87) during 1998–2002 period, 1.9 (0.6–6.1, 0.31) during 2003–2007, 5.3 (1.9–15, 0.002) during 2008–2011 (all compared with the period 1993–1997).

4. Discussion

A total of 1487 patients with burns were discharged alive from the Linköping's Burn Centre during the period 1993–2012, and most of them were men (Table 1). Not surprisingly, age influenced the risk of death, even after burn care (Tables 1 and 2). As previously stated, the TBSA % significantly influenced the risk of death during an admission for burns [6,20,21], but we found that its effect on outcome ends with discharge (Table 2).

A plausible explanation is that patients were discharged from the Burn Centre when the size of the burn ceased to be an issue, when the need of burn-specific care had ended, or when outpatient care was considered suitable. However, we found that full thickness burns still affected the outcome, even long after the burn (Table 2). Treatment of full thickness burns always includes excision, and that can lead to complications such as bleeding, infection, problems with wounds healing, or scars, with specific consequences on the patient's health and more generally long-term survival.

The need for mechanical ventilation, however, does not necessarily correlate with the severity of the patient's