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Patients over 75 years admitted to the National Burn Centre, Haukeland University Hospital, 2000–19

ORIGINAL ARTICLE

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BACKGROUND

The number of burn patients over the age of 75 receiving advanced treatment, including extensive surgery and intensive care, is increasing. We aimed to describe the treatment and outcomes for burn patients over the age of 75 admitted to the National Burn Centre at Haukeland University Hospital. We also wanted to investigate whether frailty scores can be a predictor of the treatment outcome.

MATERIAL AND METHOD

All patients ≥ 75 years admitted to the National Burn Centre at Haukeland University Hospital in the period 2000–19 were included in the study. Frailty scores were calculated retrospectively based on patients' medical records.

RESULTS

Our study included 101 patients (50 women and 51 men). The number of admissions of older burn patients increased from an average of 3.3 per year in 2000–14 to 10.2 in the period 2015–19. The median total body surface area with burns was 11 % (range 0.9–80 %). Seventeen patients received palliative care, and 12 patients receiving active treatment died in hospital. In 68 of 84 (81 %) actively treated patients, tangential excision and split-thickness skin grafting were performed. The remainder received conservative treatment (non-surgical) with wound care and application of a silver dressing. Patients who died in hospital had a significantly higher total body surface area with burns ($p < 0.0001$) and higher frailty scores ($p = 0.003$) than patients who survived.

INTERPRETATION

The yearly number of patients over the age of 75 treated at the National Burn Centre tripled during the period. More than two-thirds of the patients were discharged alive. Extent of burn injury and frailty score are associated with mortality and may be useful for adjusting therapy.

Main findings

Of 101 patients ≥ 75 years admitted to the National Burn Centre, Haukeland University Hospital, in the period 2000–19, 72 were discharged alive.

Eighty-four received active treatment, and of these, 12 died during their hospital stay. Extent of burn injury and frailty score were associated with mortality.

The number of older people (> 75 years) is increasing (1). This population group has an increased risk of burn injuries due to functional impairments, such as motor skill deficits, increased reaction time and altered cognition (2–4). Comorbidity at the time of injury contributes to high mortality among older burn patients (5, 6). Age-associated immune dysfunction predisposes older burn patients to delayed wound healing and an increased risk of secondary infection, which in turn causes further complications (7–10).

The number of older patients receiving advanced medical care is increasing, including in intensive care units. Indications for intensive care treatment, prioritisation criteria and level of treatment for these patients are the subject of much debate, as it can be difficult to predict treatment responses and outcomes. Older burn patients require a longer treatment time than younger patients, and only half of patients > 75 years can be discharged to their own home after hospitalisation in a burn unit (8, 11). Frailty scores have proven useful in the assessment of critically ill older patients (12), including those with burns (13, 14). Categorising patients according to functional level (15) gives a more accurate picture of the patient's relative degree of vulnerability than age and comorbidity (16). A separate Burn Frailty Index was also proposed recently, particularly for patients > 65 years (17).

In this article, we present burn patients ≥ 75 years who were admitted to the National Burn Centre, Haukeland University Hospital, in the period 2000–19. We report on the extent of injury, type of injury, comorbidity at the time of injury, course of treatment and mortality. Factors that can predict survival, and which will therefore be useful for adjusting therapy and prioritisation, were examined, with a particular emphasis on the significance of the burn size and frailty.

Material and method

Patient dataset

All patients ≥ 75 years who were admitted to the National Burn Centre, Haukeland University Hospital, in the period 2000–19 were identified through a local quality register. The following information was recorded: age, sex, mechanism of injury, extent of burn injury, duration of ventilatory support, number of surgical procedures performed in the operating theatre (wound care upon admission and escharotomy were not classified as surgical procedures), length of hospital stay and survival to discharge. The burn size was indicated as the percentage of total body surface area (TBSA) with partial thickness or full-thickness burns. The electronic patient records were reviewed retrospectively, and data were retrieved on comorbidities (coronary disease, hypertension, diabetes mellitus, chronic renal disease and peripheral vascular disease), use of regular medications at the time of injury, and 30-day and one-year survival after discharge.

Frailty on the Clinical Frailty Scale (CFS) (16) was scored retrospectively based on information in the electronic patient record. In the scale, patients are classified in one of nine groups based on functional level and the ability to carry out everyday tasks (15). A Norwegian translation of this scale is available (18).

Statistics

Fisher's exact test was used to compare groups (death/survival compared to size of burn and frailty score), and Spearman's rank correlation coefficient analysis was used to examine relationships (age compared to frailty score). All analyses were performed in SPSS version 26.0 (IBM Corp, Armonk, NY). *P*-values < 0.05 were interpreted as statistically significant.

Ethics

The Regional Committee for Medical Research Ethics Northern Norway considered the study to be a quality project and therefore outside the scope of their mandate and the Health Research Act (reference number 187713). Bergen Hospital Trust's data protection officer assessed the project and approved the processing and storage of patient data (project ID 2152).

Results

Patient data

Table 1 shows the characteristics of all the patients included in the study. The majority of patients were injured at home or in a nursing home (84 out of 101 patients, 83 %). Most of the injuries were flame injuries (58 out of 101 patients, 57 %), most often occurring in connection with cooking (15 out of 58 patients, 26 %) or house fires (13 out of 58 patients, 22 %). The most common area of the body for burns was the thigh/calf (55 out of 101 patients, 54 %), arm/hand (48 out of 101 patients, 48 %), front torso (46 out of 101 patients, 46 %) and rear torso (35 out of 101 patients), 35 %). Table 2 shows the correlations between the percentage of TBSA with burns and in-hospital death.

Table 1

Characteristics of 101 patients > 75 years admitted to the National Burn Centre, Haukeland University Hospital, 2000–19. Values are given as a number (percentage) or median (range). TBSA = total body surface area.

Patient characteristics	Number (%)/median (range)
Gender, male/female	51/50
Age, years (median, range)	81 (75–96)
Comorbidity	
Coronary disease	54 (53 %)
Hypertension	44 (44 %)
Diabetes	20 (20 %)
Peripheral vascular disease	6 (6 %)
Chronic kidney disease	5 (5 %)
Regular medications (≥ 1) at time of injury	84 (83 %)
Frailty score	4.0 (2–8)
Burn size (% of TBSA)	11.0 (0.9–80)
Mechanism of injury	
Fire	58 (57 %)
Scalds	24 (24 %)
Contact burn	8 (8 %)
Electrical	5 (5 %)
Other	6 (6 %)
No. of days in hospital[1]	17 (0–83)

Patient characteristics	Number (%)/median (range)
Surgical treatment[1]	68 (81 %)
Mechanical ventilation[2]	16 (29 %)
Survival	
Discharged alive	72 (71 %)
30 days after discharge	68 (67 %)
One year after discharge	59 (58 %)

[1]Calculated for actively treated patients (n = 84).

[2]Data on patients with ventilation only available for the period 2013–19.

Table 2

Burn size and status at discharge for 101 patients > 75 years admitted to the National Burn Centre, Haukeland University Hospital, 2000–19. TBSA = total body surface area.

Burn size (% of TBSA)	Discharged alive	Died despite active treatment	Died after palliative care
0–4	27	0	0
5–9	15	1	0
10–19	21	7	2
20–29	7	3	3
30–49	2	1	9
≥ 50	0	0	3

During the last five-year period (2015–19), the number of hospitalised burn patients over the age of 75 per year has tripled since 2000–14 (Table 3). Fifty-nine patients (58 %) were transferred from other hospitals: 21 on the day of injury, 21 on the day after injury and 17 more than two days after injury (four were transferred after 9–10 days).

Table 3

Number of patients > 75 years admitted to the National Burn Centre, Haukeland University Hospital, divided into five-year periods and status at discharge.

Time period	Discharged alive	Died despite active treatment	Died after palliative care
2000–04	7	5	4
2005–09	13	1	7
2010–14	10	1	2

Time period	Discharged alive	Died despite active treatment	Died after palliative care
2015–19	42	5	4

Treatment pathway

Seventeen patients were transferred to palliative care soon after admission with extensive burns and/or severe comorbidity. Thirteen of these had been transferred from other hospitals. Sixty-eight patients (81 % of the actively treated patients) required surgical treatment in the operating theatre, mostly with tangential excision and split-thickness skin grafts.

Most patients were operated on during the first 2–3 days after admission. Thirty-one of 68 surgical patients (46 %) were operated on more than once, and eight underwent four surgical procedures. The treatment was challenging and protracted for some patients. Fifteen operations were performed more than three weeks after admission. Seven out of 46 (15 %) actively treated patients who had been transferred from other hospitals had less severe injuries that did not require revision or skin grafting.

Ventilatory support was reported for the period 2013–19. Sixteen out of 56 patients (29 %) received ventilator therapy, and only five patients received this for more than 48 hours. For patients receiving active treatment, the median hospital stay was 17 days (range 0–83) (Table 1). Patients who received palliative care had a median treatment time of one day (range 0–4).

Survival

Almost one-third of the patients (29/101 patients, 29 %) died in hospital. The average TBSA with burns in patients who survived was 7 %. The corresponding figure for those who received palliative care was 40 %, and all patients who received palliative care died in hospital. The median TBSA with burns in patients who received active treatment, but who nevertheless died in hospital, was 18 %. The extent of burns in patients who died in hospital was significantly greater than for those who survived ($p < 0.0001$). Fifty-nine of 72 patients (82 %) who were discharged alive were still alive one year after discharge. Figure 1 shows patient mortality during the hospital stay and in the first year after discharge.

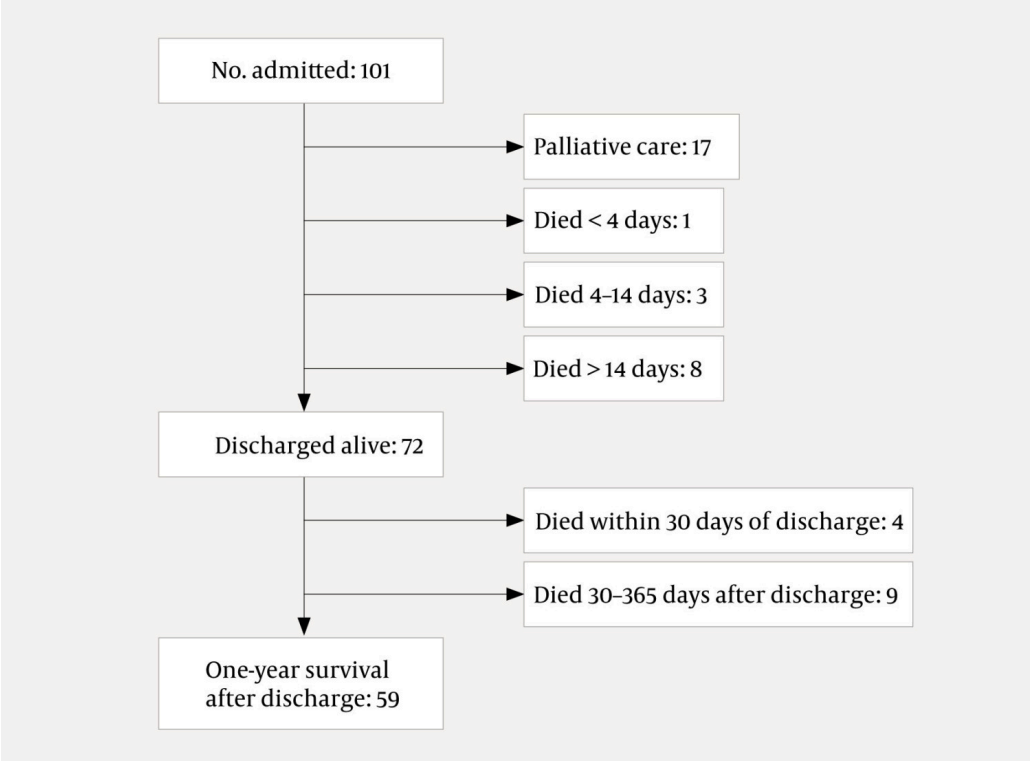

Figure 1 Mortality among 101 patients > 75 years admitted to the National Burn Centre, Haukeland University Hospital, in the period 2000–19. Twenty-nine patients died in hospital, and 59 were alive one year after the time of injury.

Comorbidity and frailty

Seventy-three out of 101 patients (72 %) had a comorbidity at the time of injury (Table 1).

Based on information in the electronic patient records, frailty (16) could be scored in 88 out of 101 patients (87 %). Figure 2 shows the distribution of frailty scores in the patient data compared to in-hospital deaths. We found no significant correlation between being more than 75 years of age and frailty (Spearman's rank correlation coefficient 0.021; $p = 0.843$). The median frailty score among all patients who could be scored was 4 (range 2–8). Patients who died had a median frailty score of 5 (range 2–8), while those who survived had a median frailty score of 3 (range 2–8) (Figure 2). Patients who died in hospital had significantly higher frailty scores than those who survived ($p = 0.003$). There were significantly more deaths in the group who scored 4–9 on the frailty scale compared to patients who scored 1–3 ($p = 0.039$).

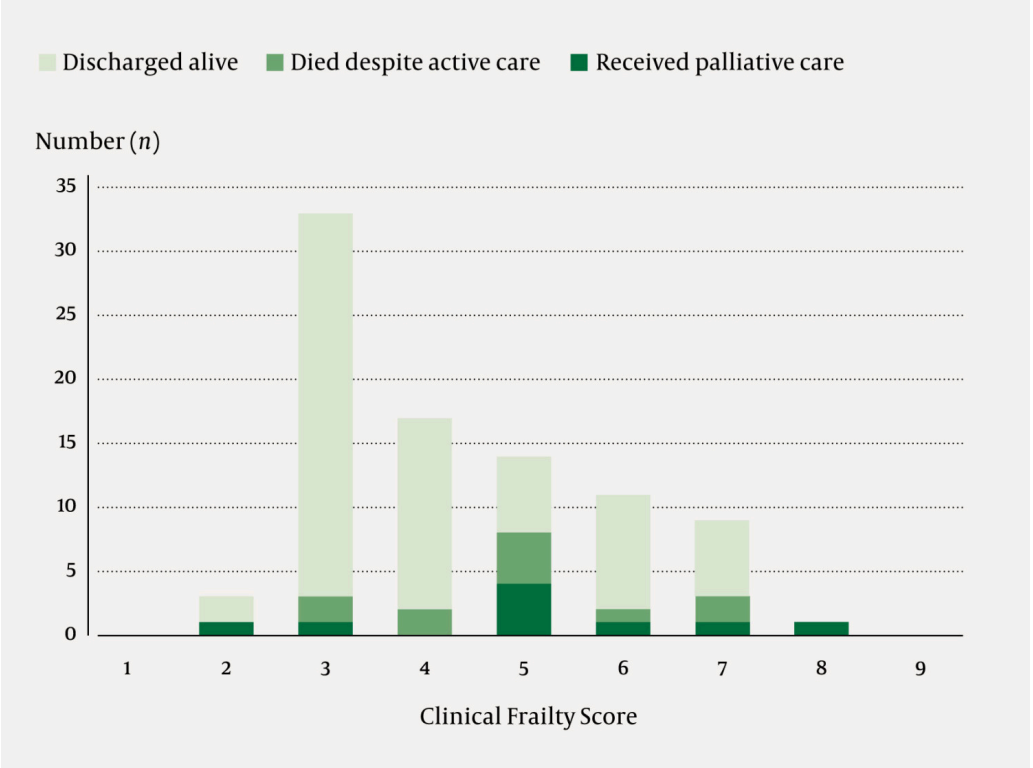

Figure 2 Frailty scores and in-hospital deaths in 88 out of 101 patients > 75 years admitted to the National Burn Centre, Haukeland University Hospital, 2000–19. For 13 patients, there was insufficient information in the patient records to score frailty. Frailty scores are classified according to Rockwood et al. (16) as: 1 = very fit, 2 = well, 3 = well, with treated comorbid disease, 4 = apparently vulnerable, 5 = mildly frail, 6 = moderately frail, 7 = severely frail, 8 = terminally ill but still independent, 9 = terminally ill and dependent on others.

Discussion

In this article, 101 patients ≥ 75 years who were admitted to the National Burn Centre at Haukeland University Hospital in the period 2000–19 are presented. The median TBSA with burns was 11 % (0.9–80 %), 17 patients received palliative care only and almost one-third of patients died in hospital. Percentage of TBSA with burns and frailty score were associated with death.

It seems that more older patients are being offered advanced treatment than before, including extensive surgery and intensive care. We found a clear increase in the number of admissions of older burn patients during the period. This partly reflects the change in practice in 2015 for more older burn patients to be accepted for transfer, also including some with less extensive burns (4). Box 1 shows the criteria for assessing the need to refer patients to the National Burn Centre. Assessing whether an older patient with extensive burns would benefit from advanced and protracted treatment at a national treatment centre is challenging. Initial clinical assessment of the extent and the depth of a burn can be difficult (19), which can lead to the referring clinician misclassifying the severity.

Box 1 Criteria for referral to the National Burn Centre, Haukeland University Hospital.

The criteria were revised in 2015. The treatment of burns in local hospitals will depend on local expertise and experience. If local expertise is sufficient, particularly in plastic surgery departments, treatment can be recommended locally and/or regionally outside the criteria. % of TBSA = the percentage of total body surface area with burns.

- Burns > 10 % of TBSA in adults
- Burns > 5 % of TBSA in children
- Full-thickness burn (3rd degree) > 5 % of TBSA
- Burn injuries in particular areas:
  - Hands, face, feet, genitalia, perineum and over large joints
  - Injuries that include the entire circumference of the extremities or thorax
- Burns with inhalation injury
- Electrical burns
- Chemical burns
- Burns in multimorbid patients
- Burns in pregnant women
- Burn patients with multitrauma
- Burns in small children or older/frail patients
- Burns where abuse/neglect is suspected

Patients were mainly referred for active treatment. Based on new assessments for the depth and extent of burns upon admission to the National Burn Centre, the patient's/families' wishes and response to treatment, it may be appropriate to limit treatment and in some cases switch to palliative care. Our dataset indicates that extensive burns (> 20–25 % of TBSA), often combined with a high frailty score (CFS > 4), were associated with a poorer prognosis – even with treatment. The treatment of these patients should be discussed individually with the burn surgeon on duty. Patients with minor burns in a critical anatomical location in terms of function should be referred to the National Burn Centre if the injury cannot be treated locally.

The median burn size in the patient dataset was 11 % of TBSA. This is consistent with other studies of older burn patients (20–22). Four out of five actively treated patients required surgery, most often with tangential excision and split-thickness skin grafts. Most patients were operated on within 2–3 days after admission, in accordance with established international guidelines (23, 24). Around half of the operated patients required more than one operation, and for some patients the treatment was quite protracted. Poor wound healing in older burn patients may be due to an impaired immune response (9, 10).

The prognosis for older burn patients has improved in recent years (5), most likely due to early excision and skin grafting (25), developments in intensive care medicine, including nutrition and metabolism (26), and better dressing materials. The depth and extent of the burn, together with the patient's age,

have previously been shown to be decisive for the prognosis (8, 27). In our data, a high percentage of TBSA with burns was associated with in-hospital death. In a recent study of 228 burn patients over the age of 65 with a median burn size of 5 %, a mortality rate of 14.9 % was found (5), while in other patient data, a higher mortality rate is reported in burn patients > 60 years of age (20, 28).

Twenty-nine out of 101 patients ≥ 75 years (29 %) died in hospital. Among the 172 patients aged 60–74 years treated at the National Burn Centre in the same time period, mortality was 12.8 %. The corresponding figure for the 45–59 age group was 7.5 % (own unpublished data). The long-term survival of patients who were discharged alive was consistent with other studies (29). One-year survival of patients discharged alive was 82 % (Figure 1). We do not have data on quality of life or functional level after discharge from hospital.

The findings regarding the relationship between comorbidity at the time of injury and survival in burn patients vary (20, 21, 30). Classifying older patients according to degree of frailty is becoming increasingly common in clinical practice and research (18). A patient who is classified as frail has a high risk of post-surgery complications, a need for a higher level of care and a greater probability of death (8, 11, 17). Assessing the patient's frailty gives a more accurate picture of their vulnerability than age and comorbidity alone, and can therefore be a useful aid in clinical decision-making. This is consistent with our data, where we found that frailty scores were associated with in-hospital deaths. It has also been shown that there is little variation and a high precision level in frailty scoring between those carrying out the assessment (31, 32). The data are therefore robust even if the scoring is carried out retrospectively (32). The level and intensity of treatment must be assessed for each individual patient.

The dataset in this study was insufficient to determine how much burn size and frailty respectively contribute to mortality. Burn size and age are the main factors when predicting mortality among burn patients (27). A research group from England recently found that a frailty score > 3 was a more sensitive predictor of one-year mortality than the modified Baux score, which is based on burn size, age and concomitant inhalation injury (33). A combination of Baux score and frailty score further improved the prediction, both with regard to in-hospital mortality and one-year mortality, compared to a modified Baux score alone (33).

Scoring frailty can therefore be an important tool in the assessment of older burn patients, also when making pivotal clinical decisions.

This retrospective cohort study has some weaknesses. The distribution of burn size among the patients was skewed: many had moderate injuries, and only 15 had 30 % of TBSA or more with burns (Table 2). The data available in the electronic patient records and the opportunity for comparison varied, particularly with regard to functional level and cognitive function/dementia, which is crucial for assessing frailty.

Conclusion

The number of patients over the age of 75 treated every year at the National Burn Centre has tripled since 2015, and more than two-thirds of burn patients are discharged alive. Extensive burns and high frailty scores are associated with mortality and may be useful factors for adjusting therapy.

The article is based on Kaja Arnes and Camilla Rygg Kjørsvik's master's thesis at the Faculty of Medicine, University of Bergen.

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