Article:
Battaloglu, E., Fragoso Iniguez, M., Lecky, F. et al. (1 more author) (2020) Incidence of combined burns and major trauma in England and Wales. Trauma, 22 (1). pp. 51-55. ISSN 1460-4086

https://doi.org/10.1177/1460408618817107

Incidence of Combined Burns & Major Trauma in England & Wales.

Emir Battaloglu[a], Marisol Fragoso Iniguez[b], Prof. Fiona Lecky[b], Prof. Sir. Keith Porter[a]

a - University Hospitals Birmingham, b - Trauma Audit Research Network

Corresponding author: Emir Battaloglu, Department of Trauma & Orthopaedics, University Hospital Birmingham, B15 2TH, UK. Email: emir.battaloglu@nhs.net

Keywords:

Burns ; Trauma ; Incidence ; Mortality ; Epidemiology

ABSTRACT

Introduction

Within the United Kingdom's major trauma networks, limited consideration is given to the management of concomitant burns and trauma injuries, highlighted in the arrangement of specialist services for major trauma and burns care. The majority of the literature, based almost exclusively on North American studies, predicts between 5 - 7% of all burn patient suffer from concomitant (non-thermal) trauma injuries, in addition to their thermal injuries. The aim of this study is to understand the epidemiology and outcomes for patients sustaining burns and trauma injuries in England and Wales.

Methods

A retrospective review of patients sustaining concomitant burns and trauma injuries was made over a 71 month period from January 2010 to November 2016, using the national trauma registry for England and Wales, the Trauma Audit and Research Network (TARN) database, identifying all patients with injury codes for burns and trauma (AIS > 3). Comparison of information was made against the total burns and total trauma cohort to form a base standard for burns and trauma injuries, respectively. .

Results

Over the period analysed, 188 patients were found to have concomitant burns and trauma injuries. The patients were stratified according to age and the percentage of total body surface area burned. Hospital length of stay for concomitant burns & trauma patients was found to be higher than that of patients with isolated burns injuries. Mortality rates, although low overall, were found to be relatively higher for patients with concomitant burns & trauma injuries.

Conclusions

This study demonstrated the rarity of this combination of injury pattern, in particular the occurrence of severe burns in the presence of major trauma, in UK. The synergistic effect of burns and trauma injuries appears to impact on the course of such patients, although larger scale analysis is required to determine the true prognostic factors.

Introduction

Great challenges exist in the management of the burned trauma patient, especially in the prioritisation and orchestration of multiple specialities for multiple injuries1-8. Conflicts arise initially during emergency assessment, continue through resuscitation & operative management, and even into rehabilitation. Mechanisms for this injury pattern are commonly road traffic accidents, escaping burning buildings, and industrial and residential explosions. Further challenges lie within the assessment and recognition of the concomitantly injured patient, where unfamiliarity with treatment and management can lead to sub-optimal outcomes7. Most commonly, the trauma injury in combination with burn injury requires orthopaedic surgery or neurosurgery8.

Literature regarding this injury combination is limited, with only a few articles from the last decade, during which time burns and trauma care has advanced, with the majority of the literature based exclusively on North American studies, where trauma is a greater burden on health services than in the United Kingdom or Europe.

The American College of Surgeons National Trauma Data Bank Annual Report 2012 shows more than 29,000 trauma deaths, comprising 3.8% of the 700,000+ national trauma admissions in 20119. By comparison, the 2010 Office for National Statistics reported approximately 5,000 trauma deaths from over 20,000 national trauma admissions in UK annually10. The US trauma injury rate is approximately 222 per 100,000 compared to a UK trauma injury rate of 87.2 per 100,000, however, rates for burns injuries are more closely similar with US burns injury rate at 5.8 per 100,000 versus UK burns injury rate of 4.7 per 100,00011,12.

The North American literature regarding the combination of concomitant burns and trauma injuries predicts between 5 - 7% of all patients admitted to burns centres will suffer from concomitant trauma injuries2,3,7. Also highlighted has been an increased mortality rate, attributed either as a function of the severity of trauma injury or related to total burn surface area (TBSA), but never as a combined calculation. Further to this, the presence of inhalation injury and the number of organ systems involved have been seen to impact upon mortality and must be accounted for when determining the prognosis for patients with concomitant burns and trauma injuries4,5.

The purpose of this study was to demonstrate prevalence for this injury pattern across the UK and determine the prognostic effect of such injury combination.

Patients & Methods

A retrospective review of patients sustaining concomitant burns and trauma injuries was made over a 71 month period from January 2010 to November 2016, using the national trauma registry for England and Wales, the Trauma Audit and Research Network (TARN) database, identifying all patients with injury codes for burns and trauma (AIS > 3). Data collected comprised of patient demographic information, Injury Severity Score (ISS), Abbreviated Injury Scale (AIS) scores for all

major anatomical regions, mechanism of injury, burns severity, clinical markers (level of trauma hospital attended, length of stay) & mortality. Patients were divided into sub-groups dependent upon injury severity and burns TBSA, with further sub-division for age stratification.

Statistical evaluation for comparison of burns & trauma patients with a TARN derived 'burns only' patient cohort was performed using chi-squared test with $p < 0.05$ regarded as statistically significant. Analyses were performed in SPSS v 13.0. TARN has HRA Section 251 approval to conduct research on this anonymised data set.

Results

Over the study period 188 patients were identified with burns and trauma injuries (Table 1). Of this cohort, the majority (66%) were aged between 16-60 years old. The remaining third of the cohort included eight children (<16 years old) and 55 elder patients (>60 years old). Median ISS for all age categories was 21 for burns and trauma patients with an AIS >3 in one domain.

Blunt trauma was the predominant injury type comprising 97% of patients sustaining combined injuries and only 3% with a penetrating mechanism of injury (Table 2). The commonest mechanisms of injury were in keeping with traditional UK trauma epidemiology, with RTC accounting for almost 40%, followed by falls at 17%. However, unspecified burns and other mechanisms were reported in >30% of cases (Table 2).

When considering the anatomical distribution of injuries sustained with an AIS>3, the thorax was most frequently injured body region (29%), followed by the head (15%) and extremities (13%) (Table 3). Burns severity showed a mixed pattern (Table 4), with isolated facial burns representing the largest proportion of burns injuries. Burns greater than 20% TBSA were seen with concomitant trauma injuries in 35 patients during the 6 year period. The outcomes for patients sustaining combined burns and trauma injuries had an overall mortality of 23% and median Length of Stay (LOS) of 12 days (Table 5).

Survival probability (Ws) for the three injury patterns demonstrate the lower than expected survival rates in the burns injured patients and combined injury patients, with higher rates of survival in "trauma only" patients, as predicted by the probability of survival calculation.

.

Paediatrics:

Only eight children under the age of 16 years old were identified in the registry with combined burns/trauma injury pattern, from the total of 12 366 paediatric trauma patients during the studied period. Over 85% of children with burns and trauma injuries were male, with a median age of 5 and median ISS of 23. Injury mechanisms were due to RTC (50%), blast (25%) and others (25%). Half of the paediatric burns & trauma patients sustained only facial burns; only one child sustained burns >10% TBSA (30-39%) with associated traumatic injury. The extremities were most frequently injured (AIS>3) in children sustaining burns and trauma, representing a higher proportion than in the trauma only cohort, 63% vs. 49%. All eight children survived their injuries, with a median length of stay of 10 days in hospital.

Elders:

Fifty five burns and trauma patients were aged over 60 years old, but less than 40% of patients were male. All were blunt injuries, but a much lower percentage of combined injuries were as a result of RTC (16%), with the major mechanism of injury being after a fall of less than 2 metres. Median ISS was 20; 16% of elder burns and trauma patients had isolated facial burns.

Mortality was higher for elder patients, with only 58% surviving their injuries. In comparison to the elder cohort of isolated burns injuries, mortality was higher in the burns and trauma injuries (42% vs. 24%) although burns severity between these cohorts was comparable, with 11 combined and eight burns only patients sustaining >40% TBSA burns.

Discussion

This study demonstrates the rarity of this combination of injury patterns in the United Kingdom, especially by comparison to the United States. Many features of the burns and trauma cohort are similar with previous studies, including age profile and prolonged length of stay. Santaniello et al conducted a similar analysis of their centre's experience over a 10 year period of patients sustaining concomitant burns and trauma injuries, as well as making comparison using national registries to evaluate their findings against the rest of the United States. They demonstrated a high mortality rate for their patients sustaining burns and trauma injuries (28.3%). They also saw markedly higher TBSA burns in both their burns and burns & trauma cohorts than in this study. Another difference impacting upon patient mortality was that of the rate of inhalation injury seen in burns patients as well as in the burns & trauma patients.

Determining predictors for patient mortality are in keeping with those demonstrated by previous studies and the general burns literature. Age as a significant risk factor is demonstrated most clearly by the elderly sub-cohort, likely due to their lesser physiological reserve to deal with injury. Inhalation injury is another risk factor contributing to poorer patient outcome and is likely to cause difficulties in clinical management, especially for those patients requiring respiratory support. However, the incidence of inhalation injury is not available within this data set which does limit the interpretation of comparative mortality between combined injuries against isolated burns.

Highlighted within these data is a disproportionate under-representation of burns injury severity as defined by AIS, when compared to traumatic injuries scoring, which would be relevant to be able to aid prognostic referencing for combined injuries.

Examining the survival probability provides relevant points regarding the lower than expected rates for burns patients. The comparative group of burns patients entering the TARN registry are those treated at non-burns specialist hospitals, which is thus a contributory factor in the low survival outcome interpretation. Furthermore, the prediction model design within the trauma cohort may not optimally describe the survival expectations for burns injuries, accompanying the limitations of AIS for burns. Yet accounting for these limiting factors, combined injury patients may experience lower than expected survival due to the clinical difficulties in managing this rare injury group.

Recent work has highlighted the ongoing modification to the Baux score in specialist burns units in the UK, which is now postulated to have a LA50 at 109 and a LA100 at 160 15. Inhalation injury has been given an additional factor of 17, to more accurately reflect this sub-group of burns patients. This suggests the possibility that concomitant trauma could also be given a factor, dependent upon the severity of the injury(s) or AIS for prognostic purposes?

Patterns of injury described within the available data do not provide sufficient detail in order to be able to ascertain preventative measures or focus risk reduction strategies.

The mass casualty incident has been seen to generate high numbers of patients with concomitant burns and trauma injuries. Incidents such as the US West Pharmaceutical Plant explosion in 2003 resulted in a third of the casualties sustaining combined injuries 16; another example from the World Trade Center disaster in 2001, where a single institution saw a rate of hospitalised patients with burns and trauma injuries of 19% 17.

Burns tended to make up a small proportion of all casualties during disasters or mass casualty incidents and in the UK over the 30 years (1980 – 2009) 37 events were recorded; only three had more than 5 patients with >10% burns 18, yet, it may be precisely in such a situation in which prognostic calculation may aid resource allocation and patient prioritisation.

Conclusions

This study demonstrated the rarity of this combination of injury pattern in the United Kingdom by comparison to the United States. Significant variations in hospital length of stay and mortality rates were found when comparing isolated burns injuries against patients with concomitant burns and trauma. The synergistic effect of burns and trauma injuries appears to have a major impact on the course to recovery for such patients.

Improvements in burns care and trauma care hopefully contributes to the higher level of survival in concomitantly injured patients against data from previous literature. However, larger scale analysis is required to determine the full incidence of such injuries and the true prognostic factors, especially if concomitant trauma is to factor in calculations such as the Baux score.

Conflict of Interest

Nil

Word Count

1806 words

References

1. Brandt CP, Yowler CJ, Fratianne RB. Burns with multiple trauma. Am Surg. 2002;68:240 –243.

2. Purdue GF, Hunt JL. Multiple trauma and the burn patient. Am J Surg. 1989;158:536 –539.

3. Dougherty W, Waxman K. The complexities of managing severe burns with associated trauma. SurgClin North Am. 1996;76:923–958.

4. Saffle JR, Schnelby A, Hofmann A, et al. The management of fractures in thermally injured patients. J Trauma. 1983;23:902–910.

5. Pruitt B. Management of burns in the multiple injury patient. SurgClin North Am. 1970;50:1283–1299.

6. Hawkins A, MacLennan PA, McGwin G Jr., Cross JM, Rue III LW. The Impact of Combined Trauma and Burns on Patient Mortality. J Trauma. 2005;58:284 –288.

7. Santaniello JM, Luchette FA, Esposito TJ, Gunawan H, Lawrence Reed R, Davis KA, et al. Ten Year Experience of Burn, Trauma, and Combined Burn/Trauma Injuries Comparing Outcomes. J Trauma. 2004;57:696 –701.

8. Rosenkranz KM, Sheridan R. Management of the burned trauma patient: balancing conflicting priorities. Burns. 2002;28:665– 669.

9. American College of Surgeons. National Trauma Data Bank 2012 Annual Report. Chicago, 2012.

10. Office of National Statistics Report. Major trauma care in England. London, 2010.

11. American Burn Association. 2012 National Burn Repository. Report of Data 2002 – 2011. Chicago, 2012.

12. Kalson NS, Jenks T, Woodford M, Lecky FE, Dunn KW. Burns represent a significant proportion of the total serious trauma workload in England and Wales. Burns. 2012;38:330-339.

13. Baker SP, O'Neill B, Haddon Jr. W, Long WB. The Injury Severity Score: a method for describing patients with multiple injuries and evaluating emergency care. The Journal of Trauma. 1974:14(3):187–196.

14. Foster MA, Moledina J, Jeffery SL. Epidemiology of UK Military Burns. Journal of Burn Care & Research. 2011;32(3):415–20.

15. Roberts G, Lloyd M, Parker M, Martin R, Philp B, Shelley O, et al. The Baux Score is dead. Long live the Baux score: a 27 year retrospective cohort study of mortality at a regional burns service. J Trauma Acute Car Surg. 2012;72(1):251-6.

16. Cairns BA, Stiffler A, Price F, Peck MD, Meyer AA. Managing a Combined Burn Trauma Disaster in the Post-9/11 World: Lessons Learned from the 2003 West Pharmaceutical Plant Explosion. Journal of Burn Care & Rehabilitation. 2005;26(2):144-150.

17. Pryor JP. The 2001 World Trade Center Disaster: Summary and Evaluation of Experiences. Eur J Trauma Emerg Surg. 2009;35:212–24.

18. 30 years of burn disasters within the UK: guidance for UK emergency preparedness. Horner CW, Crighton E, Dziewulski P. Burns. 2012 Jun;38(4):578-84.